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"LET KNOWLEDGE GROW FROM MORE TO MORE
AND THUS BE HUMAN LIFE ENRICHED."

A New Survey of Universal Knowledge

ENCYCLOPÆDIA BRITANNICA

Volume 12

IMPATIENS *TO* JINOTEGA

ENCYCLOPÆDIA BRITANNICA, INC.

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IMPATIENS *TO* JINOTEGA

IMPATIENS, a genus of annual or biennial herbs, sometimes becoming shrubby, several species of which, called balsam or snapweed, are cultivated in the garden. The genus comprises 350 or more species of the balsam family (Balsaminaceae). Chiefly natives of the mountains of tropical Asia and Africa, some species are also found widely distributed in the north temperate zone and in south Africa. The flowers, which are purple, yellow, pink or white and often showy, are spurred, irregular in form and borne in the leaf axils. Touch-me-not (*q.v.; Impatiens nolitangere*), an annual succulent herb with yellow flowers, is probably native in moist mountainous districts in north Wales, Lancashire and Westmorland. *I. roylei,* a tall hardy succulent annual with rose-purple flowers, a Himalayan species, is common in England as a self-sown garden plant or garden escape. In North America they are often called jewelweed. Two of the commonest, the spotted touch-me-not (*I. biflora*) with orange-yellow flowers mottled with brown, and the pale touch-me-not (*I. pallida*) with pale yellow flowers, are widely distributed across the continent.

ANNE JACKSON F.R.P.S.

TOUCH-ME-NOT (IMPATIENS NOLI-TANGERE)

I. balsamina, the common balsam of gardens, a well-known annual, is a native of India and China; in its many horticultural forms it is one of the showiest of garden flowers and of comparatively easy cultivation. *I. sultani,* a handsome plant with scarlet flowers, a native of Zanzibar, is grown in a greenhouse in winter, but used as a summer bedding plant outdoors.

IMPEACHMENT, a criminal proceeding instituted against a public official by a legislative body.

United States.—The U.S. constitution provides that "The House of Representatives . . . shall have the sole Power of Impeachment" (art. i, sec. 2, cl. 5); "The Senate shall have the sole Power to try all Impeachments" (art. i, sec. 3, cl. 6).

"The President, Vice President and all civil Officers . . . shall be removed from Office on Impeachment for, and Conviction of, Treason, Bribery, or other high Crimes and Misdemeanors" (art. ii, sec. 4).

In Great Britain conviction on an impeachment may include fines and imprisonment. The U.S. constitution, however, provides that judgment on an impeachment shall extend no further than removal and disqualification from office. This difference has had a profound effect on the history of impeachment in the U.S.

Following is a list of impeachment trials held in the U.S. senate:

1. William Blount, senator from Tennessee, charged (1797) with conspiring and contriving to excite the Creek and Cherokee Indians against the king of Spain. The senate held that a senator was not a civil officer within the meaning of the constitution. The impeachment was dismissed, but Blount was expelled from the senate.
2. John Pickering, judge of the district court of New Hampshire, charged (1804) with drunkenness, tyrannous conduct and disregard for the terms of statutes. Convicted.
3. Samuel Chase, associate justice of the U.S. supreme court, charged (1805) with intemperate, arbitrary and unjudicial conduct in sedition-law trials. Acquitted.
4. James H. Peck, judge of the U.S. for the district of Missouri, charged (1830) with tyrannous treatment of counsel and arbitrary conduct. Acquitted.
5. West H. Humphreys, judge of the district court of the U.S. for the eastern, middle and western districts of Tennessee, charged (1862) with supporting the secession movement. Convicted.
6. Andrew Johnson (*q.v.*), the only president ever impeached, charged (1868) with the attempted removal of the secretary of war, Edwin M. Stanton, contrary to statute, inducement of a general of the army to violate an act of congress and contempt and reproach of congress. Acquitted by the margin of a single vote.
7. William Belknap, former secretary of war, charged (1876) with accepting profits from his own appointee to an army trading post. The senate voted down Belknap's defense that he could not be impeached since he had already resigned. He was nonetheless acquitted.
8. Charles H. Swayne, judge of the northern district of Florida, charged (1905) with falsifying expense accounts, nonresidence and use of a private car belonging to a railroad in receivership. Acquitted.
9. Robert W. Archbald, judge of the U.S. commerce court, charged (1913) with using his official position for private gain and accepting loans from litigants. Convicted.
10. Harold Louderback, judge of the northern district of California, charged (1932) with favouritism in the appointment of receivers. Acquitted.
11. Halsted L. Ritter, judge of the southern district of Florida, charged (1936) with bankruptcy irregularities and income tax evasion. Convicted.

The principal criticism directed at the impeachment process is that it is cumbersome and anachronistic. An impeachment trial occupies the entire senate for from 16 days to six weeks, fills thousands of pages of testimony and involves conflicting and troublesome political pressures. Repeated attempts in congress to amend the procedure, however, proved uniformly unsuccessful. A partial explanation of the resistance to change is the fact that impeachment is regarded as an integral part of the U.S. system of checks and balances.

Instead, a more practical solution has emerged. The resignation of the officer under inquiry has generally terminated the proceedings (despite the ruling in the Belknap case). For instance, in the case of District Judge George W. English (1926) the senate, after it had received the articles of impeachment from the house and had convened as a trial court, dismissed the impeachment upon notification of his resignation. A later example occurred when the house committee on the judiciary, after noting the removal by resignation of District Judge Albert W. Johnson (1946), refused to recommend impeachment because a trial would have occupied the senate unduly "when that body is engaged in so many issues vital to the welfare of the nation."

Every state except Oregon also provides for the removal of executive and judicial officers by impeachment. (In Oregon corruption and similar crimes may be tried in the same manner as criminal offenses.) Exact procedures vary somewhat from state to state but are similar to federal impeachment. (J. B.)

England.—In England impeachment has become a form of judicial parliamentary procedure against criminals in which the house of commons are the prosecutors and the house of lords the judges. But it has not been resorted to since the case of Lord Melville (1806), who was suspected of mismanaging the finances of the admiralty. Its origins lie in the 14th century, when it grew up as a means of initiating criminal procedure based on "clamour" or outcry. John Stratford, archbishop of Canterbury, was arraigned (1341) in parliament on the basis of "articles" which "notoriously defamed" him. This did not amount to an impeachment but shows that the practice was developing. The Good parliament of 1376 produced the first recognized cases of impeachment, of which the most important was that of William, Lord Latimer. His case reveals a characteristic which persisted; subsequent victims of impeachment have often been political figures. Usually they have been royal ministers as well. Latimer had been closely associated with the government of the aging Edward III, which was under hot attack. Moreover, his case marks the point at which impeachment became not simply a means of initiating criminal proceedings but also a method of trial. When Latimer "declared his fame," demanding to know on what authority he was charged, the commons maintained their accusations against him in common and so became prosecutors, even though they claimed to act on behalf of the king. Thus, in T. F. T. Plucknett's phrase, the Good parliament rationalized impeachment. After the trial of Thomas, Lord Stanley (1459), impeachment fell out of use until it was given a new lease of life in the 17th century.

The occasion of its revival was the desire of the house of commons in 1620–21 to attack the monopolist, Sir Giles Mompesson. They found to their dismay that they could not proceed against him except for breach of privilege in their own house, and therefore suggested to the lords that impeachment should be revived. James I's attempts to prevent this development failed and Mompesson was successfully impeached. Flourishing their newfound weapon the commons attacked much more important victims, first Francis Bacon, Viscount St. Albans, and then Lionel Cranfield, earl of Middlesex. Their success was dramatic; for thus the chief officers of the crown were overthrown. From the impeachment of Mompesson to that of Thomas Osborne, earl of Danby (1678–79), the threat of this method of trial was of the first importance. Indeed in 1679 it was declared to be "the chief constitution for the preservation of the government." By it unpopular ministers and favourites such as the duke of Buckingham (1626), Archbishop William Laud (1640), the earl of Strafford (1640–41), the earl of Clarendon (1667) and Danby were brought down or at least brought into jeopardy. On one occasion it seemed as if Queen Henrietta Maria might have been added to the list.

In Danby's case it was decided that the king's power to pardon could not stop an impeachment and so save his minister. Between 1621 and 1715 there were about 50 cases of impeachment, and one by one the crown's attempts to restrict the use and scope of impeachment were swept away. In 1681 the case of Edward Fitzharris led the house of commons, in answer to a resolution of the lords, to declare it to be their own undoubted right "to impeach any peer or commoner for treason or any other crime or misdemeanour." But as time went on, impeachment found in the lawyers a far more dangerous enemy than the crown. The more closely it was defined the blunter its edge became. In attacking royal ministers the commons were, in effect, attacking their policies. Yet they could proceed by impeachment only if the minister could be convicted of crime. Strafford's case had shown that a wary minister was often hard to trap in this net. A minister might be punished severely for some trivial offense which had been cozened up and which was not the real point at issue. Never were the limitations of impeachment more clearly shown than in the case (1788–95) of Warren Hastings (*q.v.*). It was then proved beyond doubt that in a complicated case the instrument was far too blunt and its use could entail interminable delays. Moreover, the need for a criminal process against a royal minister which was incapable of being stopped by the king had at length passed away.

Impeachment differs from attainder (*q.v.*) in that the latter is a legislative and not a judicial process. In attainder king, lords and commons proceed by bill and agree on a criminal sentence. Moreover, in attainder the accused has no opportunity for defense. (J. R. L. H.)

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IMPERIA, capital of the province of Imperia, Liguria region, northwest Italy, is situated on the coast of the Ligurian sea, 122 km. (76 mi.) S.W. of Genoa and 82 km. (50 mi.) E.N.E. of Nice, France, by road. Pop. (1957 est.) 32,132 (commune). The two centres of Porto Maurizio and Oneglia united in 1923 with several villages to form the new city of Imperia, taking its name from the Impero stream which crosses the town. Porto Maurizio is on the height of a promontory; Oneglia, lying in flat country at the mouth of the Impero, is an industrial and commercial centre. On the Matteotti esplanade are the Provincia building (1910), the post office (1936) and the city hall (1932). The baroque S. Giovanni church was designed by Gaetano Amoretti in 1739; S. Maurizio church (1839) contains fine works of art. There are a museum and an art gallery and public gardens.

Imperia is on the Genoa-Ventimiglia-Nice railway and road. Chief industries are the production and export of olive oil and the making of spaghetti, perfume, drugs and cement. Flowers are grown and exported. The tourist industry is important.

Porto Maurizio was the Roman Portus Maurici of the Maritime Itinerary. It became the seat of a Genoese vicar from 1276 and with Genoa fell to the French in 1797. In 1814 it was joined to the kingdom of Sardinia. It was made a provincial capital in 1860. Oneglia originated in 935 from Castelvecchio, a Roman castle situated on the coast, and was a tenure of Albenga episcopacy from 1100. In 1298 it was sold to the Doria family and in 1576 passed to the house of Savoy. Captured by France in 1792, it passed in 1814 to Piedmont and was a provincial capital until 1859. (L. LA.)

IMPERIAL CHAMBER (*Reichskammergericht*), the supreme judicial court of the Holy Roman empire during the period between 1495 and the dissolution of the empire in 1806. From

the early middle ages there had been a supreme court of justice for the empire—the *Hofgericht*, in which the emperor himself presided and a body of assessors found the judgments. The *Hofgericht* was connected with the person of the emperor; it ceased to act when he was abroad, and it died with his death. Upon him it depended for its efficiency; and when, in the 15th century, the emperor ceased to command respect, his court lost the confidence of his subjects. After 1450 it ceased to sit.

Its place was taken by the *Kammergericht*, which appeared side by side with the *Hofgericht* from 1415 and after 1450 replaced it altogether. The king, or his deputy, still presided in the *Kammergericht* and it was still his personal court; but all the members of the new "chamber" were now officials—the *consiliarii* of the imperial *aula* (or *Kammer*, whence the name of the court). It was generally the legal members of the council who sat in the *Kammergericht* (*see* AULIC COUNCIL); and as they were generally doctors of civil law, the court they composed tended to act according to that law, and thus contributed to the "reception" of Roman law into Germany toward the end of the 15th century.

Even the *Kammergericht*, however, fell into disuse in the later years of the reign of Frederick III. The creation of a new and efficient court became a matter of pressing necessity, and was one of the most urgent of the reforms mooted in the reign of Maximilian I. This new court was eventually created at the imperial diet of Worms in 1495; and it bore the name of *Reichskammergericht*, or imperial chamber. It was distinguished from the old *Kammergericht* by the essential fact that it was not the personal court of the emperor but the official court of the empire (or *Reich*—whence its name). The emperor appointed the chief justice (*Kammerrichter*), who had to be a high aristocrat and enjoyed the rank of a prince of the empire, and the two (later four) presidents of court senates; the empire nominated the assessors or judges. More exactly, the emperor nominated, according to the regular usage of later times, a certain number of the members—partly on his authority as emperor and partly as the sovereign of his hereditary states. The rest of the judges, who formed the majority, were nominated by the empire—partly by the electors and partly by the six ancient circles. There were originally 16 judges (afterward, as a rule, 18, later 24; from 1570 even 41; during the 18th century reduced to 25). Half of these were to be doctors of Roman law, and half were to be knights; but after 1555 it became necessary that the latter should be learned in Roman law, even if they had not actually taken their doctorate. Thus the empire was at last possessed of a court—a court resting on the enactment of the diet and not on the emperor's will, paid by the empire and not by the emperor, resident in a fixed place (Speyer from 1527 to 1693, Wetzlar from 1693 to 1806) and not attached to the emperor's person.

The great result it served to achieve was the final "reception" of Roman law as the common law of Germany. That the imperial chamber should itself administer Roman law was an inevitable result of its composition; and it was equally inevitable that the composition and procedure of the supreme imperial court—despite its cumbersome machinery—should be imitated in the various states which composed the empire, and that Roman law should thus become the local, as it was already the central, law of the land.

The province of the imperial chamber, as it came to be gradually defined by statute and use, extended to breaches of the public peace, cases of arbitrary distraint or imprisonment, pleas which concerned the treasury, violations of the emperor's decrees or the laws passed by the diet, disputes about property between immediate tenants of the empire or the subjects of different rulers, and finally suits against immediate tenants of the empire—with the exception of criminal charges and matters relating to imperial fiefs, which went to the aulic council. The court also had cognizance in cases of refusal to do justice, and it acted as a court of appeal from territorial courts in civil and, to a small extent, in criminal cases; but it had no authority as a court of appeal in territories which enjoyed a *privilegium de non appellando* (such as, for example, the territories of the electors).

The business of the court, however, was badly done; the delay was interminable, largely a result of want of funds, which prevented the maintenance of the proper number of judges. In all its business it suffered from the competition of the aulic council, for that body, having lost all executive competence after the 16th century, had also devoted itself exclusively to judicial work. Composed of the personal advisers of the emperor, the aulic council did justice on his behalf (the erection of a court to do justice for the empire having left the emperor still possessed of the right to do justice for himself through his *consiliarii*); and it may thus be said to be the descendant of the old *Kammergericht*.

The competition between the aulic council and the imperial chamber was finally regulated by the treaty of Westphalia, which stipulated that the court which first dealt with a case should alone have competence to pursue it.

See Rudolf Smend, *Das Reichskammergericht* (1911); Erich Döhring, *Geschichte der deutschen Rechtspflege seit 1500* (1953).

(E. B.; A. LH.)

IMPERIAL CITIES (IMPERIAL TOWNS) is the usual English translation of the German *Reichsstädte*. These were cities and towns subject to no authority except that of the emperor, or German king; in other words, they were immediate. The earliest of them stood on the demesne land of their sovereign, and they often grew up around his royal castles.

A distinction was thus made between a *Reichsstadt* and a *Landstadt*, the latter being dependent upon some prince, not upon the emperor direct. The term *Freie Reichsstadt*, sometimes used in the same sense as *Reichsstadt*, is rightly only applicable to seven cities —Basel, Strasbourg, Speyer, Worms, Mainz, Cologne and Regensburg. Having freed themselves from the domination of their ecclesiastical lords, these called themselves *Freistädte*, and in practice their position was indistinguishable from that of the *Reichsstädte*.

In the middle ages many other places won the coveted position of a *Reichsstadt*. Some gained it by gift and others by purchase; some won it by force of arms, others usurped it during times of anarchy. There were many more free towns in southern than in northern Germany. Some free towns fell into the hands of various princes of the empire, and others placed themselves voluntarily under such protection. Mainz was conquered and subjected to the archbishop in 1462. Some towns, like Trier, declined independence because of the inescapable financial burdens. When Trier later tried to reassert its position as an imperial city, the emperor in 1580 definitely assigned the city to the archbishop. Similarly, Donauwörth in 1607 was handed over to Bavaria by the emperor's judgment. Other towns were separated from the empire by conquest. Besançon passed into the possession of Spain in 1648; Basel had already thrown in its lot with the Swiss confederation, while Strasbourg, Colmar, Haguenau and other free towns were seized by Louis XIV.

Meanwhile the free towns had been winning valuable privileges in addition to those they already possessed, and the more wealthy among them, such as Lübeck, Nürnberg and Augsburg, were practically *imperia in imperio*, waging war and making peace, and ruling their people without any outside interference. But they had also learned that union is strength. They formed alliances among themselves, both for offense and for defense, and these *Städtebünde* had an important influence on the course of German history from the 13th to the 15th century. These leagues were frequently at war with the ecclesiastical and secular potentates of their districts and in general they were quite able to hold their own in these quarrels. The right of the free towns to be represented in the imperial diet was formally recognized in 1489 at the diet of Frankfurt, and about the same time they divided themselves into two groups, or benches, the Rhenish and the Swabian. By the peace of Westphalia in 1648 they were formally constituted as the third college of the diet and later as the third estate of the empire. A list drawn up in 1422 mentions 75 free cities and another drawn up in 1521 mentions 84, but at the time of the French Revolution the number had decreased to 51.

In 1789 there were 14 free cities on the Rhenish bench: Cologne, Aachen, Lübeck, Worms, Speyer, Frankfurt am Main, Goslar, Bremen, Hamburg, Mühlhausen, Nordhausen, Dortmund, Fried-

berg and Wetzlar. The 37 free cities on the Swabian bench were: Regensburg, Augsburg, Nürnberg, Ulm, Esslingen, Reutlingen, Nördlingen, Rothenburg ob der Tauber, Schwäbisch-Hall, Rottweil, Überlingen, Heilbronn, Memmingen, Gmünd, Dinkelsbühl, Lindau, Biberach, Ravensburg, Schweinfurt, Kempten, Windsheim, Kaufbeuren, Weil, Wangen, Isny, Pfullendorf, Offenburg, Leutkirch, Wimpfen, Weissenburg (Wissembourg), Giengen, Gengenbach, Zell, Buchhorn, Aalen, Buchau and Bopfingen. But a large proportion of these free cities, both Rhenish and Swabian, had as little claim to their exceptional positions as the pocket boroughs of Great Britain had before the passing of the Reform bill of 1832.

By the peace of Lunéville in 1801 Cologne, Aachen, Worms and Speyer were taken by France, and by the decision of the imperial deputation of 1803 six cities only—Hamburg, Lübeck, Bremen, Augsburg, Frankfurt am Main and Nürnberg—were allowed to keep their *Reichsfreiheit*, or in other words to hold directly of the empire. This number was soon further reduced. On the dissolution of the empire in 1806 Augsburg and Nürnberg passed under the sovereignty of Bavaria, and Frankfurt was made the seat of a duchy for Karl Theodor von Dalberg, elector and archbishop of Mainz, who was appointed prince primate of the Confederation of the Rhine. When the German confederation was established in 1815, Hamburg, Lübeck, Bremen and Frankfurt were recognized as free cities, and the first three continued to hold that position in the later German empire; but after the war of 1866 Frankfurt am Main was forcibly incorporated in the newly formed Hesse-Nassau province of Prussia. Hitler incorporated Lübeck in the Prussian province (after 1946 the *Land*) of Schleswig-Holstein in 1937, so that only Hamburg and Bremen survive as independent entities.

In the earlier years of their existence the free cities were under the jurisdiction of an imperial officer, who was called the *Reichsvogt* or imperial advocate, or sometimes the *Reichsschultheiss* or imperial procurator. As time went on many of the cities acquired the right of filling these offices with their own nominees, and in several instances the imperial authority fell practically into desuetude except when it was stirred into action by peculiar circumstances.

The internal constitution of the free cities was organized after no common model, but all of them were ruled by a town council (*Rat*) of a generally oligarchic composition, sometimes confined to a small number of patrician families, sometimes diluted by the entry of representatives of the trade guilds.

See COMMUNE (MEDIEVAL).

IMPERIAL CONFERENCE: *see* COMMONWEALTH OF NATIONS.

IMPERIALISM. Imperialism is the policy of a state aiming at establishing control beyond its borders over people unwilling to accept such control. Because of this unwillingness imperialist policy always involves the use of power against its victims. It has therefore often been considered morally reprehensible, and the term has been employed in international propaganda to discredit an opponent's policy. This polemic use is facilitated by the fact that the imperialist nature of a policy is sometimes difficult to discover. For in foreign policy many means and methods can serve either imperialism or other purposes, depending upon the motivation of their user. The manifold and sometimes subtle or hidden political, financial, economic, technical and cultural activities of one state in another may aim at the creation of sympathy, friendship or influence, but they may also be techniques to gain control. Often only the result of a given policy can tell what the intention has been; and many imperialist policies, ending in failure, remain undetected. However, enough have been successful throughout the ages to show that, though the term as here defined dates back to only the last half of the 19th century, the phenomenon it describes is as old as civilization and that ancient and modern imperialism have in common not only the end but many means.

HISTORY

Ancient Times.—In eastern Asia, the Chinese empires of the Chou, Ch'in and Han dynasties (*c.* 1122–256 B.C., 221–207 B.C., 202 B.C.–A.D. 221, respectively) and later the T'ang dynasty (618–906) extended over vast territories in the name of bringing the blessings of Chinese civilization to "barbarians." In northern India the dynasties of the Maurya (320–*c.* 185 B.C.) and later the Gupta (320–480) ruled over large empires without advancing any excuses and claimed suzerainty over tribes far beyond the borders of the empire.

The history of western Asia and the Mediterranean is an unending succession of empires, many building upon the ruins of preceding ones. About 25 centuries before Christ, Lugal-zaggisi united the Sumerians under his rule in Mesopotamia in what might have been the first Sumerian empire. It was followed around 2550 B.C. by the Semitic empire of Sargon of Akkad and thereafter by the second Sumerian empire lasting from the 22nd to the 21st centuries. The Babylonian empire came next. It was dominated by the personality of Hammurabi (*c.* 19th century B.C.) whose influence lasted into the Christian era, long after his empire had succumbed to the invasion of Indo-European tribes from eastern Europe.

The scene then shifted to the Nile where the Pharaohs established their empires from the 16th to the 13th centuries B.C. But in contrast to preceding rulers of empire, the Pharaohs could not expand their empire to coincide with the then known world. Failing to defeat the Hittites in northern Syria, they agreed upon peaceful coexistence, each guaranteeing the integrity of the other's empire.

The heritage of these two empires fell to the tyrannical empire of the Assyrians. It reached its apex around 660 B.C. and was soon thereafter, from the 6th to the 4th centuries, replaced by the Persian empire. Persian rule was in strong contrast to the Assyrian in its liberal treatment of subjected peoples, assuring it long duration.

It eventually gave way to the imperialism emanating from Greece. When Greek imperialism reached an apex under Alexander the Great (356–323 B.C.), a union of the eastern Mediterranean with western Asia was achieved. But the cosmopolis, in which all citizens of the world would live harmoniously together in equality, remained a dream of the great Alexander. It was realized when the Romans built their empire from Britain to Egypt and based it, ideologically, upon the Stoic and Christian concepts of the unity and brotherhood of man.

This idea of empire as a unifying force was never again realized after the fall of Rome. The nations arising from the ashes of the Roman empire in Europe, and in Asia on the common basis of Islamic civilization, pursued their own imperialisms. Imperialism became a divisive force among the peoples of the world.

Modern Times.—Some novel, mostly modern versions of old forces provided the impetus behind these modern imperialisms: nationalism (*q.v.*), industrialization, improved communications, discovery of new territories and even growing humanitarianism. People of all classes became involved in the drives for empire, though they acted on different motivations: merchants and missionaries, militarists and adventurers, nationalists and politicians.

Three periods stand out in the modern era in which competing imperialist policies of the nations led to the creation of vast empires, primarily of the colonial kind. Between the 15th century and the middle of the 18th, England, France, the Netherlands, Portugal and Spain built empires in the Americas, India and the East Indies. For almost a century thereafter relative calm in empire building reigned as the result of a strong reaction against imperialism. Then the decades between the middle of the 19th century and World War I were again characterized by intense imperialistic policies.

Russia, Italy, Germany, the United States and Japan were added as newcomers among the imperialistic states and indirect, especially financial, control became a preferred form of imperialism. For a decade after World War I the great expectations for a better world inspired by the League of Nations put the problem of imperialism once more in abeyance. Then Japan renewed its empire building with an attack in 1931 upon China, and under the leadership of the totalitarian states Japan, Fascist Italy, National-

Socialist Germany and Communist Russia, a new period of imperialism was inaugurated.

THEORIES

Ancient Views.—Wherever imperialism existed, men have attempted to find its causes, usually either to denounce or to excuse, if not praise it. The Chinese Mencius, around 300 B.C., condemned imperialism as the result of man's unending greed and acquisitiveness, especially the insatiable ambitions and covetousness of princes, advised by selfish ministers and false counselors. The mass of the people, he felt, want to live in peace and are disturbed and injured by imperialistic wars. The country as a whole, he claimed, suffered because the maintenance of newly acquired territory was a burden and eventually a loss when it fell prey to the competing imperialism of another country. He saw no political, economic or moral justification for imperialism. In contrast to the idea, widely held in China, that admission to the empire was a blessing, Mencius granted that there may be a moral duty to liberate a people from its tyrannical rulers but that, once liberated, every people has a right to choose its own rulers.

In contrast to China, where ideologically war was deprecated and considered unnatural, secular Hindu philosophy in India had extreme views on the warlike nature of man. Life was considered an eternal and ruthless struggle, in which every state was the enemy of every other neighbouring state.

Quite logically, the ancient Hindu writers, Kautilya in his *Arthasastra* prominent among them, advocated the worst imperialistic power politics. They suggested that a state must strive for world domination, for only by beating its enemies into subjection can it have peace. A state must therefore be ready for war at all times, though if the aim can be achieved by cheaper means, such as diplomacy, alliances or the threat of force, they, rather than war, should be used.

Among the Persians the idea was widespread that in building their empire they were fulfilling a divine mission. And, perhaps more than most ancient empire builders, they translated this idea into reality by treating the conquered peoples with justice and fairness and granting them a certain degree of autonomy, though not neglecting to draw the greatest possible economic profit from them.

Among the Greeks ideas about empire building differed. In Sparta military prowess and the conquest of neighbouring territories were the ideals. But Sparta was satisfied essentially with military greatness and never became a colonizing power. In Athens political parties existed favouring and deprecating imperialistic wars. Thucydides (5th century B.C.) justified the expansion of Athens under Pericles by pleading security. Pericles himself, in the words of Thucydides, added that "to be within the circle of our influence is not dependence but privilege." To Plato and Aristotle, the self-sufficient city-state was the ideal. Aggressive war, Aristotle wrote, was justified only against people destined "by nature" to be slaves. Otherwise, he condemned the building of empires as endangering the morality of the citizens and also the freedom of the state which cannot remain liberal toward its own people while being tyrannical toward its vassals.

The Stoics, in the latter days of Greek imperialism, developed the ideal of world citizenship on an equalitarian basis and turned it eventually into humanitarianism. This concept never was applied in Greek political practice, but it became the ideological underpinning of the Roman empire where it fitted into the existing political and social reality. Only later, when Stoic ideals gained a hold over important leaders of the empire did they exert a positive, directive effect upon the affairs of state. They finally fused with the Christian ideology and in the new form had a most fundamental effect deep into modern times.

Modern Views.—Considering the basic similarity in the patterns and the logic of imperialism throughout history, it is not surprising that in the thoughts of the ancients can be found the essence of all theories about the causes and value of imperialism. Modern thinkers have added refinements, elaborations, adaptations to modern conditions, and they have occasionally tried to support their views with evidence rather than dogma, but they have added little new knowledge. In their modern form, arguments about the causes and value of imperialism can be classified into four main groups.

The first group contains economic arguments and often turns around the question, does imperialism pay? Those who argue that it does and consequently advocate imperialist policies, from the English mercantilists to the German, Italian and Japanese totalitarians of the 20th century, point to the human and material resources and the outlets for goods, investment capital and surplus population provided by empire.

Their opponents, among them the physiocrats of France, Adam Smith, David Ricardo, J. A. Hobson, often admit that imperialism may benefit a small, favoured group but never the nation as a whole. Their reasoning ends in the advocacy of rectification of economic maladjustments in national economies and a liberalization of international economic relations so that in fact the benefits might be obtained which imperialism claims to but does not actually provide.

Marxist theoreticians have elaborated the economic aspects of imperialism in great detail. They interpret imperialism as a late stage of capitalism when the national capitalist economy has become monopolistic and is forced to conquer outlets for its overproduction and surplus capital in competition with the monopolistic economies of other capitalist states. This is the view held, for instance, by Nicolai Lenin and N. I. Bukharin to whom capitalism and imperialism are identical. Lenin argued further that the exploitation of "colonial slaves" moderated the oppression of the European workers and delayed their revolt. It would therefore hasten revolution in the developed countries to aid the emancipation of the colonial and semicolonial areas in the name of "nationalism." Marxist theory was thus reconciled with the nationalism of colonial peoples and both were made to serve the imperialist policies of the U.S.S.R. Moderate Marxists, such as Karl Kautsky and Rudolf Hilferding, have argued that imperialism is merely a possible, not an inevitable, policy of a capitalist state. One of the chief weaknesses in these arguments is that historical evidence does not support them and that they fail to explain precapitalist imperialism and communist imperialism.

A second group of arguments relates imperialism to the nature of human beings and human groups, such as the state. Such different personalities as Niccolo Machiavelli, Sir Francis Bacon, Ludwig Gumplowicz, Adolf Hitler and Benito Mussolini, reasoning on different grounds, nevertheless arrive at similar conclusions. Imperialism to them is part of the natural struggle for survival. Nature has made men unequal, and those endowed with superior qualities are destined to rule all others. Nations must prove their strength and virility in combat and the subjection of weaker peoples. Like all organisms, states must pass through a period of growth (*i.e.*, expansion).

In Mussolini's words, "Fascism sees in the imperialistic spirit [*i.e.*, the tendency of nations to expand] a manifestation of their vitality." Critics of these viewpoints, for the most part biologists, political scientists and social psychologists, point out that in addition to being illogical in many cases, there is no evidence to support them and that they rest on mysticism rather than demonstrable fact.

The third group of arguments has to do with strategy and security. Nations are urged, proponents of this viewpoint say, to obtain bases, strategic materials, buffer states, "natural" frontiers, control of communication lines for reasons of security or to prevent other states from obtaining them.

Those who deny the value of imperialism for these purposes admit that they have been a motivating factor, but they point out that security is not achieved. On the contrary, expansion of a state's control over territories and peoples beyond its borders is likely to lead to friction, hence insecurity, because the safety belts and spheres of influence of competing nations are bound to overlap sooner or later. Related to the security argument is the argument that nations are imperialistic in the search for power and prestige for their own sake.

The fourth group of arguments is based on moral grounds,

sometimes with strong missionary implications. Imperialism is excused as the means of liberating peoples from tyrannical rule or of bringing them the blessings of a superior civilization. The white man's burden of the English, the civilizatory action of the French, the manifest destiny of the Americans, the Greater East Asia Co-prosperity sphere of the Japanese, the Pan-Slavism of the Russians and the Pan-Germanism of the Germans, and the Liberation movements of the Communist Russians belong in this category. These arguments have been used increasingly as growing liberalism and popular awareness of the price of imperialism combined with mass participation in the political process have caused a political and moral revulsion against imperialism.

The foes of imperialism have claimed that these moral arguments were merely a disguise to deceive people and gain their support for imperialist policies. But they can hardly deny that, driven by nationalist fervour and convinced of the righteousness of the moral mission, large sections among the population of imperialist states have supported, even demanded imperialist policies for no other gain than the psychological satisfactions they derive from them. The "devil theory" of imperialism, that only ruthless profiteers have engineered imperialism, is not borne out by the facts of history.

On the contrary, historical evidence, such as that assembled by Jacob Viner, Eugene Staley and William L. Langer, and theoretical analysis, such as that by Joseph A. Schumpeter and Lionel Robbins, indicate that imperialism results from a complex of causes in which in varying degrees economic pressures, human aggressiveness and greed, search for security, drive for power and prestige, nationalist emotions, humanitarianism and many other factors are effective. Hence the difficulty of eliminating imperialism.

In the League of Nations and the United Nations attempts have been made to satisfy by peaceful means the legitimate aspirations of nations and to contain their illegitimate ones. Among the measures for these purposes are the collective security system, the mandate and the trusteeship system for dependent areas, the stimulation of cultural relations between nations, aid to underdeveloped countries and the improvement of health and welfare everywhere. *See* also EMPIRE.

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IMPERIAL PREFERENCE, the commercial system that arises when preferential rates (*i.e.*, rates below the general level of the tariff) are granted to one another by the constituent units of an empire. It may also include other sorts of preference, such as favourable consideration in the allocation of public contracts, indirect subsidies to shipping, preferential access to the capital market, etc. Preferential arrangements of one kind or another were enforced in the first half of the 20th century by most countries with dependent colonies; of these, the British imperial preference introduced in 1932 may be considered as the most important.

The dominions granted preferences to Great Britain and to one another early in the 20th century; and when Great Britain imposed tariffs on certain key-industries goods in 1919 and 1921 the dominions were given preferences, which were however only of nominal value to them. But when, by the radical change in tariff policy in 1931 and 1932, Great Britain removed the ban on the taxation of food imports, the way was open for a systematic policy of imperial preference, based on the principle of "home producers first, empire producers second and foreign producers last," negotiated at the Ottawa conference of 1932. The results were embodied in a series of bilateral agreements, which were to run for five years in the first instance (though they were allowed to run on after 1937 without formal renewal).

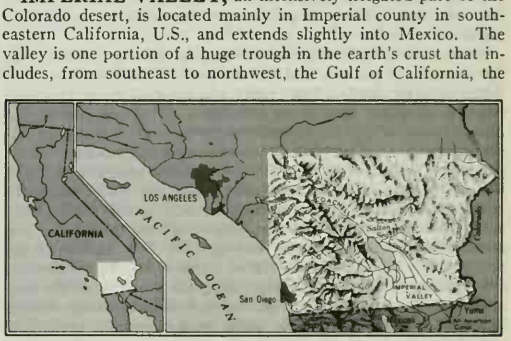
These agreements pledged the United Kingdom to allow the continued free entry of most empire goods and to impose new tariffs on certain food and metal imports from foreign countries; the dominions were to use their tariffs against United Kingdom produce in order only to protect efficient producers; and both sides were to maintain certain margins of preference. The political reasons for the agreements were strong, but the effect of the great depression and the search for "sheltered markets," as well as the spread of the protectionist spirit culminating in the Hawley-Smoot Tariff act (1930) in the United States, may have been more important. Intra-imperial trade increased after Ottawa, and empire trade as a proportion of an expanding world trade also increased in the 1930s. But other factors such as the recovery of the prices of primary products and the existence of the sterling bloc also contributed to this result.

During and after World War II exchange problems, commodity agreements and other factors had more effect than preferential tariffs. At the same time various events combined to erode the preferential system itself. The signature of the General Agreement on Tariffs and Trade (G.A.T.T.) in 1947—to which the partners of the Ottawa agreements subscribed—prohibited the extension of existing preferences, and in subsequent negotiations Great Britain and its partners agreed to some reductions of preferential margins. Inflation and trade liberalization meanwhile reduced the value of remaining preferences: by 1957 the average margin of preference on all goods of commonwealth origin entering the British market had fallen from 10–12% to 4%. Commonwealth trade also expanded at a much lower rate than trade between the industrialized nations of western Europe. During the negotiations on British entry into the European Economic Community in 1961–63 tentative agreement was reached on a gradual phasing-out of commonwealth preference, but the collapse of the talks left the system intact.

See ECONOMIC UNION.

See *Commonwealth Preference in the U.K.*, Political and Economic Planning (1960); *The Commonwealth and Europe*, Economist Intelligence Unit (1960). (R. PR.)

IMPERIAL VALLEY, an intensively irrigated part of the Colorado desert, is located mainly in Imperial county in southeastern California, U.S., and extends slightly into Mexico. The valley is one portion of a huge trough in the earth's crust that includes, from southeast to northwest, the Gulf of California, the



LEFT, MAP SHOWING POSITION OF IMPERIAL VALLEY IN CALIFORNIA; RIGHT, DETAIL OF THE VALLEY

delta fan of the Colorado river (including the Imperial valley), the Salton sea and the Coachella valley. The Imperial valley extends northward about 50 mi. from just south of the California-Mexico border to the southerly end of the Salton sea. It is flanked on the east and west by slightly higher and gently sloping areas (east mesa and west mesa) which rise to barren hills and mountains.

All of the valley is below sea level—barely below at the Mexican border and 235 ft. below at the edge of the Salton sea. Were it not for the broad, damlike deposits of the delta fan of the Colorado river, the waters of the Gulf of California would invade and drown the Imperial valley, the Salton sea basin and much of the Coachella valley.

The Imperial valley has a hot desert climate, similar in many

respects to that of the Sahara in Africa. The average temperature of the hottest month (July) is about 92° F. (33.33° C.), and shade temperatures may at times reach 124° F. (51.11° C.). The coolest month (January) averages about 53° F. (11.67° C.), although cool-season temperatures may drop as low as 20° F. (−6.67° C.) for a few hours in some years. Four months of the year average above 80° F. (26.67° C.), seven above 70° F. (21.11° C.) and only three average below 60° F. (15.56° C.). Rainfall is very meagre and uncertain from year to year; the average annual rainfall is about 3.5 in. The combination of high temperatures, abundant sunshine and numerous strong and drying winds makes the scant rainfall extremely ineffective.

Before 1900 the Imperial valley was a virtually uninhabited waste. The change from desert waste to green fields was accomplished by diverting water from the Colorado river to the deep, rich soils of the desert plain. This began with the opening of the Imperial canal (about 50 mi. of which curved through Mexico) in May 1901. Disaster struck in 1905 and 1906 when Colorado river floodwaters destroyed diversion controls and the flow of the river poured northward into the Salton depression to create the Salton sea. Not until early 1907 was control re-established. The area continued to face the possibility of new breaks, and not until the completion of Hoover dam in 1935 did major flood threat cease. In 1940 the All-American canal was completed and the valley became independent of the old Imperial canal. Chief products of the valley are beef cattle, sheep, lettuce, tomatoes, carrots, melons, sugar beets, alfalfa, barley, flax, cotton and dairy products. The chief cities and commercial centres are El Centro (*q.v.*) and Brawley.

By 1907 the Salton sea was about 40 mi. long and 13 mi. wide, covered over 400 sq.mi. and had a surface 195 ft. below sea level. In the next five years the water level fell 25 ft. and it was predicted that, because of evaporation, the sea would disappear by 1920, but it continued to exist because of irrigation drainage water fed into it from the Imperial and Coachella valleys. In the middle part of the 20th century the supply of drainage water greatly increased and in the early 1960s the sea covered nearly 300 sq.mi. and had a surface 234 ft. below sea level.

See also COLORADO RIVER. (R. M. GL.)

IMPERSONATION, or false personation, a form of fraud consisting in a false representation by one person (by words or conduct) that he is another person or that he occupies a position that he does not in fact occupy. The impersonator may be liable civilly to any person injured by his deception. He may also be prosecuted criminally under any one of a variety of modern statutes embracing the particular kind of impersonation he has committed.

In neither England nor the United States is there any general statutory prohibition of impersonation, but rather a number of separate offenses, created in response to specific situations, and bearing no obvious relation to each other. Impersonation as a means of obtaining property by false pretenses may be dealt with separately by statute, but in any event is implicitly covered by the law of false pretenses.

In the United States it is a federal offense falsely to represent oneself to be a citizen of the United States or an officer or employee of the United States. A variety of impersonations is forbidden under state law, usually confined to impersonation for an enumerated purpose or purposes. Thus, it may be an offense to impersonate a war veteran or a member of the Red Cross for the purpose of soliciting charitable contributions. The gist of the offense is typically the obtaining of monetary or other advantage by virtue of the impersonation rather than the impersonation itself. So viewed, the numerous special statutory offenses dealing with impersonation all derive from the common law of cheating. *See* also FRAUD. (H. L. PR.)

IMPHAL, the capital town of the Union territory of Manipur, India, lies 2,500 ft. above sea level in the valley of the Manipur river, about 400 mi. E.N.E. of Calcutta. Pop. (1961) 67,717. It is inhabited by Manipuris, a Tibeto-Burman race, who are mostly Vaishnava Hindus and are known for their classical music and Manipuri dance. Imphal was formerly the seat of the historical Manipur kings (*see* MANIPUR). Imphal college, Imphal Training college and Dhana Manjari college are affiliated to the Gauhati university in Assam and there are three high schools and a technical school. Imphal is a centre of cottage industries, especially weaving, brassware and bronzeware. A hard-surface road links the town with the North-Eastern railway at Manipur Road (Dimapur), 134 mi. to the north. Another road runs southeast to Tamu on the Burmese border. Regular air services operate from the airstrip in Imphal to Gauhati and Calcutta. (M. BA.)

IMPHAL, BATTLE OF (1944), an engagement of World War II in which the Japanese threat to India was finally checked by the British 14th army (consisting of British, Indian and Gurkha units) commanded by Lieut. Gen. (later Field Marshal Sir William) Slim.

At the beginning of 1944 the Japanese forces in Burma, under Lieut. Gen. M. Kawabe, saw the possibility of a breakthrough into Assam that would destroy the 14th army and, by isolating China, force the Chinese to a separate peace. General Slim, seizing the opportunity for a decisive battle, decided to concentrate the IV corps of three divisions (under Lieut. Gen. Sir Geoffrey Scoones) and, supplied and supported by British and U.S. air forces, to fight the battle on ground of his own choosing on the Imphal plain. This concentration involved the withdrawal of the 17th Indian division (Maj. Gen. D. T. Cowan) and the 20th Indian (Maj. Gen. D. D. Gracey), which were in contact with the Japanese around Tiddim (about 160 mi. S. of Imphal) and in the Kabaw valley respectively.

Though the plan was to withdraw before the Japanese attack, the 17th division became heavily involved in the attack by the Japanese 33rd division (Maj. Gen. N. Tanaka), which began on March 6. Making a fighting withdrawal on foot, it was not only cut off from Imphal by a strong Japanese force 60 mi. N. of Tiddim, but was also subjected to numerous local outflanking movements. The 20th division's withdrawal was heavily pressed, but by March 22 the division was successfully concentrated in Moreh on the southwestern approach to the plain, where an enemy attack was repulsed with heavy losses in men and tanks.

Gen. Scoones used part of his reserve, the 23rd (Indian) division (Maj. Gen. Ouvry Roberts), to move south against the enemy to assist the 17th. After heavy fighting the 17th joined up with leading elements of the 23rd and reached Imphal on April 5.

During the withdrawal to Imphal it became apparent to General Slim that the 31st Japanese division (Maj. Gen. K. Sato) was driving for Kohima and Dimapur. The loss of the base and railhead at Dimapur would have nullified any success at Imphal. The resultant battle of Kohima was entrusted to the XXXIII Indian corps (Lieut. Gen. Sir Montague Stopford), but in Slim's mind Imphal and Kohima were fought as one battle. Air support and supply were introduced on a scale never before contemplated.

During April and early May the IV corps, now reinforced by the 5th Indian division (Maj. Gen. H. R. Briggs) and strongly supported by the Royal Air Force, fought a battle of attrition with the Japanese, who continued to press on the six routes converging on Imphal. The most serious threat came from the Japanese 33rd division which, repulsed on the Tiddim road, made an outflanking movement to the Silchar track coming in from the west.

By the middle of May, General Slim could turn to the offensive, and General Scoones launched the 5th and 20th divisions against the 15th Japanese division in the east while the 17th division held firm against the last bold effort by the 33rd Japanese division to capture Imphal. On June 22, the 5th division joined up with troops of the XXXIII corps moving south from Kohima. The 14th army had overcome the fierceness and courage of the Japanese in defense and also the extreme difficulty of the jungle country under torrential monsoon rain. It could now prepare the advance into Burma.

The British lost 12,600 killed or wounded. The Japanese records do not separate Imphal from Kohima: in the two battles they admitted to 22,100 killed or missing in action and 8,400 deaths from disease; the wounded were estimated at almost 30,000.

See Field Marshal Sir William Slim, *Defeat Into Victory* (1956).

(E. K. G. S.)

IMPORT DUTIES: *see* TARIFF.

IMPORTING is the process of bringing goods from abroad into one's own country for domestic consumption or transformation; it adds to the material resources of a country. Goods in direct transit that move through a country for purposes of transport only, tourists' and travelers' effects not acquired abroad, goods for exhibition and goods destined for use of foreign embassies—all these do not add to the material resources of the country and are not regarded as imports. Nor should the inflow of foreign currencies, securities and gold be so considered, since their movements change monetary and financial rather than material resources—unless, in the case of gold, the gold content in an imported object is less than 80% of its total value. "Invisible imports," such as the purchase of foreign shipping services, do not deal with goods, and because services are generally rendered in the domicile of the caterer, their exclusion from the definition does not violate the reality as it would in the case of domestic marketing. This definition follows closely the concept underlying the standard international trade classification adopted by the United Nations. Importing, therefore, is part of the general process of marketing.

Importing Channels.—The import market structure is composed of three categories. In the first are import merchants, who buy from abroad on their own account, assume entire merchandising risks, carry goods in stock, engage in sorting, grading, cleaning, mixing and blending and do the physical importing. They generally specialize insofar as products and regions of supply are concerned. Indent houses belong to this group, but they buy from abroad only on orders from domestic customers. The second category comprises import agents, including import commission houses, commission merchants and resident agents or sales offices representing foreign supply. They sell to the domestic market on a commission basis for foreign exporters, usually with exclusive rights; they often attend to customs and details of shipments. Finally there are import brokers who, because of the need for knowledge of markets, grades, quality and trade practices, specialize in one or only a very few staples produced in many countries and by many individual producers (coffee, rubber, sugar, cocoa beans). They collaborate closely with export brokers abroad and normally act as intermediaries in bringing many domestic buyers (themselves not final consumers) and many foreign sellers together on specific lots either on the spot, already afloat or to be shipped from abroad. Unlike import agents, they are not at all associated with physical movements of goods or customs clearance.

This classification is made for analytical purposes only, for in actual practice the functions of the operators in these three categories greatly overlap and many of them carry on exporting as well as importing activities. Their relative importance varies according to product. International staples are handled in the first instance by import brokers and sometimes by import merchants who, together with import agents, generally deal with semimanufactures and finished products. Some imports, consumer goods in particular, may even bypass the market structure through the use of correspondence, samples or catalogues and reach the final user by parcel post.

In underdeveloped countries where imports consist mainly of consumer goods, foreign firms traditionally have dominated the importing structure and will probably continue to play an important role as more and more capital goods are imported for national development. In industrialized countries the import agencies, generally operated by nationals, serve a good part of the domestic market well. They have to see to it that the foreign sources of supply are reliable as to design, quality, delivery dates and prompt delivery on reorder of identical products.

However, their services are not always satisfactory to large concerns in retailing, wholesaling and manufacturing. Modern merchandising methods require product differentiation and close co-ordination between production, sales promotion activity, inventory and changing consumer tastes in style, colour and pattern. Thus many large department stores and wholesalers establish purchasing agents abroad or send out traveling buyers in order to look after proper designing and uniform quality, to assure continuity of supply and to keep abreast of changes occurring constantly in foreign production. Other retail stores buy direct either through resident buying offices abroad that are under their own management or under indigenous management (commissionaires) or through branch offices or co-operative offices supported by groups of stores.

In some trades, manufacturing in particular, the problem of availability of supply (not to mention continuous supply at stable prices and in uniform quality) looms very large and has led many big corporations to acquire, develop and maintain full authority over foreign sources of supply (mining, rubber, bananas) with the express purpose of bringing the products back to their own country for processing or consumption. The same type of consideration underlies the "bulk purchase agreements" between national governments, such as that entered into by Great Britain from 1946 to 1951 to buy the exportable surpluses of various New Zealand and Australian farm products at prices negotiated annually.

In a socialist economy the market structure differs considerably. Importers, wholesalers and retailers there are, but they are part of the state trading machinery. Foreign trade is a state monopoly and importing as well as exporting may be as much a weapon of economic warfare as it is a method of trade development.

Importing Procedure.—Every important trading country has its own laws governing imports with respect to documentation, packing, labeling, marking and customs clearance. (A separate set of regulations applies to personal baggage of nonresidents and returned residents.) The legal requirements are precise and deviation may result in financial losses, heavy penalties and in some cases even imprisonment. The most complicated among them is customs clearance, which consists of customs entry, appraisement and liquidation. For example, effective in the United States are 22 types of entry, each serving a particular purpose, and as many as five different bases of customs valuation (foreign value, export value, U.S. value, constructed value and American selling price). In the case of the United Kingdom imports are valued c.i.f., meaning that the value includes cost, insurance and freight. When goods are consigned to the United Kingdom for sale, they are valued at the latest sale value of such goods in the United Kingdom. Procedures in other major trading countries are no less elaborate.

Both the basis of valuation and the classification of the imported article for tariff purposes affect the amount of duty to be assessed. While the work of clearing import shipments may be relegated, as it is by many importers, to licensed customs brokers at reasonable costs, the uncertainty as to the amount of duty to be paid (especially on new products, novelties and specialties) remains and this partly explains the high margin in import pricing. Often appraisement entails delay in releasing the goods, and the delay might be prolonged if the importer appeals the decision of the appraiser to a higher authority. Free ports, free-trade zones and foreign-trade zones help consignment and re-export trade; but when the goods landed there proceed to the hinterland, the same customs clearance procedure applies. Complicated administrative regulations and procedures, costly to importers and consumers, may be regarded as an "invisible tariff," affecting, however, both duty-free and dutiable imports.

Importing and National Policy.—All trading nations have government boards, bureaus or ministries charged with the responsibility of assisting their own importers as well as exporters. In the United States, for example, the bureau of foreign and domestic commerce, with the help of the department of state foreign service personnel, provides importers with statistical aid relating to actual imports, reports on foreign producers as reliable sources of supply, indirect aid by means of information given to foreign producers and exporters, and surveys and analyses of domestic markets for imports. An import advisory committee to help importers functions in the office of international trade. And the Export-Import bank, a federal agency originally organized in 1934 to finance trade with the Soviet Union, has the task of assisting exporters and importers when adequate financing is not available to them from more common sources such as commercial banks and other private agencies.

As profit-seeking businesses, importing firms strive to secure goods in domestic demand from the cheapest source in terms of total outlay for purchase price and transfer cost. In actual practice this freedom is variously prescribed in different countries. Some imports are banned for reasons of public health (certain food and drugs), public morals (obscene literature), public taste (advertising matter) and fair trade practices (dumping, goods with infringing trade-marks). Although by no means uniform among countries, this type of embargo list is designed to protect public interests and tends to remain substantially unchanged in a country over long periods of time.

There is, however, great variation among countries in respect of a large group of control measures, each designed to attain a definite national policy objective and subject to modification as policy changes. The objective may be to raise revenue for the national treasury, to protect certain domestic industries, to give preference to products from certain areas, to restore equilibrium in the over-all balance of international payments, to maintain the international current account balanced with each particular trading partner, to reduce purchases that require "hard" or scarce currencies, to promote the import of essential producer and consumer goods against nonessential items, to safeguard state monopolies or to give effect to a domestic price- or income-support program which is susceptible to the depressing influences of imports.

Among the various instruments of control, the import tariff is the most widely used, either primarily for revenue or for protection purposes. A national tariff schedule is generally divided into the dutiable and the free list. Goods on the duty-free list are usually those that the country does not produce or prefers to import for political reasons (*e.g.*, Philippine sugar to the United States from 1916 to 1955). The dutiable list specifies three different levels of duty for all or some commodities: the highest is applicable to imports from countries that do not enjoy the most favoured nation treatment; the next, to those that do; and the lowest, to those accorded preferential treatment (the British imperial preference system). The duty rates are either ad valorem (*i.e.*, a fixed percentage of the imported value to be determined) or specific amounts of money per unit of quantity or weight (gross, legal or net) or a combination of the two. In some countries, certain imports are also subject to excise taxes after they have been cleared through customs. Heavy duties and taxes, however, do not necessarily bar importation completely as long as the domestic market is willing to pay high enough prices for the goods in question.

Import quotas, import licensing and foreign exchange allocation are measures of quantitative restriction. There are many types of quotas relating to imports. The tariff rate quota provides for the entry of a specified quantity of the quota product at a reduced rate of duty during a given period and unlimited quantity above the quota at higher rates; the so-called mixed quota requires domestic manufacturers to use a minimum proportion of domestic materials in combination with imported materials. In contrast, the absolute quota fixes the quantity of total imports of the quota product during a given period. It may be global with no discrimination against any one of the exporting countries or allocated to each one of them by unilateral action or by bilateral negotiation.

Import licensing restricts importation of all or specified products by permit, and is often used in conjunction with allocated quotas or when the quotas are not publicly announced. Foreign exchange control usually accompanies foreign trade control; import restriction is exercised through allocation of exchange at official rates for certain imports and through limitation of the amount of exchange to be sold in the officially controlled "free" market.

Most of these measures, including the tariff, tend to favour certain producers and commercial firms at the consumers' expense, or to discriminate among the trading countries or both. Import control thus stands in contrast to public regulation of domestic marketing activities, which frequently takes consumers' interests as the point of departure.

See also EXPORTS; TRADE, INTERNATIONAL.

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IMPRESARIO, the contractor or promoter of an enterprise (from the Italian, *impresa*, an undertaking), specifically of concert and operatic ventures. The impresario was a person of musical judgment who negotiated tours of musicians, often abroad, when wider international fields were opened up at the end of the 19th century. Gabriel Astruc in Paris, Harold Holt in London and Arthur Judson in the United States were impresarios responsible for tours of this kind. With the 20th-century mechanical diffusion of music and its partial control by municipal or state organizations the impresario's role was gradually taken over by the agent.

IMPRESSIONISM. The term impressionism, first used, derisively, by a journalist, was taken from Claude Monet's canvas representing the effect of the sun rising over the sea and entitled "Impression." The painting was shown at an exhibition (April–May 1874) organized by a group of young painters whose work had been rejected by the official Salon. The word later spread throughout the world to refer to the first revolutionary movement of modern painting, of which the chief exponents were Manet, Degas, Monet, Renoir, Pissarro, Sisley, Cézanne, Guillaumin and Berthe Morisot (*qq.v.*).

Two periods are distinguishable in its development: a preparatory phase (1862–71), which, led by Manet, was hastened by the influence of two forerunners of Impressionism, Eugène Boudin and J. B. Jongkind (*qq.v.*), and by the introduction of Japanese prints to western attention; and, after Monet's and Pissarro's stay in England (1870–71), a phase of development, also called the Argenteuil phase because it centred around Monet who was then living in that charming village on the outskirts of Paris. From 1880 onward the movement broke up and the last and eighth exhibition of the group, in 1886, confirmed its disintegration. Each of its founders developed his own individual technique, and other trends emerged.

Freed from academic fetters and artistic conventions, at one and the same time reacting against the romanticism of literary inspiration and the social tension of realism, Impressionism inaugurated independent painting based on the pure colours of the prism and the splitting-up of "tone" into its component colours. An expression of outdoor modern life, its chosen subjects were Paris and urban scenes, the coasts of the English channel and the North sea or the little village resorts on the banks of the Seine and Oise, made accessible by the railway. Influenced by what is spontaneously perceived, the Impressionists tried to convey the changing rhythm of appearances under the universal vibration of light, the rendering of which was the principal characteristic of their style.

See also PAINTING: *France: 19th Century;* and references under "Impressionism" in the Index.

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IMPRESSIONISM, MUSICAL. The word impressionism, borrowed from painting, was principally applied as a musical term to the music of Claude Debussy and later adopted to describe music of French associations of the post-Wagnerian period. An early use occurred in a letter of Renoir of Jan. 14, 1882, in which, referring to a conversation with Wagner, he wrote, "We spoke of the Impressionists of music." In 1887 the *Journal Officiel* criticized the "vague impressionism" of Debussy's *Printemps*. The

term was used in a laudatory sense by Belgian critics in 1894 in reference to Debussy's String Quartet, which was played in the hall of an exhibition in Brussels of paintings by Renoir, Pissarro, Sisley, Gauguin and others. On the same occasion, Maurice Kufferath spoke of Debussy's "musical pointillism" and stated that his music suggested "the neo-Japanese canvases painted in Montmartre."

The term was later used by Jean d'Udine to describe the subtle orchestration of Debussy's *Nocturnes* and by Romain Rolland in writing of *Pelléas et Mélisande*. Though Debussy himself compared the original form of his *Nocturnes* to "a study in grey in painting" and frequently sought the musical equivalent of a visual image, so that his work shows a strong aesthetic affinity with that of contemporary painters, there was no conscious imitation of Impressionist methods in his music, nor in that of Emmanuel Chabrier, who possessed an important collection of Impressionist paintings.

Comparisons in technique, such as that between the broken chords in Debussy's *Reflets dans l'eau* and the reflection of clouds in water in Monet's "La Grenouillère" or between a bold use of solo instruments in the orchestration of Chabrier and the use of primary colours by the Impressionist painters, were therefore conjectural.

In the first quarter of the 20th century the term was applied in a general sense to the works of many other composers (not all of them French) including Ravel, Delius, Scriabin and Stravinsky. Since an affinity with the aesthetic of the Impressionist painters in the work of such composers was remote, impressionism acquired a period sense, comparable to the use of the terms classical and romantic, and was used loosely to describe a variety of trends in post-Wagnerian music. (E. Lr.)

IMPRESSMENT, the exercise of the authority of the state to "press" or compel the service of its subjects for the defense of the realm. In England impressment may be looked upon as an erratic, and often oppressive, way of enforcing the common obligation to serve in "the host" or in the *posse comitatus* (power of the county). In Scotland, where the feudal organization was very complete in the lowlands and the tribal organization no less complete in the highlands, and where the state was weak, impressment was originally little known. After the union of the two parliaments in 1707, no distinction was made between the two divisions of Great Britain.

In England the kings of the Plantagenet dynasty caused Welshmen to be pressed by the lords marchers and Irish kerns to be pressed by the lords deputy for their wars in France. Complaints were made by parliament of the oppressive use of this power as early as the reign of Edward III, but it continued to be exercised. A small sum called imprest money or coat and conduct money was given to the men when pressed to enable them to reach the appointed rendezvous. Soldiers were secured in this way by Queen Elizabeth I, by Charles I and by the parliament itself in the Civil War.

The famous New Model army of Cromwell was largely raised by impressment. Parliament ordered the various county committees to select recruits of "years meet for their employment and well clothed." After the Glorious Revolution of 1688 parliament occasionally made use of this resource. In 1779 a general press of all rogues and vagabonds in London to be drafted into the regiments was ordered. It is said that all who were not too lame to run away or too destitute to bribe the parish constable were swept into the net. As they were encouraged to desert by the undisguised connivance of the officers and men who were disgusted with their company, no further attempt to use the press for building up the army was made.

Armies on the continent were also made up in large part of men who had been impressed. They had been taken from jails, snatched from taverns while drunk or kidnapped in dark streets or alleys. "Press gangs," as the military or naval parties that impressed men were known, were as common in France and Prussia as they were in England. The fighting qualities of troops obtained in this manner were usually incredibly poor.

The impressment of sailors for the Royal Navy was regarded as a prerogative of the crown. From an act of Philip and Mary (1556) it appears that the watermen of the Thames claimed exemption from the press as a privileged body. They were declared liable, and the liability was clearly meant to extend to service as a soldier on shore.

In the reign of Elizabeth I, an act was passed (1563) to define the liability of the sailors. It is known as "an act touching politick considerations for the maintenance of the navy." By its term all fishermen and mariners were protected from being compelled "to serve as any soldiers upon the land or upon the sea, otherwise than as a mariner, except it shall be to serve under any captain of some ship or vessel, for landing to do some special exploit which mariners have been used to do." The operation of the act was limited to ten years, but it was renewed repeatedly, and was at last indefinitely prolonged in the reign of Charles I (1631).

The justices of the peace in the coast districts, who were often themselves concerned in the shipping trade, were not always zealous in enforcing the press. The pressed sailors often deserted with the "imprest money" given them. Loud complaints were made by the naval officers of the bad quality of the men sent up to serve in the king's ships. On the other hand, the press gangs were accused of extorting money, and of making illegal arrests. In the reign of Queen Anne (1703) an act gave parish authorities power to apprentice boys to the sea and exempted such apprentices from the press for three years, and until the age of 18. It especially reaffirmed the part of the Vagrancy act of 1597 which left rogues and vagabonds subject to be pressed for the sea service. By an act of 1740, all men over 55 were exempted from the press, together with lads under 18, foreigners serving in British ships and landsmen who had gone to sea during their first two years. The act for "the better supplying of the cities of London and Westminster with fish" gave exemption to all masters of fishing boats, to four apprentices and one mariner to each boat and all landsmen for two years, except in case of actual invasion.

Subject to such limitations as these, all seafaring men and watermen on rivers were liable to be pressed between the ages of 18 and 55, and might be pressed repeatedly for so long as their liability lasted. The rogue and vagabond element were at the mercy of the justices of the peace. The frightful epidemics that desolated the British navy till late in the 18th century were caused largely by infections brought by the prisoners drafted from the ill-kept jails of the time. Even merchant ships were stopped at sea and the sailors taken from them. On one occasion, in 1802, an East Indiaman on her way home was deprived of so many of her crew by a man-of-war in the Bay of Biscay that she was unable to resist a small French privateer and was carried off as a prize with a valuable cargo.

In 1795 it was found necessary to impose on the counties the obligation to provide a quota of men, at their own expense. The local authorities provided the recruits by offering high bounties, often to debtors confined in the prisons.

The impressment of seamen from United States vessels during the Napoleonic Wars was one of the causes, though probably not the primary cause, of the War of 1812. The trouble stemmed from the British government's adherence to the generally accepted doctrine of inalienable allegiance: once a British subject always a British subject. The U.S. government advanced a new, revolutionary concept that every man was free to change his allegiance at will.

Between 1790 and 1812 thousands of British seamen, some deserters from the Royal Navy, signed up on ships of the thriving U.S. merchant marine and claimed U.S. citizenship. To cope with this problem the British insisted upon the right to board neutral ships on the high seas in search of deserters and British subjects liable to impressment. Because of the common language of the two countries and the abuses that grew up around the issuance and illegal sale of U.S. citizenship papers, the difficulty of determining a man's citizenship was great. Desperate for men to continue the fight against Napoleon, British boarding parties sometimes impressed bona fide U.S. citizens.

After the conclusion of the Napoleonic Wars in 1815, the power

of the press was not again exercised. In 1835 an act was passed during Sir James Graham's tenure of office as first lord of the admiralty by which men who had once been pressed and had served for a period of five years were to be exempt from future impressments. Sir James, however, emphatically reaffirmed the right of the crown to impress seamen. The introduction of engagements for a term of five years and then of long service produced a large body of voluntary recruits. With better pay and working conditions, service in the navy became so popular that the question had no longer any interest save a historical one. In the 20th century compulsory service, both in the navy and army, once more became necessary, but it was then referred to by such terms as conscription (*q.v.*), national service or selective service.

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IMPRIMATUR. In Roman Catholic canon law permission of the bishop is required for the publication of any work on Sacred Scripture, dogmatic, moral or ascetical theology, or, in general, writings containing anything of peculiar significance to religion or morality (can. 1385, sec. 1). Strictly speaking, the *imprimatur* ("let it be printed") is nothing more than this permission. But because its concession must be preceded by the favourable judgment of a censor (*nihil obstat*, "nothing hinders [it from being printed]"), the term has come to imply ecclesiastical approbation of the publication itself. This does not mean episcopal endorsement of the content, nor is it a guarantee of doctrinal integrity. It does indicate that ordinarily prudent means have been taken to assure the worthiness of the book, and that nothing offensive to faith or morals has been discovered (*cf.* can. 1393, sec. 2).

By the Licensing act of 1662, a "royal imprimatur" was required for all books printed in or imported into England; the act expired in 1695.

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IMPROMPTU, a name used in the 19th century as the descriptive title of pieces for the piano, from the French, *impromptu*, unpremeditated or improvised. The style of the music is similar to that of other compositions of this period, with such titles as *fantaisie*, caprice and bagatelle. In England, from the 16th century onward, music improvised by a performer, generally at the harpsichord or organ, in the form of a prelude to another composition, was known as a voluntary. The name impromptu first appeared in 1822 as the title of piano pieces by Jan Hugo Vorisek and Heinrich Marschner. In 1824 Liszt wrote an "Impromptu on Themes of Rossini and Spontini." These, and the impromptus by Chopin, Schumann and others, may have been intended to convey the impression of improvised pieces, but since they first appeared in their published form they were not actually extempore works. This also applies to the first set of impromptus by Schubert, so called by his publisher. An improvised impromptu of this period is the 13-bar "Allegretto quasi andante" dedicated by Beethoven to a granddaughter of Charles Burney. No definite form is prescribed for the impromptu, which may resemble a prelude, a set of variations or be freely conceived in the form of a fantasy. Among the impromptus of a later period are those of Gabriel Fauré and Alexander Scriabin.

IMPROVISATION (EXTEMPORIZATION) in music means composing and performing simultaneously; *i.e.*, literally making it up as you go along. Music originated as improvisation and is still extensively improvised in eastern traditions and in the modern western tradition of jazz (but this is an offshoot of African music with a higher proportion of genuinely primitive inspiration than is usually realized).

In antiquity and in many eastern schools with ancient traditions, elaborate modes (*i.e.*, forms of scale) developed for codifying melodic and rhythmic patterns. Different subjects, different emotions and even different localities are associated with different modes, between which any possibility of confusion is rigorously resisted. Knowing their modes well and preserving them jealously, musicians can improvise long compositions within the boundaries thus set. Important examples of this method of improvisation are encountered in the early history of European church music, including the Byzantine school of the so-called dark ages (*see* BYZANTINE MUSIC) and the astonishing Notre Dame school of music in medieval Paris. There the foundation was written down as plain chant and maintained according to strict and conservative rules; yet it was the originally improvised additions to it which led to a written art of flexible melody subtly combined into "horizontal" harmony by counterpoint; *e.g.*, the Renaissance polyphony of Josquin, Byrd or Palestrina. (*See* also COUNTERPOINT; HARMONY; PLAINSONG.)

Outside this central tradition in western music, full "vertical" harmony was already being improvised within conservatively established modes (orally transmitted) by Welsh and other harpers of the Celtic fringe. The nearest surviving equivalent (though it is melodic rather than harmonic) is the highly developed and sophisticated Hindu tradition. Another and vast field in which improvisation has always played a vital part is folk music.

The delight taken by Renaissance organists, harpsichordists, lutenists, viol players and other instrumentalists in adapting plain vocal compositions to the idiosyncracies of their instruments by insinuating the most elaborate variations impromptu did more than anything else to develop the specifically instrumental idioms which have been the glory of western music since the 16th and 17th centuries.

Certain types of composition came into being through the same spontaneous outpouring of invention. The prelude and the toccata ("touch-piece") were at first informal improvisations to loosen the fingers, check the tuning (*e.g.*, of a lute), establish the tonality and put both performer and audience at their ease. The chorale prelude started as improvisations on a hymn tune by church organists at suitable interludes in the service. The theme and variations grew out of that most sophisticated of early parlour games: improvising contrapuntal descants on a given plain chant, or free variations on a ground bass (divisions on a ground) or the like.

A favourite 18th-century development of this, continued frequently in the 19th century and occasionally (*e.g.*, by French virtuoso organists) in the 20th, was improvising not merely variations but a formal fugue on a theme handed up by a member of the audience—not necessarily an accomplice of the performer. The art was quite genuine; and there were listeners who put it on record that the improvisations of John Bull and Frescobaldi, of Bach and Handel, of Mozart and Beethoven, of Liszt and Busoni impressed them as being almost as highly organized as, and in some ways even more moving than, the written-out compositions of these composers.

That impression may have been in part due to the excitement of hearing great music spontaneously shaped and no sooner shaped than lost again. Some allowance must also be made for the composer's bringing memory to the aid of invention in the spirit of that "offhand discourse which (all nature, no art)" as Browning tells us in his poem "Englishman in Italy," "the Dominican brother, these three weeks, was getting by heart." No one can genuinely improvise outside an existing tradition with which he is intimately familiar. But this is a condition which applies almost as strictly to composition in its ordinary, written form. A composer can only modify the existing tradition because he has the indispensable advantage of having grown up inside it. The primary patterns out of which music is built up are archetypal in the sense that everyone inherits a predisposition to produce them and to understand them when other musicians produce them. It is because these archetypes not only well up from within the musician's consciousness, but, to a certain extent, organize themselves by their own autonomous nature that genuine improvisation can happen. *See* also ORNAMENTATION. (R. DO.)

IMPROVISATORE (Italian, *improvvisatore*), a word for a poet who recites verses which he composes on the spur of the moment. It became recognized as an English word in the middle

of the 18th century and is used by Tobias Smollett in his *Travels* (1766). The feminine form is *improvisatrice*. (G. W. A.)

IMROZ (Imbros), a Turkish island in the Aegean sea, is situated 10 mi. off the southern end of the Gallipoli (Thracian Chersonese) peninsula. Pop. (1960) 5,791; area about 112 sq.mi. Herodotus (v. 26) mentions it as an abode of the historic Pelasgians (*q.v.*). The island is mountainous (maximum height 1,930 ft.) and is composed mainly of volcanic and tertiary rocks and is structurally a part of the mainland. Administratively it is a *bucak* (district) of Canakkale *il* (province). Imroz town is in the eastern part of the island. Wheat, oats, barley, olives and grapes are grown; grapes and wine are exported. The island, occupied by Greece during and after World War I, was an important base for the Allied operations during the Gallipoli campaign. It was returned to Turkey by the treaty of Lausanne (1923).

(N. Tu.; S. Er.; E. Tu.)

IMRU'-AL-QAYS (Amru-'l-Kais; 6th century A.D.) Arabian poet and author of one of the Mu'allaqat (*q.v.*), was regarded by Mohammed and others as the most distinguished poet of pre-Islamic times. He was of the kingly family of Kinda, and his mother was of the tribe of Taghlib. While he was still young, his father was killed by the Bani Asad (a rebel Bedouin tribe) and his life was devoted to the attempt to avenge his father's death. He wandered from tribe to tribe to gain assistance, but his attempts were always foiled by the persistent following of the messengers of Mundhir, king of Hira. By means of Harith of Ghassan he procured an introduction to the Byzantine emperor Justinian I. After a long stay in Constantinople he was named phylarch of Palestine, and received a body of troops from Justin II. With these he started on his way to Arabia. The story that he was charged before the emperor with the seduction of a princess and that Justin sent him a poisoned cloak, which caused his death at Ancyra (Ankara), is generally regarded as legendary.

Bibliography.—His poems were published in W. Ahlwardt's *The Divans of the Six Ancient Arabic Poets* (1870) and in McG. de Slane's *Le Diwan d'Amro'lkais* (1837). *See* also G. Olinder, *The Kings of Kinda* (1927); R. A. Nicholson, *A Literary History of the Arabs* (1953).

IMSCHOOT, PAUL VAN (1889–), Belgian scholar who encouraged the acceptance in the Roman Catholic Church of the sound conclusions of critical biblical studies, was born in Ghent on Sept. 17, 1889. He studied theology in Rome at the Gregorian university and the Pontifical Biblical institute but was prevented by World War I from completing his doctorate. Ordained priest in 1912, he was for three years professor at the episcopal college at Eeklo and professor of Scripture in the Grand Séminaire Episcopal at Ghent (1919–47), where he succeeded Canon Camille van Ongeval and Canon (later Bishop) Honoré Coppieters. He became honorary canon of Ghent cathedral in 1929, canon in 1941, emeritus in 1954 and director of the Convent of the Sisters of the Christian Doctrine at Ghent (till 1963).

Imschoot published many articles in the *Collationes Gandavenses*, the theological periodical of the Ghent diocese, and was one of the chief collaborators in the *Bijbels Woordenboek*, an excellent biblical lexicon that has been translated into French, German and Italian. But he is best known for his *Théologie de l'Ancien Testament*, of which two volumes, *Dieu* and *L'Homme*, were published in 1954 and 1956 respectively. (Jh. C.)

INBREEDING is the mating of relatives. The consequences of inbreeding are slight unless the relationship is close. Hence the matings are not usually called inbreeding unless the mates are related at least as closely as half brother and sister or as individual and grandparent, although usage varies in this respect. In man, for example, matings of first cousins are often called inbreeding, and the term is even applied occasionally to the mating of second cousins.

Among species of plants that customarily reproduce by self-fertilization are some hardy and widespread ones like wheat, beans, barley, oats, cotton and the sorghums. Other species (*e.g.*, beets, alfalfa and many clovers) are equipped with special mechanisms to prevent self-fertilization and to ensure cross-pollination. In still other species pollination is mainly by the wind and there is no special device either to favour or hinder self-pollination. Corn and many of the forest trees are examples (*see* Pollination). In the higher animals self-fertilization is impossible because the two sexes are not combined in the same individual. But among the lower animals, as among the plants, are many functional hermaphrodites (*q.v.*). In a few of these (*e.g.*, some tapeworms) self-fertilization is the rule. Many others (*e.g.*, oysters) have structures or devices to prevent self-fertilization or at least to make it rare.

Most breeders of farm animals regard inbreeding as dangerous, especially for the inexperienced, but a few have dared to inbreed when they thought their own animals were unusually good. Some of these have had conspicuous successes. From at least as far back as Robert Bakewell's time, inbreeding has generally been considered the most effective way to "fix" type and to isolate "pure" (homozygous) lines.

Consequences of Inbreeding.—The primary effect of inbreeding is to increase genetic purity; *i.e.*, to make the offspring homozygous for more pairs of genes than if the parents had been unrelated. Inbreeding does not create defective offspring. It is not harmful in itself; however, the increase in homozygosity permits more recessive genes to show their effects. These are generally less desirable than the effects of dominant genes. Therefore inbreeding usually increases the proportion of defective, weak, slow-growing or otherwise undesirable individuals. Yet inbred individuals vary much from this general rule and many of them are highly meritorious. The fundamental units of inheritance, the genes, are not themselves changed by inbreeding but are merely brought together in combinations that would be rarer under outbreeding (matings between nonrelatives). Families become more distinct from each other as the inbreeding proceeds. The members of an inbred family resemble each other genetically (genotypically) much more closely and outwardly (phenotypically) somewhat more closely than members of an ordinary family do. The inbreeding permits them not only to be alike because they can inherit the same things from their sire or from their dam but also because one member can inherit from the sire the exactly same gene groupings as another inherits from the dam.

Measures of Inbreeding.—In ordinary speech inbreeding is measured only by describing verbally the relationship between the mates. In civil and canon law, inbreeding is measured in degrees by counting the number of generations intervening between the individuals who marry and the ancestor through which they are related. Since 1921 Sewall Wright's coefficient has been available for expressing inbreeding intensity as a fraction of the initial heterozygosity ("mixture" of genes) that is expected to have been lost because of the inbreeding. Approximate values of this fraction in some of the more intense systems of inbreeding are as follows:

System of mating or relationship of mates	Inbred generation			Fraction of remaining heterozygosis lost per generation
	First	Second	Third	
Self-fertilization	.50	.75	.88	.50
Full brother-sister or parent-offspring	.25	.38	.50	.19
Male and many half sisters (one-sire closed herd)	.12	.22	.30	.11
Two males and many females (two-sire closed herd)	.06	.12	.18	.06

Clearly, self-fertilization is the most effective means of removing heterozygosity and creating a pure line.

Practical Uses of Inbreeding.—Inbreeding helps in purging a breed or other population from its recessive defects by bringing these to light in larger numbers. If the possessors of these defects can be culled, the population is freed from that undesirable heredity more rapidly than could be done without inbreeding.

Inbreeding makes family selection more effective. This it does in three ways. First, it makes the families drift apart, so that their averages become increasingly different. Second, it makes members of the same family more like each other genetically, so that what is true of the family average is more likely to be true of each member. Third, it permits increasing the family in numbers without mixing it with other families. In this way the family is still intact when it has declared its merit clearly. Probably much of the usefulness of inbreeding in the production of hybrid

corn consists in its thus increasing the effectiveness of family selection.

Inbreeding is often used by livestock breeders to preserve the merits of a highly admired ancestor long after that ancestor is dead. This is generally called "line breeding." When the descendants of animal X are bred to each other the offspring tend to resemble X about as much as their parents did, whereas if they were mated to individuals unrelated to X their offspring would resemble him only about half as closely. Since all inbreeding except that necessary to hold high the relationship to the admired ancestor is avoided, line breeding is generally somewhat less intense than the inbreeding done when the primary intention is to make families distinct or to purge a stock of its defects.

Some inbreeding is done merely because the breeder thinks there are no animals as good as his, and that to mate his animals with unrelated stock would contaminate and dilute some inheritance that is especially meritorious. This was influential in originating many of the pure breeds.

Inbreeding in Nature.—Even among wild species that must cross-fertilize, some inbreeding may occur because of subdivision into small groups that rarely interchange breeding stock. Random mating within such isolated groups is inbreeding with respect to the whole species, since sooner or later all members of a subgroup become related to each other. This relationship continues to increase except as it is cancelled by immigration of individuals from other groups. Besides isolation by geographical barriers and by distance itself, there can be some isolation by having breeding seasons at different times of the year, by genes for partial sterility, and by other mechanisms. Some inbreeding due to isolation and to widely unequal reproductive rates between individuals certainly occurs in nature but whether it is an important factor in evolution, through permitting natural selection to operate on a family basis, is still uncertain (*see* HYBRIDISM; EVOLUTION, ORGANIC; SELECTION).

Inbreeding in man, except for a few striking cases such as among royalty in ancient Egypt, has generally been prohibited (as incest) among civilized peoples and among primitive peoples was often prohibited by taboos. In civilized societies individuals more closely related than first cousins have generally been forbidden to marry. The marriage of first cousins has sometimes been forbidden, sometimes permitted freely, and sometimes permitted only on special dispensation (*see* CONSANGUINITY). Biologically the last arrangement seems the most desirable, provided the dispensation is granted when the common ancestors were meritorious. The arguments against inbreeding have more validity in man than in animals because a few defectives occurring among domestic animals can be discarded without serious economic loss, whereas the production of even a few completely incompetent human beings may be a serious burden on a society that does not permit the deliberate elimination of such individuals. *See* also EUGENICS; ANIMAL BREEDING; PLANT BREEDING.

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(J. L. LH.)

INCA: *see* ANDEAN CIVILIZATION.

INCENDIARY MIXTURES are used to start fires, generally for military purposes but occasionally for arson or sabotage. They may be made from a variety of ingredients. Some mixtures ignite spontaneously when exposed to air; others take fire when the ingredients are brought together; still others require a fuse or first-fire mixture to heat them to the temperature at which they will begin to burn. Many incendiary mixtures may be extinguished if smothered with sand or dirt.

Greek Fire.—Simple incendiary mixtures have been known since ancient times. The Romans made mixtures of pitch, sulfur and other flammables, poured them into pots and threw them, burning, upon enemy buildings and ships. The most famous of the early incendiary mixtures was Greek fire (*q.v.*) invented by Callinicus around 670 A.D., and used by the Byzantines to defeat an Arab fleet. The composition of Callinicus' mixture is not known for certain because attempts were made to keep it secret and also because later writers applied the term Greek fire to many different kinds of incendiary mixtures and thus brought about unravelable confusion. Generally, the Greek fire of the middle ages contained petroleum and other flammables such as gums, resins and sulfur. The assertion that Greek fire contained quicklime that reacted with water and generated heat to ignite the petroleum is certainly incorrect because quicklime does not give off any flame when it is quenched.

Whatever the composition of the original Greek fire may have been, the name persisted down to the middle of the 19th century. During the American Civil War, Confederate agents burned Union transports on the Mississippi by throwing into the holds bottles containing a spontaneously flammable mixture which they called Greek fire; they set fire to buildings in New York city by similar means. Northern artillery upon occasion fired so-called Greek fire shells in attempts to burn Confederate positions and towns.

Thickened Gasoline.—An important advance in incendiary mixtures during the 20th century occurred when gasoline was thickened or solidified by the addition of materials such as rubber, plastics and soaps. The thickening process changed the liquid gasoline into a sticky, jellylike solid which was much less volatile than ordinary gasoline and which burned with an intense heat. Early in World War II several countries used natural rubber as a thickener. As supplies of rubber gave out other thickeners were found. The U.S. army chemical corps made use of a plastic known as isobutyl methacrylate, and of napalm (*q.v.*), an aluminum soap of naphthenic and coconut fatty acids. The U.S. army used millions of pounds of thickened gasoline during World War II and the Korean War in incendiary bombs, fire bombs and flame throwers (*q.v.*). (*See* also AIR WARFARE: *The B-29 Campaign.*)

Phosphorus.—One of the oldest incendiary mixtures is a solution of phosphorus. The ability of phosphorus to ignite spontaneously in air was discovered coincidentally with the isolation of phosphorus in 1669. After substances capable of dissolving phosphorus were found, it was natural that phosphorus solutions be suggested as incendiary agents. A common solvent is carbon disulfide, which evaporates rapidly and leaves behind a residue of spontaneously ignitable phosphorus. British patents were issued to John Macintosh in 1855 and to John Norton in 1863 for shells containing solutions of phosphorus and carbon disulfide. The U.S. army chemical corps standardized a mixture of phosphorus, carbon disulfide and rubber as a filling for glass grenades in World War II.

The German air force used a filling of phosphorus, benzene and rubber in incendiary bombs dropped on England. One of the most effective and most widely used types of artillery ammunition in World War II and the Korean War was the white phosphorus shell.

Metallic Incendiaries.—Thermite type mixtures contain a metal and an oxide of another metal. A number of combinations may be made using various metals and oxides. One of the most common is a mixture of powdered iron oxide and powdered or granulated aluminum, similar to thermite (*q.v.*) used in welding. This mixture is inert at ordinary temperatures but when heated to a certain point by means of a first-fire charge, the ingredients react, forming iron and aluminum oxide. Intense heat then develops, raising the temperature of the mass to more than 2,000° C., hot enough to melt iron to a liquid. Iron–aluminum oxide mixtures with their burning characteristics modified by addition of other materials have been used in incendiary bombs, grenades and artillery shells. In World War II the magnesium bomb was a metallic incendiary used in great quantities. It consisted of an aluminum–magnesium body filled with a compressed thermit mixture.

Other Types.—The above classes of incendiary mixtures are those that are most important from the viewpoint of history or because of the large quantities used in warfare. Many other mixtures are known. Sulfuric acid and potassium chlorate react vigorously when they come in contact, a property that has been applied in constructing delayed-action sabotage devices. Potas-

sium and sodium react violently with water, generating hydrogen, which then takes fire from the heat of reaction. This fact has led to the development of sodium–oil and potassium–oil mixtures that burn on the surface of water. The reaction between chromic anhydride and alcohol has been used to ignite gasoline in glass grenades. In the final analysis, the range of incendiary mixtures is limited only by the ingenuity of chemists.

See also CHEMICAL WARFARE. (W. D. Ms.)

INCENSE, grains of resins (sometimes mixed with spices) which burn with a fragrant odour and have been widely used as an oblation or in the hope of reviving the dead, particularly in the higher religions (*see* also RESINS; FRANKINCENSE; MYRRH). The incense is commonly sprinkled on lighted charcoal in a censer, or thurible (*q.v.*).

Incense-bearing trees were imported from the Arabian and Somali coasts into ancient Egypt where incense was prominent in religious ritual; *e.g.*, at the daily liturgy before the cult image of Amon-Re and in the mortuary rites, when the souls of the dead were thought to ascend to heaven in the flame. Incense was employed to counteract disagreeable odours and drive away demons and was said both to manifest the presence of the gods (fragrance being a divine attribute) and to gratify them. The Babylonians used it extensively while offering prayer or divining oracles. It was imported into Israel before the Exile and was assigned miraculous powers (Num. xvi, 41 ff.); later, in the 5th century B.C., altars were set apart for incense offerings.

The Hindus, especially the Shivaites, use incense for ritual and domestic offerings, and so do Buddhists, who burn it at festivals and initiations as well as at daily rites. In China incense was burned to ancestors and household gods, in festivals and processions, and in Japan it was incorporated into Shinto ritual.

In Greece, from the 8th century B.C., woods and resins were burned as an oblation and for protection against demons, a practice adopted by the Orphics. In Rome fragrant woods were replaced by imported incense (Ovid, *Fasti*, i, 337 ff.), which became important in public and private sacrifices and in the cult of the emperor.

In the 4th century A.D. the early church began to use incense in eucharistic ceremonial, where it came to symbolize the ascent of the prayers of the faithful and the merits of the saints. Until the middle ages its use was more restrained in the West than in the East. After the Reformation it was employed sporadically in the Church of England until widely restored under the influence of the Tractarian (Oxford) movement in the 19th century; elsewhere in both Eastern and Western Catholic Christendom its use during divine worship and during processions has been continuous.

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INCENSE CEDAR (*Libocedrus decurrens*) is a handsome North American tree of the cypress family (Cupressaceae), native to high mountains from Oregon and Nevada to Lower California. It is a valuable timber tree, with cinnamon-red bark, frequently attaining a height of 150 ft., and sometimes a trunk diameter of 7 ft. The slender branches, with much-flattened branchlets and lustrous, cypresslike leaves, form a beautiful crown. The soft, durable, straight-grained, fragrant, resinous wood is utilized for pencil slats, fence posts, telephone poles and lumber.

RUTHERFORD PLATT

THE INCENSE CEDAR (LIBOCEDRUS DECURRENS)

The incense cedar is planted for ornament, as is also the smaller South American species (*L. chilensis*). Besides the foregoing, six other species of incense cedar are found, one each in Chile, New Caledonia, China and Japan and two in New Zealand. Of these, *L. uvifera* of Chile and *L. plumosa* of New Zealand are valuable timber trees.

INCEST is any prohibited sexual association between persons who are members of the same culturally or legally defined kinship group. Every society undertakes to channel the expression of the sex drive through rules as to whom one must or ought to marry, at the same time discouraging or forbidding certain matings and marriages. Incest prohibitions are found in all cultures, primitive and civilized. In the modern law prohibitions against incest are enforced principally through the imposition of criminal sanctions and by rendering marriages invalid between ineligible persons.

England.—Incest is not an indictable offense at common law. Except for a brief period when under Cromwell's Commonwealth it was made an offense punishable by death, it was left to the ecclesiastical courts until the enactment of the Punishment of Incest act, 1908. The provisions of the 1908 act were substantially reenacted in the Sexual Offences act, 1956. Section 10(1) of this statute provides that "It is an offence for a man to have sexual intercourse with a woman whom he knows to be his granddaughter, daughter, sister or mother"; and section (11)(1) provides that "It is an offence for a woman of the age of 16 or over to permit a man whom she knows to be her grandfather, father, brother or son to have sexual intercourse with her by her consent." Both sections include half brothers and half sisters within the prohibited degrees of relationship and both provide that the prohibition applies whether or not the relationship is traced through lawful wedlock. The degrees of relationship defined above for the purposes of the criminal law form a narrower class than the more numerous degrees prohibited for the purposes of matrimony by the laws of, *e.g.*, the Roman Catholic Church or the Church of England, and, in the United Kingdom, by the Marriage act, 1949. Thus a man may not marry his niece; but, provided that she has reached the age of consent and does in fact consent, it is not a criminal offense for him to have intercourse with her. Thus the definition of incest in English law does not altogether accord with that given, for example, in the *Concise Oxford Dictionary*, namely, "sexual intercourse between near kindred."

The maximum penalty in English law for incest by a man is imprisonment for seven years, except when committed with a girl under 13 when it is imprisonment for life. The maximum penalty for a woman is seven years. The maximum penalty for attempted incest by either a man or a woman is two years' imprisonment.

Scotland.—In the law of Scotland, before 1887, incest was an offense punishable with death, but more often the penalty was imprisonment for life. The Criminal Procedure (Scotland) act, 1887, made imprisonment for life the maximum penalty. Scots law differs very widely from English law regarding this offense. In the first place, in Scotland it was a common-law offense, though the penalty (of death) was fixed by a statute of 1567. Secondly, any act of intercourse between parties within the degrees of relationship specified in the 18th chapter of the book of Leviticus is an offense under Scots law.

United States.—In the United States the crime of incest is defined by statutes in the various states. Although there is considerable variation in the provisions of these statutes, the gist of the offense is always an act of sexual intercourse between persons within a prohibited relationship. Intercourse between father and daughter, mother and son, and brother and sister are universally forbidden. In some states intercourse between first cousins is also made punishable. Brothers and sisters of the half blood are ordinarily included within the scope of such legislation, and some statutes encompass intercourse between a father and an adopted daughter. Incest is ordinarily punished as a felony. In some states more severe penalties are reserved for particular cases, such as intercourse between parent and child. In most states knowledge of the relationship by one or both parties to the act is required for criminal liability.

In all states marriages between persons within the specified de-

grees of consanguinity or affinity are prohibited. The relationships that bar marriage may include those not specified in the criminal offense. Thus, in Illinois, marriages between first cousins are forbidden by law, but intercourse between such persons is not made criminal. There is considerable variation among the states in the characterization of a marriage within the prohibited degrees as void or merely voidable. The prevailing view appears to be that such a marriage is valid unless annulled in the lifetime of the parties. In some jurisdictions the marriage is conceived as void until cohabitation and birth of issue occur. In a few states the incestuous marriage is treated as absolutely void. A marriage within the prohibited degrees may be annulled by a court of competent jurisdiction at the suit of either party; such a suit is not barred by the guilty knowledge of the moving party at the time of the marriage.

See also MARRIAGE, LAW OF; MARRIAGE, PRIMITIVE.

(F. A. A.; W. T. Ws.)

INCH: *see* WEIGHTS AND MEASURES.

INCHBALD, ELIZABETH (1753–1821), English novelist, playwright and actress, whose novel *A Simple Story* may have inspired Charlotte Brontë in writing *Jane Eyre*, was born at Standingfield, Suffolk, Oct. 15, 1753, the daughter of Joseph Simpson. At 18 she ran away to London to seek her fortune on the stage. Two months later she married Joseph Inchbald, an actor, and made her debut at Bristol as Cordelia to his Lear. They toured the provinces until his sudden death in 1779, after which she continued to act for ten years, also writing adaptations of plays and some original farces and comedies, the most successful being *I'll Tell You What* (1785). She was never a great actress, but her beauty, vivacity and blameless personal life won her great admiration. Her fame rests upon her two novels, *A Simple Story* (1791) and *Nature and Art* (1796); they are among the earliest examples of the novel of passion and enjoyed immediate success.

Mrs. Inchbald died at Kensington on Aug. 1, 1821.

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INCHCAPE, JAMES LYLE MACKAY, 1ST EARL (1852–1932), British shipowner, was born at Arbroath, Forfarshire (Angus), Scot., on Sept. 11, 1852, and educated there and at Elgin. In 1874 he went to India to join the firm of Mackinnon, Mackenzie and company, Calcutta, of which he ultimately became senior partner; he was a member of the legislative council of the viceroy (1891–93) and a member of the Council of India from 1897 to 1911.

In 1902, consequent upon the Boxer rebellion, Mackay negotiated a commercial treaty with China. In 1911 he was raised to the peerage as Baron Inchcape of Strathnaver. As a representative of the shipping industry Inchcape took a leading part in all its affairs both during World War I and after, being president of the Chamber of Shipping of the United Kingdom (1893, 1918, 1919) and president of the Shipping federation (1926). He served on most of the government commissions of inquiry both in India and England. He was a member of the Geddes committee on national expenditure (1921) and chairman of the Indian retrenchment committee (1922). In 1924 he was created viscount and grand commander of the order of the Star of India. The positions of chairman of the P. and O. Steam Navigation company and director of the National Provincial bank and Suez Canal company were other important positions he occupied. In 1928 Lord Inchcape lost his daughter, Elsie Mackay, in an attempted transatlantic flight. He was created an earl June 3, 1929. He died at Monaco, May 23, 1932.

INCHIQUIN, EARLS AND MARQUESSES OF: *see* O'BRIEN.

INCIDENTAL MUSIC, a type of music so called because it is incidental or subservient to the action of a play, film, radio or television program, being intended to reflect or enhance a dramatic situation, rather than to form an integral part of it. The best of such music, originally written to form part of a dramatic performance, has acquired a life of its own and can be played and heard without reference to the work for which it was intended, although it is, in a sense, "programme music" (*q.v.*), *i.e.*, music written to express a literary idea, rather than a purely musical one.

The place of music in drama is closely bound up with the origins of both drama and opera (*qq.v.*). It is not really possible to describe the music in Greek drama or in oriental drama, with its ritual associations, as "incidental," although the songs in Menander's comedies seem to have been forerunners, as do the flute accompaniments to speeches in Roman plays. In any case, our knowledge of this music can only be inferred from stage directions and it is difficult to determine how far it was regarded as essential, or whether it always took the same form. The gradual emergence of drama from the liturgy of the church in the late middle ages was marked by a development of a more truly "incidental" music. But it was not until the 16th century that the use of music in the theatre began to approximate to modern practice. In Italy attention was concentrated on opera and oratorio, and in England on the spoken drama: thus it was in England that incidental music developed. It took the form of songs within the plays themselves, interludes between acts and instrumental music accompanying the interpolated dumb shows or masques or even off stage (indicated by the frequent stage direction "music within") as a means of heightening dramatic effect. Early examples of such music are the comic songs in Nicholas Udall's *Ralph Roister Doister* (*c.* 1553), the dumb-show music in *Gorboduc* (1562) and the music between the acts in *Gammer Gurton's Needle* (*c.* 1559).

Incidental music was used in a variety of ways by Shakespeare. The use of songs serves many dramatic purposes and instrumental music not only forms an accompaniment to the masque scenes (as in *Timon of Athens*, *Much Ado About Nothing* and *The Tempest*), and to the dances which sometimes ended the plays, but also heightens the dramatic tension (as in the casket scene in *The Merchant of Venice*), and introduces supernatural characters (as in *Cymbeline*, *Pericles* and *As You Like It*). Knowledge of this music is derived both from Shakespeare's own stage directions (*e.g.*, "Music! ho") and from the inventories of Elizabethan theatres, which show the types and number of instruments used and make possible a reconstruction of the manner of performance. Settings of Shakespeare's songs were made by such contemporary composers as Robert Johnson, Thomas Morley and John Wilson.

In the Restoration theatre elaborate scores of incidental music were written by Purcell for adaptations of *A Midsummer Night's Dream* and *The Tempest*, for John Dryden's *King Arthur* and for *The Indian Queen* by Dryden and Sir Robert Howard. Purcell also wrote incidental music for about 40 other plays, by Thomas D'Urfey, Beaumont and Fletcher, John Dryden, Thomas Shadwell, William Congreve and others.

In France Lully, in association with Molière, wrote a series of *comédies-ballets*, forming interludes in the plays for *la troupe du Roi* (Louis XIV). The king and princes of the blood themselves took part in the performances of these ballets which fell into two categories: majestic ballets such as that in *Les Amants magnifiques* and comic ballets such as those in *Monsieur de Pourceaugnac* and *Le Bourgeois gentilhomme*. Since vocal items were introduced into these ballet interludes the former was held to have anticipated the French opera and the latter the *opéra comique*.

In the 18th century there was relatively little incidental music, though Handel wrote music for Ben Jonson's *The Alchemist* (1732) and Mozart for T. P. von Gebler's *Thamos, König in Aegypten* (1779). Where opera and drama were performed in the same subsidized theatre, as at the 19th-century German and Austrian courts, the orchestra was also available for dramatic productions, with the result that incidental music was written by Beethoven for Goethe's *Egmont* (1810), by Mendelssohn for *A Midsummer Night's Dream* (1826) and by Schumann for Byron's *Manfred* (1849). These scores, like those by Bizet for Daudet's *L'Arlésienne*, Grieg for Ibsen's *Peer Gynt* and Fauré for Maeterlinck's *Pelléas et Mélisande*, were later played independently of the plays for which they were written and which they sometimes outlived.

Among later associations of playwrights and composers of incidental music are those of Paul Claudel and Darius Milhaud,

Virgil Thomson and Ernest Hemingway and Benjamin Britten and W. H. Auden.

Toward the middle of the 20th century developments in motion-picture productions and in radio and television programs created an enormous demand for incidental music. Much of it was ephemeral, but some of the scores by composers who experimented with new forms of film and broadcast music, among them Vaughan Williams and Prokofiev, survived in their own right. These new opportunities in film and radio for incidental music increasingly supplied the main sources of income for many composers. Motion pictures and radio also made use of experiments with electronic music in Germany, Italy and France. These types of incidental music branched out in two directions. They either tended to become more accurate and telling in expression, as when films or radio programs represented the joint efforts of composer and producer; or they tended to become debased, as when background music was selected from libraries of recorded music, written not so much to be heard during the performance as to be overheard.

(E. Lr.)

INCINERATOR, a term which came into use during the first half of the 20th century, replacing "destructor" in England and "crematory" in the United States, to describe a plant designed to burn solid wastes (refuse). An incinerator is comprised of a furnace into which the refuse is charged and ignited, a secondary combustion chamber in which burning at a high temperature is continued to complete the combustion process, flues to convey the gases of combustion to a chimney and thence to the atmosphere. Incinerator plants also include facilities for unloading and storing the refuse for short periods to permit uniform charging of the furnaces, and a building, if necessary, to house the incinerator appurtenances. Incineration of community refuse is not a complete disposal process as the remaining ash (about 10% by volume) must be disposed of (*see* REFUSE DISPOSAL).

The growth of large cities was primarily responsible for the development of refuse incinerators since it was not practical from nuisance, public health and aesthetic viewpoints to permit refuse dumps in their midst. The burning of refuse provided an efficient means of inoffensively reducing the bulk of refuse to a readily transportable and often usable ash. To accomplish the burning in a sanitary and effective manner it was necessary to develop specialized furnaces and other equipment as well as buildings laid out to facilitate delivery, storage, handling and salvage of the refuse and ash.

Although many refinements of equipment have been developed during the 20th century the basic components of a municipal incinerator remain the same.

Incineration Costs.—Incineration has always been costly as compared with other methods of disposal, so it is usually resorted to as a final choice dictated by necessity. In the United States, capital costs for pit-and-crane incinerators have been found to range from $3,000 to $4,500 per ton of rated capacity. Of a complete municipal incinerator, about 40% of the cost is for the furnaces and their appurtenances and about 60% for the access roads and ramps, storage bins, building and chimney. Operating costs range from $3 to $6 per ton of refuse burned.

Nature of Refuse.—Town or community refuse is considered the useless, unused or unwanted solid wastes resulting from the normal course of community activity. It consists primarily of food wastes (garbage), rubbish (paper, wood, glass, metal, leather, plastic, etc.) and ashes.

The composition of refuse received at an incinerator plant may vary widely with the season of the year and with local conditions, such as the presence of various industries. Pre-World War II analysis of English refuse indicated its composition to average 48% noncombustibles (including fine dust) and 52% combustibles, such as rags, garbage, paper and cinders. Later analyses on a limited basis showed a higher vegetable content. The average over-all yield of town refuse in England is about 1,800–1,900 lb. per 1,000 population per day. In the United States, an analysis of refuse in a city where natural gas was used extensively could be expected to show 80% by weight of combustible material (paper, rags, wood, garbage), 13% of noncombustibles (metals, glass) and only 7% ash. Normally, community incinerators in the United States and Canada are designed to handle 2,500 lb. of refuse per 1,000 population per day. A higher design figure is needed where a heavy industrial refuse contribution is encountered.

For plant design purposes the combustible component of refuse may be considered the same as cellulose ($C_6H_{10}O_5$). Actually, refuse contains a small percentage of carbohydrates and fats but these do not influence the design significantly. The calorific or heat value of refuse has been found to vary from 3,000 to 5,000 B.T.U. per pound in England.

Incinerators constructed by the city of New York utilized a calorific design value of 4,000 B.T.U. per pound (7,000 to 9,000 B.T.U. per pound of dry combustible solids).

Engineering Design.—The combustion equipment in an incinerator plant is similar to the furnace system in a power plant, except that it must be designed to receive a heterogeneous fuel rather than a uniform fuel such as coal or oil. In order to determine the amount of air and, if necessary, auxiliary fuel needed to consume the combustible refuse and evaporate the water present, it is necessary to compare the heat value of the refuse with the heat required to maintain the proper combustion temperature. Through use of the basic combustion formula (cellulose + oxygen → carbon dioxide + water) and the molecular weights of the combustible refuse, the amount of oxygen and thus the air required to sustain combustion is found. The total moisture in the refuse and in the combustion air, the water formed during the combustion process and heat losses through furnace doors and refractories are calculated to determine minimum heat requirements to raise the gases of combustion to at least 700° C. (1,300° F.). The heat available from the refuse is then calculated to determine the excess heat value available or additional heat required for proper combustion.

Facilities for Receiving Refuse.—Refuse is usually delivered to an incinerator in trucks. It may then be fed directly into a furnace or undergo a separation process to remove salvable material before the remainder is incinerated. In England, the relative economics of direct salvage of components of the refuse *v.* the production of steam from burning it was an issue for many years. Successful plants of both systems were built, the controlling feature being local conditions. However, subsequent to World War II, very few plants in Great Britain were designed on the direct incineration principle. In the United States, because of the high cost of separating refuse and the poor market potential for salvage, direct incineration is practiced almost exclusively.

Incinerator plants are referred to as "floor dump" plants or "pit-and-crane" plants depending on whether the refuse is dumped on the charging floor and pushed into the charging opening to the furnace or dumped into a pit first for storage and subsequently fed into the furnace with a bucket crane. Smaller plants operated eight hours a day are usually of the floor dump type since the storage area required for the refuse received is not great; such plants require smaller capital outlay and can be operated more economically on a limited basis. Cities of more than 100,000 population almost always build pit-and-crane plants since it is more economical for such plants to operate on a 16- to 24-hour basis.

The refuse is collected and delivered to the plant during the eight-hour working day. The storage pits of a modern plant are usually designed to hold 70% to 100% of the plant's 24-hour burning capacity.

Furnaces.—The furnace chamber of an incinerator, sometimes called the primary or ignition chamber, must be designed to promote the rapid desiccation of the raw refuse, leaving only volatile gases to be burned in the secondary chamber and ashes to fall into the ash pit.

A mixing chamber, placed immediately following the combustion chamber and equipped with baffles or restricted passageways, promotes mixing and burning of volatile gases to prevent odours. The gases in the mixing chambers should be at a temperature of at least 700° C. (1,300° F.), and usually the temperature is from 870° to 980° C. (1,600° to 1,800° F.) in modern incinerators. A secondary combustion or expansion chamber is provided to permit expansion of the combustion gases, complete the burning

process and permit particulate matter (fly ash) to settle out.

The sizes of these chambers are governed by the volume of the gas produced in the combustion process. After the amount of refuse that must be burned per hour is established, grate areas, chamber volumes and size and placement of air ports are determined. U.S. designs which take into account air pollution requirements employ a grate loading factor of about 50 lb. per square foot per hour.

Similarly, a furnace volume of 12.5 cu.ft. per ton of rated capacity is deemed reasonable and a combined volume of the secondary combustion chambers and flues of 80 cu.ft. per ton of rated capacity is indicated for municipal plants (rated capacity of a plant is the amount of refuse in tons that can be burned over a 24-hour period).

Grates.—The function of a grate is to support the refuse without leakage of the combustibles and to provide a free flow of air to support combustion. The design of furnace grates has undergone considerable change because community refuse no longer consists primarily of garbage with its high moisture content and because high labour costs have necessitated automation.

Prior to World War II practically all incinerators constructed in the United States were hand stoked. Within a few years after the war, automatic and semiautomatic mechanical grates were being installed in practically all new plants. Mechanical grates developed during this period were of four basic types: rectangular, cylindrical, traveling grate and rotary kiln.

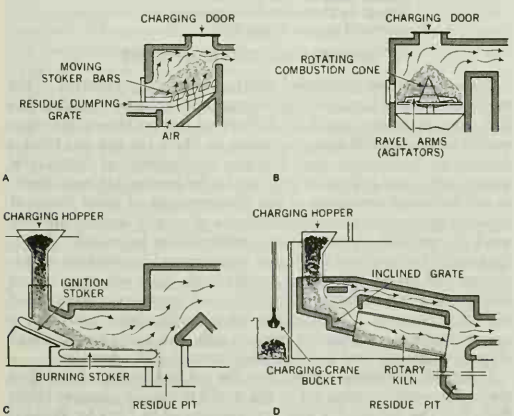
The rectangular type (fig. [A]) is provided with alternately moving stoker bars that agitate the burning refuse and keep noncombustible materials moving toward the front of the furnace, where they pass through a dumping grate.

In the cylindrical incinerator (fig. [B]), refuse is dropped onto a circular grate over a rotating perforated cone through which combustion air is passed. Ravel arms, attached to the cone, stir the burning mixture and move unburned material toward dumping grates at the outer edges.

Higher production rates can be achieved in incinerators equipped with traveling grate stokers (fig. [C]), for these permit continuous charging of refuse and removal of residue. In this type, the more inflammable refuse is largely consumed on the ignition stoker; the remainder then drops onto the burning stoker, which runs about 25% faster than the ignition stoker so as to spread the less inflammable materials thinner over the grate surface.

Continuous charging and residue removal also is possible in the rotary kiln incinerator (fig. [D]), in which refuse is dumped onto an inclined grate and thence into a rotary kiln, which provides greater agitation and more intimate mixing with combustion air.

Flues.—A flue is the connection between the secondary combustion chamber and the chimney. In large plants, when more than one furnace is employed, the flues are interconnected so that one chimney can serve two or more units. Flues are designed to facilitate removal of particulate matter from the combustion gases as they flow to the chimney.



FROM "INCINERATOR ENCLOSURES," 1956; REPRODUCED BY PERMISSION OF M. N. OETRICK CO.

BASIC INCINERATOR DESIGNS: (A) RECTANGULAR; (B) CYLINDRICAL; (C) TRAVELING GRATE; (D) ROTARY KILN

Chimneys.—The chimneys (or stacks, as they are usually referred to in the United States and Canada) are the means of conveying the gases of combustion to the atmosphere. Their dimensions must be chosen so as to obtain proper draft for the incinerator and to dispense the gases over a wide area. A large municipal plant may have a chimney as high as 200 ft., depending on the velocity and volume of flue gases, the height of nearby buildings and the nature of the terrain.

Preheaters.—If an incinerator handles a large percentage of refuse of high moisture content, a recuperative type of preheater is placed before the flues to furnish preheated air to the forced draft fan supplying air to the stoker. In the United States, community refuse is composed primarily of readily burnable material and preheaters are not used in many incinerators. Auxiliary oil or gas burners in the furnace may be provided in lieu of preheaters in order to maintain combustion chamber temperatures for short periods when the refuse contains a high percentage of moisture.

Draft Facilities.—The air needed for combustion is provided by forced, by induced or by natural draft. The first two require fans; the third requires a chimney of adequate height and cross-sectional area. The quantity of air required varies from 4 lb. per pound of mixed refuse with 54% moisture to more than 10 lb. per pound of highly combustible rubbish having a moisture content of 15%. In the latter instance almost half of the air requirement is needed to cool gaseous products of combustion to prevent thermal damage to the furnace refractories. Dampers to regulate furnace draft are usually placed between the combustion chamber and the secondary chamber or between the secondary chamber and the flues.

Ash Hoppers.—The ash hoppers are designed to receive the residue or ash from the furnace grate. Hoppers usually are of steel construction and lined with vitrified paving brick. Usually the ash is cooled by water quenching in the hoppers and dumped directly into a truck or transported through a water bath on an endless belt conveyor to an ash storage hopper or to an ash truck.

Instruments.—The instruments necessary for operation of the plant usually include recording pyrometers connected to thermocouples placed in the combustion chamber and chimney, gauges to record draft at the base of the chimney and forced draft pressure beneath the grates, a recording meter for wind direction and a smoke density meter mounted in the chimney. A carbon dioxide recorder for determining the percentage of CO_2 in the flue gases is also recommended. The instruments usually are mounted on the stoking floor for easy observation by the operator.

Fly Ash Control.—The problem of controlling particulate matter (fly ash) in the combustion gases to prevent a nuisance condition from the plant chimney discharge in the vicinity of the incinerator has continued to plague designers. The expense of installing, maintaining and operating the necessary fly ash control equipment has been the principal deterrent to achieving desired standards. Two basic methods of fly ash control are used in modern incinerators: entrapment with water sprays (or baffles) and gravity settlement. Fly ash emission was effectively controlled in one type of incinerator by utilizing extremely large flues along with a series of wall baffles to settle out and trap the fly ash under natural draft conditions. Another incinerator design accomplished fly ash removal by using forced draft to force the flue gases through stainless steel baffles equipped with water sprays; the water trapped the particulate matter in the gases and carried it via drains to a lagoon where the ash was allowed to settle out.

Waste Heat Utilization.—Much attention has been paid to the possible utilization of the heat generated by the incineration process for steam or power production. In Great Britain many such plants were built in the early half of the 20th century. It was found in the Birmingham plants, for example, that 2 lb. of steam were obtained from each 1 lb. of refuse burned. Glasgow had a successful method of power production wherein the electrical au-

thority purchased excess power from the incinerating plant to help meet demand periods during the week. The incinerating plant ran for 5½ days each week and thus its power production fitted in with the demand for electricity, which fell off on Saturday afternoon and Sunday.

Generation of steam for heating or other purposes is also found profitable in certain locations. The Miami, Fla., plant is designed to provide steam for a nearby hospital. Generally, in the United States and Canada heat produced from the refuse is wasted to the atmosphere because it has been found that the equipment required to produce steam and electricity cannot be installed and operated economically in competition with regular power supply sources.

Institutional and Household Incinerators.—On-site disposal of combustible refuse is an economical method for many industries, multiple apartment dwellings and many large retail commercial establishments as well as, in certain instances, for householders. There are thousands of such plants in the larger cities and they usually form an important part of the over-all disposal system. The basic furnace design for such units is similar to that required for their larger municipal counterparts.

There is usually incorporated in the design of apartment house incinerators special charging features for the convenience of their users. Such units are often "flue fed"—that is, a chute extends to the upper story of the building and rubbish placed into an opening in the chute drops directly into the furnace. These units have often been the source of nuisances, however, where insufficient attention is given their operation.

Because such units have been found to be a significant source of air pollution, much attention has been given to improvement of their design.

Household incinerator units are not recommended by refuse disposal authorities in lieu of use of a community-wide collection system, but have found application in rural areas. When garbage is included in the refuse burned, some odour can be detected in the gases discharged into the flue when a single-cell unit is used. Such units usually are equipped with a gas burner to assist in the combustion of refuse such as garbage.

It has been the practice in many communities to encourage the burning of refuse in "backyard incinerators." These are sometimes specially built single-cell burning units, but usually are converted oil drums or wire baskets. To call them incinerators is a misnomer. Usually such practice is necessitated by inadequate or incomplete refuse collection systems.

In Los Angeles, Calif., for example, the collection of combustible rubbish was instituted in 1957 because it was shown that the practice of burning combustible rubbish by householders was a significant contributing factor to that city's severe air pollution problem. At the time the municipal collection system was instituted and backyard burning banned, there were 1,500,000 household rubbish burners in the city. (Lo. W.)

INCOME, NATIONAL: *see* NATIONAL INCOME ACCOUNTING.

INCOME TAX. An income tax, in the generally accepted meaning of the term, is a tax imposed upon net incomes, that is, on total incomes less expenses incurred in earning them. An income tax may apply to individuals (personal income tax), corporations (corporation income tax) or both. The personal income tax usually applies only to income in excess of a certain figure, and thus low-income groups are freed from the tax. Income tax rates may be the same at all income levels, but they are more commonly progressive, the rate rising as the size of the income rises. Progression (or graduation, as it is sometimes called) is particularly common with personal income taxes. An income tax may be applied in blanket fashion to all income (or to all except certain specially treated items), as in the United States, or it may consist of a series of schedules applying to various forms of income, as in Great Britain and some other countries. An income tax in the typical form is distinguished from a gross income tax, which applies to the entire gross income of individuals, corporations or both, without deduction of expenses of gaining the income, or other items.

After World War I, the income tax became the most important source of tax revenue in many countries, particularly the United States, Great Britain and most nations of the Commonwealth of Nations and the countries of northern Europe. In the 1960 fiscal year, Great Britain obtained about 48% of its total revenue from income and profits taxes; the United States 82% (personal tax 55%, corporate tax 27%); Canada 58%. In western Europe the percentage was highest in Luxembourg (67%), the Netherlands (58%), and Sweden and Norway (each 53%). Italy, with only 18%, relied less heavily on such taxes than any other west European country.

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I. HISTORICAL DEVELOPMENT

Income taxation developed slowly, with many reverses. The merits of income taxation were recognized centuries ago, but fear that administration would be difficult or impossible—a fear supported by evidence in many instances in which the tax was tried—delayed its widespread use. But the development of democratic government gave important impetus to the income tax movement, as did increased awareness of the disadvantages of other forms of taxation in terms of accepted standards of society and the growing need for revenue as government expenditures increased. Introduction of the tax was facilitated by increased importance of exchange and the earning of money incomes, more adequate record keeping and use of banking facilities and improved standards of tax administration. The income tax can effectively constitute a major source of government revenue only in a society with a high state of economic and political development and education.

1. Great Britain.—Credit for the establishment of the first major successful income tax in the world is usually given to Great Britain. The British tax was first introduced in 1799 by William Pitt, to aid in the financing of the war against France. Exemptions and progressive rates were provided, with a standard rate of 10%.

The tax was repealed in 1802, but reimposed in 1803 when war resumed. This tax, which involved the use of income schedules and deduction at source, was repealed in 1816 after the battle of Waterloo. In 1842 the tax was revived by Sir Robert Peel, initially for a three-year period. The levy was extended a number of times, and became accepted as a more or less permanent tax in 1860, when tariff reductions made its revenue essential. The tax was gradually reduced from the 1860 rate of 1*s.* 4*d.* in the pound figure, but was raised during the South African War of 1899–1902 to 1*s.* 3*d.*

These earlier taxes, with minor exceptions, had been levied with proportional rates. In 1909, however, graduated rates were permanently established, through the introduction of the surtax. The standard rate reached 6*s.* during World War I, was reduced during the 1920s and raised to a level of 10*s.* during World War II. The figure was cut to 9*s.* in 1946, raised to 9*s.* 6*d.* during the Korean War and cut to 8*s.* 6*d* in 1955. The 1963 figure was 7*s.* 9*d.* The exemptions were reduced somewhat during World War II and raised after 1945. A separate tax on profits, primarily on those distributed as dividends, was introduced for the first time in 1937, largely replaced by an excess-profits tax during World War II and reinstated, at relatively high rates, in 1946. The profits tax was increased in 1955 and 1956 as a part of an anti-inflationary and exchange-control program. In 1958 a flat rate tax on company profits (with a rate of 15% in 1961) replaced the previous levy which placed a relatively heavier burden on amounts paid out as dividends.

2. United States.—Limited attempts to use income taxes were made by four states early in the 19th century. But administration was weak and the yield was very low. While additional states attempted to use the tax prior to 1900, the first successful state use came with the Wisconsin tax in 1911. Other states then followed. Expansion of state use, however, was retarded after 1940 by the high federal tax.

The first federal income tax was imposed in 1862 to meet Civil War expenditures. The rate, at first 3%, was later raised, made progressive for a time and then returned to a proportional 10% figure in 1865. Exemptions were provided. Despite the lack of adequate enforcement machinery, the tax yielded substantial revenue. But complaints of evasion and the dislike of many groups for the principle of the tax led congress to allow it to expire in 1872.

During the succeeding decades the tax remained a political issue, support coming primarily from farm and labour groups. Finally, in 1894, a proportional 2% tax was imposed, in part to offset revenue losses from tariff reductions. In a reversal of the Civil War tax decision, the 1894 tax was held to be unconstitutional by the supreme court on the grounds that certain portions of it were direct taxes, and therefore were invalid because the tax was not apportioned according to population as required by the constitution. An immediate attempt was made to sanction income taxation by constitutional amendment; this culminated in the 16th amendment, which became effective in 1913. Meanwhile, in 1909, a levy had been successfully imposed upon corporation profits in the technical form of an excise tax.

In 1913, immediately after the 16th amendment became effective, congress enacted a personal income tax, with a normal rate of 1% on incomes in excess of $3,000 for a single person and $4,000 for a married person, and surtax rates on taxable incomes in excess of $20,000 ranged from 1% to 6%. The corporate rate was 1%.

The development of the tax after 1913 can be summarized briefly, in terms of the following major trends:

1. Sharp increases during World War I. In 1918 the normal rate was made progressive, with a range from 6% to 12%, and the progression of the surtax greatly sharpened, the rate rising from 1% to 65%. The combined normal and surtax rate on income in excess of $1,000,000 was 77%, the highest rate used in any country to that date. Exemptions were also lowered.

2. Gradual reductions in rate and increases in exemptions during the 1920s. The exemption reached $1,500 for single persons and $3,500 for married persons, with $400 for other dependents, by 1925. The normal tax was lowered to a range of from ½% to 4%, and the top surtax rate to 20%.

3. Increases during the 1930s. In an effort to reduce budget deficits, the exemption for married couples was lowered to $2,500, and the basic rate raised to 4% in 1932; progression was sharply increased in an effort to place more of the burden on the higher income groups. Later in the period the surtax rates were raised to a maximum of 75%.

4. Drastic increases during World War II. At the beginning of World War II, the tax was converted almost overnight from a "rich man's tax" to one which reached down to the great majority of workers. The exemption, after several reductions, was set at a flat $500 per person, including the taxpayer, and the surtax rate made to apply to all taxable income, the initial tax rate reaching 23%. The maximum combined normal and surtax rate reached 94%. The normal and surtax rates were eventually consolidated into a single rate. The number of returns, which had been 6,000,000 in 1937, reached 50,000,000 in 1945, or 38% of the population. In 1943 a significant change was made in methods of collection by the establishment of the withholding system on wages and salaries.

5. Postwar trends. In the postwar period, continuing high expenditures prevented sharp reductions in income tax, and the general level, while fluctuating somewhat, remained much closer to the wartime figures than to those of the 1930s. Several modifications were made, however, in the structure of the tax.

Rates were reduced in 1946 to a basic figure of 19% and a maximum of 86.45%. In 1948 the exemption figure was raised to $600 per person, rates were reduced again (basic, to 16.6%) and the splitting of income between husband and wife was universally permitted. This rule greatly reduced the operation of progression for married couples. During the Korean War (1950–53) rates were raised again, to a high of 22.2% basic and 92% maximum. In 1953 the rate increase was eliminated and the basic rate table, with rates ranging from 20% to 91%, was restored. In 1954 a number of other modifications were made, primarily in the direction of easing the severity of various rules relating to dependents, to working wives, to depreciation and other questions. A step was also taken to reduce double taxation of dividend income. In 1964 congress reduced tax rates for individuals and corporations, part of the reduction applying to 1964 income and part to 1965 income.

The corporation income tax followed a pattern somewhat similar to the personal tax. The rate, originally 1%, reached a high level of 13.5% in 1926, was reduced to 12% in 1928 and raised again in the 1930s. During the latter period limited rate progression was introduced, primarily to lessen the adverse effects of the tax on the growth of small businesses. In 1936, for example, the beginning rate was 8%, the maximum rate 15%. Subjecting dividend income of individuals to both the normal and surtax rates in 1936 established double taxation of corporate dividend income; a proposal to apply the corporate tax only to undistributed profits was rejected by congress in favour of a supplementary tax on such profits in addition to the regular levy. This tax led to great protests and was abandoned in 1937.

During World War II the corporate income tax was raised drastically, the maximum rate reaching 40%. The structure of the tax was greatly simplified in 1946 with the establishment of a two-rate structure, a 23% rate applying to all corporate income and a surtax rate of 19% on income in excess of $25,000. The basic rate was raised to 28% in 1951 and to 30% in 1952, the maximum effective rate becoming 52%. The 1964 tax reduction act lowered the maximum rate for larger corporations from 52% to 48%.

While expanded state use of income taxes was restricted after 1940 by the high federal tax, there was a tendency toward greater use of income taxes (restricted usually to wages and salaries) by the cities, especially in Pennsylvania and Ohio.

3. Canada.—In Canada income taxation began at the municipal level, with substantial development of such taxes at the time of confederation (1867). The first provincial use came in 1876, although only two provinces levied the tax prior to 1923. Five others followed during the 1920s and 1930s, but all provinces temporarily surrendered their right to impose this tax in 1941 in exchange for federal tax rental payments. Municipal income taxation also came to an end in 1941. Quebec did not renew its

tax rental agreement after World War II and imposed its own personal income tax beginning in 1954. Other provinces continued under the rental system until it was eliminated in 1962. The federal government continues to collect the provincial income taxes in eight provinces (personal income tax in nine).

The first dominion income tax was introduced in 1917 to aid in the financing of World War I. It was increased after the war, in contrast with the usual pattern, to eliminate continuing deficits. After 1925 rates were reduced on several occasions and there was some belief that the tax would be repealed. However, after 1932, deficits led to increases in the tax. World War II brought drastic increases in rates and reductions in exemptions. After the end of the war the tax was reduced sharply, the prewar exemptions being re-established (in contrast with United States policy). In 1947 a tax credit for dividend income was granted. Rates were raised in 1952 because of the increased defense spending, subsequently reduced again, and increased slightly in the late 1950s. The rates in 1963 ranged from 11% to 80%.

Corporation income taxation was introduced in 1916 in the form of a special war tax on excess profits; this was supplemented by a tax on all corporate profits in 1917. The rate was raised immediately after the end of the war, reduced during the late 1920s, raised during the depression and increased sharply during World War II. Rates were lowered after the war, but increased somewhat in 1950, reduced between 1953 and 1958, and raised again at the end of the decade. The rates in 1962 were 18% on the first $35,000 of net income and 45% on income in excess of this figure, plus 3% for social security.

4. Other Countries.—In the countries of continental Europe the income tax developed slowly during the 19th century. Income taxes of limited significance were imposed in Belgium as early as 1828, and a general income tax was levied by the Swiss canton of Basel-Stadt in 1840. Austria imposed a general income tax in 1849, and Italy in 1864. Germany entered the field in 1894. Spain imposed an income tax of limited significance in 1900. France was one of the last major countries to enter the field, imposing the tax in 1914. Most of the Swiss cantons did not impose income taxes until the World War I period, and the confederation levied the tax only in 1940. The general trend in most countries has been toward a gradual strengthening of the income tax, the rate levels, however, being greatly increased in periods of war and often not falling back after the end of the wars to prewar levels.

II. PRACTICAL ASPECTS OF INCOME TAXATION

A. United States

In the early 1960s the United States applied a single income tax to all taxable personal income, with a corporation income tax imposed upon the net profit of corporations.

1. Returns.—Filing of personal income tax returns was required of all residents whose gross income exceeded $600, and of nonresidents in certain instances. There were two primary return forms. The first was Form 1040A, on which the tax liability was figured by the internal revenue service. It was available only to those with wage income subject to withholding of less than $10,000 per year (including not over $200 of other specified incomes). Form 1040 required calculation of tax liability by the taxpayer, either by the use of a table (permissive only if the income was under $5,000), or by application of the actual tax rates. Normal filing date was April 15. Married couples might file separate or joint returns, but the latter was almost always preferable because it provided automatic splitting of income between the two persons.

2. Gross Income.—The law did not define income, but the regulations indicated the types of items which had to be included in gross income. These included all incomes in the usual sense, including gross receipts of operators of business firms, professional men and farmers. Receipts which involved merely a change in the form of wealth with no increase in value did not constitute income. Increases in the value of property were taxed only when realized through sale of the property and at that time they received special treatment. Among items of income specifically excluded were most veterans' benefits, social security benefits, gifts and inheritances, casualty insurance benefits received, life insurance benefits upon death and interest on state and municipal bonds. Partial exclusion was permitted for sick leave pay and the first $50 of corporate dividends received was exempt.

3. Business Deductions and Adjusted Gross Income.—In general, various expenses incurred in gaining the income, known as business deductions, could be subtracted from gross income to determine adjusted gross income. These were of primary importance for operators of business firms, professional men operating their own practices, farmers, etc. All business and trade expenses, in the usual sense of the term, were deductible, including depreciation on capital equipment and interest on borrowed money. Depreciation deductions had to conform with regulations relating to length of life of the property and allocation formulas.

For an employee, business deductions were restricted to expenses of travel (including meals and lodging while away from home) in the services of the employer. The cost of travel to and from work was not deductible.

4. Nonbusiness Deductions.—From adjusted gross income the taxpayer could deduct certain personal expenses, which were designated as nonbusiness deductions. These included:

1. Contributions to religious, charitable, educational and similar organizations, up to 20% of adjusted gross income, with an additional 10% for certain types of contributions.
2. All state and local taxes paid (including sales taxes separately quoted by the vendor) with minor exceptions, such as special assessment levies. No federal taxes were deductible as nonbusiness deductions.
3. Casualty and theft losses in excess of insurance compensation.
4. Medical and dental expenses in excess of 3% of adjusted gross income, subject to certain maxima ($10,000 for a married couple, for example).
5. Interest payments, with minor exceptions.
6. Expenses for the care of children, by a woman or widower, when necessary to permit employment of the person.
7. Certain expenses related to employment, such as union dues, and expenses of certain tools, supplies, special clothing, professional journals, etc.

The taxpayer had the option of taking the standard deduction, equal to 10% of adjusted gross income up to a maximum of $1,000, in place of itemizing deductions.

5. Exemptions.—A taxpayer was allowed a $600 exemption for himself, for his spouse and for each dependent, as defined by law. To qualify as a dependent, the person had to have received more than half of his support from the taxpayer (with special rules when several persons provide joint support of a dependent), have received less than $600 per year gross income (except for students and persons under 19) and be related, as defined, or living in the taxpayer's home.

6. Tax Rates.—The tax liability was determined by applying the tax rates to the sum of taxable income, or by using the tax tables (in the case of incomes under $5,000 only). Separate rate tables were applicable to single persons, married taxpayers and unmarried heads of households, the latter receiving partial benefit of the income-splitting provisions.

As of 1963 the basic rate was 20%, applying to the first $2,000 of taxable income for a single person, and the first $4,000 for a married couple. The rate rose to 22% for the portion of income in excess of $4,000 (married couple) up to $8,000, to 26% in the third income bracket and ultimately to 91% on the excess over $400,000. The effective rate on the entire amount of a particular taxable income was much lower than the marginal rate, which applied only to the excess of income over the previous bracket figure.

7. Dividend and Other Credits.—The taxpayer was entitled to a credit against the figure of tax due, of an amount equal to 4% of corporate dividends received in excess of the $50 exclusion, and for certain tax payments to foreign countries.

8. Withholding.—With minor exceptions, all employers were required to withhold tax on a current basis from employees' pay checks and transmit the sums to the government. Thus when the taxpayer filed his return at the end of the year he merely paid

the difference due, or received a refund if overpayment had been made. Withholding was not applied to other incomes. Persons not covered by withholding and those subject to withholding but earning in excess of a certain sum were required to file declarations of estimated income and pay tax on a quarterly basis during the current year.

9. Capital Gains and Losses.—Capital gains from the sale of property held more than six months were taxable either at a flat rate of 25% or through inclusion of one-half of the gain with other income, at the option of the taxpayer. Gains on property held less than six months were fully taxable. Special provisions were made for owner-occupied residences, which in effect exempted the gain from the sale of a home if one of equivalent or greater value was purchased or built within a given time interval. Capital losses could be deducted only from capital gains or from other income in limited amounts.

10. The Corporation Income Tax.—The corporation income tax applied to the net profit of corporations, calculated in the usual accounting manner, apart from certain special rules relating to depreciation. Bond interest was fully deductible. Contributions to charity were deductible up to 5% of net income. As with the personal income tax, losses incurred in one year might be carried back three years and forward five years against earnings of those years. The rate structure, as of 1963, contained a basic rate of 30%, applying to all taxable income, and a surtax of 22% on income in excess of $25,000.

11. Administration.—The tax is administered by the internal revenue service. Returns are filed with the district offices of the service. All returns are subject to routine office audit, and larger returns, plus all about which there is any doubt, receive more thorough field audit. Except in cases of fraud, examination of returns is subject to a three-year statute of limitations.

General regulations are issued by the internal revenue service in amplification of the code. Rulings are issued on specific cases as they arise and are summarized in the semimonthly *Internal Revenue Bulletin*. Appeals from the rulings may be taken by the taxpayer to the tax court.

12. State Income Taxes.—Two-thirds of the states imposed personal income taxes in the early 1960s. The rates were low by comparison with the federal rates. Progression was usually limited, and terminated at a low figure. Business and personal deductions were similar to those of the federal tax, but exemptions were higher. Some of the taxes applied only to income of residents of the state, and others only to income earned in the state regardless of residence. Most states, however, combined the two bases, taxing residents on all income and nonresidents on income earned in the state. The amount of double taxation was lessened, however, by reciprocal provisions in the laws of most states.

A large majority of the states also imposed corporation income taxes. The rates ranged from 1% to about 10% with limited progression in a few instances.

B. Great Britain

The British income tax system in the early 1960s consisted of three distinct but co-ordinated elements: (1) the income tax, levied at a standard rate; (2) the surtax, applied only to incomes in excess of £4,500; and (3) the profits tax, imposed on company profits. The income tax was applied not only to the income of individuals, but also, in effect, to undistributed profits of corporations. Husband and wife had to aggregate their income for tax purposes. Among the exclusions from income were certain capital gains (others being taxable for the first time in 1962); benefits in kind which are not convertible into money income, as for example lodging for a servant; interest on National Savings certificates; certain armed forces benefits; and benefits under the national insurance program (for unemployment, sickness, etc.).

1. Schedules.—The tax was levied under five different schedules (but at uniform rates):

Schedule A: income from the ownership of real property, including until 1963 the rental value of owner-occupied homes. The tax was assessed on the "net annual value," the amount at which the property is or could be rented, less repairs and other expenses. By the early 1960s the net annual value figures had not been completely reassessed since 1936, the figures of that year generally remaining in use. Actual rentals in excess of the assessed figure are included in Schedule D income. In 1963 tax was removed from the rental value of owner-occupied housing.

Schedule B: income from certain types of land, now of minor importance.

Schedule C: interest from certain government securities, collected at the source.

Schedule D: profits of trades, businesses, professions and farming; and interest. Normal accounting rules were employed in determining net income, except with respect to depreciation. Specific schedules of depreciation allowances for tax purposes were established, with, in many instances, a high allowance in the initial year, partly to compensate for rising cost of capital equipment, partly to give a direct stimulus to investment. In most years from 1954 on investment allowances were granted in addition to the depreciation allowed over the subsequent years of life of the equipment, which was equal to original cost.

Schedule E: wages and salaries. Deduction of certain expenses of employees in the performance of their duties was permitted. The tax on wages and salaries was subject to the PAYE (pay-as-you-earn) system, involving current collection from the employer and deduction from the pay checks. The system of determining the amount deductible was much more complicated than in the U.S. as it was designed to ensure that the exactly correct amount, instead of an approximate amount, would have been deducted by the end of the year. Withholding was applied to other incomes where possible.

2. Deductions and Exemptions.—The system of personal deductions and exemptions in the early 1960s differed substantially from that of the U.S. and Canada:

1. Relief was given for earned income (labour income) by allowing deduction of $\frac{2}{9}$ of such income, up to a maximum figure of £4,005, and of $\frac{1}{9}$, up to £9,945.

2. Personal allowances (exemptions) were: £200 for a single person, £320 for a married couple, and amounts for each child according to age: under 11, £155; 11–15, £140; and over 15, £165. Special rules are provided for other dependents.

3. A portion of amounts paid as life insurance premiums was deductible.

3. Rates.—The standard tax rate was 7*s*. 9*d*. on the pound, or 38¾%. Progression was introduced in two ways:

1. Lower incomes were taxed at rates reduced below the standard figure; as of 1963, 4*s*. rate on the first £100, 6*s*. on the next £200. The standard rate was applied only to the excess.

2. The surtax, technically a separate tax, applied to all income in excess of £4,500 (£2,000 prior to 1961). The combined normal and surtax rates reached, in 1956, the maximum figure of 88¼% on income in excess of approximately £15,000.

With relatively low exemptions and a standard rate of nearly 40%, the tax burden on the typical wage earner was very much heavier than that in the United States. While the maximum rates were not fundamentally different from those in the U.S., they were reached at a much lower income level, and were thus much more significant.

Corporations were subject to the standard income tax rate on their entire income, but the portion on dividends paid was subtracted from the dividend and was treated by the stockholder as prepayment or withholding of tax on the dividend, in the same manner as withholding of tax on wages. There was, therefore, no double taxation of dividend income by the income tax.

4. Profits Tax.—Distinct from the income tax was the profits tax, applied only to corporations. The tax was applied to net profit, after deduction of bond interest, in the same manner as the income tax. Companies with incomes of less than £2,000 a year were exempt, and a reduction in tax was provided for those with income between £2,000 and £12,000. The standard rate in 1961 was 15%. The profits tax created an element of double taxation of dividend income.

C. Canada

The Canadian income tax system has been influenced by both the U.S. and British taxes, although in general structure it resembles the former more than the latter.

1. Personal Income Tax.—In the early 1960s this tax was applied to income from all sources, excluding capital gains (more narrowly defined than in the U.S.), armed forces pay (subject to separate assessment), most veterans' benefits, gifts and bequests, life insurance proceeds at death, casualty insurance proceeds, unemployment benefits, family allowances and, in part, annuities. Net income was determined by deducting the expenses of gaining the income: for business firms and the professions, usual business expenses, including depreciation on a prescribed basis (the diminishing balance system); for employees, expenses involved in travel away from home in connection with employment, and union dues. Contributions by both employees and employers into approved pension systems were deductible.

Taxable income was obtained by subtracting from net income the following deductions: contributions (up to 10% of net income); medical expenses (in excess of 3% of net income); personal exemptions of $1,000 each for taxpayer and for spouse, $550 for each dependent over 16 and $300 for each dependent under 16 (the lower figure offsetting the exclusion of family allowances from taxable income).

Joint returns might be filed if the wife earned less than $1,000; if she earned more, she was required to file a separate return. No splitting of income for tax purposes was permitted.

The rate on the first $1,000 of taxable income in 1963 was 11%, and on the second $1,000, 14%. The marginal rate reached 35% at $10,000, 55% at $50,000 and a maximum of 80% on income in excess of $500,000. An additional 4% tax was applied to investment income in excess of $2,500 and an additional 3% tax on all income up to $3,000 for social security purposes. An abatement of 16% was granted for provincial income taxes paid.

A credit of 20% of the amount of the dividends received from Canadian corporations was deductible in determining tax due, and thus double taxation of dividend income was greatly reduced.

Tax on wage and salary income was collected through a withholding system.

2. Corporation Income Tax.—The dominion corporation income tax was very similar to the United States tax, applying to the entire net profit of the corporation whether distributed or not. The basic rate in 1963 was 21% on the first $35,000 of net income, with a combined rate of 50% (including 2% for social security purposes) applying to the portion in excess of $35,000.

D. Other Countries

1. Australia.—Income taxation in Australia in the early 1960s was employed only by the commonwealth government. The concept of income was basically the same as in the U.S., except that capital gains were not taxable. Usual business deductions were permitted, as well as certain personal expenses, including those for medical care, gifts to charities but not churches, insurance premiums and tuition fees. Special deductions were permitted for persons living in high-cost areas. These, as well as deductions for dependents, took the form of deductions from tax rather than from taxable income, and thus did not reduce the tax rate class into which the income fell. The allowance was £A130 for a married couple, £A78 for the first child under 16 and £A52 for subsequent children. No income splitting was permitted. Property income was taxed more severely than other income.

The rate structure was highly progressive and was based on a formula system that eliminated wide brackets. The initial rate was only 1*d.* in the pound, but the maximum rate of 160*d.* (66⅔%) was reached at the income level of £A16,000. Collection by withholding was employed.

Corporate income was subject to a tax on net profit, with a slight degree of progression; the principal rate was 40%. Small corporations were taxed as though they were partnerships. There was no mitigation of double taxation of dividends.

2. New Zealand.—The New Zealand income tax applied to income defined in the usual manner, excluding capital gains and excluding dividends, which were, however, taken into consideration in determining the tax rate applicable. Dividends themselves were taxed only at the corporate level. Usual business deductions were permitted, but personal deductions were limited to a very few items. Corporations were taxed on their entire incomes, at somewhat progressive rates.

3. France.—The French income tax was schedular prior to 1948, applying at different rates to various forms of income. Between 1948 and 1960, a dual system was used, with a uniform 18% tax applying to all types of income, and a progressive-rate surtax applying to higher incomes (to only about 2,000,000 out of a total of 30,000,000 taxpayers). In 1960 the uniform-rate tax was eliminated and the coverage and rates of the progressive tax were raised. With both the old and the new systems, low incomes were excluded from tax, and exemptions were allowed for dependents. Earned income and income of farmers, craftsmen and some other groups received special treatment. Income splitting was provided not only between husband and wife, but between parents and children as well. Small business firms and farmers were, in effect, taxed upon an estimated profit figure rather than a calculated figure of profits.

The corporation income tax, introduced in 1948, applied to all corporate profits; the rate in 1961 was 50%. A partnership had the option of being treated as a corporation.

4. Italy.—The Italian income tax system consisted of two parts, a proportional schedular tax on various forms of income, and a progressive tax on total income. The schedular tax was imposed at different rates on various forms of income. Three flat-rate taxes applied, respectively, to income from land, from buildings and from other sources. The third group was classified into three categories: investment income, profits from operation of business and wage and salary income. The wage income was treated most leniently, in both rates and exemptions. These taxes applied to both individuals and corporations.

In addition to these proportional taxes, a complementary personal income tax was imposed at progressive rates. Personal exemptions were provided. The yield of this tax was limited.

After 1951 all taxpayers were required to file an annual return. Previously tax was paid primarily on the basis of estimates.

5. Federal Republic of Germany.—The income tax revenue in West Germany was shared between the *Länder* and the federal government. The personal income tax resembled that of the United States, being imposed on all income regardless of source, the rate being the same on all types of income. The tax rate was progressive, from 20% to 53%. Exemptions were provided for dependents.

A corporation income tax was imposed on the net profit of all corporations, at a proportional rate (51% on undistributed profits and 15% on distributed profits in 1961). Reduced rates were applied to certain types of businesses.

6. Others.—Belgium imposed schedular taxes on various types of income, at different rates. There were three such levies: on income from land and buildings; on interest and dividends; and on labour income. There were two supplementary taxes, the first on both individuals and corporations, at a progressive rate, with exemptions similar to those of the tax on labour income; the second a steeply graduated tax on personal incomes only.

The Netherlands applied a uniform income tax at progressive rates to all income. Exemptions were provided for dependents. A corporation income tax was applied to all corporate profits at rates ranging from 44% to 47%.

Personal and corporate income taxes were major revenue sources in the Scandinavian countries. In some instances local income taxes were levied as supplements to the national tax. In Switzerland the primary income tax was that imposed by the cantons, but from 1940 the confederation imposed a tax, at progressive rates, uniform on all types of personal income.

III. ECONOMIC ASPECTS

A. The Role of the Income Tax

The role of the income tax in the tax structure and the effects it has upon the economy have become questions of major signifi-

cance, as the tax has grown in importance. Income taxes have been introduced primarily to raise revenue in a manner which conforms most closely with the ability-to-pay doctrine of taxation. In the literature of public finance, and in less explicit form in popular thinking and discussions of legislative bodies, the principle that persons should pay tax on the basis of their ability is widely accepted. In turn, net income, after certain adjustments, is regarded as the best measure of ability, since it is the principal determinant of a person's economic well-being—the level of consumption and savings which he can enjoy. Adjustments can be made in net income in determining taxable income to reflect certain circumstances, such as size of the family, which influence the standard of living that the family can enjoy from a given net income.

The importance of income taxation is also due in part to the fact that the burden of such taxes can be made progressive relative to income. There is wide acceptance of the principle that taxpaying ability rises faster than income, and thus that persons with high incomes should pay not merely more taxes, but a higher percentage of their income in taxes, than persons with lower incomes. Only by a direct tax on income can this result be accomplished readily. Closely related has been the goal of lessening inequality of real income. Under the philosophy that income distribution tends to be excessively unequal relative to the standards regarded by society as desirable, the income tax has been regarded as an effective instrument for producing greater equality.

The willingness of countries to employ the income tax has been greatly increased by its high revenue yield (under favourable circumstances) and by the belief that such a tax does not seriously affect economic behaviour and thus does not significantly reduce total national product or alter its composition to the detriment of the welfare of society. This belief is not necessarily entirely valid.

Acceptance of the principle of income taxation is by no means universal. Most of the attack upon the tax centres upon the use of progressive rates, rather than upon the principle of taxation of income as such. It is charged that there can be no possible scientific standards for determining the desirable degree of progression. Thus, progression tends to become excessive and seriously weakens the incentives of persons to work, to take more responsible positions, to develop and expand businesses, to invest in securities, etc.

In part, however, the attack is made against the income basis itself. It is maintained that administration of an income tax is inherently difficult because of the impossibility of checking reported figures of earnings and deductions. As a consequence, it is charged, substantial evasion results and great incentive is given for dishonesty. This argument receives particular emphasis in countries in which record keeping, accounting methods and standards of administration are not highly developed, and has been a major factor discouraging such countries from using income taxes of any magnitude.

The income basis is also condemned on the grounds that its use results in double taxation of the portion of income saved, since both the savings and the earnings from them are taxed, to the detriment of capital formation and economic development. This argument is regarded as spurious by defenders of the tax.

Finally, it is charged that excessive reliance on income taxation tends to penalize persons who have not yet accumulated wealth, compared with those who have.

B. Problems Relating to the Tax Structure

If a particular income tax is to meet the threefold requirements, under generally accepted standards, of (1) equity relative to ability to pay, (2) avoidance of adverse effects on the economy and (3) administrative feasibility, certain problems must be solved in the establishment of the tax. These can be summarized briefly:

1. Definition of Income.—In principle, income, as a measure of economic well-being, can most appropriately be defined as the sum of (1) the person's consumption during the period, plus (2) the net increase in the person's wealth. The second item may, of course, be a negative figure. It is this sum which constitutes the gain obtained by the person from economic activity during the period. But the difficulties of calculating these two magnitudes and of taxing persons on unrealized increases in wealth have led in practice to a different approach to the definition. Income is usually defined or described, therefore, in terms of the flow of wealth to the person during the period.

There are two important consequences of the use of the flow definition. In the first place, in the U.S. persons are usually not taxed on the value of income arising in cases in which no market transaction is involved, as, for example, the gain from the use of durable consumption goods previously acquired, the rental value of their own homes, etc. As a consequence, persons are given some artificial tax incentives to buy homes instead of renting them, to perform tasks for themselves instead of working for money income and paying others for the work, etc.

In the second place, the definition of income as flow during the period results in the taxation of capital gains—increases in the value of assets held—only when the gains are realized when the property is sold, instead of when they accrue. Since taxation at progressive rates in the year of realization of the gain would, in some instances, be inequitable, special favourable treatment is usually provided for capital gains, compared with that given other income. The recurrent flow concept of income led Great Britain and most British Commonwealth nations to exclude capital gains from taxable income. In countries in which the gains are partially taxable there has been constant demand for complete exemption, partly on the basis of the argument that such a policy would stimulate investment.

The favourable treatment or complete exemption of capital gains has provided great incentive to taxpayers to convert other income into the form of capital gains whenever possible; this in turn has led to progressive narrowing of the definition of such gains for tax purposes.

2. Exclusion of Certain Types of Income.—There is a strong presumption in favour of taxing all income regardless of the source, to avoid inequities and administrative problems in delineating various types of income. But arguments can be advanced for excluding certain types on grounds of general economic or social policy, or to avoid administrative complications. Bequests and gifts, for example, are universally excluded, because of their irregularity and consequent tax penalty under progressive rates, and the significance for taxpaying ability of the relationship of the donee to the donor. Small gifts are difficult to check. Pay to persons in the armed forces and veterans' benefits are often excluded on grounds of general governmental policy. Incomes from some types of economic activity may be excluded in order to stimulate the conduct of such activity.

3. Business *v.* Personal Expenses.—If an income tax is to rest upon net income, provision must be made for deduction of those expenses involved in gaining the income, generally known as business expenses. But even as a matter of principle it is difficult to distinguish precisely between such expenses and those for personal consumption purposes, and it is even more difficult to ensure correct application of the rules which are established. The greatest problems of principle arise in cases in which purchases are made for both business and consumption use (purchase of a car by a farmer or doctor) and with expenditures for education. Typically income tax laws have not recognized the latter as expenses of gaining the income, to the possible detriment of the maintenance of the supply of labour in fields requiring extensive training. Apart from the matter of principle is the very serious problem of preventing taxpayers from listing personal expenses as business expenses.

4. Time-Period Problems.—Income is essentially a more or less continuous stream through the years in which a person is earning a livelihood. But for tax purposes the stream must be segmented into periods, usually annual ones. Thus rules must be established to control the allocation of income and expenditures to particular periods. The item which has given rise to greatest time-period assignment difficulties has been depreciation charges on capital equipment. Typically, businesses are not permitted to charge capital purchases as current expenses for tax purposes, but are permitted to depreciate the purchase price over a period of

time. Governments have set up rather arbitrary rules relating to such allocation, with consequent problems of interpretation and complaints from business firms.

The depreciation question has been complicated in the mid-20th century by the sharp rise in the cost of capital equipment for replacement purposes. Demands that depreciation be permitted on the basis of replacement cost rather than the original cost of the equipment have been denied in most instances, although some countries have made special provisions to ease the problem for the firms created by higher replacement cost.

Because of the use of exemptions and progressive rates, the segmentation of the income stream results in an inequitable burden on those persons whose incomes fluctuate sharply from year to year. Over a ten-year period a person who earns a uniform $10,000 per year will pay much less tax than a person who earns $100,000 in one year and nothing in the other nine years. This penalty can be avoided by a system which allows the averaging of income over a period of years. But except in limited instances, as, for example, with capital gains, with business losses (which typically may be carried forward or backward against business profits of other years) and with incomes of certain specified occupations (farmers and fishermen in Canada, for example), governments have been reluctant to permit averaging because of the added administrative complications.

5. Personal Deductions and Exemptions.—It is generally recognized that the suitability of income as a measure of taxpaying capacity can be improved by adjusting the figure in terms of certain circumstances which affect the standard of living which can be attained with a given money income. The most important adjustment permitted is that for dependents, including the taxpayer himself. This allowance serves two primary functions: families with very low incomes are excluded completely from the tax; and the height of the tax on other families is adjusted in terms of the family size. The exemption may be a flat amount per dependent, or adjusted according to the dependent's status, a larger sum often being given for the taxpayer and spouse than for others. In theory the amount of the exemption should be based upon an estimate of the sum necessary for a minimum living standard, but in practice it has been dictated by revenue needs.

It is obvious that certain types of expenditures, such as those for medical care, directly reduce tax capacity, and many countries have authorized deductions for items of this type, as noted in previous sections. But the fear of eroding the tax base and opening avenues for evasion has tended to minimize the granting of such deductions.

6. The Taxpaying Unit.—A question of major importance is that of the taxpaying unit. The unit may be each individual separately, the husband and wife, or the entire family, including children. The treatment of each individual as a separate taxpayer ignores the basic nature of the family as a spending unit. In practice, husband and wife are usually permitted or required to file joint returns. A requirement for pooling of the income of the husband and wife has the unfortunate effect of causing marriage to increase total tax liability if both partners are earning substantial incomes.

An alternative, of allowing the division of income between husband and wife for tax purposes regardless of who earns it, as permitted in the United States, is the most equitable in many ways, but it does place a heavy tax premium on marriage. The usual practice of treating children merely as dependents encourages the splitting of property income with the children; only France has sought to meet this problem by treating children as partial partners in the entire family income.

7. The Problem of Corporation Income.—One of the most controversial aspects of developing a satisfactory income tax structure is the treatment of income earned by corporations. If only individual persons are subject to tax, the portion of corporate income not paid out as dividends is not subject to current income tax. To prevent this, special levies on corporations are typically employed. In some instances, particularly in Great Britain in the past, these have been regarded purely and simply as devices to reach the undistributed profits. But in many countries, and particularly in the U.S., the taxes on corporation income have gone far beyond merely reaching the undistributed profits, and have applied to all corporation net income, whether held or distributed. The effect is to place a double burden on corporate income paid out as dividends, so long as the initial tax burden rests on the corporations and is not passed on to their customers in the form of higher prices. This policy has been in part based upon the idea that the corporation is a suitable object for taxation, independently of any tax on the stockholders, and in part on the fact that such a tax raises a large amount of revenue with relatively little complaint and is perhaps less objectionable than most alternative sources. After 1945, however, several countries, including the U.S. and Canada, took partial steps in the direction of lessening the double burden on dividends, typically by reducing the net impact of the personal income tax on dividends. An alternate approach, under which the corporate tax would be limited to the portion of profits held in the company, has not met with favour, although it has important merits, and is used in Germany and some other countries.

C. Economic Significance

There are three primary aspects of the economic significance of the income tax: the incidence, or pattern of distribution of burden; the effects on economic development; and the significance of the tax for fiscal policy.

1. Distribution of Tax Burden.—It has been traditionally assumed that the burden of an income tax rests on the persons upon whom it is levied. So far as wages and other individual incomes are concerned, it is argued that the tax does not enable the persons to obtain higher incomes than they would otherwise receive, because the tax does not affect the supply of or demand for the particular goods or services used in production. With respect to business firms, it is assumed that the tax will not lead to a change in supply or price, since the reduction of the net earnings by a given percentage will not alter the levels of output and price which allow the firm to make the most profit.

In the mid-20th century these assumptions have been questioned. When labour unions develop in an industry, the income tax may be a factor leading them to demand and obtain higher wages than otherwise, and thus a portion of the tax burden will be shifted from their members. In view of the fact that the income tax applies to all net profit and not merely to excess profit, business firms also may in fact shift at least a portion of the income tax imposed upon them. Especially in markets that are not purely competitive, the tax may serve as a stimulus to movement closer to the price which would allow the maximum profits for the firms as a group, but was not previously obtainable, given the relationships among the firms. Others have argued that the tax will reduce the volume of investment and thus the output of goods by lowering the net return on capital, and cause shifting of the burden. The state of knowledge in the early 1960s did not permit any exact statement of the extent of the shifting, but it was obvious that the traditional assumptions were too restricted. To the extent that shifting of the tax does occur, the distribution of burden of the tax will differ from that which is intended.

2. Effects on Economic Development.—Particular emphasis was given after 1940 to the possible adverse effects of the income tax on the level of national product and the rate of economic development. There are several aspects of this question:

1. Effect on the supply of labour. It has commonly been charged, especially during and after World War II, that the income tax tends to reduce the total supply of labour-hours available and, particularly, the supply of highly trained executives, professional men, etc. It is argued that the tax makes such persons less willing to work because the government takes an increasing percentage of their incomes as they earn more. The tax may discourage overtime work, and encourage absenteeism and the taking of longer vacations. The tax may make persons unwilling to undertake the training necessary for more highly skilled jobs or to accept more responsible positions by reducing the net financial gain.

While isolated illustrations can be found to demonstrate these effects, and wartime tax rates apparently had a noticeable effect

on overtime work and absenteeism in some instances, there was little evidence in the early 1960s that income taxes were significantly reducing the labour supply, even at the higher income levels. Increased income taxes will cause some persons to work more rather than less to maintain old levels of living, particularly if the basic rate, rather than the marginal rate, is raised. Motives other than financial gain obviously play a major role in encouraging persons to take more responsible jobs.

2. Effects upon investment and economic development. The income tax has been charged with retarding business development and investment. It has been argued that the tax lessens the supply of money capital in the hands of individuals and may reduce their willingness to invest in business, that the tax curtails the amounts of money the firms themselves have for expansion and lessens their willingness to undertake the risks of loss.

Despite many complaints about these effects, business expansion progressed at an extremely rapid rate in most countries after 1945; the deterring effects of the taxes were much less obvious than might have been expected. In part, the taxes merely operated in the same manner as restrictive credit policy, holding expansion down to levels permitted by availability of resources. In part, as demonstrated by several studies of the question, the favourable tax treatment of capital gains reduced the adverse effects of the high tax rates by shifting some investors from other outlets to those involving the financing of business expansion by purchase of common stock. However over a period of time, the restrictive effect of high personal and corporate taxes on investment might become much more marked. By 1963 the lag in the rate of economic growth in the United States below levels regarded as optimum led to renewed attention to the question of the effects of income taxes upon economic growth.

3. Income Tax and Fiscal Policy.—From the standpoint of fiscal policy, that is, the attempt to gain greater economic stability by adjustment of government revenues and expenditures, the income tax has an important advantage. Because of its exemptions and progressive rates, its yield tends to fall drastically in depressions and rise more rapidly than the national income in inflationary periods. Thus, it cushions the fall of purchasing power and spending in depressions and curtails them in inflationary periods. This instability in yield, however, appears as a definite disadvantage to those persons who believe that any use of fiscal policy is unwise and that the budget should be balanced at all times. It is also a disadvantage to subordinate units of government, such as states and cities, which often have limited borrowing capacities and are not in a position to conduct deliberate fiscal policy. If the income tax does seriously retard investment, it would aggravate the problem of maintaining long-range full employment. *See* also references under "Income Tax" in the Index.

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INCREASING RETURNS, an economic term that denotes the possibility of increasing efficiency in production as the scale of operations of a plant or an industry increases. Mass production, for instance, is more efficient than small-scale handicrafts. Such a concept may have been in Adam Smith's mind when he stated that the division of labour was limited by the extent of the market. As markets expand, greater specialization increases efficiency. Increasing returns may be due to "internal" or "external" economies. Internal economies emerge as the size of the plant increases. External economies emerge with the expansion of industry regardless of plant size, as, for example, where expansion helps to create larger supplies of better-trained labour. *See* also DIMINISHING RETURNS. (H. O. Sc.)

INCUBATOR, an insulated enclosure in which temperature, humidity and similar environmental factors can be regulated at levels optimal for growth or hatching. This article discusses first the design and construction features common to all incubators and then the specialized incubators that are used to hatch poultry, to rear premature or feeble newborn infants, and to grow microorganisms in the laboratory.

Design and Construction.—Incubators vary greatly in size, shape and general appearance, according to the use for which they are intended; design and construction often involve many considerations specific to the application. The basic elements of design, however, are common to all incubators past and present, and the apparent differences are concerned mainly with size and with special accessory devices included for specific purposes.

All incubators comprise the four following elements of construction, with only limited variations in each: (1) an insulated enclosure to thermally isolate the synthetic environment from its surroundings; (2) a system or device to circulate the air or other medium to ensure uniformity of temperature to the required degree; (3) a thermoregulator to sense changes in temperature from a set point and to control the addition or withdrawal of heat as necessary to correct such changes; (4) a heating or cooling system, depending upon whether the desired operating temperature is above or below that of the surroundings.

Selection of specific materials and devices in each of the categories is determined principally by the size and shape of chamber required, the range of operating temperature, the required accuracy of temperature control and the facilities available for heating or cooling. All parts are interrelated in the final apparatus but may be selected somewhat independently.

Enclosure.—The design and construction of the enclosure are dictated primarily by the required size and shape and by the operating temperature. Size may vary widely from small chambers for bacteriological incubation to large rooms or entire buildings for poultry incubation. In every case access through doors or windows is restricted to minimize heat exchange with the surroundings, and the enclosed space is insulated to minimize heat transfer through the walls. The amount and type of insulation are determined principally by the operating temperature; the greater the difference between inside and outside temperatures, the greater the amount of insulation required. The type of insulating material used is determined to some extent by ease of handling in construction, ranging from a simple air space between double walls to layers of glass wool and, in the case of large enclosures, to the insulating materials used in commercial buildings.

Circulation System.—The circulation system is designed to provide the required accuracy of temperature control; the system must be efficient enough to maintain a uniform temperature in all parts of the enclosure. Many small laboratory incubators depend upon gravity convection or thermal drafts to provide sufficient circulation of the air. Larger enclosures and those requiring closer temperature control are equipped with mechanical devices such as blowers or fans to provide forced air circulation. In room or building incubators the circulation system is usually integrally incorporated in the heating or cooling system, comprising essentially an adjustable air-conditioning system.

Thermoregulator.—The earliest thermoregulator used in an incubator was a man who sensed changes in temperature from that desired and manually adjusted the intake of heat or cooling air

to correct such changes. Electrical thermoregulators, commonly called thermostats, are used in modern incubators. A modern thermoregulator is selected chiefly on the basis of the sensitivity and range of control required, and on the type of heating or cooling system used. The expansion regulator, which is the type commonly used for incubator control, comprises an electrical switch that may be set to open at temperatures above a selected point by expansion of a metal strip or liquid reservoir; at all lower temperatures the switch remains closed. It may thus be installed inside the enclosure and connected directly or through suitable electric circuits to the heating or cooling device to add heat when the temperature falls below the set point or to withdraw or withhold heat at temperatures above the set point. In large incubators where temperature control within a range of several degrees is required, the thermoregulator may be of the form used conventionally for control of building temperature.

Heating or Cooling System.—The heating system used for laboratory incubators are almost all of the electric type because such systems are efficient, convenient to install and require little maintenance. Larger systems, however, may incorporate external hot-air systems operated by conventional fuels. For incubation at temperatures below that of the surrounding environment, a conventional refrigeration system is commonly used to cool the walls of the chamber or to cool air forced through the chamber.

(E. F. E.)

Poultry Incubators.—The Egyptians and Chinese used incubators to hatch poultry eggs before the 3rd century A.D. While these incubators varied greatly in size, shape and construction, all were essentially heated rooms. Fires provided the necessary heat; temperatures were estimated and regulated by an attendant, who controlled the amount of heat by adjusting the fire and by opening or closing vents in the walls of the incubator. Eggs were placed in layers, either within baskets or on the floor, and were turned by hand two or three times daily.

The early chicken incubators of the western hemisphere employed a kerosene lamp to heat water or air, which circulated in pipes within the egg chamber. A wafer type of thermostat regulated the temperature either by opening or closing a vent in the top of the incubator or by controlling the amount of heated air entering the egg chamber. The necessary moisture was supplied by the evaporation of water from shallow pans located beneath the trays of eggs. Eggs were turned by hand several times daily.

Larger and more efficient incubators are now used. Electricity has largely replaced oil as the source of heat. Electric fans operating within large cabinets circulate the air, ensuring uniform temperatures of 37.5° to 37.6° C. (99.5° to 99.75° F.).

Humidity and temperature are controlled automatically in modern incubators. It is important that the correct amount of moisture be maintained at all times and at a uniform level throughout the incubation period. The air should contain approximately 57% moisture, which is indicated when the wet bulb thermometer reading is 30° C. (86° F.) and the dry bulb thermometer reads 99.5° F. Under these conditions, hatching eggs, during the first 18 days, will lose from 9% to 12% of their original weight. Excess humidity or too little moisture reduces hatchability, the former condition resulting in wet soggy chicks, the latter causing some chicks to stick to the shell.

The eggs in most modern commercial incubators are turned automatically at least eight times daily and at predetermined intervals. The eggs in some incubators are turned hourly. Frequent turning prevents the developing embryos from sticking to the inner membranes of the shell. In the larger commercial incubators as many as 75,000 eggs may be hatched at one time.

Most hatchery operators fumigate their incubators and hatchers regularly to control infections. Fumigation procedures vary at different hatcheries. Some operators fumigate the eggs when they are placed in the incubator and again at the end of the incubation period. Others fumigate only at the end of incubation, just as the chicks are starting to emerge from the shell. The most widely used chick fumigant is formaldehyde gas generated by mixing commercial formalin (formaldehyde solution) with potassium permanganate. (*See* also POULTRY AND POULTRY FARMING: *Renewing the Flock; Rearing Chickens.*) (M. W. O.)

Infant Incubators.—Incubators of this type are used primarily to provide a warm environment for infants born prematurely or for other infants who are unable to maintain a normal body temperature in environments that are warm enough for vigorous babies. The handicaps of small, weak infants with respect to the maintenance of body temperature are: (1) an inadequate insulating blanket of fatty tissues and skin; (2) a large surface area in relation to body weight; and (3) a limited ability to increase heat production by muscular activity.

The air temperature required to keep a baby's body temperature normal is dependent upon a number of factors in the environment, as well as upon the size and condition of the child. The smaller and weaker the infant, the higher the air temperature must be. If the air temperature is too high, however, the premature infant may develop fever since inadequate sweat production prevents such babies from adjusting to excessive heat.

Construction.—The earliest infant incubators were double-walled metal tubs that were heated by filling the space between the walls with hot water. In 1880 E. S. Tarnier of Paris constructed a closed incubator, which was divided into an upper chamber for the infant and a lower section containing a series of hot-water bottles. Outside air, admitted through a vent in the lower chamber, was heated as it passed over the hot-water bottles. The warm air rose into the upper compartment and passed out of the incubator through an outlet aperture above and just behind the head of the infant.

Modern closed incubators are not radically different from Tarnier's model. In most, a thermostatically controlled electrical heating element warms the air as it enters the unit. The incubator is vented to permit circulation of air and to prevent the accumulation of carbon dioxide. The walls of the chamber housing the infant are constructed of glass or transparent plastic to allow observation by attendants. The incubator remains closed while in use and medical and nursing procedures are performed through portholes fitted with plastic sleeves with elastic wristbands.

Humidity.—The air in infant incubators is usually moistened to reduce evaporation of water from the skin and lungs of small infants, thereby reducing the loss of body heat and of water. When it is necessary to treat the infant with oxygen, the desiccating and irritant effects of the dry oxygen on the lungs are minimized if the air breathed by the infant has a high moisture content.

The air in the incubator is humidified by directing some of the warmed air over a water reservoir. A higher degree of humidity can be produced by blowing nebulized water mist into the incubator. The temperature-humidity relationships required for premature infants vary considerably, depending on their size and age. Air temperature and humidity can be individually controlled in most modern incubators.

Oxygen.—The oxygen concentration in a modern incubator can be raised by administering supplemental oxygen. Following the discovery that the eyes of premature infants can be damaged by prolonged exposure to high concentrations of oxygen (retrolental fibroplasia), many incubators have been fitted with special devices to control the concentration of oxygen; limiting valves that prevent a rise in oxygen concentration above 40% are in common use. In addition, the concentration of oxygen in the incubator usually is monitored frequently by measuring it with an oxygen analyzer.

Isolation.—In 1938 in Philadelphia C. C. Chapple designed an infant incubator that is individually ventilated with fresh outdoor air to prevent the spread of airborne infections among infants housed in a nursery.

In this type of incubator the intake of air is adjusted to maintain a slightly greater pressure inside the incubator than in the room. Whenever a porthole is opened, air moves out of the incubator, thereby barring the entrance of nursery air. The mechanical and ventilation barriers provided by these incubators have proved to be effective in controlling cross infections in nurseries for premature infants. The development of effective air filters later made it possible to use nursery air instead of outdoor air for ventilating incubators of the Chapple type. (W. A. SI.)

Bacteriological Incubators.—Bacteriological incubators pro-

vide a specialized, controlled atmosphere or environment that is used to promote or control the rate of growth of bacteria and other microorganisms in various culture media. Essentially they comprise insulated enclosures and are thermostatically regulated to maintain a constant temperature, commonly in the range from room temperature to 60° C. (140° F.). For special purposes, incubators may be equipped with additional devices for cooling to low temperatures, for controlling humidity and the composition of the atmosphere surrounding the culture samples, for providing mechanical agitation and for illuminating photosynthetic cultures.

Bacteriological incubators are used in many fields of science. In medicine, for example, they are used to grow cultures in the identification of disease-producing organisms and in the selection of the most effective chemotherapeutic agent; other medical uses include the development and testing of antibiotics and other antimicrobial agents. In microbiology and biochemistry they serve in the study of the life cycles, genetics, growth and metabolism of microorganisms. In food-processing industries, particularly those involving dairy products, incubators are used in the development of sterilization methods and the testing of existing procedures. In water and sewage treatment plants they are used to determine the amount of treatment necessary to reduce microbial levels to a safe condition. In all divisions of science and industry where microorganisms are helpful or dangerous to health, bacteriological incubators are standard laboratory equipment.

Bacteriological incubators may be grouped into two classes according to whether water or air is used as the medium for achieving constant temperatures in the environment surrounding the cultures of bacteria. The large heat capacity of water, as compared with air, presents an advantage in that less temperature change occurs for a given amount of heat lost or gained when samples are added or removed, and operating temperature is more quickly regained. Incubators that use water suffer from a disadvantage, however, in that only test-tube or flask-type containers are readily accommodated, hence the water bath incubator is widely used only in special cases such as serology.

Hot-air incubators are more commonly used than water bath incubators since they are more convenient to employ with the widely used Petri dish, as well as with other containers. Hot-air incubators are insulated chambers that resemble ovens; they are thermostatically controlled and fitted with racks or shelves to hold flasks, tubes or culture dishes.

The modern hot-air incubators usually are built with double walls, double doors (one of which is glass) and double-pane windows to permit observation of the interior without disturbing the temperature equilibrium. Heating and temperature are generally controlled electrically, especially in laboratory sizes, since the maximum accuracy, uniformity and simplicity of control are obtained with electricity. Temperature regulation to an accuracy of ±0.5° C. (0.9° F.) is sufficient for most incubation purposes with a range from ambient to 60° C. (140° F.), the most commonly used fixed setting being 37° C. (98.6° F.), which is the normal body temperature of man. In warm climates, cooling coils are necessary to achieve these settings; water or refrigerated liquid is circulated through the coils to reduce the incubator temperature to below that of the room.

One form of special purpose incubator incorporates equipment for replacing air with carbon dioxide or other gas; it is used for growing and studying anaerobic bacteria. (E. F. E.)

INCUNABULA, a Latin neuter-plural, signifying in classical times "cradle" or "baby-linen" and so "beginning," now used to describe books printed during the earliest period of typography; *i.e.,* from the invention of the art in the 1450s to the end of the century (Dec. 31, 1500). The word has been adopted also in French (*incunables*) and Italian (*incunaboli*), as well as other languages, and the German *Wiegendrucke* expresses the same idea. The word incunabula seems to have been first used of early printing generally by Philippe Labbe in a book of 1653 and more specifically of 15th-century books by Cornelius à Beughem in a sale catalogue issued in 1688, but the year 1500 as the limit of a period was first adopted in 1643 by J. Saubertus in his history of the Nürnberg library, which includes the first known catalogue of a collection of such books. The limit is convenient but arbitrary, since no special development in the printing art can be connected with it.

The first comprehensive attempt to catalogue incunabula in general was made by Georg Wolfgang Panzer in the five volumes of his *Annales* (Nürnberg, 1793–97); this listed the books chronologically under printing centres. It was succeeded by Ludwig Hain's *Repertorium bibliographicum* (Stuttgart, 1826–38), which described in detail and with remarkable accuracy over 16,000 editions in alphabetical order of authors; its usefulness was much enhanced by an index of printers supplied for it by Konrad Burger in 1891. Panzer and Hain, however, paid very little attention to the study of types, which form by far the most important clue to the origins of those incunabula, one third perhaps of the total, which contain no indication of date of printing or printer's name. Henry Bradshaw, the librarian of the Cambridge University library, was the first to envisage this problem, but its solution was the work of Robert Proctor, of the British museum, London. Gifted with an extraordinary eye and memory for types, he arranged the incunabula of the British museum and of the Bodleian library, Oxford, under the printers, the centres where they worked and the centres and countries into which printing was gradually introduced, in each case chronologically. The succinct *Index* which he published in 1898 revolutionized the study of the subject and forms its foundation to this day. Later the British museum collection, numbering more than 10,400 separate editions and probably the most representative extant, was exhaustively dealt with in an official *Catalogue,* while a *Gesamtkatalog der Wiegendrucke,* describing all known incunabula on the principles of Hain but with full account taken of later research, was started in Germany in 1925. The editions produced in France, the Low Countries, Spain and Portugal and England have been separately the subjects of important publications, while catalogues of the incunabula preserved in the public libraries of France and of Belgium have also been compiled. Margaret B. Stillwell's *Census* of incunabula owned in the United States counted, in 1940, 35,332 copies of 11,132 editions; figures since then have greatly increased. Valuable aid to the study of types is rendered by facsimiles, of which extensive series appeared in England and Germany, and by Konrad Haebler's *Typenrepertorium* (6 parts, 1905–24) which groups all known types according to some of their characteristic letter-forms.

The sum total of the editions produced by the 15th-century presses is generally put at about 35,000 or upward, to which must be added a considerable percentage for ephemeral literature (*e.g.,* single sheets, cheap romances, ballads, and devotional tracts) which has either perished completely or exists only in fragments of waste lining bindings and other hiding places. The weightier texts naturally fared better, as they passed into the hands of students and librarians and book-conscious folk generally. The first printers working in Germany devoted much labour to reproducing the classics of medieval learning in large volumes, most of which were duly acquired by monastic libraries. Their condition today suggests that they were very little read, and as the lore which they contained became obsolete they sank to the status of curiosities, from which modern research into the history of printing has redeemed them. In Italy a somewhat similar result followed from a too sanguine estimate of the demand for the Latin classics, great as this everywhere was; the market became early overstocked, so that the first printers at Rome found themselves after four years of intense activity with quantities of unsalable books on their hands. The situation changed as output became diversified, the imposing but unhandy early fonts were replaced by smaller and more adaptable types, with great saving of space and paper, and more experienced presswork secured evenly filled pages throughout the book (one consequence being that by 1490 standardization is already much in evidence). Circulation was also helped on in northern Europe by annual book fairs at Frankfurt and elsewhere and by colportage. Competition naturally became increasingly severe and resulted in the concentration of the trade in a few hands as the weaker firms were beaten off. The size of editions varied greatly; the earliest printers of Rome struck off 225 copies and those of Venice 300 copies, but later the numbers rose and some of the standard legal texts, which were in regular demand, were

printed at Venice in as many as 2,300 copies. An average of 500 copies, giving a possible total of 20,000,000 copies put on the European market during the 15th century, appears to be a reasonable estimate.

The most important contributions to the output of incunabula are those of Germany (including Austria and German-speaking Switzerland) and of Italy, with that of Italy perhaps the greater as it is certainly much the more varied, almost monopolizing the printing of scientific and legal texts. In Germany the chief typographical centres were in the progressive south (Strasbourg, Nürnberg, Augsburg, Basel) and in Nürnberg the press of Anton Koberger put forth an immense amount of print from 1473 onwards. Although in Italy some 80 towns had presses, these were mostly short-lived and the main contribution again came from the flourishing northern cities (Venice, Milan, Bologna, Florence), together with Naples and Rome in the south. Venice far outdistanced all rivals everywhere and is reckoned to have produced some 4,500 editions in 1,125,000 copies. There follow in order France (more than 3,000 editions, mostly Parisian or Lyonnese), the Low Countries (fully 2,000), Spain and Portugal (about 1,000) and England (approaching 400, of which William Caxton's share was a little over 100).

Religious literature was much printed everywhere, but especially in Germany. The Bible was printed 94 times in Latin (the Vulgate version), 15 times in German and 11 times in Italian. Once overproduction had ceased, the demand for the Latin classics continued steady and was largely covered by the Italian presses, which were responsible for more than 200 of some 340 recorded editions of the writings of Cicero, the favourite author of the humanists. Greek authors were mostly available in translations only. The importance of law printing may be estimated from the fact that the standard collection of canon law, the Decretals of Pope Gregory IX, went through some 50 editions and that the commentary of Nicolaus de Tudeschis upon it, running to five or six immense folio volumes, was printed in its entirety no fewer than 15 times.

BIBLIOGRAPHY.—R. Proctor, *An index to the Early Printed Books in the British Museum . . . With Notes of Those in the Bodleian Library* (1898–1938); *Catalogue of Books Printed in the 15th Century Now in the British Museum*, parts 1–9 (1908–62); *Gesamtkatalog der Wiegendrucke*, vol. 1–8 (1925–40); Marie Pellechet and Marie-Louis Polain, *Catalogue general des incunables des bibliothèques publiques de France*, 3 vol. incomplete (1897–1909); M.-L. Polain, *Catalogue des livres imprimés au quinzième siècle des bibliothèques de Belgique*, 4 vol. (1932); M. B. Stillwell, *Incunabula in American Libraries. A Second Census* (1940); Edward Gordon Duff, *Fifteenth Century English Books. A Bibliography* (1917). *See* also K. Haebler, *Handbuch der Inkunabelkunde* (1925; Eng. trans. *The Study of Incunabula*, 1933).

(J. V. Sc.)

INDALSÄLVEN (INDAL RIVER), in Sweden with headwaters in Norway, flows about 220 mi. southeast to enter the Gulf of Bothnia between Sundsvall and Härnösand. Its tributary streams include Lången, Håkan and Amnerån, which have considerable lakes along their courses. Draining a large part of Jämtland, with lakes which even the flow and with many rapids in the middle sector, this river is the most important hydroelectric source in Sweden. Power is taken by high-tension cables to industrial centres in the south, especially from Krångede. In 1796 at Ragunda a morainic dam ruptured, leaving a deserted waterfall and defile now known as Döda Fallet (Dead falls). An important logging route, there are sawmills and pulp mills in the Indal estuary area. (A. C. O'D.)

INDENTURE. This legal term, which once indicated a specific form of deed, has lost its technical significance and is applied to a diversity of documents. Most commonly, it refers to a written agreement executed between two or more parties and embodying a conveyance of property (*e.g.*, indenture of trust). Other familiar uses relate to certain contracts for service abroad (whence the phrase "indentured servant") and contracts of apprenticeship (thus, the apprentice "takes up his indentures" upon completing his term). (*See* CONTRACT LABOUR; APPRENTICESHIP.)

The name derives from the early practice of inscribing copies or counterparts of a deed of mutual covenant on a single skin or sheet, then separating them along a notched or "indented" line, thus providing for subsequent authentication by matching the serrated edges. A deed executed by one party alone had a smooth or "polled" edge and was called a deed poll.

In Great Britain, by the Real Property act, 1845, s. 5, deeds purporting to be indentures have the intended effect although not indented; and by the Law of Property act, 1925, s. 57, indentures may be described according to the transaction intended (*e.g.*, "this mortgage"). In the United States, like results have been reached without special legislation. (C. H. Li.)

INDENTURED SERVITUDE: *see* CONTRACT LABOUR.

INDEPENDENCE, a city of Missouri, U.S., 10 mi. E. of Kansas City (*q.v.*) and 3 mi. S. of the Missouri river; the county seat of Jackson county. Independence is within the Kansas City standard metropolitan statistical area and co-operates with Kansas City in area planning. Pop. (1960) 62,328; for comparative population figures *see* table in MISSOURI: *Population.*

Best known since his presidency as the home of Harry S. Truman, Independence was once the only city of consequence west of the Mississippi. It was settled in 1827; Mormon settlers arrived in 1831 and were driven out in 1833 (*see* LATTER-DAY SAINTS, CHURCH OF JESUS CHRIST OF: *History*). From the early 1820s until 1848, Independence was the starting and outfitting point for the Santa Fe and Oregon trails (*qq.v.*) and the California trail. It was chartered as a city in 1849.

The Harry S. Truman library, a research centre on the presidency, including a museum was dedicated in 1957. A colonial-style courthouse, rebuilt in 1932 when Truman was presiding judge, is on the square in the centre of the city. The restored log courthouse (1827) houses the welfare office; the old jail, built in 1859, is a museum and county historical society headquarters. World headquarters of the Reorganized Church of Jesus Christ of Latter Day Saints are in Independence; and in 1907 the Mormons of Salt Lake City moved their central states mission there. More than 60 industries make a variety of products. Independence is also a residential suburb of Kansas City. (S. C. G.)

INDEPENDENCE, DECLARATION OF, U.S.: *see* DECLARATION OF INDEPENDENCE.

INDEPENDENCE DAY, U.S., or Fourth of July, the anniversary of the adoption by the continental congress, July 4, 1776, of the Declaration of Independence, is the greatest secular holiday of the United States. Congress actually approved the resolution of independence on July 2 but the Declaration of Independence, which was drafted to justify this momentous decision, was not sanctioned by congress until July 4. It was publicly read in the yard of the Pennsylvania statehouse in Philadelphia on July 8. The fact that congress had formally cut the last tie with Britain on July 2 was quickly forgotten, and July 4 was celebrated as the day of independence. (*See* DECLARATION OF INDEPENDENCE.)

The first anniversary of the declaration was observed in Philadelphia by the adjournment of congress, a ceremonial dinner, bonfires, the ringing of bells and fireworks. The custom spread to other cities and states, where the day was marked by parades, patriotic oratory, military displays and fireworks. Civic-minded groups worked to link the ideals of democracy and citizenship to the patriotic spirit of the day. Games and athletic contests, picnics, patriotic programs and pageants, and community fireworks displayed by experts became characteristic of the day.

Many undertakings of public interest have been initiated on July 4: digging the Erie canal, 1817; building the Baltimore and Ohio railroad, first railway in the country, 1828; laying the cornerstone of the Washington monument, 1850; formal recognition of the Philippines' independence, 1946.

BIBLIOGRAPHY.—R. H. Schauffler, ed., *Independence Day* (1912); Carl L. Becker, *The Declaration of Independence* (1922); Dumas Malone, *The Story of the Declaration of Independence* (1954).

(J. K. So.; J. R. Al.)

INDEPENDENCIA, a small province in southwestern Dominican Republic. Area, 719 sq.mi.; pop. (1960) 27,475. It largely comprises the arid basin between the Sierra de Neiba to the north and the Sierra de Bahoruco on the south. Lake Enriquillo, a large salt lake near the centre where flamingos and alligators breed, lies 144 ft. below sea level. The province produces small amounts of irrigated sugar cane, rice and bananas. It was created from the western section of Bahoruco province in 1948 as part of

a plan to develop the area bordering Haiti. The provincial capital, Jimaní, founded 1949 on the west shore of the lake, is a small frontier town. (D. R. D.)

INDETERMINATE EQUATIONS: *see* DIOPHANTINE EQUATIONS.

INDEX, a list of the matter discussed in a book or set of books, showing the pages where each subject is to be found; or, in a more general sense, an indicator of the position of information on any given subject. Such a list may contain the names of persons, places, specific subjects or ideas discussed. An alphabetical arrangement of an index is usually found to be more convenient for consultation than one divided into several parts under large subjects.

Indexes are a valuable key to the material they are concerned with, and for many books they are essential. They have been found in volumes printed as early as the 15th century; the growth of indexing from a short table of contents to an extensive subject index is traced in H. B. Wheatley's *What Is an Index?* (1878). In modern books the table of contents and the index are distinguished, the table of contents being printed at the beginning of the book and the index at the back. Indexes to sets of books, such as the complete works of an author or an encyclopaedia, may be printed in separate volumes. The Index to *Encyclopædia Britannica* is an example; the introduction to it sets forth some principles that apply to other indexes as well.

Periodical Indexes.—Almost all periodicals have an index covering the entire volume, issued with the last number. A useful type of periodical index is for many volumes of a set, especially when the publication has not been analyzed in one of the indexing mediums. *Gentlemen's Magazine,* for example, has a *General Index* in 2 volumes covering the years from 1731 to 1818; *Poole's Index to Periodicals* did not begin indexing the *Gentleman's Magazine* until 1868. Daniel C. Haskell has compiled a *Check List of Cumulative Indexes to Individual Periodicals in the New York Public Library* (1942) that lists about 4,500 different indexes.

In 1848 William F. Poole published the first index to English periodicals, *An Alphabetical Index to Subjects Treated in the Reviews and Other Periodicals to Which No Indexes Have Been Published.* In 1876 Poole proposed a co-operative plan for indexing current periodicals. This resulted in the publication in 1891 of the first two volumes of *Poole's Index to Periodicals,* covering 1802–81. This was followed by five supplements, each covering five years.

The H. W. Wilson Co. has published indexes for many years, beginning in 1900 with the *Readers' Guide to Periodical Literature,* which analyzes over 100 of the popular current periodicals. This was followed in 1913 by the *International Index to Periodicals,* now indexing about 175 of the more scholarly journals too specialized for inclusion in the *Readers' Guide.* Readers asked for more specialized indexes, with the result that the *Industrial Arts Index* was begun in 1913, the *Agricultural Index* in 1916, the *Education Index* in 1929, the *Art Index* in 1930, *Library Literature* in 1936, and the *Bibliographic Index* in 1938.

Other Indexes.—Newspaper indexes are valuable, but few have been compiled because of the magnitude of the work. The best-known ones are the Palmer's *Index to the London Times* from 1790 to 1906, followed by the *Official Index to the Times* (begun in 1906), and the *New York Times Index* (begun in 1913). An index to one newspaper can serve as an index to other papers, since general news items appear in all the papers of the country at about the same time.

The *Great Books of the Western World,* edited by Robert Maynard Hutchins and published in 1952 in 54 volumes, contains 443 works of 74 authors. In volumes 2 and 3, entitled *The Great Ideas, a Syntopicon,* are 163,000 references arranged under 3,000 topics contained in the *Great Books.* It is the greatest index ever made of ideas found in the classics.

See also BIBLIOGRAPHY: *Enumerative (or Systematic) Bibliography.*

Making an Index.—The making of an index is an art that requires certain skills, such as accuracy, keenness in acquiring the point of view of the author, good judgment and conciseness, as well as knowledge of certain accepted rules for compiling such an index. For a brief discussion of basic considerations and procedures see *A Manual of Style,* published by The University of Chicago Press.

The rapid increase in the volume and complexity of the literature to be indexed has forced a serious consideration of the contribution that automation can make to indexing operations. "Mechanized indexing" is a generic term that includes a wide variety of mechanical and electronic devices and the indexing systems which they use.

Hand-sorted marginal-punched cards, the Peek-a-Boo system developed at the U.S. bureau of standards and Calvin Mooers' Zatocoding are effective for small files of material. Much experimentation has been conducted in adapting standard computer equipment, the IBM series, the Remington Rand UNIVAC, and similar machines, to the indexing of large collections of material. The most efficient devices, however, are those designed specifically for indexing operations such as the Minicard system of the Eastman Kodak Co., and the Filmorex developed in France by Jacques Semain, both of which employ microfilm as the storage medium. The Searching Selector developed at the school of library science of Western Reserve university is the most flexible yet devised and can use punched cards, microfilm or magnetic tape.

The advantages of mechanization are the ability to index large volumes of material so that it can be searched at extremely high speeds, the ability of the machine to correlate a great number of characteristics of the literature to be searched in a variety of complex ways and the capacity to perform other repetitive indexing operations that a machine can do more efficiently than man.

See also Robert L. Collison, *Indexes and Indexing* (1959); Martha T. Wheeler, *Indexing* (5th ed. rev., 1957), which is a pamphlet published by the New York State Library and an excellent brief treatment. (W. V. N.)

INDEX LIBRORUM PROHIBITORUM (INDEX OF FORBIDDEN BOOKS), the official list of books authoritatively forbidden to members of the Roman Catholic Church, together with the general rules of canon law which declare certain classes of books forbidden *ipso jure; i.e.,* without specific mention. The exact origin of this legislation cannot be assigned with certainty. Scripture records the burning of superstitious books after the preaching of St. Paul at Ephesus (Acts xix, 19). Early ecclesiastical condemnations of books are the Muratorian canon (2nd century), giving the canon of the New Testament and condemning apocryphal books; the condemnation of Arius and his book *Thalia* by the Council of Nicaea (325); and the so-called *Decretum Gelasii,* most probably written about the beginning of the 6th century. Though vigilance against the contamination of faith and morals through bad books had been constant throughout the earlier centuries, it became still more necessary after the invention of printing. The principal later editions of the *Index* are those of 1559, 1564, 1596, 1664, 1670, 1681, 1752, 1758, 1819, 1835, 1877, 1881, 1900, 1917, 1922, 1929, 1930, 1938, 1940 and 1948. Specific later additions to the *Index* up to March 31, 1959, are listed according to author and title in a supplementary leaflet which names 30 items, including all the works of Jean Paul Sartre (decree of Oct. 27, 1948) and André Gide (April 2, 1952).

The principle underlying this legislation is the same as that which inspired the earlier prohibitions cited above—the protection of faith and morals. It signalizes the belief of the Catholic Church that whereas freedom of the press is a relative and conditional good, eternal salvation is an absolute and unconditional one. The church protects human liberties as means to the attainment of the one supreme good; when so-called freedoms are contrary to that end, it restricts them, for its own children. The term "bad," as applied to books and reading in this context, means harmful to faith and morals. As to the specific books which may have this harmful effect, the Catholic Church, for its own children, is the judge.

The Code of Canon Law conceives the remedy against bad reading under two aspects, one preventive, the other suppressive. Accordingly there is one chapter on the previous censure of books (a matter with which this article is not concerned) and another on the prohibition of books. By far the more comprehensive and important part of this latter chapter are the canons which state in a

general way what classes of books are forbidden and the effect of the prohibition. The *Index* is not even mentioned in the code; it is in fact the less important part of the law on forbidden books. Consequently it necessarily supposes, though it does not strictly include, the canons referred to. These are accordingly printed in the preliminary pages of published editions of the *Index*.

Books which are thus forbidden by law though not mentioned in the *Index* are classified by can. 1399 under 12 heads. The definition of each of these categories is quite detailed and would require more explanation than is possible in limited space. As examples may be mentioned: certain editions of the Sacred Scripture; books on the liturgy or indulgences which are not correct; sacred pictures that are not in the spirit of the church's tradition; books which approve of superstitions or which treat of new devotions or prophecies, etc., without having complied with the requirements of canon law; books which defend heresy or schism, purposely attack religion or sound morals, treat of religious matters in a way contrary to the Catholic faith, ridicule Catholic dogmas, etc.; books which favour suicide, dueling, divorce, Masonic sects; books which purposely treat of lascivious or obscene matter.

The procedure prescribed by Benedict XIV in the constitution *Sollicita ac provida*, July 9, 1753, remained substantially unchanged when, in 1917, the Holy Office took over the entire charge of the prohibition of books from the now defunct Congregation of the Index, which had in turn received it from the Congregation of the Inquisition. Books are first examined by one of the *qualificatores* or by one of the consultors, then discussed and voted on by all the consultors; the verdict is given by the cardinals of the Holy Office and then submitted to the pope, who makes the final decision. The effect of a condemnation is to forbid the publication, reading, keeping, sale, translation or communication of the book. Cardinals, bishops and ordinaries are exempt from the law. Other persons must obtain permission from the Holy See or, with certain restrictions, from the ordinary. The law is subject to a rather liberal rule of interpretation in accordance with the general principle that laws which restrict liberty are to be narrowed rather than enlarged in their operation (can. 19). The penalty of excommunication *ipso facto* for violation is incurred only in a very few strictly limited cases (can. 2318).

The *Index* of 1948 contained a preface by Rafael Cardinal Merry del Val, reproduced from the 1929 edition; the canons of the Code of Canon Law (effective May 19, 1918) on the prohibition of books; a decree of the Holy Office (May 3, 1927) on sensual and sensual-mystic literature; a page of *praenotanda* or prenotes; and the authentic list of forbidden books. These are listed alphabetically by author and title, usually with the date and source of the condemnation. An asterisk designates a book which was condemned *donec corrigatur* (*i.e.*, only until it be satisfactorily amended); a cross distinguishes those condemned by apostolic letter from those condemned only by a decree of a Roman congregation. *See* also CENSORSHIP: *Christianity*.

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INDEX NUMBERS, statistics commonly used to show changes in the level of such economic factors as prices, wages, industrial production and employment. Ordinarily, the value 100 is arbitrarily assigned as the index number for a particular reference (base) period, with values for other periods of time compared as percentages of the base. For example, the U.S. department of commerce selected 1957 as the base year for total industrial production. In Jan. 1960 the index number was 111, indicating an increase of 11% over the 1957 level.

Among the more important index numbers are those designed to estimate trends in the cost of living. Large groups of workers have union contracts requiring employers to make salary adjustments as the cost of living fluctuates (*see* COST OF LIVING).

The data on which index numbers are based consist of records of particular quantities at two or more dates or places. In constructing an index number it is necessary to decide on the choice of the separate quantities, on their relative importance, on the period or place to be taken as base and on the formula of compilation. Thus, in the measurement of the change of wholesale prices in the United Kingdom (based on an index number called the Statist), 45 commodities were selected and regarded as of equal importance, the periods 1853–62, 1867–77 and 1913 served in turn as base, the average price in the base period of each commodity was equated to 100, the terms in each series of prices were expressed as percentages (price relatives) of that average and the simple average of the 45 relatives in any year formed the index number for that year. (*See* PRICES, STATISTICS OF.)

A distinction sometimes is drawn between two classes of index number: (1) where the object is to measure the movements of a magnitude without specific reference to any predetermined application, *e.g.*, the purchasing power of money in general (*indice monétaire*) as conceived by W. S. Jevons (1865); (2) where the measurement is to be applied to a defined group, *e.g.*, the changes in the cost of a quantitative standard, such as is used in a cost of living index (*indice budgétaire*). Many index numbers, however, are intermediate between these classes, and much of the analysis of the form and content of the numbers is appropriate to both. Thus, in all cases of price measurement, only those commodities can be included that are measurable in a defined and unchanged unit and for which the price can be ascertained.

PURCHASING POWER

In the measurement of the purchasing power of money in general it is argued that the prices of all commodities, not subject to regulation or monopoly, are equally significant. Theoretically the problem is one of pure sampling, and the precision of the result in any year is directly proportional to the square root of the number of independent terms included and inversely proportional to the mean dispersion of these terms from their average in that year (*see* STATISTICS).

In practice, the terms are not completely independent, for the prices of related commodities influence one another, and the precision is thus reduced. Also, the greater the interval from the base year, the greater tends to be the dispersion and the lower the precision. In periods when prices are changing rapidly, as in the years following World War I and World War II, the dispersion is usually considerable and the measurement loses accuracy.

There are three types of average applicable to price relatives: their arithmetic mean (A.M.) as described above for the Statist index number; the geometric mean (G.M.) of the same numbers, that is the nth root of their product if there are n commodities; and the harmonic mean (H.M.), which is the reciprocal of the arithmetic mean of the reciprocals. Thus, for two commodities whose prices were 6 cents and 10 cents in the base year, and 12 cents and 25 cents in any other year, the price relatives are 200 and 250, their A.M. is 225, their G.M. is $\sqrt{(200 \times 250)} = 223.6$ and their H.M. is $1 \div \frac{1}{2}(\frac{1}{200} + \frac{1}{250}) = 222.2$. If the latter year is taken as 100, the relatives in the original base year are 50 and 40, the A.M. is 45, and $45:100 = 100:222.2$. The H.M. of the "forward" relatives gives the same measurement as the A.M. of the "backward" relatives; or, if the comparison is between two places the H.M. of the relatives when the first is taken as base gives the same measurement as the A.M. when the second is so taken.

A general change in the relation of currency to its use tends to affect all prices in the same proportion, and "if other disturbing causes may be considered proportional to the ratio of change of price they produce in one or more commodities, then all the individual variations of prices will be correctly balanced off against each other in the Geometric Mean" (Jevons, *Investigations in Currency and Finance*, 1884, pp. 121–122). The geometric mean is therefore considered appropriate to this problem. It has the advantage that it gives less importance to extreme measurements than does the arithmetic mean. Also, its use makes the comparison of any two years independent of the choice of the base year.

CHANGE IN A FIXED AGGREGATE

The method generally used in the more objective problem of measuring the change of cost of a fixed aggregate of goods is as follows: the quantities of defined commodities that are produced or consumed in a year, or exported or imported, or are purchased in a week by a family, are estimated and the prices per unit are ascertained in a base year and also in the year to which the measurement is to refer. This budget of quantities is valued at base-year prices and again at the prices of the year in question. The computation of the index number is often effected by writing down the relative expenditure (quantity × price) on each commodity in the base year, applying to each the percentage that its price in the second year forms of that in the first, and adding the products. This sum (divided by the total of the base year's relative expenditures) gives the same index number as before. Cost of living index numbers are computed by this method. In this form the index number appears as a weighted average, where the weights are the relative expenditures and the things weighted are the price relatives. Considerable roughness in the weights has little effect on the result. It may also be regarded as an average of price relatives that form a sample of a larger group than that included.

The weakness of this method is that in comparing two years or two places, the relative expenditures generally differ and each plan of expenditure appears to have an equal claim to be included. This difficulty may be met theoretically by computing the index twice, first with the expenditures in year or place A and then with those in B and averaging the result. For comparison between places this method is applied; but it is seldom that the necessary weights can be obtained for more than one year, and till there is a further census of production or a new collection of working-class budgets the double computation cannot be made. Further, if the weights are available for three years or places, A, B and C, the index for B in reference to A multiplied by that for C in reference to B does not by any weighted average formula give that for C in reference to A (÷100), as it should. This so-called condition transitive is not satisfied by any formula that is symmetrical with regard to weights. The algebra of the method is as follows:

Write ${}_aQ_1, {}_aQ_2 \ldots$ and ${}_aP_1, {}_aP_2 \ldots$ for quantities and prices in A, and ${}_bQ_1, {}_bQ_2 \ldots, {}_bP_1, {}_bP_2 \ldots$ in B. The "forward" index number is $I_a = 100\Sigma_a Q_1 \cdot {}_bP_1 \div \Sigma_a Q_1 \cdot {}_aP_1$ and the "backward" index number is $I_b = 100\Sigma_b Q_1 \cdot {}_bP_1 \div \Sigma_b Q_1 \cdot {}_aP_1$. The geometric mean $\sqrt{I_a \times I_b}$ is Irving Fisher's ideal index number (*The Making of Index Numbers*, 1922, p. 220). The arithmetic average, $\frac{1}{2}(I_a + I_b)$ and the form $I_2 = 100\Sigma\frac{1}{2}({}_aQ_1 + {}_bQ_1) \cdot {}_bP_1 \div \Sigma\frac{1}{2}({}_aQ_1 + {}_bQ_1) \cdot {}_aP_1$, may be conveniently used. The three forms of average may be expected to give nearly identical results.

There is a great diversity of methods for computing index numbers in addition to those described above. Essentially, the usefulness of index numbers depends on the selection of base periods (or places) that are reasonably stable and typical, and the inclusion of a properly weighted and representative group of elements. Unfortunately, since the selection of base and components is in many ways arbitrary and subjective, index numbers should be regarded only as providing more or less trustworthy trend estimates; they should be interpreted with some caution.

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(A. L. B.; X.)

INDIA (BHARAT), a republic in southern Asia formed of a Union of States and Territories, came into existence on Aug. 15, 1947. It covers those parts of the former Indian empire (which consisted of British India and Indian princely states) with a predominantly Hindu population; those parts with a predominantly Muslim population forming Pakistan (*q.v.*). New Delhi is the capital. The mixed Indian-Pakistani commission failed to agree on boundaries and it was left to the chairman, Sir Cyril (later Lord) Radcliffe to draw the lines. The position of Kashmir remained undecided in the mid-1960s, the *de facto* boundary being an armistice line with Pakistan. Pakistan also claimed certain other tracts; there were areas of disputed territory with China in the northwest (Kashmir) and northeast (Assam) but the total area claimed as union territory by India was 1,261,416 sq.mi.

Certain of the old provinces of the British India became "states" with little change of boundary. The former princely states of Indian India were drastically reorganized and grouped; in 1956 the states of peninsular India were completely realigned on a linguistic basis; in 1960 Bombay state was divided into two. The Republic of India in the mid-1960s consisted of 16 states and 10 territories.

India's relations with the Commonwealth of Nations were defined at the London conference of prime ministers on April 27, 1949. Unanimous agreement was reached that the Republic of India should remain a full member of the commonwealth and accept the British sovereign as the symbol of the free association of its independent member nations and, as such, the head of the commonwealth. This was later ratified by the constituent assembly of India and reaffirmed when India became a sovereign democratic republic on Jan. 26, 1950.

Boundaries.—As described under INDIA-PAKISTAN, SUBCONTINENT OF, the subcontinent stretches broadly from the main crest line of the Himalayas in the north to Cape Comorin in the extreme south. The central part of the great Himalayan area, however, is occupied by the independent state of Nepal. To the west Uttar Pradesh and Himachal Pradesh stretch to the crest line of the Great Himalayas and beyond to a frontier with China (Tibet). Farther west the Kashmir-China border was still in dispute with China in 1963. East of Nepal, Indian territory projects northward into the Himalayan region to include Darjeeling, with Sikkim and Bhutan as buffer states between India and China. Still farther east, however, the very large area known as the North East Frontier Agency (*q.v.*), attached to the state of Assam, is claimed by China also.

In the east India has a long frontier through mountainous country with Burma, with the state of Nagaland and the territory of Manipur on the borders. East Pakistan, coinciding closely with the Ganges-Brahmaputra delta, forms a large enclave in Indian territory and renders communications between the main mass of Indian territory and the isolated state of Assam particularly difficult.

In the west the boundary with West Pakistan passes through the featureless plains of the Punjab, cutting rivers, canals, rails and roads so as to include the Sikh country and their "capital" Amritsar, in India and Lahore in Pakistan, then through the almost uninhabited heart of the Thar or Indian desert to the head of that marsh or desert waste the Rann of Cutch (Kutch). Pakistan has laid claim to some sections of Kathiawar but otherwise the southern boundaries of India are clearly defined by the sea—the Arabian sea on the southwest, the Bay of Bengal on the southeast. The small French enclaves were retroceded in 1954, and the small Portuguese territories were annexed by India in 1961.

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I. PHYSICAL AND REGIONAL GEOGRAPHY

India embraces (1) portions of the Himalayan and sub-Himalayan regions of the subcontinent and part of the eastern mountain divide with Burma; (2) the extensive middle section of the Indo-Gangetic plain together with the Brahmaputra valley of Assam but excluding the greater part of the delta; and (3) practically the whole of the Indian plateau of ancient rocks which makes up peninsular India. Climatically the whole enjoys a tropical monsoon climate but with extreme ranges of rainfall from under 5 in. in the desert to the wettest stations in the whole subcontinent—indeed in the world. The north is drained by the Ganges (Ganga) and its tributaries, for the most part deriving their waters from the monsoon rains and snows of the Himalayas and so enjoying a perennial though markedly seasonal flow. In the northwest the Indian state of the Punjab is traversed by tributaries of the Indus, likewise deriving their water from the Himalayas. In the northeast the state of Assam is drained by the great Brahmaputra.

In contrast to the north, the rivers of peninsular India derive their water essentially from the monsoon rains; even the largest are almost dry in the dry season so their value for navigation has never been great and their use for irrigation presents great problems.

Geographical Regions.—The marked changes in relief, combined with related geology and soils, together with very great differences in rainfall, afford a basis for the division of India into contrasted geographical regions. Authorities differ regarding number and boundaries but the broad pattern is agreed.

The Himalayan and Sub-Himalayan Regions.—These include Kashmir, Himachal Pradesh, parts of Uttar Pradesh, West Bengal and Assam, and they have all the complexities of highly mountainous regions. The unhealthy foothill strip, the Terai (*see* TARAI), has gradually been settled from the plains.

The regions of the Indo-Gangetic plain fade imperceptibly into one another but include the densely peopled alluvial and intensively cultivated plains ranging from the dry, irrigated Punjab plains through the irrigated Upper Ganges plain to the Middle Ganges plain of Bihar and to the wet Deltas region in West Bengal (the greatest part of the natural region lying in East Pakistan). The Brahmaputra or Assam valley is a distinctive unit of its own. The Satpura range is usually considered the boundary between northern and peninsular India. Accepting this view, the large tangle of plateaus and hills, corresponding roughly with the state of Rajasthan which lies between the Satpuras and the northern plain, may be considered a distinct region fading westward into the desert.

The regions of the Indian plateau include the vast lava plains of the northwestern plateau, mainly in Maharashtra, the varied forested hill and cultivated basin land of the northeastern plateau (including Chota Nagpur), and the higher tableland of the Deccan proper or southern plateau, mainly in Mysore.

In the west, between the edge of the plateau or Western Ghats and the sea, is the wet, even-temperatured Malabar coast (roughly the state of Kerala) in the south and the wet Konkan coast farther north stretching to Bombay. North of Bombay, in Gujarat, there is the rapid transition from very wet to very dry, through Gujarat, Kathiawar and Cutch. On the eastern side of the peninsula, coastal plains of greater extent, with some major deltas, include the Northern Circars region in Orissa and Andhra Pradesh and the Coromandel coast and Carnatic region (Tamilnad—where Tamil is spoken), behind Madras with its winter rainfall. *See* also the *Physical Geography* and *Natural Resources* sections of INDIA-PAKISTAN, SUBCONTINENT OF. (L. D. S.)

II. THE PEOPLE

India is the world's second most populous country. Its more than 450,000,000 inhabitants show an enormous variety of distinct racial and ethnic types (*see* INDIA-PAKISTAN, SUBCONTINENT OF: *Anthropology*). Corresponding to this complexity of the racial composition is the wealth of different cultural patterns, ranging from the primitiveness of seminomadic forest dwellers to the highly advanced stage of civilization represented by the inhabitants of the great modern industrial cities, such as Bombay and Calcutta. Moreover there are major religious and linguistic divisions, and the differences between the populations of many parts of India are far more fundamental than those between the individual nations of Europe.

1. Religions.—Religion is still the principal basis for the delineation of the great cultural and social divisions of the Indian population, and it is only among a small sophisticated urbanized class that religious affiliations have ceased to provide the focal points for a sense of group identity. In 1960 adherents of Hinduism constituted 85% of the population, but among this vast majority there are innumerable sects each of which instills in its members a feeling of exclusive solidarity. Muslims account for just under 10%, Christians for 2.3%, Sikhs for 1.7% and Jains for under .5%. At the 1961 census the adherents of unspecified tribal religions accounted for only .5% of the tribal population, but this figure did not include the far more numerous tribal populations whose religion has a thin Hindu veneer while retaining most of its original, non-Hindu features. While Islam and Christianity clearly set off their adherents from Hinduism (*q.v.*), the border line between Hinduism and tribal cults is blurred and there is on neither side a clear sense of distinction.

2. Language Groups.—Language has always been an index of cultural and social groupings, and since 1947 linguistic distinctions have assumed great political importance. The 1951 census listed 845 languages and major dialects. The four major language groups represented in India are the Indo-Aryan, the Dravidian, the Tibeto-Burman and the Munda. While the culturally advanced sections of the Indian population speak mainly Indo-Aryan and Dravidian languages, the languages of the Tibeto-Burman and Munda groups are spoken almost exclusively by tribal populations that stand apart from the main stream of Indian cultural development. There is, however, no complete coincidence between linguistic and cultural groups. Many aboriginal tribes have lost their own tribal tongues and now speak the languages of their economically and politically more advanced neighbours. As a result of this process the same languages are now spoken by populations of widely divergent cultural levels; in Andhra Pradesh, for instance, Telugu is the language of the urban population of a highly sophisticated brahmanical tradition, of a peasantry persisting in an archaic rustic culture pattern, and even of the seminomadic food gatherers as primitive as any of India's aboriginal tribes. The planned national language of the Union is Hindi (*q.v.*) but English continues to be used officially until replaced by Hindi at some future date (see *Constitution* below). (*See* also INDIAN LANGUAGES; INDO-ARYAN LANGUAGES; MUNDA LANGUAGES; DRAVIDIAN LANGUAGES; TIBETO-BURMAN LANGUAGES.)

3. Racial and Cultural Groups.—While there is great racial and cultural diversity in some regions of India, there are other areas of comparative uniformity. An outline of the population pattern can best be given on the basis of a geographical framework.

Northern India.—The people of the greater part of northern India speak Indo-Aryan languages (Panjabi, Hindi, Urdu and Bengali) and are predominantly of Mediterranean (Europoid) racial stock. In the Punjab there are Hindus, Sikhs and Muslims, and after the partition of the subcontinent and the subsequent

transfer of populations the eastern Punjab became the main stronghold of the Sikhs. The numerically dominant castes are the Jats, who are excellent cultivators, and the Rajputs. There are also castes of herdsmen (Gujar, Ahir), and associated with all these are several untouchable castes, among which the Chamar and the Chuha are the most important. Cultivation on dry land is the basis of the economy.

In Rajasthan the old culture of the Rajputs, originally a martial people of landowners and feudal chiefs, persists in many respects, though most of the ancient forts are in ruins and there is now little scope for the traditional heroic Rajput virtues. The Rajput princes of such famous houses as Udaipur, Jaipur and Jodhpur are no longer temporal rulers. Most of the agricultural work is done by Jats; trade is mainly in the hands of the Banya caste.

In Uttar Pradesh, on the upper course of the Ganges, lies the classic homeland of Hinduism, where the Aryan settlers are believed to have first established themselves. In this area there is a strong concentration of Brahmans, and this priestly caste has maintained the purity of the old Aryan stock to a high degree. While only few Brahmans follow the priestly vocation, many work in the administration, in the learned professions and in other socially elevated occupations. Next to the Brahmans rank Bābhan and Rajput landholders, while Kurmis constitute the principal cultivating caste. Chamar leatherworkers are the most numerous of the untouchables but many of them have abandoned their traditional caste occupations and make a living as farmers and agricultural labourers. (*See* also BRAHMAN; CASTE [INDIAN]; UNTOUCHABLES.)

Punjab, Rajasthan and Uttar Pradesh are characterized by a comparatively great cultural and linguistic uniformity. Except in the Himalayan foothills included in these states, there are few linguistic and ethnic minorities and the social structure is more or less homogeneous throughout each state. The entire population speaks Aryan languages (Panjabi, Rajasthani and Hindi respectively) and the Mediterranean (Europoid) racial type predominates. Muslim influence, which was strong there in Mogul times, has left traces in the architectural style, in etiquette and in other outward forms of living; the women of the higher castes, for instance, lead a far more secluded life than those of the purely Hindu regions of the south.

East of Uttar Pradesh, in Bihar, populations of Aryan speech and Hindu religion inhabit mainly the Ganges valley, whereas in the hills of Chota Nagpur there live tribal people speaking Munda and Dravidian languages. They follow customs and an ancient way of life fundamentally different from those of the Hindus of the plains. These tribes stand outside the Hindu caste system. Their internal social structure is based on a system of exogamous patrilineal clans and on the principle of the essential equality of all members of the tribe. The Munda-speaking Santals and Hos, and the Dravidian-speaking Oraons are the most populous of these tribes, in whose racial make-up Veddoid elements predominate. While, traditionally, subsistence farming on land owned jointly by the village or the clan forms the mainstay of its tribal economy, many of the aboriginals have been drawn into modern industrial enterprises and particularly the steel industry of Bihar.

Some of the tribes (*e.g.*, the Santal) extend eastward into West Bengal, but the Hindu inhabitants of the fertile plains of Bengal have little in common with such aboriginals. The Bengali in general, and particularly the urbanized Bengali, is among the most advanced and intellectually active of Indians. Bengali Brahmans and Kayasths have a long tradition of intellectual achievements, and it was among them that western culture first took root on Indian soil. Speaking an Aryan language and conforming on the whole to the Mediterranean racial type, the Bengalis of the higher castes are akin to the inhabitants of the more western parts of the Ganges valley, but among the lower castes there are strong traces of Mongoloid and Veddoid elements. In Calcutta, the greatest urban centre of India, Bengalis, though forming the majority of the population, live side by side with people from all parts of India, such as Sikhs from Punjab and Marwaris from Gujarat. But each of these ethnic groups remains self-contained and there is little intermarriage.

An eastward extension of the Bengali type is found in the plains of Assam, but there Mongoloid elements are stronger. The Assamese of the Brahmaputra valley, though now caste Hindus, show in their culture pattern as well as in their racial make-up clear traits of eastern affinities derived largely from the Ahom, originally a Shan tribe.

The hill areas of both Bengal and Assam are inhabited by populations that have little in common with the Bengalis and Assamese-speaking Hindus of the plains. In the Darjeeling area and in the Himalayan state of Sikkim dwell Tibeto-Burman speaking communities of Buddhist religion as well as large numbers of immigrants from Nepal (*q.v.*); the latter belonged originally to different castes and tribes but in India tend to form a compact Nepali community. In the hill areas of Assam live numerous distinct tribes of the Mongolian race. Most of them speak Tibeto-Burman languages (*e.g.*, Nagas, Kukis, and Garos), but the language of the Khasis of the Shillong area, known for their matrilineal family organization, is of the Mon-Khmer type. The traditional culture pattern of these hill tribes belongs to an archaic civilization of southeast Asia rather than of India, and shows remarkable similarities with the primitive cultures of Borneo and the Philippines. These hill tribes are isolated not only from the Hindu populations of the plains, but also from each other, and in the Naga hills, for instance, linguistic diversity has reached a point where the inhabitants of groups of three or four villages speak a language not even understood by their immediate neighbours.

In the hills north of the Brahmaputra river, separately administered as the North East Frontier Agency, similar Tibeto-Burman-speaking tribes (*e.g.*, Daflas, Apa Tanis, Abors and Mishmis) persist in a primitive way of life only slightly modified by the imposition of a loose administrative control by the government of India. In the westernmost part of this region are small areas of Tibetan culture and Buddhist religion. (*See* BUDDHISM.)

Throughout the hill areas of Assam and the North East Frontier Agency, slash-and-burn cultivation is the predominant agricultural method, and only a few tribes practising rice cultivation on irrigated terraces have advanced beyond such shifting cultivation.

Middle India.—Another zone of archaic tribal civilizations stretches through middle India approximately along the contact zone between Indo-Aryan and Dravidian languages. But there tribes such as the Munda-speaking Saoras or Savaras, Gadabas and Bondos of Orissa, the Dravidian-speaking Gonds of Madhya Pradesh and Maharashtra, or the Aryan-speaking Bhils of Gujarat do not live in an isolation comparable to that of the hill tribes of Assam, but share some features of the culture pattern of the surrounding, economically more advanced, Hindu castes. It is these Hindu castes, rather than the remnants of the primitive autochthonous populations, which determine the specific character of the various regions of the Deccan plateau. In the west Maharashtra is dominated by the Marathas, a race of hardy dryland farmers with great martial qualities. The city of Bombay, though included in Maharashtra, has a mixed population consisting partly of Gujarati and Parsee traders and business men, and partly of an industrial working class hailing largely from Maratha villages. Poona, in contradistinction, is a centre of Brahman intellectuals and a Brahman and Maratha élite inclined to extreme nationalism.

The eastern part of the Deccan, now constituted as Andhra Pradesh, is inhabited largely by populations of Telugu speech whose agricultural economy is focused on rice cultivation in irrigated fields. The dominant castes among the Telugu landholders are Reddis and Kammas, in whose hands most of the agricultural land is concentrated, whereas large castes of lower, and partly untouchable, status were until recently landless and totally dependent on the landlord class. Compared with the highly polished intellectuals of Maharashtra to the west and Madras to the south the Telugus are somewhat rustic and lack an upper class of cultural aspirations extending beyond the frontiers of the Andhra region. But the Muslim ruling class of the former Hyderabad state has impressed on the central Deccan a veneer of Mogul style apparent in the architecture and the manner of living.

Southern India.—Muslim influence is much less apparent in the Kanara (Karnatak) region, now included in Mysore, and is virtually absent in Tamilnad, officially still known as Madras state. These are the strongholds of orthodox Hinduism where Brahmans have been the undisputed leading class. Tamil is the Dravidian language with the most ancient literary tradition, and some of the greatest Hindu temples and centres of pilgrimage (*e.g.*, Thanjavur [Tanjore], Tiruchirapalli [Trichinopoly], Madurai, and Rameswaram) are situated in the Tamil country. Intellectuals of the high Tamil castes are found throughout India in leading governmental posts, and it is among Tamils that the English language has the widest currency. At the same time caste distinctions are more rigid in the south than elsewhere in India, and the untouchables are more blatantly underprivileged than elsewhere. Among the lower classes of Tamils there are large castes (*e.g.*, Kallar) which used to be labeled "criminal" and whose caste customs did indeed countenance such acts as cattle theft and robbery.

The Malayalam-speaking populations of the southwestern regions of India, now combined in the state of Kerala, are clearly distinguished from those of Madras and Kanara. In this long strip of fertile country, known also as the Malabar coast, which enjoys a much ampler rainfall than the Deccan plateau, the cultural scene is of striking contrast to that of the adjoining regions of Madras and Kanara. Outwardly the settlement pattern of scattered homesteads situated between palm groves and rice fields differs radically from the compact Tamil villages. The density of population is great, and particularly in the former states of Travancore and Cochin there is a high level of education and literacy. Side by side with these progressive tendencies goes the persistence in a system of matrilineal family organization and succession rules inconsistent with orthodox Hindu ideas. Particularly among the Nayars, an important caste of landowners, the women are the owners of all real property, and the system of inheritance through women used to be combined with polyandry; though this type of marriage is no longer officially practised, the great freedom it gave to women has been retained and prevails also among other castes of Kerala. At the top of the hierarchical scale are the Nambudiri Brahmans, aristocratic landowners and priests. Most important among the non-Hindus are Syrian Christians who claim apostolic origin from St. Thomas but whose ancestors were probably converted by Nestorian missionaries, Roman Catholics and the Muslim Moplas, partly descended from Arab traders. Though a comparatively small state with little industrial development, Kerala has contributed an unusually large quota of administrators to the central government. Yet, despite the high level of education and general social advancement among the superior castes, there dwell in the hills of Kerala some of the most primitive of India's jungle tribes, and the general character of India as a land of ethnic and cultural contrasts is thus emphasized in this state.

The Beginning of Social Integration.—While most Indians live entirely within the frame of their regional culture pattern and abide by the rules of their own caste communities, there is a growing number of individuals whose loyalties and aspirations are not bound by state borders, but who live and work outside their natal regions, and think in terms of Indian rather than of regional aims. They constitute the beginning of an All-India society at home in all parts of the country and are usually inclined to a cosmopolitan outlook. Members of this stratum are found in the civil service, in the management of trade and industry, and in academic circles. By the early 1960s it was only in this thin stratum, and perhaps among the lowest industrial proletariat in urban slum areas, that caste barriers were breaking down, and the intermingling of different ethnic elements was leading to a blurring of the division of India's populations into distinct regional types.

Further aspects of Indian culture are discussed in INDIAN ARCHITECTURE; INDIAN ART; INDIAN LITERATURE; INDIAN MUSIC; INDIAN PHILOSOPHY; HINDI LITERATURE; SANSKRIT LANGUAGE; SANSKRIT LITERATURE; URDU LITERATURE. (C.V. F.-H.)

III. HISTORY

For history to 1947 *see* INDIA-PAKISTAN, SUBCONTINENT OF.

1. Partition.—Partition was accompanied by mass migration and communal massacres. Figures are conjectural. Over 500,000 lives may well have been lost. By March 1948 about 6,000,000 Hindus and Sikhs had migrated to India from West Pakistan, while some 6,500,000 Muslims had left India. Subsequent unrest in Bengal led to further migration: by 1950 about 4,000,000 Hindus had entered India from East Pakistan, while 1,000,000 more Muslims had left. Many of the refugees came from towns: this increased the difficulty of their resettlement. Remedies undertaken included the allocation of waste land suitable for reclamation as well as of land formerly held by evacuees. In the early months, the maintenance of law and order was made more difficult by the division of the civil and military services that resulted from partition. Civil servants were allowed to choose whether to remain in the service of India or enter that of Pakistan. The mixed composition of military units necessitated a division in two stages: first, units with a majority of Muslims were assigned to Pakistan, those with a non-Muslim majority to India; the voluntary transfer of individuals then followed. More lasting difficulties were created for India with the loss of the jute-growing districts of East Pakistan and the wheat- and cotton-growing districts of West Pakistan.

2. Republican Status.—The good will which accompanied the transfer of power from British to Indian hands was reflected in the new government's decision to retain the services of Viscount Mountbatten as governor general. He held office until June 1948, when he was succeeded by Chakravarti Rajagopalachari, and his administrative skill proved valuable during this troubled period. Although India was soon to become a republic, the government informed the commonwealth prime ministers' conference in April 1949 that it wished to remain a full member of the commonwealth, recognizing the crown as a symbol of the free association of the members and as such as head of the commonwealth. The conference thereupon agreed to India's continued membership in the commonwealth on those terms.

The new constitution was finally enacted by the constituent assembly in Nov. 1949 and came into force on Jan. 26, 1950. (See *Constitution* below.) Rajendra Prasad became the first president of the new republic. His functions were more those of a constitutional monarch than of a chief executive and effective power remained in the hands of Jawaharlal Nehru (*q.v.*), who continued to serve as prime minister at the head of a cabinet responsible to parliament (he had been *de facto* prime minister since 1946). Indeed, up to and after the elections of Feb. 1962 the Indian National Congress party held an overwhelming parliamentary majority and the only serious opposition to Nehru's policies came in the early years of independence from the right wing of the party led by Sardar Vallabhbhai Patel, who had charge of the important home and states ministries. After the partition Patel's pressure for a sterner policy toward Pakistan was so strong that Mohandas K. Gandhi (*q.v.*) appealed to him to support Nehru. Gandhi made his appeal a few hours before his own assassination on Jan. 30, 1948, by a Hindu extremist. A period of co-operation followed, but Patel's opposition was again aroused by Nehru's policies of economic planning and social reform, and he supported the candidature of the orthodox Hindu, Purshottamdas Tandon, for the presidency of the Congress party, in Sept. 1950. Tandon was elected but Patel's death before the end of the year left the right wing without an effective leader. When Tandon attempted to challenge Nehru's authority in 1951, he was forced to resign office, and Nehru himself served as party president until 1954. His authority was henceforth unquestioned, but he governed through parliament and his support greatly enhanced the importance of that institution in the governmental system. Parliamentary committees proved an effective means of uncovering administrative inefficiency and corruption. All ministers had to give serious attention to questions asked by members of parliament. An indication of the popular interest in parliamentary government was the fact that 53.7% of the electorate voted in the general election of 1962.

3. The Princely States.—The princely states seemed a constitutional anomaly in 1947. Their allegiance to the British crown lapsed with the ending of British rule, but the existence of more than 560 independent principalities was out of the question. They

were free to accede to India or Pakistan: geography required that most should accede to India. But the Muslim nawab of Junagadh acceded to Pakistan although about 80% of his subjects were Hindus. India's response was to send troops to occupy the state, after which a plebiscite was held, when the great majority of the votes cast were in favour of accession to India. Kashmir presented a more complex problem; it had common frontiers with both India and Pakistan and its Hindu maharaja postponed a decision although more than 75% of his subjects were Muslims. When Pathan tribesmen invaded Kashmir in Oct. 1947 the maharaja appealed for help to India and was persuaded to accede to that country. India sent troops and the Pathan tribesmen were subsequently reinforced by troops from Pakistan. With the help of a UN commission appointed by the Security council a ceasefire was proclaimed for Jan. 1, 1949, leaving India in possession of the vale of Kashmir and of the greater part of Jammu and Ladakh. The Muslim nizam of Hyderabad also postponed a decision, although he was surrounded by Indian territory and over 80% of his subjects were Hindus. After fruitless negotiations, prolonged by his hopes of winning virtual independence, India sent troops which occupied the state in a "police action" lasting less than a week in Sept. 1948.

Meanwhile, Sardar Vallabhbhai Patel, as states minister, was persuading the princes who had acceded to India to agree to the "integration" of their states. Many were joined together to form larger units: Saurashtra, for example, absorbed over 200 principalities of Kathiawar. Some were placed under the direct administration of the central government. Some were merged with neighbouring provinces. Mysore and Hyderabad were allowed to stand on their own as viable units. The princes were awarded pensions, and a few became *rajpramukhs* (prince-presidents), of these larger groupings. The process of integration was completed by the accession of Hyderabad to the Indian union on Jan. 26, 1950.

4. Provincial Boundaries.—Within the Congress party pressure was at this time being exerted for the reorganization of provincial boundaries on a linguistic basis. The Linguistic Provinces commission, appointed on the recommendation of the constituent assembly, reported in 1948 to the effect that provinces formed solely on linguistic considerations were inadvisable as they might hinder the spread of a national language and national consciousness. The Congress party thereupon appointed its own committee. Its report cautiously endorsed the views of the Linguistic Provinces commission, while admitting that an overwhelming popular demand in any area might have to be satisfied.

Such a demand was being stimulated by the activities of the Communist party, which was making a combined appeal to agrarian discontent and linguistic consciousness in an attempt to secure control of the Telugu-speaking districts of Hyderabad. Such was its success that troops had to be retained in the area for several years after the "police action" against Hyderabad in 1948, in order to restore ordered government. After that the Communist party continued to appeal to Telugu feeling by supporting the agitation that had arisen in the Madras province for the creation of a Telugu-speaking state of Andhra. Its influence contributed to the widespread outbreak of mob violence that ensued when the Telugu leader Shri Potti Sriramulu fasted to death for the same cause in 1952. The government then capitulated and a new state of Andhra was formed in 1953. The consideration of other provincial boundaries could no longer be avoided, and a States Reorganization commission was appointed in the same year. Its report, which was published in 1955, recommended a reduction in the number of states from 27 to 16, in addition to centrally administered territories.

After much controversy and popular agitation, the main proposals of the commission were carried into effect on Nov. 1, 1956, the total number of states being further reduced to 14. The changes included the creation of a new state of Kerala, the disappearance of some existing states—for example, Hyderabad and Saurashtra—and drastic changes in the boundaries of others. Much dissatisfaction was caused by the merger of Marathi- and Gujarati-speaking areas into an enlarged Bombay state. After sustained popular agitation, this was divided into the separate states of Maharashtra and Gujarat, on May 1, 1960. Much dissatisfaction was also caused by the rejection of the Sikh demand for a separate Panjabi-speaking state. A Sikh agitation by methods of civil disobedience followed the government's concession of a separate Gujarat, and culminated in the decision of the Sikh devotee Sant Fateh Singh to fast to death for a separate Panjabi-speaking state, in Dec. 1960. His fast was, however, broken on the expectation that fruitful negotiations with the government were about to take place. This expectation proved groundless, and a subsequent fast to death was undertaken by the Sikh political leader, Master Tara Singh, on Aug. 15, 1961. This fast was also broken on a similar expectation, and by then the Sikh agitation had lost momentum. Naga unrest had meanwhile assumed the proportions of a military rebellion, and the government established in 1961 a separate state of Nagaland with an interim government.

5. Communism in Kerala.—In the new state of Kerala the 1957 elections returned a Communist government to power. Its policies soon aroused such resentment that the opposition parties undertook "direct action" against it in June 1959. This action was nonviolent in character, but there were a number of casualties when the police opened fire on demonstrations and a breakdown of law and order seemed imminent. On July 31, 1959, President Rajendra Prasad therefore dismissed the Communist ministry, dissolved the state legislature, and took over the administration. Fresh elections were held in 1960, when the united democratic front formed by the opposition (the Congress, Praja Socialist, and Muslim League parties) won a majority of seats, and a coalition ministry was formed. The Communist share of the total vote was nevertheless substantial.

6. Social Policy.—Elsewhere, both in the states and at the centre, the Congress party retained its dominant position in the elections of 1952, 1957 and 1962, though a loss of momentum was perceptible. Moreover, after the satisfaction of its desire for national independence, the differences between the right and left wings of the party became more apparent. Radical reforms were achieved, however. The new constitution declared untouchability to be abolished and forbade its practice in any form. In fact, the eradication of such a deep-rooted institution was likely to take generations, but the inclusion of this provision in the constitution revealed the government's reforming spirit. The Hindu Code bill, involving drastic changes in Hindu law, encountered so much opposition and delay in its passage through parliament that the government decided instead to enact its provisions in separate statutes, notably the Hindu Marriage act of 1955 and the Hindu Succession act of 1956. Monogamy was made compulsory, divorce was facilitated and regularized, and women's rights to property were greatly improved.

7. Economic Policy.—Economic policy at first reflected the divided counsels within the party. Price controls imposed during the war were relaxed in 1947 in response to pressure from the right wing, led by Patel and supported on this occasion by Gandhi, but inflation soon led to their restoration. Nehru, on the other hand, had long been sympathetic to socialistic ideas, though he understood that to alarm the business community at such a time would have been inexpedient. A resolution on industrial policy was accordingly promulgated in April 1948: instead of nationalizing existing firms, the government would concentrate on the development of industries of national importance hitherto neglected by private enterprise. Certain industries, in the public sector of the economy, would remain the monopoly of the state—munitions, railways and atomic energy. In certain other industries of national importance such private enterprise as existed would be allowed to continue, but the state reserved the right to start new ventures. The rest of the economy—the private sector—would be left to private enterprise.

A Planning commission was established in 1950, and drew up a five-year plan for economic development, which was officially launched in the following year. Special emphasis was laid on agricultural development and on multipurpose irrigation and hydroelectric schemes. The Planning commission estimated that the national income increased by 17.5% during the first five-year

plan. During this period also, great efforts were made to eliminate intermediary landlord tenures between the peasant-cultivator and the state. Meanwhile, under Nehru's influence, the Congress party declared in 1955 that the goal of economic planning should be the establishment of "a socialistic pattern of society." An Industrial Policy resolution in April 1956 greatly increased the number of industries for the future development of which the state would be responsible and in the second five-year plan, which was inaugurated in the same year, emphasis was placed on the rapid expansion of basic and heavy industries in the public sector. This policy elicited a warning from the International Bank for Reconstruction and Development (the World bank) against underestimating the potentialities of private enterprise in a time of capital shortage. The second plan indeed encountered serious foreign exchange difficulties, which were only surmounted with the help of international loans arranged through the World bank. Great reliance was again placed on the World bank when a third five-year plan was inaugurated in 1961. But the period of the second plan saw some significant achievements. Three new steelworks were opened, each with an annual capacity of 1,000,000 tons, one built by British engineers at Durgapur (West Bengal), one by West German engineers at Rourkela (Orissa) and one by Soviet engineers at Bhilai (Madhya Pradesh). Both western and Soviet help was similarly obtained in the exploitation of India's oil resources. An event of significance for the future was the successful operation of India's first atomic reactor at Trombay, in 1956. Food production remained one of India's most serious problems, and in 1959 the government decided to encourage cooperative enterprise in agriculture. This problem seemed all the more serious when the census of 1961 revealed that India's population had increased by 79,000,000 in a decade, to a total of more than 440,000,000. Meanwhile, in protest against the government's declarations of faith in socialistic and co-operative methods, the Swatantra or Freedom party was founded in 1959 by Chakravarti Rajagopalachari, the former governor general.

8. Foreign Policy.—In foreign affairs, although India remained a member of the commonwealth, Nehru attempted to follow a policy of "neutralism and non-alignment" between the western and Communist blocs. In the hope of creating an "area of peace" in Asia and of encouraging a consciousness of common interests, India took the lead in summoning conferences of the representatives of Asian countries, the first being held in New Delhi in 1947. Another was held in 1949 to discuss Dutch policy in Indonesia. An attempt to extend such feelings of solidarity to African governments was made in 1955, when India took a leading part in the conference of 29 Afro-Asian states at Bandung, Indonesia. India also played an important part in the deliberations of the United Nations. Its representatives frequently urged the peaceful settlement of international disputes, and attempted to mediate between the great powers, while expressing the hostility of Afro-Asian states toward colonialism: they were quick to condemn the Anglo-French intervention in Suez in 1956, though slower to criticize the Soviet intervention in Hungary in the same year. India firmly supported the UN operations in the Congo after the withdrawal of Belgian rule in 1960: Indian troops formed part of the UN force there, and an Indian diplomat, Rajeshwar Dayal, served for a time as the secretary-general's personal representative there.

Opposition to colonialism was one of the main themes of Indian foreign policy. After some negotiation, an amicable agreement was reached with France for the transfer of its territories in the subcontinent to Indian authority, the process being concluded during 1950–54 with the transfer of Pondicherry, Mahé, Chandernagore and some smaller towns. Portugal, however, proved unwilling to relinquish its authority over Goa, Damão (Daman) and Diu, and India took them by force in Dec. 1961.

9. Relations With China.—Friendship with the Communist government of China was a consistent aim in India's foreign policy. India recognized it as the legitimate government in 1949, and continued to press for China's admission to the UN. India condemned the Chinese invasion of Tibet in 1950, however, and shortly afterward asserted its determination to protect the border states of Nepal, Sikkim and Bhutan. China's response to such criticism was to assert that its policy in Tibet was an internal matter. Noninterference in each other's internal affairs was one of the *panch shila* (five principles) to which Nehru and Chou En-lai, the Chinese prime minister, proclaimed their adherence in 1954. (The other principles were: mutual respect for each other's territorial integrity and sovereignty, mutual nonaggression, mutual help, and peaceful coexistence.) Nehru even refused to criticize the Chinese suppression of the Tibetan revolt of 1959 on the ground that this was an internal matter that concerned China alone. But India granted asylum to large numbers of Tibetan refugees and to the Dalai lama, while disclaiming all responsibility for his criticisms of Chinese policy. Such disclaimers failed to propitiate the Chinese government, which asserted that the "rebels" were receiving help from sources inside India. In Aug. 1959, Nehru stated that Chinese troops had entered Indian territory in the North East Frontier Agency. This was on the Indian side of the boundary known as the McMahon line. Chinese troops were also reported in southeast Ladakh, where they were soon involved in a clash with an Indian patrol. China replied to Indian protests by asserting extensive territorial claims in those areas. Chou En-lai visited New Delhi in April 1960 in an unsuccessful attempt to settle the dispute and subsequent discussions between Indian and Chinese officials were no more fruitful. In 1962 there was a marked incursion of Chinese troops in the territories in question and hostilities erupted that were followed by an uneasy truce. (*See* North East Frontier Agency; Jammu and Kashmir.) Moreover, Chinese influence in Nepal seemed to be growing after the revolution of 1960, when King Mahendra dismissed the Nepali Congress party ministry headed by B. P. Koirala, well-known for his Indian sympathies, and himself assumed control of the administration.

10. Relations With Pakistan.—Relations with Pakistan were overshadowed by the Kashmir dispute. The UN commission which had arranged the cease fire in 1949 was unable to formulate plans acceptable to both India and Pakistan for the withdrawal of their forces from Kashmir so that a plebiscite could be held to determine the future of the country. Individual mediators were therefore appointed by the UN—the Australian jurist Sir Owen Dixon in 1950, the U.S. administrator Frank P. Graham in 1951. Neither was able to suggest arrangements for demilitarization that were acceptable to India. In 1953 direct negotiations between India and Kashmir broke down and on Jan. 26, 1957, Kashmir was declared to be an integral part of India, in spite of a resolution by the Security council reaffirming its policy that the future of the country must be decided by a plebiscite under UN supervision. When Pakistan proposed the withdrawal of the troops then in Kashmir and their replacement by a UN force, Nehru refused to allow foreign soldiers in what he claimed was now Indian territory. The Security council then appointed a new mediator, the Swedish diplomat Gunnar Jarring. He visited the two countries in March 1957, but had no more success than his predecessors. Graham returned in 1958, to make a further attempt at conciliation, and recommended the acceptance of Pakistan's offer to withdraw its own troops, which would be replaced by a UN force, but Nehru's reaction was unfavourable. Graham also proposed to convene a meeting of the two prime ministers, but Nehru objected on the ground that this would be to treat Pakistan as being on an equality with India in the matter.

Agreement was, however, reached in the dispute with Pakistan over the apportionment of the Indus waters. The Indus river system fed an extensive network of irrigation canals begun by British engineers in the Punjab during the second half of the 19th century. The partition of the subcontinent in 1947 not only divided that territory but left India in control of the headworks of the rivers needed by both countries. There were occasions when Pakistan accused India of deliberately cutting off supplies, and India's professed intention was to divert the waters of the three eastern rivers into irrigation canals in its own territory by 1962. In accordance with the World bank's suggestions, the two governments finally agreed in 1960 that feeder canals should be dug from the western rivers to supply those areas of Pakistan which had hitherto depended on the eastern rivers. Financial help would be

obtained from western countries under the auspices of the World bank. In the result, Pakistan would have the use of the western rivers and India that of the eastern. (KE. A. B.)

IV. POPULATION

India is (after China) the second most populous country in the world. Its total population, excluding the North East Frontier Agency, Nagaland, Manipur, Sikkim and Goa, was 436,424,429 on March 1, 1961. (It was afterward estimated that there had been an undercount of about 3,000,000, which, with the estimated population of 3,000,000 of Goa, Damão and Diu, Dadrá and Nagar Aveli, and the North East Frontier Agency, brought the total population of India in 1961 to approximately 442,000,000.) In 1891, when the first effective census was taken, the figure was 279,446,000 and between then and 1961 there has been an increase of 157,000,000 of which 77,000,000 was in the decade 1951–61. The figure for the increase during those ten years was greater than that of the total population of any European country in 1961 excluding the U.S.S.R. Apart from the massive size of the population, its alarming rate of growth exceeded the forecast of the experts by no less than 16,000,000. This increase of 21.49% was by no means uniform over the whole of India: West Bengal showed an increase as high as 32.94% while that of Madras was as low as 11.73%. The density per square mile over the whole of India (excluding Jammu and Kashmir) was 384.

The population of India is predominantly rural. According to the 1961 census the rural population numbered 358,584,529 or 82.16%, while the urban population was 77,839,900 or 17.84% of the total. Agriculture is the major occupation and about 70% of the total population is directly dependent on it for a meagre living. There were 109 towns with a population of over 100,000 and of these only five, Bombay, Calcutta, Madras, Hyderabad and Ahmedabad, had a population of more than 1,000,000. In 1957 there were 558,089 villages in India, a village being "a community of less than 5,000 inhabitants with pronounced rural characteristics."

The sex ratio of the Indian population in 1961 was 940 females to 1,000 males. Male domination is a well-known feature of Indian demography. The ratio was higher in rural than in urban areas, and only in a few districts of south and central India did females outnumber males. This discrepancy in the sex-ratio is caused principally by a high mortality among mothers in childbirth, neglect of girl children and confinement in purdah.

The expectation of life in India showed a considerable improvement in the decade 1951–61. In 1951 it was 32.45 years for males and 31.66 for females, while in 1961, it had increased to 42 for males and 40 for females, though this is still lower than for Japan and Ceylon in Asia, and for countries of Europe and North America. Associated with this low expectation of life is the "young" age composition of the Indian population. In 1951 the total number of infants under one year constituted 3.3% of the total population, while children between 5 and 14 constituted 10.2%. Young men and women between 15 and 34 comprised 33% while those in the 35–54 and 55–74 formed 20.4% and 7.3% respectively. Those of 75 years and over constituted only 1% of the total population.

Indian vital statistics, which are somewhat defective and not very reliable, when adjusted for under-registration revealed a high birth rate (calculated at 40.0 per 1,000) and a relatively declining death rate (21.6). The infant mortality rate (death of infants under one year old per 1,000 live births) is still high and exceeds 100.

India's population growth and economic development are closely interrelated. The number of people bears directly on the country's economic resources, and thus affects the standard of living, employment, current consumption, and investment and saving possibilities. Whereas during the first five-year plan the national income rose by 18%, and during the second plan by 20%, or an average of 3.8% over the ten-year period, the population during this period increased at an annual rate of 2.15%. The per capita income during these ten years rose by 14% instead of 20% as envisaged by the plans. It thus became clear that if future rises in the per capita income were going to take place, the government must pay more attention to its plan for population as well as to its plan for continued economic growth. If this was not done greater production would be used up by the greater population, and no improvement in the lot of the Indian in general would result.

TABLE I.—*Area and Population of the States of the Indian Union*

States	Area (sq.mi.)	Population (1961 census)	Density per sq.mi.	Capital	Principal language
Andhra Pradesh	106,052	35,977,999	339	Hyderabad	Telugu
Assam	47,098	11,860,059	252	Shillong	Assamese and Bengali
Bihar	67,198	46,457,042	691	Patna	Hindi
Gujarat	72,226	20,621,283	286	Ahmedabad*	Gujarati
Jammu and Kashmir	86,024	3,583,585	—	Srinagar	Kashmiri, Dogri and Urdu
Kerala	15,005	16,875,199	1,125	Trivandrum	Malayalam
Madhya Pradesh	171,210	32,394,375	189	Bhopal	Hindi
Madras	50,132	33,650,917	671	Madras	Tamil
Maharashtra	118,741	39,504,294	332	Bombay	Marathi
Mysore	74,191	23,547,081	318	Bangalore	Kannada
Nagaland	6,236	—	—	Kohima	Assamese and local Naga dialects
Orissa	60,162	17,565,645	292	Bhubaneswar	Oriya
Punjab	47,084	20,298,151	431	Chandigarh	Panjabi and Hindi
Rajastban	132,150	20,146,173	152	Jaipur	Rajasthani and Hindi
Uttar Pradesh	113,454	73,752,914	650	Lucknow	Hindi
West Bengal	33,928	34,967,634	1,031	Calcutta	Bengali
Union territories					
Andaman and Nicobar Islands	3,215	63,438	20	Port Blair	Bengali
Delhi	573	2,644,058	4,614	Delhi	Hindi, Urdu and Panjabi
Himachal Pradesh	10,879	1,348,982	124	Simla	Hindi and Pahari
Laccadive, Minicoy and Amindivi Islands	11	24,108	2,192	Kozhikode	Malayalam
Manipur	8,628	778,318	90	Imphal	Manipuri
Tripura	4,036	1,141,492	283	Agartala	Bengali and Tripuri
Centrally Administered Territories					
Dadra and Nagar Haveli	189	—	—	Delhi	Gujarati
Goa, Damão and Diu	1,426	—	—	Panjim	Portuguese and Konkani
North East Frontier Agency	31,346	—	—	Shillong	Assamese and Gorkbali
Pondicherry	186	369,083	199	Pondicherry	French and Tamil

*To be replaced by Gandhinagar in 1964-65.
Note: Dash indicates data was not available.

The plan for population was to be achieved by reducing the birth rate by making families accept and adopt family planning on a large scale. Accordingly, in the third plan £20,000,000 was allocated to the family planning program, a 15-fold increase over the amount spent in the second plan. The chief feature of the family planning program was to establish clinics, which by the end of the third plan were to number 8,200. These would be organized mainly by the primary health centres, which would also disseminate information and strengthen public opinion in favour of a small family. Only by curbing the birth rate in this manner can economic development proceed faster than population growth and so bring the improvement in the standard of living so much needed over the whole of India. (S. CH.)

V. ADMINISTRATION AND SOCIAL CONDITIONS

1. Constitution.—The Indian constitution, which came into force on Jan. 26, 1950, with amendments comprised 397 articles and 9 schedules in 1963. The Indian federation or union is a dual polity with a single citizenship and a single judiciary. The preamble of the constitution, which constitutes India into a sovereign democratic and secular republic, embodies the resolve of the people to secure for all its citizens, social, economic and political justice; liberty of thought, expression, belief, faith and wor-

ship; equality of status and of opportunity; and to promote fraternity among them, thus assuring the dignity of the individual and the unity of the nation. The constitution provides for a single and uniform citizenship for the whole of the Indian republic which can be acquired by birth, descent, registration, naturalization, or by residence for five years at the commencement of the constitution. The Citizenship act of 1955 also grants the status of a commonwealth citizen in India to citizens of a commonwealth country.

The fundamental rights guaranteed by the constitution are grouped under seven broad categories: (1) right to equality before the law, prohibition of discrimination on grounds of religion, race, caste, sex or place of birth and equality of opportunity in matters of public employment (untouchability was declared abolished); (2) right to freedom of speech and expression, assembly, association or union, movement, residence and right to practice any profession or to carry on any occupation or business; (3) right against exploitation, which prohibits traffic in human beings, prohibits forced labour and restricts the employment of child labour; (4) right to freedom of religion and of conscience and to the profession, practice and propagation of religion; (5) right of minorities to conserve their own culture, language and script and to receive education and to establish and administer educational institutions of their choice; (6) right to property; and (7) right to constitutional remedies which make the fundamental rights justiciable.

One of the striking features of the Indian constitution is the incorporation in it of certain directive principles of state policy. Though not legally enforceable, these principles are fundamental in the governance of the country as they require the government "to promote the welfare of the people by securing and protecting . . . social order in which justice—social, economic and political—shall inform all the institutions of the national life." They enjoin the government to secure a living wage and a decent standard of life to all citizens; proper distribution of the material resources for the common good; equal pay for equal work; public assistance in the event of unemployment, old age, sickness, disablement and other cases of undeserved want; free and compulsory education to all children up to the age of 14; prohibition of intoxicating drinks and drugs; promotion of international peace and security, just and equitable relations between nations, respect for international law and settlement of international disputes by arbitration.

The Indian union is organized into 16 federative states, eight centrally administered territories including the former French establishments in India comprising the territories of Pondicherry, Karaikal, Yanam and Mahé, and one administrative unit—the North East Frontier Agency. The tribal regions of Assam comprising the Naga Hills–Tuensang Area were given the status of a separate state, Nagaland, of the Indian union under the Nagaland (Transitional Provisions) Regulations promulgated on Jan. 24, 1961. Goa, Damão and Diu, the former Portuguese territories, became a part of India in Dec. 1961. They are now centrally administered as a union territory. Details of the Indian states, territories and administrative units are given in Table I.

To provide a forum for close co-operation in matters of common interest, the states and territories have been grouped into five zones: central, southern, eastern, western and northern. An advisory zonal council headed by a union minister and consisting of the chief minister and two other ministers of each of the included states has been set up for each zone.

The distribution of legislative powers between the central and states governments is controlled by three lists: the union list, the state list and the concurrent list. The union list of subjects for which the union parliament has exclusive power to make laws consists of 97 entries of importance to all India, such as, defense, foreign affairs, citizenship, railways, posts and telegraphs, election to parliament and state legislatures, customs and duties, tax on income, atomic energy, etc. The state legislatures have exclusive authority to make laws in respect of 66 subjects, such as, law and order, police, prisons, local government, public health and sanitation, education, lands, agriculture, etc. In respect of the concurrent list, consisting of 47 subjects, such as, welfare of labour, social security, price control, factories, electricity, newspapers, books and printing, both the union and state legislatures can make laws. Residuary powers for subjects not enumerated in the three lists are vested exclusively in the union parliament. The union government can give administrative directions to state governments on certain matters and require them so to exercise their executive power as to ensure compliance with the laws made by parliament. In the financial field, the constitution allocates the sources of revenue between the union and states and empowers parliament to pass legislation for giving grants-in-aid to needy states from the revenues of the centre. The constitution makes provision for the setting up of a finance commission to allocate the proceeds of certain taxes between the centre and states; a comptroller and auditor-general of India; an attorney general; an election commission; union and state public service commissions to deal with recruitment, conditions of service, etc., of persons serving the union or states; and a commissioner for scheduled castes and scheduled tribes.

The constitution provides for Hindi in Devnagari script to be the official language of India after 1965, and international numerals were used for official purposes. English, the official language in the mid-1960s, would, under the Official Languages Act, 1963, continue to be used after 1965 in addition to Hindi. Besides Hindi, the constitution recognizes 13 other languages: Assamese, Bengali, Gujarati, Kannada, Kashmiri, Malayaam, Marathi, Oriya, Panjabi, Sanskrit, Tamil, Telugu and Urdu. The states can adopt any one or more languages used in their territory or Hindi as their official language.

Except for a few articles vital to the federal polity, the constitution can be amended by an absolute majority of the membership of each house of parliament and a two-thirds majority of those present and voting. By 1963, fourteen amendments had been effected adding, *inter alia*, two new articles and an extra (9th) schedule. The unitary character of the constitution is secured by giving the president emergency powers to direct the states as to how their authority is to be exercised, to suspend from operation certain articles relating to contributions to states, and to assume to himself all or any of the functions of government of a state if a grave emergency created by war or internal disturbances threaten the security of the country or if the state's constitutional machinery fails.

2. Government.—The union executive comprises the president, the vice president and the council of ministers headed by the prime minister. The president is elected for a period of five years by the elected members of both houses of parliament and of state legislative assemblies. He is the head of the state and the supreme commander of defense forces; all executive authority of the union formally vests in him. The vice president, who is also the ex-officio chairman of the council of states, is elected by the members of both houses of parliament assembled at a joint sitting. The prime minister, who is the leader of the majority party of the house of the people and is the *de facto* head of executive, is appointed by the president. The council of ministers is collectively responsible to the house of the people and holds office during the pleasure of the president.

The central legislature, called parliament, is bicameral; it consists of the president and two houses known as the council of states (*Rajya Sabha*) and the house of the people (*Lok Sabha*). The council of states consists of 238 elected and 12 nominated members. It is a permanent house; one-third of its members retires every two years. The elections to the council are indirect; the allotted quota of the representatives of each state is elected by the elected members of the legislative assembly of that state. The house of the people, which has a duration of five years, consists of not more than 500 members directly elected on the basis of adult suffrage from territorial constituencies and not more than 20 members representing union territories; seats to different states are allotted on the basis of their population.

In the states the executive consists of a governor, appointed by the president, and a council of ministers headed by a chief minister. Except in Assam, Gujarat, Kerala, Orissa and Rajasthan where there is only one house—the legislative assembly—the state legislatures consist of two houses—legislative councils (*Vidhan Pari-*

shad) and legislative assemblies (*Vidhan Sabha*). The legislative council is a permanent body; one-third of its members retires every second year. It consists of not more than one-third of the total members in the legislative assembly subject to a minimum of 40. The legislative assembly consists of not more than 500 and not less than 60 members chosen by direct election on the basis of adult suffrage. In five union territories—Himachal Pradesh, Manipur, Tripura, Pondicherry and Goa—elected legislative assemblies deal with legislation relating to local affairs. Councils of ministers are to be constituted to aid and advise in the local administration. Parliament, however, remains the supreme legislative body and the administration of the territories rests in the president of India. In the territory of Delhi an advisory committee assists the union home minister in its administration. For the Andaman and Nicobar Islands and the Laccadive, Minicoy and Amindivi Islands, the president makes rules for government and appoints a chief commissioner for their administration.

The constitution makes special provision for the administration of tribal areas of Assam by constituting certain autonomous districts and regions in these areas. The governor of Assam, on behalf of the president, is empowered to constitute councils for these districts which can make their own laws for disposal of land, administration of villages, inheritance of property and social customs; these councils can also establish village councils or courts for trial of suits and disputes, administration of district, regional and local funds, schools and dispensaries, and can assess and collect taxes on land, profession, trades and employment.

For the administration of Nagaland (Naga Hills–Tuensang Area) an elected interim body of 45 members has been set up. An executive council of five members advises the governor in matters other than finance and public order as may be specified by him.

The chief unit of the administration is the district, into which the entire country is divided. The head of the district, called the collector or the deputy commissioner, has dual functions as the principal revenue-collecting officer and as the district magistrate responsible for maintaining law and order; in his latter duties he is assisted by the district superintendent of police who is the head of the district police force. Both these officers are usually members of the two All-India services, the Indian administrative service and the Indian police service. The district is divided into a number of subdivisions—*taluks* or *tehsils*. The magistrates or *mamalatdars* or *tehsildars* of these subdivisions are the principal assistants of the district magistrate for the collection of revenues and maintenance of law and order in their areas. The village, which is the basis of the administrative system, is in the charge of a headman who collects revenue and looks after law and order. The local self-governing institutions are called municipal corporations or committees in urban areas, and district boards and village *panchayats* in rural areas. The *panchayats*—more than 200,000 in the early 1960s—are elected by and from the villagers to look after the civic needs of the village. (S. B. L. N.)

3. Political Parties.—Before independence, political parties in India had an essentially different character from those in the west. The Indian National Congress was a national movement rather than a political party, containing within itself many groups with differing interests whose main basis of agreement was opposition to foreign rule. With the exception of communal organizations, which substantially divided the national movement, most opposition parties existed within the Congress. The most important of these was the Congress Socialist party, the Communist party having been expelled in 1945.

With the achievement of independence in 1947 conflicts over policies and programs hitherto submerged by the national struggle came to the surface. The Indian National Congress was transformed from a national movement into a political party. In 1948 the Socialist party left the Congress and organized itself in opposition. Another section left in 1951 to form the Kisan Mazdoor Praja party (Worker or Peoples' party). Many smaller parties also left the Congress.

In the first general elections under universal adult franchise in 1951–52, the Congress scored an overwhelming victory, winning an absolute majority in the central parliament as well as most of the states. The opposition was badly fragmented, 14 parties entering the elections as national and 51 as state parties. Of the opposition parties only four emerged as national parties. The Socialists although getting the largest share of the national vote after the Congress did not do so well in the matter of seats in the legislatures. The Communists secured the largest number of opposition seats in the Legislative assemblies and had notable successes in Travancore-Cochin, Madras, Hyderabad, Tripura and West Bengal. The Kisan Mazdoor Praja party and the Jan Sangh were the other parties that received recognition from the Election commission as national parties. Besides these, there were a number of smaller parties that received regional support.

After the elections the Socialists and the Kisan Mazdoor Praja party merged to form the Praja Socialist party. This, however, split in Dec. 1955 when a new Socialist party was formed. In the general elections in 1957 the Congress maintained its position as the largest and most powerful party. The Communist party more than doubled its vote and replaced the Praja Socialist party as the second largest group in parliament. It secured representation for the first time in all the state assemblies and in Kerala formed the first Communist government in any state. Since 1957 the most significant event has been the formation of the Swatantra party in 1959. Otherwise, the broad organizational pattern of political parties remained unchanged.

Congress, which maintained its leading position in the 1962 elections, aims at establishing a socialist co-operative commonwealth in India by peaceful and democratic means. Its economic policies have found expression in the five-year plans based on a mixed economy with the public sector playing an increasingly dominant role over the private sector. The Praja Socialist party's differences with the Congress are pragmatic rather than ideological. It believes that the Congress, while professing Socialist ideology, is incapable of implementing a socialist program and that its policies have led to increased social inequalities and concentration of wealth. The Socialist party though more militant in its approach, also stands for a democratic socialist society based on equality of opportunity and removal of class distinction. As opposed to the parties professing socialist ideology, the Swatantra party stands for a free economy with minimum state interference and is the nearest approach to a conservative party in Indian politics. The Jan Sangh turns to the ancient Indian tradition for inspiration and derives its political strength from the Rashtra Swayam Sewak Sangh, a militant Hindu organization. The Communist party is wedded to Marxism-Leninism and draws its inspiration from the U.S.S.R. and, to a more limited extent, China. On foreign policy it supports the Soviet bloc. The other opposition parties broadly support the nonalignment policy of the Congress although they are critical of its implementation specially in relation to China. (Ad. P.)

4. Taxation.—The basic framework of the Indian tax system, which was evolved primarily to meet the financial rather than social needs of the state, remained unchanged until the mid-20th century. In 1953–54, as in 1938–39, commodity taxes and taxes that fell mainly on consumer goods, viz., customs duties, excise, sales tax, octroi, and terminal taxes levied by local bodies and interstate transit duties in some states, accounted for about 45% of the total revenues of the central and state governments. Direct imposts formed only 24% of the total tax revenues collected by the central, state and local bodies in 1953–54. Even after the levy of new direct taxes and increase in the existing ones at the beginning of the second 5-year plan in 1956, the central excise and customs duties constituted more than 60% of the total central revenues.

The inadequate, inelastic and inequitable nature of the tax system was not suitable to deal with the rapid economic development after World War II and with the additional finance needed to fulfil the social and industrial aspirations of the country. The total tax revenue of the central and states governments was under 8% of the national income in 1955–56 and by the early 1960s had shown only a slight increase in percentage. As against the fourfold rise in the national income over the war and postwar years there

had been very little addition to the national tax since before the war. The second plan envisaged an additional tax revenue of Rs. 450 crores (£337,500,000 or $945,000,000) and, reckoning the uncovered deficit expenditure and the gap between estimated resources and planned outlay, the additional taxation during 1956–61, for the fulfilment of planned targets, was estimated at about Rs. 1,250 crores (£937,500,000 or $2,625,000,000) (1 crore = 10,000,000 rupees). To collect this amount, a much more broad-based, efficient, and progressive system of taxation was needed.

The inequitable nature of the former taxation system was obvious not only because of the low share of direct taxes but also because the base of direct taxation, "income," was capable of being manipulated. The sense of equity in a democratic and socialist society, India's social objective, warranted a reduction in the inequalities of income as well as an avoidance of the increase in the wealth of the richest class as a result of vast expenditure on development as had happened during the war. That inequalities in income remained is shown by the fact that the 0.45% of the earners who paid taxes in 1951–52 enjoyed 6% of the national income; the average earnings of this group were 13 times the national average. The super tax payers, numbering only 0.027% of the population, had 2.1% of the national income; an average earner in this group had 78 times the national average. It was in this setting that a taxation enquiry commission was appointed in 1953 to examine, *inter alia*, the system of taxation with reference to the development program of the country and to the reduction of the inequalities of income. Based on the suggestions of this commission and also on those of Nicholas Kaldor, an economist from Cambridge, Eng., who submitted his report on Indian tax reform in 1956, various measures have been taken by the government to broaden the tax base and to make the system more progressive (*i.e.*, the proportion of tax increases with increase in income), to promote equity and to increase incentive.

Income Tax.—Taxes applicable to personal income in India consist of income tax and super tax. The income tax which was levied in 1860 has been gradually made progressive. Super tax on higher incomes was introduced in 1931 and in 1939 the progressive "slab" system replaced the "step" system. (See *The Economy: National Finance* below). A distinction between earned and unearned incomes, and a relief in the case of the former, was introduced in 1945–46. It was, however, in 1957–58 that substantial progressive changes were made. Tax on earned income was brought down at all levels and a surcharge of 20% on unearned income above Rs. 7,500 per annum levied. Income tax was reimposed on capital gains resulting from transfer, sale or exchange of capital assets after March 1960. Concessions were given to married people with children in the lower income brackets making all persons with an annual income below Rs. 20,000 entitled to an allowance of Rs. 300 per child subject to a maximum of Rs. 600, in addition to a marriage allowance of Rs. 2,000.

To encourage savings and investments, the rebate on income tax allowed for investment in provident funds and insurance was increased and the rates of super tax on higher incomes were slightly reduced. The tax base was broadened by lowering the exemption limit for personal income tax from Rs. 4,200 to Rs. 3,000 and by increasing the basic income tax and corporation tax payable by a company.

Estate Duty.—As an equalitarian device an estate duty, whose levy was recommended as far back as 1925 by the taxation enquiry committee, was imposed in Oct. 1953 on property passing or deemed to pass on the death of a person. It is levied on property worth more than Rs. 100,000 in the case of an individual and Rs. 50,000 if he was a member of a Hindu joint family (*see* INDIAN LAW). The duty rises progressively from 5% on the "slab" from Rs. 50,000 to Rs. 100,000 for joint family property and 7½% on the first Rs. 50,000 above Rs. 100,000 in all other cases to 40% on the excess over Rs. 5,000,000.

Wealth Tax.—An annual tax on net wealth payable by individuals, Hindu joint families and companies, having taxable net wealth of more than Rs. 200,000, Rs. 400,000 and Rs. 500,000 respectively, was introduced in 1957–58. The original rates for individuals and Hindu joint families for different taxable "slabs" were revised upward in 1959–60 to 1%, 1½% and 2%. The flat rate ½% in the case of companies was merged in 1960 with the company income tax. This tax is meant to provide a sounder base for assessment and a check on the evasion of income tax.

Gift Tax.—A tax on gifts made in excess of Rs. 10,000 in a year was introduced in 1958–59. Payable annually by all taxpayers from 4% on the first "slab" of Rs. 50,000 to 40% on the "slab" exceeding Rs. 5,000,000, it was intended primarily to check the evasion of estate duty.

These measures not only promoted progress and equity but helped the sustained and steady growth in tax revenue so essential for a developing economy. At the same time the tax structure was made more realistic and integrated, so that it reached nearly everybody and taxes rose with rises in income.

5. Living Conditions.—*Wages.*—Except for the Minimum Wages act passed in 1948 enabling the government to prescribe minimum wages in agriculture and in 12 industries, there was no regulation of wages by the state of India. The only other wage legislation was the Payment of Wages act of 1936 which ensured correct and prompt payment of dues to workers. Though the constitution provides that all workers should be secured a living wage, in the mid-1960s it was still far from being achieved. By then, too, the recommendations of the Fair Wage committee, appointed in 1947 to discern principles for the determination of fair wages, had not been enforced though they were accepted by the government in 1950. Apart from collective bargaining, which was not yet well developed, the government helped to settle wage disputes by referring them to industrial tribunals whose decisions, as well as the pronouncements of the supreme court in appeal cases, influenced wages. The most important measure, however, which formed the cornerstone of the government's wage policy, was the appointment of tripartite wage boards for an industry on the lines of British wage councils. Three such boards, for the cotton textile, sugar and cement industries, submitted their report; three more boards for jute, plantation, and iron and steel were set up while further boards for other industries were planned. The recommendations of these boards were to be implemented on a voluntary basis.

Wages in India have tended to lag behind prices. While the index of money earnings of factory workers rose from 100 in 1939 to 253 in 1947, the index of real earnings declined to 78. Real earnings gained a little thereafter, but remained below the 1939 level till 1951 when the index was 92. From 1952 to 1961 the real earnings index ranged from 102 to 106, except for 1955 when it touched 113; but in 1959 it dropped to 101 because of a sharp rise in the cost of living index and a decline in the money earnings index from 431 in 1957 to 424. Moreover, though the average annual earnings of factory workers increased from Rs. 737 in 1947 to Rs. 1,296 in 1958, the share of wages in the total output declined from 15.2% to 12.1% over the same period. Again, whereas productivity increased by about 45% between 1947 and 1957, real wages rose by only 34%. These facts, revealed by the census of manufactures for 1957, not only made it difficult for some planners and industrialists to advocate the case for a wage-freeze to hold the price line, but gave a strong support to labour leaders to press their demands for a general wage increase.

Employment.—Despite considerable investment during the two plan periods, 1951–61, the problem of unemployment remained intractable. The total employment in factories, mines, plantations, railways, posts and telegraph and central government, in 1958, was about 7,500,000, constituting roughly 5% of the total labour force. The employment problem facing the country in the early 1960s was threefold. Firstly, jobs were to be created for the existing unemployed in the urban and rural areas. A survey in 1955 revealed that about 22% of the rural labour force, *i.e.*, about 25,000,000 persons, were only partially employed. At the beginning of the second plan in 1956 the number of unemployed in rural and urban areas was estimated at 2,800,000 and 2,500,000 respectively; these were expected to rise considerably in the early 1960s. Secondly, employment had to be provided for the increase in the labour force which, during 1956–61, was estimated to be on

average about 2,400,000 persons a year and was expected to be about 3,400,000 persons a year during 1961–66. Lastly, increased opportunities for work were to be found for the vast number of underemployed persons in rural and urban areas. During the second plan period, it was estimated that additional employment could be secured for about 6,500,000 outside agriculture and about 1,500,000 in agriculture. Assuming that the third plan's target of creating an additional 3,500,000 full-time jobs in agriculture and 10,500,000 jobs outside agriculture was achieved the unemployed at the end of 1965–66 would number about 12,000,000. The solution of this problem depended mainly on the pace of economic development and the control of the ever-increasing population.

There is no unemployment insurance in the country though the Industrial Disputes act requires employers to pay retrenchment and layoff compensation to workers who have put in at least 240 days continuous service. A network of employment exchanges renders employment assistance to job seekers. An act passed in 1959 makes it obligatory on all employers to notify vacancies to employment exchanges without restricting their right to select their own workers.

Trade Unions.—Though the first formally organized trade union, Bombay Mill Hands association, was established in 1890, the trade union movement was loose, sporadic and ephemeral until 1918 when several unions of a permanent character were formed. Two years later the first central organization—the All-India Trades Union congress (A.I.T.U.C.)—was established. The growth of this loosely co-ordinated central organization was marred by frequent conflicts and splits, and by 1945 the Communists had captured its leadership completely. This led to the formation of three more All-India federations—the Indian National Trade Union congress (I.N.T.U.C.), the premier organization in the country, was formed by the Congress party in May 1947; the Socialists sponsored the Hind Mazdoor Sabha (H.M.S.) in Dec. 1948; and the left-wing group organized the United Trades Union congress (U.T.U.C.) in May 1949.

Despite a phenomenal rise in union membership the labour movement had not by the early 1960s become a sound and major force mainly because of mutual rivalries, multiplicity of unions of different ideological and political cleavages, close linkage with political parties and such inherent drawbacks as lack of leadership from within and a weak financial position. Of the total labour force of about 165,000,000 less than 4,000,000 persons were claimed as members by more than 11,000 unions in the early 1960s. In factory industries over 40% of the workers belong to unions—the highest, 60%, being in basic metal industries and metal products, and the lowest, less than 30%, in engineering industries.

Housing.—The extremely unsatisfactory housing position is the result of several complex situations. Ignorance, poverty and age-old habits of people coupled with the apathy of the government in the past, led not only to the haphazard growth of towns and cities but also to the acute shortage of houses throughout the country. According to the census figures, urban population increased by 10,400,000 between 1931 and 1941 and 18,100,000 between 1941 and 1951. The number of urban houses during these decades increased by only 1,800,000 and 1,700,000 respectively. The influx of about 9,000,000 refugees after the partition of the subcontinent in 1947 worsened the situation. In 1951 the shortage of houses was estimated at 2,500,000 while the requirement during 1951–61 was reckoned at 8,900,000 houses. To deal with this problem a ministry of works, housing and supply was set up in 1952 by the central government. The housing program launched by this ministry included: (1) the subsidized industrial housing scheme under which loans and subsidies were granted to state governments, statutory housing boards, municipal boards, co-operative societies and industrial employers for constructing houses for factory workers; (2) the plantation labour housing scheme to help planters by lending them money to acquire houses for workers and their families; (3) the slum clearance scheme which would give financial assistance to state governments and municipal boards for housing families living in slum conditions; (4) the low- and middle-income groups housing schemes under which house-building loans were advanced to persons with an annual income not exceeding Rs. 6,000 and Rs. 12,000 respectively; (5) the village housing project scheme, introduced in 1957, to build houses in 5,000 selected villages on the basis of aided self-help (government assistance being limited to a 20-year loan not exceeding 50% of the cost of construction or Rs. 1,500 per house, whichever was the less); and (6) house-building advances to central government employees recoverable in easy installments. As a result of these efforts about 1,340,000 houses (740,000 by public authorities and 600,000 by private enterprise) were constructed during 1951–56. During the second plan, under various housing schemes and the construction programmes of ministries, about 500,000 houses were built. Under the third five-year plan 900,000 houses were projected.

6. Welfare Services.—Before the 19th century little organized effort was made either by voluntary associations or by the state to provide welfare services for the people. The structure of Indian society, with institutions like the joint family system, the caste system and the *panchayat* (rural village council) was eminently well-suited to care for the needs of the aged, the ill and the infirm. These institutions, however, decayed gradually and the Christian missionaries during the 19th century pointed out glaring defects of the social systems such as child marriage, polygamy, female infanticide, suttee (*q.v.*), restrictions on widow remarriage, untouchability, etc. A new conscience was awakened among the Indian social leaders, and voluntary organizations like the Brahmo Samaj (*q.v.*) in Bengal, the Paramhans Sabha in Maharashtra and the Prarthna Samaj in Bombay were established. The Arya Samaj (*q.v.*), founded in 1875, and the Ramakrishna mission (1897) stimulated voluntary welfare work. Raja Ram Mohun Roy, Keshub Chunder Sen, Mahadeo Govind Ranade (*qq.v.*), Dayanand Saraswati and Vivekananda (*q.v.*) were the great social reformers of the 19th century who, inspired mainly by their religion, campaigned for raising the status of women and their right to property, for education, for raising the age of marriage and for widow remarriage and for the abolition of caste distinctions, untouchability and suttee. The beginning of the 20th century saw the emergence of a rational and scientific approach to social problems without appeal to religious sentiments. The Servants of India society, founded in 1905 by Gopal Krishna Gokhale (*q.v.*), was the first secular organization to work for the welfare of the underprivileged and the rural and tribal peoples, for the increase of literacy, the emergency relief of distress and other social causes.

In 1920 Mohandas K. Gandhi revolutionized welfare work by attacking, successfully, the evil of untouchability and establishing several institutions for untouchables and lepers. Mahatma Gandhi's work was carried on by Acharya Vinoba Bhave who laid the main emphasis on *Bhoodan; i.e.,* voluntary donations of land for redistribution among the landless. *Gramdan* (village gift) was an extension of *Bhoodan* whereby the inhabitants of a village surrendered all cultivable land to the community.

Voluntary, including foreign, agencies (over 10,000 in the early 1960s) had done much to help the growth of organized social services. Their main contribution was in child welfare, charity schools and orphanages, the care of physically handicapped children and the deaf and dumb, voluntary hospitals, homes for widows, the promotion of education, and the welfare of women, untouchables and backward classes. Welfare activities organized and developed by the government after 1950 included the care of the blind, adult social education, the rehabilitation of displaced persons, maternity and child care services, the welfare of the backward classes, tribal people and industrial workers, beggars' homes and prohibition. A comprehensive welfare program was organized by the central social welfare board after 1953. One of the functions of this board, which was assisted by social welfare boards in all states, was to distribute grants to voluntary social service organizations to improve and extend their work. The board ran two welfare schemes, for rural and urban areas. The activities of the rural welfare extension projects (646 in 1959 covering 30,000 villages and 24,000,000 people) comprised the organization of community creches, pre-basic schools, maternity and infant health services and the extension of literacy, social edu-

cation, arts and crafts centres for women and recreational activities. Under the urban family welfare plan small-scale industries providing employment to women of middle and lower classes in their own homes were set up through industrial co-operatives. By the end of 1960–61, 20 such co-operatives benefiting 10,000 families had been started. Some of the other schemes of the board, effected mainly through voluntary organizations, included the setting up of night shelters for homeless industrial workers, holiday (vacation) homes for poor children, homes for unmarried mothers and provision of basic welfare services in villages.

Public Health.—Appreciable progress was made after independence (1947) toward the prevention and control of disease, the supply of protected drinking water and the general promotion of health. The registered death rate fell after 1950, the infant mortality declined and the expectation of life increased. Although the states are mainly responsible for health, some aspects, such as malaria and filaria control, family planning, protected water supply, control of communicable diseases and training of health staff are undertaken by the central ministry of health. A central health council consisting of the health ministers of all the states, with the union health minister as chairman, co-ordinates the various programs and evolves a common policy for the country. Primary health units, which look after the rural people, are the bases of the health services organized by the states. In each district there are district and subdivisional hospitals, maternal and child welfare centres, and malaria, tuberculosis, leprosy and filaria teams. In the early 1960s there were 10,000 hospitals and dispensaries with over 164,000 beds. The national water supply and sanitation program, launched in 1954, covers 287 projects for the supply of protected water in urban areas and 232 projects in rural areas. A contributory health service scheme serves about 400,000 central government employees and their families in Delhi and New Delhi, while about 1,400,000 industrial workers and their families throughout the country receive medical care under the contributory employees' state insurance scheme. The overwhelming problem of ever-increasing population is being tackled through an intensive family planning drive. The central ministry of health is trying to make people conscious of the need for family planning and promotes knowledge of the relevant techniques.

In addition to western systems of medicine the government sponsors the practice of indigenous medicine. There is a research council and a research institute for investigation of diagnosis and treatment in indigenous systems of medicine and for the study of their relationship to western medicine. At a number of colleges training is available in *Ayurveda* and *Unani*. State boards regulate the practice of these forms of medicine, and they also control the practice of homoeopathy. There is a five-year degree course in *Ayurvedic* medicine at four universities and in *Unani* medicine and surgery at one. There is also a degree course in homoeopathy, and over 30 institutions give training in it, some of which are recognized by the state boards, of which a smaller number receive financial assistance from the government.

7. Justice.—Ancient India had a well-developed judicial system of village courts (*panchayats*), district courts, and a central King's court. During British rule a well-knit judicial system on the English pattern was set up.

The federal constitution, adopted in 1950, did not alter the previous judicial system except to establish a supreme court as the highest court of the land. The constitution preserved the unity of the judicial structure by including subjects on the concurrent list (transfer of property, contracts, evidence, marriage and divorce, intestacy, succession, etc.) in the civil and criminal law procedures. Both parliament and state legislatures can make laws, though an act passed by the former abrogates the laws of the states on the same subject.

The supreme court, which is a court of record, has original, appellate and advisory functions subject to the provisions of any law made by parliament. Its original jurisdiction extends to all disputes between the government of India and any state or between states themselves; it is also empowered to issue writs of *habeus corpus*, *mandamus*, prohibition, *quo warranto* and *certiorari* to enforce the fundamental rights under the constitution. The appellate jurisdiction extends to all constitutional, civil and criminal cases in prescribed circumstances. The advisory role consists in pronouncing on any question of law or fact referred to it by the president. A judge of the supreme court cannot be removed from office except by an order of the president on the ground of proved misbehaviour or incapacity. The order can only be passed after an address by each house of parliament, supported by a majority of not less than two-thirds of the members present and voting, has been presented to the president in the same session.

In all the states of the Indian union the judicial system is headed by a high court which has original and appellate jurisdiction and supervises all courts and tribunals within its jurisdiction. High courts are empowered to issue to any person or authority, including any government within their jurisdiction, directions, orders or writs for the enforcement of any of the rights conferred by part iii of the constitution and for any other purpose. The union parliament alone can change the organization and constitution of the courts and the only administrative link with the supreme court is that the chief justice of India is consulted by the president while appointing high court judges. Below the high courts are the district civil courts for each district which, besides having original jurisdiction, are also courts of appeal from the decrees and orders of the different subordinate courts, viz., courts of judges, *munsifs*, civil judges and small causes courts with varying pecuniary jurisdiction. In some states there are also courts of minor jurisdiction like the courts of honorary *munsifs* in Uttar Pradesh, courts of *mamlatdars* in Bombay and village courts in Madras. The criminal courts, of which there are three types, function under the provisions of the criminal procedure code. At the lowest level there are magistrates with varying powers and jurisdiction under the general supervision and control of the district magistrate, who in his capacity as the district collector is subordinate to the executive administration of the state. The officer presiding over the district court in civil suits is the judge of the sessions division for criminal cases in that district. The sessions judge, assisted by additional or assistant sessions judges, is subordinate only to the high court. He deals with more serious crimes and with cases committed to him by a magistrate after a preliminary enquiry. At the highest level is the high court. The major drawback of this system is the combination of judicial and executive functions of the magistrates. This was being remedied by introducing separate judiciary and executive magistrates. A law commission appointed in 1955 recommended, *inter alia*, the establishment of country-wide village *panchayat* courts, a central ministry of justice, an All-India judicial service, the abolition of trial by jury, the partial replacement of English by Hindi in the courts, the creation of an Indian bar, the separation of the judiciary from the executive, legal aid and measures for quick disposal of cases.

Islamic law is applied by the courts in certain cases involving Muslims concerning such matters as succession, inheritance and marriage, while modern Hindu laws, forming the "Hindu code" of 1955–56, are applied to Hindus in similar circumstances. (*See* also INDIAN LAW.)

Police.—Law and order are primarily the responsibility of the states, which raise their own police forces. The central ministry of home affairs and the central intelligence bureau co-ordinate the work of the states. The head of the organization in the states is the inspector general of police who is assisted by a number of deputies, each in charge of several districts. The head of the district police is a superintendent who, though administratively under a deputy inspector general, helps the district magistrate in maintaining law and order. A district is divided into six to eight circles and a circle into a number of police stations or *thanas* each under a subinspector who is assisted by a number of chief constables and constables. In rural areas a police station works through a number of outposts. The regular force depends mainly, as in ancient India, on the village headman and the watchman who report crimes to the station house officer. The unity and uniformity of the organization is maintained through a combined All-India body of senior officers, above the rank of deputy superintendent, recruited and trained by the central government.

In the early 1960s the strength of the force for the entire country was about 450,000, which was approximately one policeman per 2.5 sq.mi. and for every 790 people. A small women's police force had also been organized in many states.

8. Education.—At no period of its history has India been an unenlightened country. Inscriptions on stone and copper, the palm-leaf records of the temples, and, later, the manufacture of paper, all indicate not only the general knowledge, but also the common use, of the art of writing. As F. W. Thomas, a distinguished Indologist, remarks, "education is no exotic in India. There is no country where the love of learning had so early an origin or has exercised so lasting and powerful an influence."

In ancient India education, being a religious obligation, was more or less compulsory for every Brahman, Kshatriya or Vaisya boy. By about the 7th century B.C., however, it was confined to Brahmans only to prepare them for their priesthood. This led to the rise and growth of two new religions, Buddhism and Jainism, which challenged the exclusive claim of the Brahmans to learning. Buddhism introduced the monastic system of education which was available to all, irrespective of caste or creed. The Muslim invaders did not at first disturb the existing system but confined their education to the followers of Islam. It was Akbar (1542–1605) who first organized education on systematic lines by establishing *maktabs* (primary schools) and *madrassahs* (higher schools), which were attended by Hindus also, for learning Persian, the court language. With the downfall of the Mogul empire and internecine war, education was neglected. The East India company did not recognize the promotion of education as its responsibility until 1813 when the Charter act prescribed a small grant of Rs. 100,000 for the encouragement of education. About the same time, Christian missionaries and the semi-rationalist movement in Bengal under Raja Ram Mohan Roy gave great impetus to the development of vernacular literature. The efforts of the government did not make much headway till 1823 when a general committee of public instruction was set up to give effect to the legislation of 1813. Soon a controversy arose between the Orientalists, who wanted to extend oriental learning in India in the vernacular and the Anglicists, who urged the promotion of western learning through the medium of English. Lord Macaulay's famous minute of 1835 supported the latter view, was the last word on the controversy and in 1837 English was made the language of the law courts. In 1854 Sir Charles Wood's despatch determined the methods and machinery for organizing the new educational system. From that date onward education has been obtained through vernacular elementary schools, middle and high schools, colleges and universities, ultimately controlled by the government either directly or through a system of grants-in-aid.

According to the 1951 census only 16.6% (24.9% males and 7.9% females) of the population was literate. In the second plan, 1956–61, a provision of Rs. 3,070,000,000, as against 1,690,000,000 in the first plan, was made for the development of education. The results claimed showed an increase in literacy percentage: 24% (34.4% males and 12.9% females). Of the educational institutions 26% were managed by the government, 41% by local boards and 33% by private bodies; 0.3% of the pupils were in preprimary stage, 72% in primary stage, 21% in secondary stage, 1.7% in universities and 5% in professional schools and colleges.

Primary Education.—The duration of primary education varies in different states from 4 to 5 years, the age period being 6 or 7 to 10 or 11. By 1960 it had been found impossible to provide free and compulsory education to all children up to the age of 14 as required under the constitution. Shortage of competent teachers has not only hampered the progress but has made it necessary to set up a large number of single-teacher schools. The third plan seeks to provide universal, free and compulsory education for the age-group 6–11.

Secondary Education.—Secondary education advanced rapidly during the 20th century. Following the recommendations of the secondary education commission in 1953 the secondary education system was to be changed so as to broaden the base of instruction, to diversify courses and to convert high schools into higher secondary and multipurpose schools. High secondary education of three years duration was to follow eight years of elementary education.

Higher Education.—University education also was remodeled to suit the country's new needs and aspirations. Most of the universities had already adopted a three-year course for the first degree after the higher secondary school course. Some of them adopted the regional language as the exclusive medium of instruction or as an alternative to English. A university grants commission set up in 1953 was entrusted with the task of determining and coordinating standards of education and facilities for study and research. There were, in 1963, 55 universities of three types: affiliating, unitary and federal. Four (Banaras, Delhi, Aligarh and Visva-Bharati) are administered by the central government, the others by the state legislatures; all, however, enjoy the greatest degree of autonomy in their internal administration. India has also a large number of learned societies, research institutes, libraries and museums.

In addition there were more than 800 arts and science colleges, 475 professional and technical colleges, about 150 special education colleges and over 3,000 vocational schools. (S. B. L. N.)

9. Defense.—*Army.*—The origins of the Indian army can be traced to the small garrisons maintained by the East India company for the protection of its factories. These evolved into the three presidency armies of Bombay, Bengal and Madras, which were taken over by the British crown in 1858. With the abolition of the presidency armies in 1895 and the reorganization carried out under Lord Kitchener from 1902, a unified army was formed, divided into three commands—Northern, Western and Eastern—replaced in 1907 by two armies—Northern and Southern. The Indian army thus reorganized fought with distinction in World War I and won many awards for gallantry.

Before the war the officers of the army were exclusively British, no Indian being entitled to hold the king's commission. In Jan. 1918, the king's commission was opened to Indians and in 1924, 8 units, subsequently extended to 16, were selected for indianization. In 1932 the Indian Military academy was inaugurated at Dehra Dun to provide Indian officers for all branches of the service. The process, however, was slow until the needs of World War II compelled rapid indianization. By the end of World War II the proportion of Indian to British officers had risen from one-tenth to one-quarter in the Indian army and from one-quarter to one-half in the Royal Indian Navy. In 1945 the ranks of the Indian army and navy were closed to Europeans as was already the case in the Indian air force. Transfer of power in 1947 brought about the partition of the Indian army, the Royal Indian Navy and the Royal Indian Air Force between India and Pakistan. All the three services in India are now almost exclusively officered by Indians. At the same time important changes in the defense organization were instituted. Civilian control over the armed forces was ensured by the appointment of a defense minister responsible to parliament. Under the constitution of the Indian republic, the supreme command of the armed forces is vested in the president. The ministry of defense is the central agency for formulating and obtaining policy decisions of the government of India on defense matters and having them implemented through the three defense service headquarters. Each service is under an independent head, their designations being chief of the army staff, chief of the naval staff and chief of the air staff. The co-ordination of the activities of the three services is carried out by the defense ministry through a number of committees.

The army is organized into three commands—Western, Eastern and Southern. The commands are divided into areas which are further subdivided into subareas. The army headquarters located in Delhi functions under the chief of the army staff and has six branches, each under its own head.

Navy.—The East India company under its charter maintained an armed naval force, and in 1829 the company founded an Indian navy. After the mutiny this service was abolished for reasons of economy; and an Indian marine service was formed which developed in 1892 into the Royal Indian Marines. This was converted in 1929 into a combatant service and in Aug. 1934 it was renamed

the Royal Indian Navy. The Chatfield committee prepared a plan for the expansion of the Indian navy to be carried out in five years, but before this could be completed World War II broke out. During the war the service was greatly expanded and served with the highest distinction not only in the Arabian sea and the Indian ocean but also in the Mediterranean and the Atlantic in association with the Royal Navy.

During the British period, the Indian navy was an arm of the Royal Navy and could depend upon it for support. Such as it was, it had to be partitioned in 1947 and India was left with 4 sloops, 2 frigates, 1 corvette, 12 mine sweepers, 4 tankers and a few auxiliary vessels. The Indian navy had then to be organized as an independent force with every branch necessary for a modern navy and consequently it has been considerably expanded and modernized while suitable training institutions have been established. The naval aviation wing, which started in 1953 with a squadron of 10 amphibious aircraft, has target-towing and jet aircraft. An aircraft carrier, H.M.S. "Hercules," was acquired in 1957 and joined the navy as "Vikrant" in 1961 after being refitted in the United Kingdom. The Hydrographic office, set up for the marine survey of India, produces charts of its surveys.

Air Force.—Before World War II the air force in India consisted of the Royal Indian Air Force, the Indian air force, the R.A.F. Voluntary reserves and the I.A.F. Voluntary reserves. The Indian air force was an entirely Indian service and its strength by the end of 1939 was one squadron with over 200 officers, excluding the voluntary reserve. The operational role of the Indian air force was mainly to co-operate with and assist the army in its various tasks. During World War II considerable expansion took place in the air force. With the partition of the subcontinent the air headquarters, till then controlled by the air ministry in London, was closed and the R.A.F. units with British staff withdrawn. A new air headquarters staff was appointed under the chief of the air staff who was assisted by four principal staff officers controlling the operational, training, maintenance, and the eastern air commands.

In pursuance of the Reserves and Auxiliaries Air Force act, passed by parliament in 1952, seven auxiliary air force squadrons were formed.

Civil Defense.—The Territorial army raised in 1949 gives military training to the youth of the country in their spare time. Its aim is to serve the country in times of emergency by providing units for the regular army and taking over the responsibility for internal defense. It is supplemented by the auxiliary territorial army and is designated as the Lok Sahayak Sena. The National Cadet corps and Auxiliary Cadet corps provide military training to young people in colleges and schools.

Scientific Research and Production.—Before independence India relied heavily on Britain for research and for the more complicated arms and heavy equipment. With the advent of independence India felt the need to set up its own organizations for research and for the manufacture of all kinds of equipment. The Defense Science organization was established in 1948 under the scientific adviser to the ministry of defense to engage in research on different aspects of defense. A Defense Production board was set up to co-ordinate the production of military stores and equipment with the activities of the three services in the fields of research, design and development. The Research and Development organization was brought into being in Jan. 1958 to promote and apply scientific research for production. It was closely associated with the Production and Inspection organization whose principal function was to achieve self-sufficiency in respect of stores required by the three services.

Training Institutions.—After 1947 the training of service personnel was expanded by the establishment of schools for specialized courses. The National Defense academy was opened in Khadagvasla near Poona in 1954. It conducts a three-year course of basic training for cadets of all three services, after which the cadets receive one year's training at the Indian Military academy at Dehra Dun before being commissioned. The Defense Services Staff college at Wellington trains officers on an interservice basis. The National Defense college was set up at New Delhi in 1960 to train senior officers of all three services, on the pattern of the Imperial Defense college in the United Kingdom, to enable them to study matters of policy and the higher direction and strategy of warfare. Besides these there are separate training colleges and schools for the navy and air force and also for various specialized studies. (AD. P.)

VI. THE ECONOMY

In 1939, in spite of substantial recovery from the depression of the 1930s, no long-term trend toward improvement in the general standard of life could be discerned in the then undivided India. Output and trade had been greatly expanded by the opening-up of the country in the second half of the 19th century, but the increase in national income was counterbalanced by the population growth which was greatly accelerated after 1921.

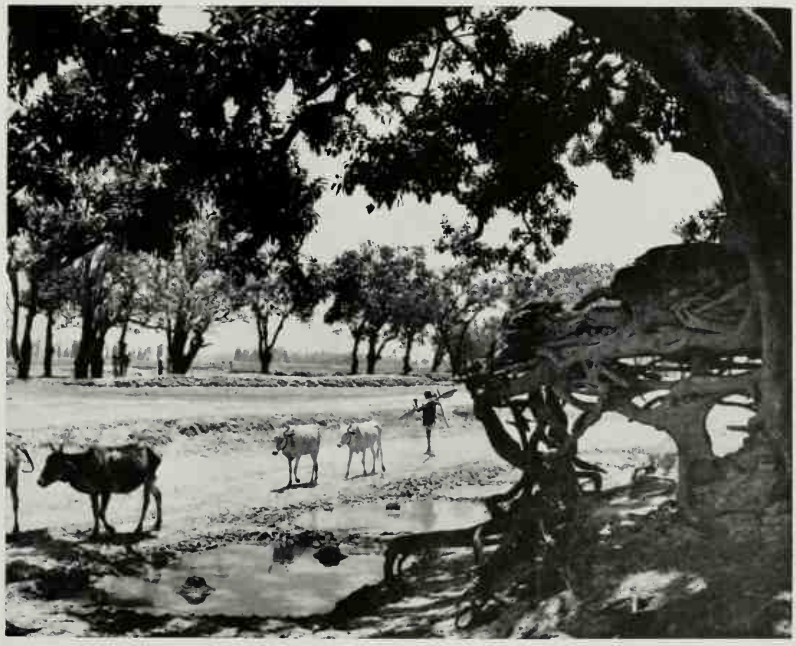
The approximate stabilization of All-India's food production from the 1890s onward meant that, whereas at the beginning of the 20th century India had been a major food (especially wheat) exporter, by 1936—when Burma was separated—it became merely self-sufficient (including rice imports from Burma). Although, largely because of discriminating protection, some half-dozen modern industries had developed, yet there were few signs of general industrialization.

World War II brought certain advantages, including substantial industrial progress, when India became the arsenal for the eastern theatre of war. Basic industries, however, could not be established owing to the impossibility of importing the requisite plant and machinery. The financial agreement whereby payments for goods supplied for the Allied governments' war purposes were made in sterling (in London), enabled India to repatriate the bulk of its public external debt (£360,000,000), to purchase railway capital still in British ownership, and yet to retain sterling assets amounting to some £1,000,000,000, which it was hoped to use for postwar development investment. In addition, many technicians had been trained, and the rise in the price-level assisted debtors, particularly agriculturists, to repay their creditors. But, on balance, the economy suffered severely. Real income per head fell markedly, because of the scarcity of food grains and consumer goods. Imports were cut to a minimum. After the fall of Burma the food situation became critical and inflation started, bringing great distress to all with fixed incomes. Gearing the economy to war naturally involved the imposition of far-reaching controls. Exchange, price and trade controls, food procurement and distribution, and eventually rationing (at the barest subsistence levels) were introduced. The financial agreement, which prevented the purchase of imports in return for the many Indian products diverted to war purposes, increased the scarcities and helped to engender inflation, which was, however, no greater and much less than in many other countries in Asia and the middle east.

Hence, when war ceased, India was faced with serious economic dislocations and problems rendering the transition to normality extremely difficult. The greatest check to recovery came as a result of partition (1947). This involved disastrous strife and massacres, the creation of the enormous problem of the resettlement of millions of refugees, and the complete dislocation of transport and trade between newly formed India and Pakistan. The enduring bad relations were aggravated when India devalued its currency along with the United Kingdom in 1949, whereas Pakistan did not. Fundamental changes in production, trade and investment became necessary. India could no longer secure food grains or sufficient raw cotton and jute from Pakistan, and progressively lost its former important markets there for its staple manufactures, as Pakistan began to establish cotton and jute mills. In spite of the "grow more food" campaign initiated during the war, India became dependent upon food-grain imports from the west, while its growing industries reduced its power to export raw materials. Thus it was already beginning to draw upon its sterling assets for current consumption. The Korean War was another disturbing event.

All this meant that, when India introduced its new era of planned development in 1951, its economy was at a very low ebb.

Muslim women on a hill overlooking the vale of Kashmir, located deep within the Himalayan range in the northern part of the Indian subcontinent



A farmer of the middle Ganges plain (in Bihar), carrying a primitive wooden plow, leaves the fields with his lean draft cattle

SCENES IN INDIA

PHOTOGRAPHS, (TOP) HENRI CARTIER-BRESSON—MAGNUM. (BOTTOM) WERNER BISCHOF—MAGNUM

INDIA

After their husbands have prayed, women at the Bageswar Hindu festival in the Himalayan foothills perform their pujas (rituals)

An old Hindu holy man sits on one of the ghats (stairs) that descend to the Ganges, the most sacred of Indian rivers, at Varanasi (Benares)

Muslim women gathering at a shrine in Kashmir. India is officially a secular state and Muslims comprise almost 10% of the population

A Sikh priest reading from the Granth, the Sikh holy book. Sikhism is a casteless religion, founded in the 15th century as an offshoot of Hinduism

INDIAN RELIGIOUS LIFE

PHOTOGRAPHS, (TOP LEFT) JEAN LYON FROM BLACK STAR, (TOP RIGHT) UPI COMPIX, (BOTTOM LEFT) HENRI CARTIER-BRESSON—MAGNUM, (BOTTOM RIGHT) MARILYN SILVERSTONE—NANCY PALMER AGENCY

An untouchable woman sweeping the street in Jaipur. The caste system, though still a social problem, has begun to decline

A Bengali woman milking the family cows. About 70% of the Indian people live in villages and depend on agriculture for their livelihood

A young mother learning to read. Since independence there has been a marked expansion in public education

A village on a sheltered lagoon in Kerala in southwest India. In this coastal state rain falls heavily throughout the year and many villages are connected by canals

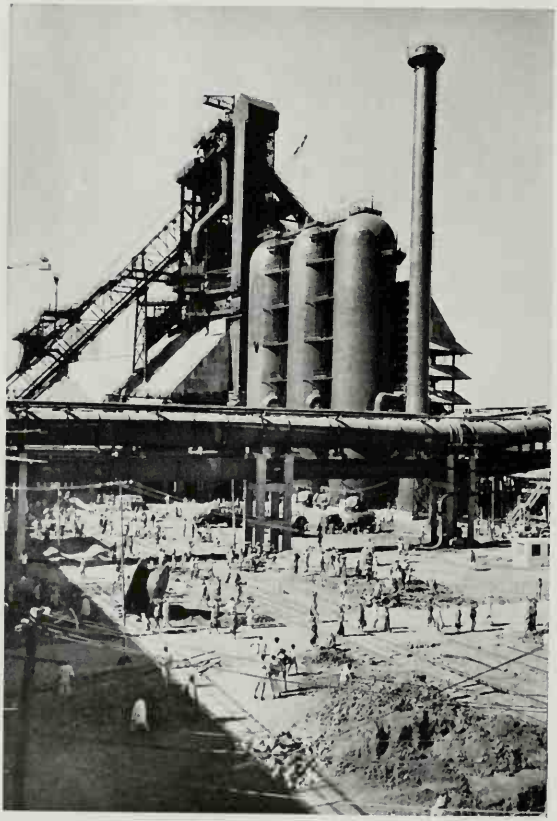
SCENES IN INDIA

PHOTOGRAPHS, (TOP LEFT) UPI COMPIX, (TOP RIGHT, BOTTOM LEFT) MARILYN SILVERSTONE—NANCY PALMER AGENCY, (BOTTOM RIGHT) RICHARD LANNOY

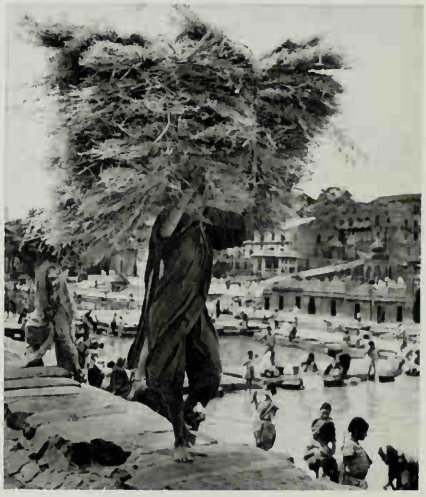
INDIA

Government clerks commuting to work by bicycle in New Delhi, the capital of India

Girls spinning yarn in the traditional hand-spun way. Cottage and small-scale industries still play an important role in Indian life



The Soviet-built, government-owned steelworks at Bhilai. India is concentrating heavily on increasing industrial production



In a riparian village still untouched by change two women balance their burdens of straw

SCENES IN INDIA

PHOTOGRAPHS, (TOP LEFT) TED POLUMBAUM—PIX FROM PUBLIX, (TOP RIGHT, BOTTOM RIGHT) WERNER BISCHOF—MAGNUM, (BOTTOM LEFT) BRIAN BRAKE—MAGNUM

Scarcity of food and consumer goods, and the poverty of the masses were probably greater than ever. Lack of domestic capital and insufficient governmental resources all limited its power to invest for development. The formidable nature of the economic problem confronting the planners can hardly be exaggerated.

(V. AN.)

The Five-Year Plans.—*The Background to Planning.*—The idea of economic planning has an ancestry which antedates Indian independence by some years. In the late 1930s the Congress party set up a National Planning committee and secretariat under the chairmanship of Jawaharlal Nehru, and it produced a series of reports on individual industries and how they might be developed. The committee was planning *in vacuo* with very limited funds at its disposal and without the comprehensive statistical data which has since become available. The concept of a planned Indian economy was given further impetus by the publication in 1944 of the first installment of a 15-year program of development which became known as the Bombay plan, because five of the eight prominent industrialists who sponsored this were Bombay men. The second part of the plan followed early in 1945. The main target was to double the then per capita income within a period of 15 years, which required that the aggregate national income should be trebled.

In the circumstances of the time the Bombay plan was no more than a paper exercise and, like those of the National Planning committee of the Congress party, its economic assumptions have only a limited significance which is mainly historical. But the real importance of both the National Planning committee reports and the Bombay plan is that they prepared Indian public opinion for the more serious decisions that had to be taken when the country became an independent sovereign state. Meanwhile the British government of India had constituted a Post-War Reconstruction committee to deal with questions concerning the economy which would arise when hostilities came to an end, and in 1944 had created a special department called the Planning and Development department to deal with matters pertaining to industrial planning and development. So far as there was a policy at all it was that government would encourage industrial development in any way it could but would not itself actively participate in development plans.

This was the situation when India became an independent member of the commonwealth in Aug. 1947, and for a time the successor Indian government under Jawaharlal Nehru appeared to be continuing to pursue the previous policy of economic nonintervention. The fact is that the new government had many matters other than economic planning on its mind in these first three or four anxious years of independence—the absorption and integration of the former princely states, the Kashmir dispute, the problem of the refugees, the 1949 devaluation of the rupee and the economic consequences of partition. It was not, therefore, until late in 1952 that the first five-year plan, covering the period 1951 to 1956, was published in detail. This first plan represented a very modest venture in planning and is chiefly significant for the fact that most of its targets were comfortably attained, and in not a few cases exceeded, thus giving the authorities a considerable measure of confidence for future planning exercises. In scope and purpose the first plan was small and consisted largely of the collation of existing investment projects some of which (*e.g.*, the Sindri fertilizer project) had been left in various stages of incompleteness by the British.

The Planning Commission.—Notwithstanding its limitations, the first five-year plan was an important milestone in the development of India's post-independence economic policies. It laid the foundations of the machinery of planning and required the planners to evolve and state for public acceptance some kind of philosophy in support of their actions. The Planning commission (which was set up in 1950 and later made responsible to a National Development council consisting of the chief ministers in the central and states governments) stands at the centre of the whole complex of Indian economic planning for which it both gathers the intelligence and provides the strategy. It is staffed mostly by civil servants and economists. It has no executive powers, but its importance as the supreme adviser on over-all economic strategy may be gauged from the fact that the prime minister is its chairman. India has genuinely sought to engage in planning by popular consent; apart from the scrutiny exercised by parliament and the states legislatures over the five-year plans at various stages of their evolution, the Planning commission has consistently encouraged local authorities to study and comment upon its proposals in relation to their local problems. By this means India has sought to avoid the rigidly controlled and monolithic systems of economic planning favoured by the Communist countries.

The First Plan.—The proclaimed objectives of Indian planning were to raise the standard of living of the people, to create the setting for a richer and more varied life and to reduce inequalities of income, wealth and opportunity. "A program aiming only at raising output might result in most of the increased wealth flowing into the hands of a few, leaving the mass of the people in their present state of poverty; it would thus fail to achieve wider social objectives . . . Our program must, therefore, be twofold leading at once to increased productivity and the reduction of inequalities" (*Preamble of the First Plan*). The egalitarian aspect of planning was given a somewhat sharper twist by the adoption in 1956 by the Congress party of a resolution in favour of the creation of a socialist pattern of society, a concept which has never been precisely defined but whose meaning is clear enough to those who direct India's economic policy. The first five-year plan proposed an expenditure of Rs. 2,378 crores (£1,783,500,000 or approximately $4,992,400,000) by the centre and the states in the public sector of the economy (1 crore = 100 lakhs = 10,000,000 rupees); in addition to this it was envisaged that the private sector (including agriculture, organized industry, cottage and small industries and construction) would require an outlay of Rs. 1,700 crores (£1,275,000,000 or $3,570,000,000). In fact expenditure in the public sector amounted to Rs. 2012.4 crores (£1,509,300,000 or $4,226,040,000) and though statistics of expenditure in the private sector are incomplete, the final plan report declared that private investment targets were fulfilled. New private investment in organized industry was estimated at Rs. 233 crores (£174,750,000 or $489,300,000).

As a result of this massive injection of resources during the first five-year plan (1951–56) national income was raised by 17.5%, average per capita incomes by 10.5%; annual food-grains production increased by over 11,000,000 tons on 1949–50 output; about 16,800,000 additional acres of land were brought under cultivation by new irrigation projects, and cotton, jute and oilseeds production was considerably higher than in 1951, though output has varied from year to year. In industrial output production of mill-made cotton, cloth increased from 3,718,000,000 yd. in 1950–51 to 5,102,000,000 yd. in 1955–56, the first plan target being exceeded by 400,000,000 yd. Cement production increased from 2,700,000 tons in 1950–51 to 4,600,000 tons in 1955–56. Production increases reached or exceeded plan targets in the case of sugar, paper and paper board manufacture, bicycle production, general engineering, chemical products, etc. A number of new industrial lines were introduced including the manufacture of penicillin, typewriters and alternators, petroleum refining, etc. Indigenous production of locomotives rose from 27 in 1950–51 to 179 in 1955–56, of wagons from 3,077 in 1950–51 to 13,526 in 1955–56 and of coaches from 573 to 1,260.

In addition community projects and the National Extension service, both of which are designed to improve conditions of rural life, had been taken up in 140,000 villages serving a population of 77,500,000 by the end of the administrative year 1955–56. Finally the number of persons who graduated from engineering and technological institutions rose from 2,200 in 1950–51 to 3,700 in 1955–56. Those who took diplomas rose from 2,700 to 4,000 over the same period.

The Second Plan.—Though the first plan served to make the country think in terms of planning, it made little impact on India's basic economic problems. Population continued to increase faster than resources, and poverty, malnutrition and under-employment abounded. In this situation no government could afford to stand still. The second five-year plan (1956–61) was accordingly drawn

up as a much bolder venture over a wider front. It was submitted to parliament on May 15, 1956, and its main objectives were stated to be: an increase of 25% in the national income; more rapid industrialization, particularly of basic and heavy industries; a large expansion of employment opportunities and a reduction of inequalities of income and wealth and a more even distribution of economic power. The proposed development outlay of the central and states governments was fixed at Rs. 4,800 crores (£3,600,000,000 or $10,080,000,000) while the probable level of private investment was assumed to be Rs. 2,300 crores (£1,725,000,000 or $4,830,000,000) of which about Rs. 500 crores would be in organized industry and mining. Between 1951 and 1956 per capita income had risen from Rs. 253 to Rs. 281 per annum which would make it Rs. 331, or about £25.10.0 or $71.40 per head of the population.

The detailed resources budget for the second plan disclosed that, after taking credit for all normal heads of revenue and borrowing, there remained a gap of Rs. 1,200 crores to be covered by deficit financing and that the expected shortfall on foreign exchange account for the five-year period was no less than Rs. 800 crores. Assuming that these deficiencies would somehow be made good, there still remained an uncovered gap in the account of about Rs. 400 crores. Nonetheless, the Indian leaders decided to go ahead with the second plan, proceeding on the basis that it represented India's minimum needs rather than resources in sight. The centrepiece of the industrial part of the plan was three new state-owned steel works designed to provide the expanding secondary metal-using industries with their raw material and, by raising production from 1,300,000 tons in 1956 to 4,300,000 tons of finished steel in 1961, to reduce the country's heavy steel import bill. The distribution of development expenditure, by major heads in the public sector, was apportioned as follows: agriculture and community development, Rs. 565 crores or 12% of the whole; irrigation and flood control, Rs. 458 crores or 9%; power, Rs. 440 crores or 9%; industries and minerals, Rs. 891 crores or 19%; transport and communications, Rs. 1,384 crores or 29%; social services, housing and rehabilitation, Rs. 946 crores or 20%; miscellaneous, Rs. 116 crores or 2%.

Specific targets set for achievement by the end of the second plan in 1961 included an increase in national income from Rs. 10,800 crores in 1955–56 to Rs. 13,480 crores (£10,110,000,000 or $28,308,000,000) in 1960–61; *i.e.*, by about 25%. This implied an increase of about 18% in per capita incomes. Some of the increases which the plan envisaged were: an increase of 18% in agricultural output, including an additional 10,000,000 tons of food grains bringing the total of this item to 75,000,000 tons by 1960–61; national extension and community development programs to cover 325,000,000 of the population; 21,000,000 ac. more of land to be brought under irrigation; generation of electric power to be increased to 6,800,000 kw. in 1960–61 against 2,300,000 kw. at the beginning of the first plan; in addition to the increase in the output of finished steel, production of coal was to be raised from 37,000,000 to 60,000,000 tons; of cement from 4,800,000 to 13,000,000 tons; of nitrogenous fertilizers from 380,000 tons to 1,450,000 tons and of phosphate fertilizers from 120,000 to 720,000 tons. These are some of the chief production gains which the second plan was expected to achieve in an industrial upswing in which the over-all output of producer goods would go up by 150%. Additional employment likely to be generated in sectors other than agriculture was put at 8,000,000 and a significant advance was envisaged in education, health, housing and other social services as well as the rehabilitation of refugees—a problem which had never been fully resolved since the partition of 1947.

By 1958 it was clear that the second plan had begun to run into a certain amount of difficulty; this was not surprising considering the magnitude of some of the operations involved. The weak links in the chain were the increasingly exiguous character of India's foreign exchange reserves, and the failure of most of the states' administrations to mobilize their share of development resources. Between 1956 and 1958 India's foreign assets rapidly declined, mainly because of the heavy imports of capital goods for development projects. Whereas on April 1, 1956, they had stood at Rs. 746 crores (£559,500,000 or $1,466,600,000) they had declined to Rs. 267 crores (£207,750,000 or $582,700,000) by April 1, 1958. By the end of that year they had registered a further fall in spite of the draconian measures which were taken in the field of import control. In an interim report on the second plan, published in April 1960, the Planning commission recommended that no scheme involving foreign exchange which had not already made substantial progress should be taken up, and that the foreign exchange aspect of those schemes which might be allowed to proceed should be critically scrutinized. At the same time the Planning commission noted the disappointing performance of states administrations in raising additional revenue. In some cases where they had issued loans the Reserve bank had to give a good deal of support to the capital market and some of the state governments had to repurchase their own securities. A number had also failed to adopt additional measures of taxation, though the fiscal powers of the states are notoriously limited.

To meet a situation of mounting financial difficulty two major steps were taken: firstly, all nonessentials were removed from the plan, which was pared down to its hard core, and secondly, on the initiative of the International Bank for Reconstruction and Development, a consortium was formed in Aug. 1958 of friendly nations (the U.S., the U.K., Canada, the German Federal Republic and Japan) willing to help India with sufficient foreign credits to see the revised second plan through to completion. The members of the consortium undertook to provide foreign exchange and credits amounting in all to £335,000,000, or approximately $938,000,000. This sufficed to finance the foreign exchange component for the remainder of the plan period. In addition to western and Japanese aid, the U.S.S.R. and certain other members of the Communist bloc provided extended credits, or entered into barter transactions, designed to help India to acquire capital goods. Not all of the second plan aims were realized and in particular fresh employment opportunities failed to keep pace with the growth of the labour force. (See *Administration and Social Conditions: Living Conditions: Employment* above.)

TABLE II.—*Economic Growth Under the First and Second Five-Year Plans*

Item	Unit	1950–51	1955–56	1960–61	% increase in 1960–61 over 1950–51
National income at 1960–61 prices	Rs. crores	10,240	12,130	14,500	42
Per capita income at 1960–61 prices	Rs.	284	306	330	16
Index of agricultural production	1949-1950=100	96	117	135	41
Food-grains production	000,000 tons	52.2	65.8	79.3	46
Nitrogenous fertilizers consumed	000 tons	55	105	230	318
Area irrigated (net total)	000,000 ac.	51.5	56.2	70.0	36
Co-operative movement: advances to farmers	Rs crores	22.9	49.6	200.0	773
Index of industrial production	1950–51=100	100	139	194	94
Production of:					
Steel ingots	000,000 tons	1.4	1.7	3.5	150
Aluminum	000 tons	3.7	7.3	18.5	400
Machine tools (graded)	value in Rs.crores	0.34	0.78	5.5	1,518
Sulfuric acid	000 tons	99	164	363	267
Petroleum products	000,000 tons	—	3.6	5.7	—
Cloth—mill-made	000,000 yd.	3,720	5,102	5,127	38
khadar handloom and powerloom	000,000 yd.	897	1,773	2,349	162
total	000,000 yd.	4,617	6,875	7,476	62
Power: installed capacity	000,000 kw.	2.3	3.4	5.7	148
Railways: freight carried	000,000 tons	91.5	114.0	154.0	68
Roads: surfaced including national highways	000 mi.	97.5	122.0	144.0	48
General education: Students in schools	000,000	23.5	31.3	43.5	85
Technical education: Engineering and technology—degree level-intake	000	4.1	5.9	13.9	239
Health: Hospital beds	000	113	125	186	65

Source: Third Five-Year Plan Summary published by the Planning Commission (New Delhi).

Nonetheless, a report to the president of the World bank on the eve of the third plan stated that despite all difficulties, the basic result of the first and second five-year plans had been to accelerate the process of development. The third five-year plan proposed to take this process one stage farther.

The Third Plan.—Work on the preparation of the third five-year plan had begun toward the end of 1958 though the plan was not formally inaugurated until April 1, 1961. Introducing the printed text of the plan to the Indian public, the Planning commission declared that the preparation of the plan had been a vast national undertaking in which valuable contributions had come from many sources. At every stage there had been close collaboration with the states' governments and the central ministries. The third plan also figured prominently in the Congress party's manifesto at the 1962 Indian general election, and it was remarkable that after 10 years of planning a sincere effort was still made to ensure that as far as possible the plans should have the backing of popular consent.

The declared objectives of the third plan included the following: an increase in national income of more than 5% per annum; self-sufficiency in the production of food grains and an all-round increase in agricultural production; further expansion of the basic industries such as steel, chemicals, fuel and power and the establishment of machine-building capacity; fuller utilization of India's manpower resources and an expansion of employment opportunities; greater equality of opportunity, further reduction of disparities of income and wealth and a more even distribution of economic power. To achieve a cumulative rate of growth of over 5% per annum it was necessary to undertake net investment of more than 14% of the national income against a level of about 11.5% in 1960–61. This involved raising the rate of domestic savings from 8.5% in the second plan to about 11.5% at the end of the third plan. The plan envisaged a total investment program of the order of Rs. 10,400 crores (£7,800,000,000 or $22,840,000,000), part of which was to be financed through external assistance. Of this, fixed investment and outlay on current expenditure in the public sector was to account for Rs. 7,500 crores, while the balance (including the contribution of some public sector resources to the private sector) was to represent investment in the private sector. The indispensable foreign exchange content of the third plan investment of Rs. 10,400 crores has been estimated at Rs. 2,030 crores (£1,522,500,000 or $4,263,000,000). The consortium mentioned above committed its members to providing sufficient aid to meet the estimated shortfall in foreign exchange for the first two years of the plan, and the indications at that time were that though the task of mobilizing internal resources were formidable, it would be successfully accomplished. (G. W. Ty.)

A. Production

1. Agricultural and Rural Development.—The census of 1951 and other data revealed a decline, since 1939, in the Indian food situation and in general conditions in rural areas. The price and procurement policies pursued during World War II, which fostered hoarding and widespread black markets, had to be continued thereafter and seriously hampered the working of the price mechanism. Hence all the long-recognized defects in the agricultural sphere, including the progressive subdivision of holdings, primitive methods of cultivation, poor marketing facilities, heavy rural indebtedness and dependence upon the monsoon, remained.

The first five-year plan recognized that for many years there had been no appreciable increase in net area sown or in yields per acre, that reclamation of waste areas, needed to increase output and settle landless labourers and refugees from Pakistan, was beyond the capacity of individual farmers and that the per capita availability of cereals was lower than prewar. Hence great emphasis was laid on investment in agriculture and irrigation (31% of total outlay) and in related programs. The policies extended those adopted under British rule, including research, the distribution of better seed, soil conservation, agricultural education, greater use of manures (including the completion of the Sindri fertilizer factory), and improvements in implements and methods of cultivation. Food policy aimed at self-sufficiency but this proved an intractable problem. Partition accounted for the loss of food supplied from Pakistan while there was an urgent need to increase raw cotton and jute.

The first plan targets for food grains (rice, wheat, jowar, bajra, maize [corn] and barley) were substantially exceeded, because of favourable monsoons, but this success engendered complacency so that the second plan reduced the proportion of investment in agriculture and irrigation, but otherwise continued the first plan's policies while including others to stabilize prices. Far-reaching state trading in the main crops and controls over crop movement continued. Achievements during the two plans were remarkable, despite continued dependence upon cereal imports (3,000,000–4,000,000 tons per annum after 1956). The total cropped area and the index of agricultural production both rose substantially while the output of food grains rose from 57,600,000 tons in 1949–50 to about 79,000,000 in 1961–62. The production of tea (now India's leading export), coffee and rubber also rapidly increased.

The third plan aimed at finally achieving self-sufficiency in foodstuffs, and at increasing the output of commercial crops (to supply growing domestic industries and provide export surpluses). The outlay targets for agriculture, including irrigation and co-operation, were stepped up from Rs. 616.6 crores (£462,700,000 or $1,295,560,000) during the second plan, to Rs. 1,281.0 crores (£961,500,000 or $2,692,200,000) during the third. Doubt was expressed of the possibility of securing self-sufficiency in food grains by 1965–66, because of likely increases in demand arising from greater prosperity, together with the possibility of a higher rate of population growth than was at that time anticipated.

Irrigation.—Irrigation has been practised over the centuries in India. Plentiful supplies of water for large-scale canal works are mainly obtained from the Indus rivers system, and from tanks from monsoon water precipitated by the Western Ghats. After partition a number of multipurpose and other irrigation projects were initiated. The net area irrigated rose from 51,500,000 ac. in 1950–51, to about 70,000,000 in 1960–61. The third plan target was 90,000,000 ac. Flood control and the restoration of saline areas were also being carried out. After partition the water supplied by the Indus river system proved insufficient for the needs of both India and Pakistan. This resulted in an acrimonious dispute which was ended only in 1960, when the Indus Waters treaty was signed.

Animal Husbandry, Dairying and Fisheries.—Animal husbandry is of first-class importance to Indian farmers, who depend for motive power mainly upon bullocks, while cows, buffaloes and chickens provide valuable foodstuffs. An increase in animal products, together with fish, could supply much of the protein needed for a balanced diet. In addition, wool products and hides and skins contribute significantly to India's exports. The country of India has a large livestock population, but the quality is poor. Fodder supplies and grazing facilities are insufficient, there is a large proportion of useless cattle and a severe shortage of good breeding bulls. The Indian constitution prohibits the slaughter of cows, while religious or caste sentiments prevent many farmers from castrating bulls. Apart from certain breeds the average milk yield per cow is, perhaps, the lowest in the world, while the milk supply for urban centres was for long insanitary and unorganized.

The main objectives of the first plan were to develop dual purpose cattle breeds, to encourage mixed farming and to expand grazing grounds and fodder production, to isolate useless animals in special centres and to organize clean and cheap milk supplies for urban areas. Improvements along the lines indicated are being carried out through the "key village scheme," whereby a key block acts as a centre for a number of villages. There are plans for the breeding of better bulls, the elimination of pests, poultry and pig improvement, extended veterinary services and more technical training centres. The third plan recognized that many of the old problems remained unsolved and its target outlay was Rs. 54 crores (£39,000,000 or $109,200,000) as compared with Rs. 29 crores (£21,000,000 or $58,800,000) spent during the first two plans.

India has vast undeveloped potentialities for marine, estuarine

and inland fisheries. In the early 1960s about 3–4 lb. per head per annum were produced, as compared with 90 in Japan. Many rivers needed clearing. Surveys, provision of mechanized craft, training of fishermen, and provision of harbour and marketing facilities were all contemplated.

Forests.—Forests play a vital role in the India economy, as suppliers of fodder, grazing grounds and many minor products. They also provide protection against floods and erosion. Conservation started in 1855, and a forest code was gradually evolved. The long-term policy was to bring one-third of the land area (instead of the existing 22%) under forests. By the early 1960s, however, the policies pursued had done little more than prevent further deterioration.

The Co-operative Movement.—The Indian co-operative credit movement was started by legislation in 1904, which was later extended to societies with noncredit functions (such as production, purchase, marketing, housing, etc.). After 1935 the Reserve bank played a leading role in providing finance for the movement. A report in 1954 revealed that credit co-operatives provided only 3% of the total borrowings of agriculturists and recommended an integrated scheme. Hence in 1955 the Imperial Bank of India was nationalized and converted into the State Bank of India, whose principal function was to organize credit for co-operative institutions and rural industries. This appeared to be in complete opposition to the principle of self-help, which elsewhere formed the basis of the whole movement. With some exceptions the co-operative movement in India had made disappointing progress. It was, nevertheless, felt in the early 1960s that unless the peasants learned to pool resources and work together, they would never be able to overcome their financial, marketing and technical difficulties. Hence a vigorous effort was made to revitalize the movement in connection with community development projects and in the early 1960s the number of co-operative societies numbered well over 300,000.

The first plan recommended that all governmental financial assistance to agriculturists should be given through co-operatives, while the second plan drew up an integrated scheme. The third plan's policy was to bring all Indian villages, 74% of the agriculturists, and 55% of the rural population, into co-operatives by 1965–66. Much discussion also centred round co-operative farming, a possible solution for the land problem. Individual farming is practised in many co-operatives; few, if any (except in governmental colonies) include all the village cultivators, let alone landless labourers. Hired labourers are often employed and many cultivators take no part in actual cultivation. Experience suggests that it is difficult to persuade Indian peasants to relinquish their own plots of land and that it will be long before co-operative farming can become more than a marginal form of organization.

Community Development.—The importance of rural reconstruction involving every aspect of the lives of India's predominantly agricultural population has long been recognized. The slow progress made in persuading the villagers to apply known methods of improvement has led to a new, co-ordinated approach through the community development (or national extension organization) movement, which started in 1952. The results varied greatly from area to area and progress proved disappointingly slow. Hence in 1959 it was decided to revive the traditional *panchayats,* or village committees, and to organize representative bodies at higher levels. These bodies and the *panchayats* are responsible for drawing up development programs and for determining priorities, while the villagers are responsible for part of the costs of the work undertaken. They are assisted by technically qualified officers and work largely through co-operative societies. By 1963 the whole country was covered by this type of organization. Quick results could not be expected, particularly as the democratic nature of the village *panchayats* may be questioned. The chairman may well be the largest landowner, or the representative of a high caste, whom the humbler villagers dare not question or oppose.

Land Reform.—Dissatisfaction with India's land systems has long been felt. Land is the responsibility of state governments, so that there are variations in the prevailing systems and in the legislation. Formerly two main types of land tenure existed. According to the first (*zamindari*), intermediary land holders, many of whom had been recognized as owners, paid land revenue (at a flat rate per acre) to the government, and collected rent from their tenants. According to the second (*ryotwari*), the government at first dealt directly with the actual cultivators, and levied land revenue on them. As population and pressure on the land grew, the value of land rose and the landowners (and larger holders) became able to raise rents progressively. Subdivision and fragmentation of holdings also increased, while subtenancies grew apace. There was much exploitation of the cultivators by wealthy and often absentee landlords.

Under British rule measures were introduced in some areas to limit or reduce rents, and to give some security to certain classes, but no fundamental reform was introduced, as this would have entailed interference with social institutions and customs. After partition one state after another introduced legislation to remove impediments and disincentives to productivity arising from the land systems, to eliminate exploitation by providing security for the tiller of the soil, and to reduce inequalities in land distribution. The principal measures were (1) the abolition of intermediary tenures, *i.e.*, the removal from the ownership of landlords the land leased to certain types of tenants who possessed recognized land rights (some compensation was given for loss of rental receipts); (2) tenancy reforms which reduced rents, gave security of tenure and the right to purchase their land to some classes of tenants, limited the power to resume land for self-cultivation, and brought many tenants into direct relation with the government; (3) the fixing of ceilings to landholdings.

Unfortunately, many legislative defects appeared and implementation was delayed, especially with regard to ceilings. Thus the more prosperous peasants benefited, while many small tenants and crop-sharers were either ejected or were no better off. But even if the longer-run objectives of the reforms had not been attained by the early 1960s, the way had been prepared for future progress, particularly if the poorest classes could be emboldened to assert their rights, and if the co-operative movement and community developments were carried out along sound lines.

The Bhoodan or land gift movement, led by Acharya Vinoba Bhave, aimed at securing cultivable land for distribution to the landless by persuading landowners to present land to the community. Many practical difficulties arose, and more recently the movement tended to become a moral and spiritual, rather than an economic, one. (V. An.)

2. Industry.—Indian manufacturing industry is broadly divisible into two main compartments: (1) the old staple industries developed in the 19th century which are significantly oriented toward the export markets; and (2) the newer industries in which metals, chemicals, etc., figure prominently as the basis of the finished product. The first category includes such industries as jute and cotton textiles, the production of tea and coffee and other plantation products and certain extractive industries; *e.g.*, manganese. In the second group are a widening range of electrical and mechanical plant and appliances, pharmaceuticals and chemicals, traction and transmission equipment and consumer goods of various kinds and degrees of durability. Industries in category (1) were for the most part the direct result of the impact of Europe's 19th-century Industrial Revolution upon the Indian subcontinent, especially that part of it which resulted in the displacement of small-scale manual operations by power-driven factory production; while industries in category (2) are the result of the importation of new 20th-century technological methods and skills. These industries have grown up inside an economy that was effectively hedged in by quotas and other import restrictions, justified by the continuing shortage of foreign exchange, so that formerly imported consumer goods had to be largely replaced by local manufactures in a highly protected home market.

Though classified as a developing country, India is the world's principal producer of tea and manufactured jute goods. It is also one of the world's leading manufacturers of cotton piece goods, occupying according to the variations of annual output the third or fourth place in world production. Major manufacturing activities, which do not qualify for any kind of international comparison

but which are of great importance to India, are the production of coal, pig iron, steel, aluminum, sugar, *vanaspati* (vegetable oils), paper and paper board, nitrogenous and phosphatic fertilizers, cement, electric lamps and fans, bicycles, sewing machines, automobiles, tires and tubes, refrigerators, cement and sugar machinery, caustic soda and soda ash and petroleum products. Production of a number of these commodities and articles was only taken up seriously after 1951.

Between 1956 and April 1963 the general index of industrial production (1956 = 100) rose to 153.2. A substantial part of the advance is attributable to the iron and steel and engineering groups rather than to the older staple industries whose production has tended to move up and down within narrow limits. Much of the progress made in the newer industries is the result of collaboration between Indian and foreign industrial interests, whereby foreign manufacturing and similar skills are allied to local capital and other resources. During the early 1960s numerous technical and financial agreements between Indian and foreign parties were sanctioned by the authorities. The Indian attitude toward foreign industrial enterprise may be described as one of enlightened self-interest; provided it introduced a manufacturing process which would benefit the country and further the purposes of the five-year plans, foreign participation in Indian industry was welcomed on the basis of partnership and was assured of the same treatment as indigenous enterprise. In many cases it was required that provision be made for the acquisition of a majority shareholding by Indian interests and that Indians be trained for the higher executive and technical posts.

A further major dividing line in Indian industry is that which is drawn between the public and private sectors. Though the private sector is still much the larger of the two, the public sector includes major producers in a number of industries. Thus the three government-owned steel plants at Rourkela, Bhilai and Durgapur are public-sector concerns coming directly under the authority of the ministry of steel and heavy industries. Among a number of other government-owned and controlled concerns are the Hindusthan machine tools factory at Bangalore, the Sindri fertilizer factory, Hindusthan antibiotics, Hindusthan cables, the national instruments factory, Hindusthan photo films, Hindusthan organic chemicals and sundry other manufacturing concerns. All the above operate under the aegis of the ministry of commerce and industry which exercises final authority in matters of major policy. Otherwise day-to-day management is in the hands of the senior executives in charge of the undertaking. Both the central and state governments have a major interest in the manufacture and distribution of salt.

Varying forms of management and organization are used in the private sector of Indian industry. Many of the bigger industrial concerns (*e.g.*, the two leading steel works in the private sector) are managed by managing agents, a system of business organization peculiar to India. Managing agency has done much to develop Indian industry, and though details are lacking it is probable that the system provides management and other services for substantially more than half of the organized industry of the country which of course excludes cottage and small-scale industries. However, in the 1960s legislation disclosed a trend against the managing agency and in favour of director-managed companies, and the Companies act of 1956 limited, among the other things, the number of companies that might be managed by a single managing agency. The act also approved a new management unit in the shape of secretaries and treasurers.

In the early 1960s textiles accounted for the employment of more than 1,150,000 workers, and jute manufactures for about 230,000. Iron and steel employed less than 90,000, though the three new public-sector steel works had considerably increased the number of workers. It is also known that the Indian tea industry labour force is now of the order of 1,000,000. The service industries, such as the railways, are the country's largest employer with well over 1,000,000 workers.

The heaviest concentrations of industry are to be found in Bombay, West Bengal, Uttar Pradesh, Madras and Bihar and include cotton mills, tea plantation companies, coal-mining companies, jute mills, rubber-growing companies, and sugar-producing companies. These are among the larger industries in India. Since independence a number of smaller industries have also come into existence and begun to flourish. Typical of these are radio and bicycle manufacture, power-driven pumps and sewing machines.

India has also many smaller rural industries which are an integral part of its economy. The great bulk of India's population continues to live in the countryside and, as agriculture does not provide continuous employment, the five-year plans paid special attention to the development of *khadar* (homespun) and other cottage industries with a view to extending opportunities for work and raising the income of the cultivator. Typical village industries are the making of handwoven cloth, the processing of cereals and pulses, the manufacture of leather goods, the manufacture of paper and nonedible oil and soap, village pottery, etc. In the absence of reliable statistics it is difficult to estimate how much employment these industrial activities provide, or to what extent they enter into the main stream of Indian production. Manifestations of the concern for cottage industry are the recognition of the essentially rural basis of Indian society, and an extension of the Gandhian philosophy of self-help to the problems of rural areas. However, the great industrial effort in which India is engaged is chiefly concentrated upon the creation of a modern industrial state and it is by its success or failure to do this that its economic policies are likely to be judged.

3. Power.—Small quantities of electric power were available in India from about the beginning of the 20th century, Calcutta receiving its first supply of electric current in 1899. Thereafter electricity was rapidly installed in half a dozen of the bigger cities. The first Indian Electricity act was passed in 1902. After independence a plentiful supply of industrial and domestic power was essential if the real wealth of the community was to be exploited and industry was to be diversified in accordance with the national plan targets. During the first year of the third five-year plan the country became aware for the first time of an acute shortage of electric power, by no means confined to any one part of India. Indeed, it looked for a time as though the shortage might bring development to a complete standstill. The total installed generating capacity at the beginning of the first plan stood at 2,300,000 kw. of which 630,000 kw. was in state-owned public utility concerns, 1,080,000 kw. in utilities owned by joint-stock companies and 590,000 kw. in industrial establishments operating their own generating stations and supplying themselves and their neighbours with electric power. During the first plan aggregate installed generating increased by 1,200,000 kw. or about 51%, against a plan target of 1,400,000 kw. During the second plan generating capacity was raised from 3,420,000 kw. to 5,700,000 kw., the actual addition being 2,280,000 kw. against a target of 3,480,000 kw. Foreign exchange difficulties and delays in the physical execution of some of the power projects were mainly responsible for the shortfall.

Investment in electricity utilities at the beginning of the first plan was Rs. 150 crores (£112,000,000 or $313,600,000) and during the plan period the total outlay on power development was increased to Rs. 452 crores (£339,000,000 or $949,200,000). By the end of the second plan the figure had been increased to Rs. 1,017 crores (£7,479,000,000 or $20,941,200,000), of which state-owned public utilities accounted for Rs. 790 crores (£590,000,000 or $1,652,000,000). During the third plan it was hoped to commission new generating capacity yielding 1,400,000 kw. per year on an average, while the pace of development in the fourth and subsequent plans was to be accelerated to give an installed generating capacity of 35,000,000 kw. by 1975–76. As laid down in the text of the third plan presented to parliament, roughly half of this capacity was to be provided by hydroelectric projects and the balance would come from thermal stations. The third plan also contained provision for an atomic power station. Industrial consumption of electric power in the early 1960s accounted for about 62% of all power used, domestic or residential, and small power requirements for about 8%, irrigation for 4% and traction for no more than 2.5%. The rest went in miscellaneous usage, including auxiliaries' consumption and transmission losses which together were estimated at no less than 16.3%.

There were about 135,000 circuit kilometres of transmission line in the early 1960s and it was aimed to raise the figure to 240,000 by 1965–66. The estimated cost of the power program in the third plan was Rs. 1,039 crores (£780,000,000 or $2,184,000,000) which includes Rs. 51 crores (£38,000,000 or $106,400,000) for atomic power, Rs. 661 crores (£487,000,000 or $1,363,600,000) for hydro- and thermal-generating schemes and about Rs. 327 crores (£244,000,000 or $683,200,000) for transmission and distribution. It was hoped to relieve previous dependence on imports of electrical equipment by expanding production from the first heavy electrical manufacturing plant at Bhopal which was a venture sponsored jointly by the government of India and British electrical manufacturing interests. By the end of the second plan the total number of towns and villages receiving supplies of electricity from the various grids and other generating units was reckoned at 23,000 and the third-plan program aimed to raise the number to about 43,000 to include all villages with a population exceeding 5,000. Any significant extension of manufacturing industry to rural areas clearly requires that adequate supplies of power should first be available. An atomic reactor (a joint Canadian-Indian enterprise) was inaugurated in Jan. 1961 at Trombay, near Bombay. In addition to basic research and the production of radioactive isotopes the reactor was to be used to train scientific personnel. How much that remains to be done, however, can be judged from the fact that cow dung remains the principal fuel in most of the vast number of villages. For mineral resources *see* INDIA-PAKISTAN, SUBCONTINENT OF: *Natural Resources.* (G. W. TY.)

B. Transport and Communications

1. Railways.—A skeleton railway system serving India's main ports and inland centres was constructed by 1900. Railways did more than anything else to modernize India, primarily by unifying and opening up the country, but also (through their workshops) by providing the basis for an engineering industry. Some important new and branch lines had been constructed by 1939, but thereafter huge arrears of replacement and rehabilitation piled up, so that the first two plans could do little more than repair wartime and partition damage. Nevertheless the system is one of the largest in the world (more than 35,000 route mileage).

After nationalization the former independent systems were grouped into eight zones. The railways contributed a guaranteed dividend to general revenues. From the outset the freight rate structure was based on the principle of charging what the traffic can bear, operated in accordance with prevailing social and economic objectives. Goods were divided into classes, each subject to particular rates. Discrimination was prohibited. After independence the classification and rates were revised in the interest of uniformity and the promotion of a planned program of development.

Railway equipment of all types, including locomotives, coaches, signals, safety devices, telecommunication facilities, track, bridges or stations, were rapidly being modernized in the 1960s. Progress included de luxe (air-conditioned) trains, great improvements in third-class accommodation and services and improved welfare services for staff. Suburban electrification also proceeded steadily. Yet fares and freight charges remained exceptionally low.

Immense strides have been made in the indigenous production of locomotives, rolling stock and other railway equipment, for some of which self-sufficiency had already been attained. The third plan aimed at complete self-sufficiency except, perhaps, in diesel and electric locomotives. Hence for the third plan period there was a great reduction in the need for foreign exchange for railway purposes.

2. Roads.—Until the introduction of motor vehicles relatively little attention was paid to roads (a provincial responsibility). After World War I the railways began to suffer from competition from road transport, after which the problem of transport co-ordination became one of continuous concern. In practice, the danger did not become acute because of a general shortage of all forms of transport, but by the 1960s it was expected that the financial position of the railways would suffer from loss of valuable consignments to the roads, competition from long-distance buses and compulsory social (but unprofitable) responsibilities. No definitive policy had been adopted by the early 1960s though competition from the roads was still limited by innumerable (state) licensing and other regulations. In certain states passenger road traffic became nationalized while after independence national highways and interstate road traffic were assigned to the central government.

3. Inland Waterways, Shipping and Ports.—The importance of inland waterways has greatly diminished since the introduction of modern forms of inland transport. Nevertheless there are more than 5,000 miles of navigable waterways (in particular the Ganges [Ganga] and Brahmaputra, Godaveri and Krishna, Kerala backwaters and canals, and the Buckingham canal of Madras and Hudhra), of which over 1,500 miles are navigable by mechanically propelled vessels. Measures are being taken to deepen the channels and to design appropriate shallow craft.

Although considerable attention was paid to port development under British rule, there were hardly any Indian-operated deep-sea vessels before independence, while even coastal shipping was very limited. On the other hand the gross tonnage of Indian operated deep-sea ships increased from some 173,000 before planning started, to more than 400,000 in the early 1960s. Further progress would depend partly on the development of India's new shipbuilding industry (see *Industry* above), but the third plan's target was 1,420,000 gross tons.

After independence two governmental shipping corporations were formed, and a national harbour board was advising the central and state governments on port development. The six major ports (Bombay, Calcutta, Madras, Cochin, Vishakhapatnam and Kandla) were administered by port trusts or from the centre, whereas the state governments were responsible for the minor ports.

4. Civil Aviation.—India is excellently situated for the development of aviation both internally (on account of its vast distances and good flying conditions throughout most of the year) and externally (as occupying an important position in the east-west air routes). At the end of World War II many private companies were floated, leading to financial insecurity. Hence in 1953 the Air Corporation act nationalized the industry, and two governmental corporations were formed. India now has over 80 airports. A national aircraft industry was also established (see *Industrial Production* above).

5. Posts and Telecommunications.—The post office (covering postal, telegraph, telephone, overseas communications and allied services) remains India's second largest nationalized industry (*i.e.*, after the railways). It employs more than 360,000 persons, and runs a postal savings bank and postal life insurance. Like transport, with the expansion of industry and commerce it is subjected to ever-increasing demand, and therefore strain.

Radio broadcasting is becoming an important medium of communication and many villages have (mainly short-wave) community sets installed. All India Radio (A.I.R.), controlled by the ministry of information, broadcasts from New Delhi in the principal languages and dialects, and is linked throughout the country by a network of transmitters. The third plan gives priority to the expansion of medium-wave broadcast services, and the establishment of a television centre at Bombay (in addition to the small education unit at New Delhi inaugurated in 1959).

C. Trade and Finance

1. Trade Trends and Balances.—Whereas India's overseas trade tended to expand rapidly up to 1939, and a large favourable balance was normally achieved, since then the trend has changed notably. During World War II trade was restricted by scarcity of import goods and shipping, and by loss of war-devastated markets, together with exchange, export and import controls. Despite rising prices, even the value of exports and imports failed to increase until nearly the end of the war, while the quantum fell, as is confirmed by the very substantial decline in shipping cargoes. The balance of trade remained favourable, because of the large war demand for Indian goods, until 1944–45, when there was a continuous, although fluctuating, surplus of imports. When the war ended India participated in the various economic and financial international agreements and, after independence, notified the exchange value of the rupee to the International Monetary fund at a

rate which left the previous rupee-sterling ratio unaltered (at 1 rupee to 1*s.* 6*d.* or 21 cents). Trade recovery, however, was fluctuating and inadequate, especially as regards exports. India's share of world exports fell from 2.1% in 1950 to only 1.13% in 1962. Throughout the whole period there was a strong tendency toward an increasing surplus of imports, kept within some bounds only by controls.

After the war there was a large pent-up demand for imports of consumer goods, and great need to import cereals and certain raw materials. These shortages were accentuated by partition, which deprived India of cereals and raw materials and previously obtained from areas which then fell within Pakistan. When planning started the large import content of India's industrial and other modern projects, as well as the need to import capital goods, increased the demand for imports.

On the export side great difficulties were experienced. Partition entailed the loss (to Pakistan) of some of All-India's largest traditional lines of export, such as raw jute, and hides and skins. In Sept. 1949 India devalued its currency at the same time as the U.K., but Pakistan did not (until 1955), which led temporarily to almost complete cessation of Indo-Pakistani trade, although subsequently trade agreements were made and periodically renewed. Even so, Indo-Pakistani trade resulted in a large import surplus for India, as Pakistan had built up its own cotton and jute mill industries, so that it no longer required Indian cotton and jute manufactures. It thus became essential for India to discover and develop new types of export and new export markets. In addition, the recovery of Japan intensified competition, especially in cotton piece goods in overseas markets. By the early 1960s the result was export stagnation, which, combined with pressure to import, created a serious long-term imbalance in Indian trade.

From time to time attempts were made to liberalize imports in order to satisfy pent-up demand and avoid inflation, but with disastrous results on the balance of trade so that restrictions had to be reimposed. Import duties, prohibitions and quantitative restrictions on imports continued and were greatly enhanced because of the payments crisis in 1957. At this time the second plan's investment target was reduced. Luxury imports were prohibited and more severe restrictions placed on imports of many types.

For exports the policy was gradually to remove controls and work out a plan of export promotion. The plan included incentives to exporters, fiscal reliefs, bilateral agreements on a balanced trade basis and the establishment of export promotion councils.

A state trading corporation was established in 1956 and played an important role in promoting exports of particular goods and in stimulating trade through bilateral agreements, especially with Communist countries of eastern Europe. The latter's share of India's foreign trade rose from about 1% during the first half of the first plan, to over 8% at the end of the second plan.

It is impossible to trace and measure the trade trends before, and after, partition and independence. Trade trends in the 1950s and early 1960s can, however, be summarized as follows. The average annual value of imports during the second plan (Rs. 1,072 crores or £796,000,000 or $2,228,800,000) increased by almost 50% over those during the first plan (Rs. 724 crores or £535,000,000 or $1,498,000,000), but as import prices rose during the second plan, and the nature of imports changed substantially, this provides little guidance to quantum changes. In both plans the largest class of imports was "raw materials and intermediate goods." In the second plan, capital goods increased most, chiefly chemicals, iron and steel products and machinery.

The average annual value of exports hardly changed over the two plans (Rs. 609 crores [£449,000,000 or $1,257,200,000] for the first plan and Rs. 614 crores [£454,000,000 or $1,271,200,000] for the second). In the first plan exports were raised by the Korean War, while the 1958 recession in the United States and Europe reduced exports for the second plan. It has been estimated that there was an increase of 9% in volume in the second plan over the first, but because of a fall in export prices this was not reflected in larger export earnings. In both plans "agricultural commodities and related manufactures" formed the largest export class, but this classification is somewhat misleading, as tea exports greatly expanded and formed about 80% of all purely agricultural exports. "Other manufactures" doubled in the second plan, while the "new manufactures" trebled in value.

World War II formed a turning point for Indian trade. Cereals became a major import, while imported manufactures became capital instead of consumer goods, machinery heading the list. Other outstanding imports are base metals and mineral oils. Jute manufactures and tea are the leading exports. Total exports have tended to stagnate, although new types of manufacture are slowly gaining ground. The distribution of Indian trade was chiefly changed by a fall in the share of Japan and a great increase in that of the United States. The United Kingdom remained India's foremost market, taking 24.7% of India's exports in 1961 compared with 17.3% by the United States, but was surpassed as a supplier of India's imports by the U.S., whose share became 23.6% against the U.K.'s 19.7%. Together these two countries accounted for about 43% of India's exports and imports as a whole. India's internal trade remained far greater than its external trade, but was unrecorded except on the basis of railway blocks.

Domestic Trade.—Despite the development since the middle of the 19th century of a large volume of long-distance internal trade and of overseas trade, local trade is still carried on by primitive methods in rural markets and village bazaars. Cultivators, cottage workers and middlemen (who purchase from the producers and resell) bring to the bazaars agricultural and other rural products, such as handmade cloth, metal goods and other handicraft articles. Prices may vary greatly as between one locality and another. Efforts are being made to introduce uniform weights and measures and prevent the exploitation of purchasers.

2. Banking, Public Debt and Monetary Policy.—India's banking and credit system is divided into the organized (Reserve Bank of India, State Bank of India, foreign exchange banks, Indian joint-stock banks) and unorganized (indigenous) sectors. The Reserve bank, which performs all the normal functions of a central bank, was established in 1935 and nationalized in 1948. The Banking Companies act, 1949, laid down stricter requirements to strengthen joint-stock banking and increase the Reserve bank's control. The scheduled banks associated with the Reserve bank have to maintain prescribed interest-free reserves with the latter, in return for which they secure privileges, such as remittance and rediscount facilities. The indigenous banks, which often combine money lending and trading with deposit banking, in the early 1960s remained backward and often charged usurious interest rates. Nevertheless, they were the main source of credit in rural areas and for small industries. Hence the Reserve bank's control over the credit supply of the economy was very circumscribed, so that changes in the bank rate (3% throughout the war, raised to 3½% in 1951 and to 4% in 1957) played a minor role in monetary policy. Management of the public debt and monetary policy are necessarily closely related. The desire to reduce the cost of the public debt, to control inflation, and yet to enable credit to be made available at favourable rates for priority projects have led to a policy of controlled expansion, for which other methods of controlling credit besides the bank rate have been used.

The demand for currency and credit expanded with the rising national income and prosperity of the advanced portion of the private sector. The relative decline in the commercial banks' "time" liabilities, and their increased investment in long-term industrial finance, led to their ever heavier demands on the Reserve bank. All this increased the inflationary pressure. Hence, from 1959 onward a series of measures, operated in a flexible manner, were introduced to reduce excess liquidity and contain inflation. These included "selective credit controls" on advances against crops, variable reserve requirements by the Reserve bank, and "slab rates and quotas" relating the Reserve bank's charges to the extent of borrowing. Commercial banks were directed to raise their interest rates. These measures had salutary results.

The value of India's public debt has expanded considerably since 1939. Under planning the domestic debt increased rapidly (Rs. 5,123 crores [£3,835,000,000 or $10,738,000,000] in 1960), and foreign loans for development, necessitating provision for interest payments and eventual repayment, amounted to Rs. 630 crores

(£472,000,000 or $1,321,600,000) in 1960. A new feature in the structure of the domestic debt was the increasing resort (since exhaustion of the sterling assets) to treasury bills, which again increased the pressure on prices and tended to stimulate speculation.

The index number of wholesale prices (old series) rose continuously from 100 in 1939 to a peak of 439.3 in 1951, that was not surpassed until 1959. The price level fell by 18% during the first plan, but rose by 30% during the second. During World War II and the immediate postwar period, agricultural, particularly food, prices rose relatively to other prices. But it would be a misapprehension to assume that because food grains normally remained scarce, their prices would have continued to stay relatively high. On the contrary, largely owing to the wheat loans from the United States under public law 480, food grain stayed relatively stable, while the index for industrial raw materials soared.

India, as a member of the sterling area, maintains the greater part of its external currency reserves in London in the form of sterling balances. The currency unit is the rupee which is maintained at a fixed parity with gold equivalent to Rs. 13.33 to the pound sterling (Rs. 4.76 to the U.S. dollar). A decimal coinage was introduced April 1, 1957, whereby the rupee, which remains unaltered in value and nomenclature, is divided into 100 equal parts called *naye paise*. The metric system of weights and measures was made compulsory in April 1963.

3. National Finance.—India's system of federal finance, embodied in its constitution of 1950, is largely based on the Government of India act, 1935. There is a threefold distribution of legislative powers (the union, state and concurrent lists), to which the distribution of financial resources and taxing powers is closely related.

Revenue.—The most important exclusively union revenue resources are transport and communications (except road transport); union property; public debt; currency and mint; customs; capital taxes, succession and estate duties (except on agricultural land); specified stamp duties; corporation taxes; and excise duties on medicinal and toilet preparations and commodities not on the divisible revenue list. The states' chief sources are land revenue; taxes on agricultural income; succession and estate duties on land; taxes on land, buildings and mineral rights; excise on alcoholic liquors and drugs; sales taxes, taxes on road and inland waterway transport and vehicles; taxes on professions, trades, entertainments, etc., terminal taxes and taxes on railway fares and freights; tolls; and certain stamp duties and fees.

Income tax (except on agricultural incomes) and specified excise duties are levied by the centre but shared with the states. Under the constitution a finance commission makes recommendations on these and other matters assigned to it. It was hoped thereby to give greater financial autonomy to the states and more elastic sources of revenue for the "nation-building" functions which devolve upon them. By the early 1960s the finance commission had raised the states' share of income tax to 60%, extended the list of divisible excise duties and recommended increased grants.

Nevertheless, no long-term solution had been found for the intractable problem of distributing resources between the union and the states in a manner assuring financial independence to both parties, in the context of the ever-increasing need for investment under the plans. In particular the states failed to raise sufficient revenue to cover their share of development expenditure.

The changes in the area of India since partition and the financial integration that followed the union of the former princely states make comparisons between budget revenue raised before independence and 20 years later impossible. Great changes also occurred in the relative importance of various types of taxes. For instance, in 1938–39, the centre and provinces (now states) together secured from customs 55%, income tax 22% and land revenue 14% of the total revenue, whereas in 1960–61, excise provided 36%, income tax not quite 20%, customs 13% and land revenue 8%. But this was not the result of a continuous trend. During the war, because of interruptions to trade and the great need for revenue, although customs receipts fell drastically, taxes on incomes and corporations were progressively raised, so that in 1945–46 the central government's direct taxes yielded 63% of its total tax revenue.

The provinces, on the other hand, experienced a phenomenal increase during the war from the excise on alcohol, which may partially account for the drive for prohibition thereafter, involving them in a heavy loss of revenue.

When peace came the trend again changed. In the short run budgetary policy fluctuated, but when planning started it became integrated with planned development. The Taxation Enquiry commission of 1953–54 made far-reaching recommendations. In 1955–56 excise duties were extended to a number of additional commodities and by 1956–57 the share of direct taxes had fallen to 37%, while that of indirect taxes rose to 63%.

At that time the balance of payments position began to cause great anxiety and led to the prohibition of imports of luxuries and semi-luxuries and to stricter trade controls in general. This tended to reduce customs revenue, while excise duties continued to be extended and revenue therefrom went up by leaps and bounds. In 1956 N. Kaldor, having been invited to investigate the Indian tax system with special reference to personal and business taxation, recommended placing direct taxation upon a broader basis, involving the imposition of a series of new taxes. Accordingly, but by no means precisely as recommended, the tax on capital gains was revived in 1956 and taxes were subsequently imposed on wealth, expenditure (this tax was abolished in 1962 because of low yield, administrative difficulties and limited coverage) and gifts. In spite of these new taxes (of which only the wealth tax brought in any significant revenue), and a continuous and substantial rise in revenue from company taxation, in 1961–62 taxes on income and property accounted for only 26% of the central government's total tax revenue as contrasted with 74% from taxes on commodities and services. Some part of the decline in the central government's income tax receipts may be attributed to the larger share now going to the states.

At first sight this suggests that India's taxation system has become more regressive. A brief survey of the main characteristics of the outstanding taxes may throw some light on the matter.

After some preliminary experiments, a general income tax (except on agricultural incomes) was imposed in 1886. Progression was introduced in 1916 after which an intricate, progressive tax, revised and raised on many occasions, and to which supertax and surtaxes were added, was gradually evolved. In 1939 the "slab" system, whereby total income is divided into a series of "slabs," each subject to a particular tax rate, replaced the former "step" system. Rates were progressively raised during World War II, after which various differentiations (between earned and unearned incomes, and as between individuals and Hindu joint families) were made and on occasion rates were adjusted and sometimes reduced.

The only way in which the burden of Indian taxation can be compared with that of other countries is by estimating the percentage of total incomes of various sizes taken as tax, and even so the expenditure tax is necessarily excluded.

An estimate for 1956 comparing the Indian figures with those of various countries showed that only Norway had higher rates of income taxation at all levels. Indian rates were slightly lower in some cases, for certain income brackets. At high income levels India's rates were invariably above those of the U.S., Canada, the Federal Republic of Germany and Japan. When the wealth tax is included, at the highest bracket the total annual tax rises above total annual income.

Agricultural income is still excluded from the general income tax, but most states now levy a tax thereon, normally at low rates.

Foreign personnel, foreign companies and investors usually pay the same rates of tax as Indian individuals and companies, with some concessions related to their special circumstances.

Corporations of all types have, ever since 1880, been treated as distinct taxable entities. The method of computing taxable income and rates of taxation (distinguishing between types of companies) and many concessions made during the second plan, to encourage investment in particular industries and new companies,

resulted in an excessively complicated system. A far-reaching reform in 1959 simplified the procedures and taxes. The wealth tax has also been withdrawn from companies. Companies were to pay income tax at 20%, and a corporation tax of 25%. Special methods and rates of taxation still apply to special types of companies. Companies started since 1954, on account of the generous depreciation allowances, tax holidays and development rebate, could in 1959 secure a reduction in rate from 45% to only 22%. International comparisons showed that the 45% standard rate placed India in about the middle of the list of countries with which comparisons are made. In 1962 the income tax rate on companies was raised to 25%, the corporation tax remaining unaltered.

In considering the total burden of Indian taxation and its distribution several factors must be taken into account. It was estimated that in 1951–52 the union and states total tax revenue amounted to 7.6% of the national income; it rose to about 10% in 1961–62; and was expected to rise to some 11% by the end of the third plan. This is a low figure in comparison with many advanced and many undeveloped countries. The number of incomes assessed for income tax was under 1,000,000, and substantially less if companies are excluded. In India's case many commodity taxes fall upon goods which are either not consumed by the poorer classes, or the qualities consumed by the latter are subject to low rates. Apart from the excise on kerosene, excise duties thus tend to be progressive rather than regressive.

Much the same can be said of the customs tariff, which is exceedingly elaborate. Duties are classified as revenue, protective and, or, preferential. The export tariff still includes 21 items, in addition to export cesses.

The other main sources of union revenue (in order of importance) consist of net receipts from public enterprises (chiefly currency and mint, and railways) administrative receipts and miscellaneous receipts, but these account for only 17% of the union's total revenue. The largest sources of states' revenues are the general sales tax and land revenue, apart from transfer and grants from the union.

The union's budgetary deficits and surpluses on current account have varied at different periods, but the deficits—unlike those on capital account and in the balance of payments—have not posed major problems.

Expenditure.—The expenditure of the central government (on revenue account) has expanded correspondingly with revenue receipts, although not necessarily exactly in step. Moreover, since planning started, there has been a great expansion of public expenditure on capital account, mainly for development purposes (the capital outlay by the union and state governments together was Rs. 1,179 crores [£884,250,000 or $2,475,900,000] during the first plan, and Rs. 3,307 crores [£2,480,250,000 or $6,944,700,000] during the second plan).

Main items of expenditure of the central government in the early 1960s were defense, social and development services, administrative services and collection of taxes, debt services and contributions and adjustments (*i.e.,* grants and transfers, etc., to the states). (V. An.)

4. Balance of Payments and Foreign Aid.—India is a member of the sterling area and a major portion of its overseas trade is with countries in the sterling group, though since independence the trend has been to diversify the pattern of its external transactions and to enlarge the volume of its commerce with countries such as the U.S. and those in the Soviet bloc (see *Trade Trends and Balances* above). As has been noted in *The Five-Year Plans* above, serious balance of payments difficulties began about halfway through the second plan when there was a sharp fall in foreign exchange reserves which was only halted as a result of stringent import cuts and increased foreign aid. This was due to a significant rise in imports of capital goods including machinery and vehicles, defense equipment, iron and steel and the other industrial materials required in the first two years of the plan. The deficit which subsequently developed in India's balance of payments has been made good by foreign loans and credits and it is clear that India cannot hope to pay for the capital goods required for its program of industrialization out of normal export earnings. For this purpose it is wholly dependent upon aid or loans upon special terms for extended periods.

The strategy of the five-year plans presumes a continuing balance of payments deficit on current account which for the period 1962–63 exceeded Rs. 333 crores. This will be made good by external aid, until the economy has reached the point of self-sustaining growth, perhaps by the end of the fourth five-year plan in 1971. Vigorous efforts were being made in the 1960s to increase export earnings.

The total of foreign loans and grants to India which had been authorized up to Dec. 31, 1962, was Rs. 3,825.24 crores. Included in this large sum are the proceeds of the sale of U.S., Canadian and Australian loan wheat, the value of assistance received from commonwealth countries under the Colombo plan in the form of technical aid, equipment, materials, etc., the estimated cost of equipment and materials received under the Indo-U.S. Technical Cooperation Agreement program, assistance under the U.S. public law 480 and gifts from international philanthropic organizations such as the Ford and Rockefeller foundations. But the great bulk of the total is made up of loans and credits from international institutions and friendly governments anxious to assist India in the implementation of five-year plans. Loans from the U.S. totaling more than Rs. 2,400 crores ($5,000,000,000) constitute the largest element in the form of Development Assistance loans, International Co-operation Administration (I.C.A.) credits, the President's Asian Economic Development fund and loans from the U.S. Export–Import bank. These have been used for a variety of purposes ranging from the purchase of tube-well casing to the acquisition of aircraft for Air India International.

U.S.S.R. credits have been largely concentrated upon the steel works at Bhilai, a heavy machine plant and an oil refinery at Barauni. Soviet loans in the second plan amounted to about Rs. 150 crores in value, while two agreements for credits of 1,500,000,000 rubles (old) (Rs. 178.58 crores) and 500,000,000 rubles (old) (Rs. 59.53 crores) were negotiated for the third plan. Loans and credits from the U.K. amounted to approximately Rs. 250 crores (£187,500,000), part of which were applied to the construction of the Durgapur steel plant and the laying of the oil pipeline for the Nahorkatia oil fields project. The U.K. also accorded India a series of general credits to finance agreed broad categories of imports from Britain. Other Indian borrowings abroad include smaller loans from the Federal Republic of Germany, Japan, Switzerland, Czechoslovakia, Yugoslavia, etc. Finally, the International Bank for Reconstruction and Development granted loans for various development purposes in India from 1949. The total sanctioned up to Dec. 1962 was Rs. 389.25 crores, out of which Rs. 140.42 crores had been contracted by private sector industries and Rs. 248.83 crores by public sector nongovernment bodies under the guarantee of the government of India. The major portion was in the form of six separate loans for the development of India's railway system.

See also references under "India" in the Index. (G. W. Ty.)

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INDIA, FRENCH (Inde Française), the name for those parts of India which were formerly under French control. They were first founded by the French East India company (formed by Jean Baptiste Colbert in 1664), which established a settlement at Surat in 1668. This was followed, five years later, by another at Pondicherry, whose director, François Martin, made it the capital of the French posts. Mahé was founded in 1725 and Karikal in 1739. French concerns multiplied in Bengal, with Chandernagore as centre, especially after 1730 with the impulse given by Joseph François Dupleix (*q.v.*).

In 1742 Dupleix was appointed director general. During the War of the Austrian Succession he seized Madras, which he had to restore at the peace settlement. He then used his army in the quarrels of the princes of Deccan, and his general, C. J. P. Bussy-Castelnau, won several victories. Dupleix, who had become a nawale, then ruled a territory of 30,000,000 inhabitants and controlled 800 km. of coast. But the Seven Years' War brought English intervention; several of Dupleix's lieutenants were defeated by Robert Clive (later Baron Clive of Plassey) and Dupleix was recalled to France. The Comte T. A. de Lally was forced to surrender Pondicherry to the English after nine months of siege; the treaty of Paris in 1763 gave back to France only the settlements which it had held before the conquests of Dupleix. Dupleix died in the same year and the Comte de Lally was accused of treason and executed.

From this time the French establishments in India, which were under the authority of the king after the abolition of the company in 1770, comprised—apart from a few small posts (*loges*)—no more than five settlements of moderate size: Chandernagore in Bengal, Yanaon (Yanam), Pondicherry and Karikal on the Coromandel coast, and Mahé on the Malabar coast. The English conquest of India lessened the commercial activity of the settlements. They were occupied by the English in 1778 and then again in 1793, but were returned to France in 1816. The second republic gave them local government and representation in the French parliament. Under the second empire commercial liberalism and Anglo-French understanding gave these settlements a moment of passing prosperity.

In 1947 the *loges* were given back to independent India; Chandernagore was finally transferred in 1951; and, after an agreement between the two countries in 1954, the remaining settlements were merged into a new Indian state, to be known as Pondicherry. At that time the settlements (Pondicherry, Karikal, Mahé and Yanaon) covered 193 sq.mi. and had a combined population of 402,000; of this Pondicherry with 317,000 inhabitants comprised 112 sq.mi. A Franco-Indian institute was established in the town of Pondicherry. *See* also articles on the individual settlements.

See A. Martineau, *Dupleix* (1931); L. G. Hanotaux and A. Martineau, *Histoire des Colonies Françaises*, vol. v hy A. Martineau and H. Froidevaux, *Histoire de l'Inde Française* (1932). (Hu. De.)

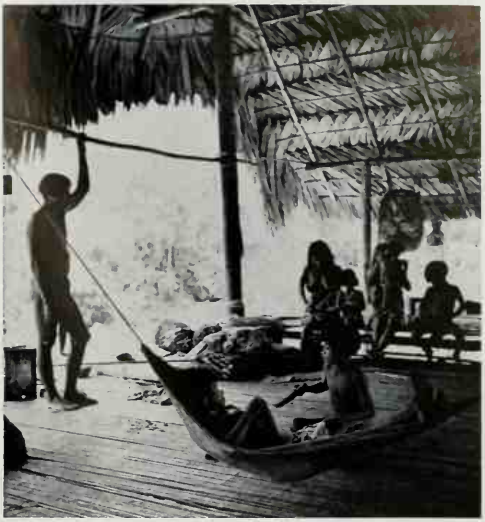
INDIA INK: *see* Ink: *Writing Ink.*

INDIAN, LATIN-AMERICAN. Of the 16,000,000 or more people who, according to estimates of A. L. Kroeber and J. H. Steward, inhabited the western hemisphere at the time of European discovery, about 15,000,000 lived in what is now Latin America. Heavy concentrations were in Mexico and adjacent parts of Central America with perhaps 5,000,000, and the Andean area of western South America with at least 6,000,000. Today these same areas tend to have proportionally large Indian populations. Thus, while of the population of the U.S. only about 0.4% are Indians, in Ecuador, Bolivia, Peru and Guatemala the percentage of persons recognized as and called Indians runs from 40% to 50% and higher. There are large areas in Mexico, Guatemala and the Andes where the vast majority of the people are Indian in ancestry and maintain Indian languages and cultures. In much of Latin America the aboriginal population therefore has been of great importance historically and represents in modern times a highly significant segment of life. Nor are the Indians disappearing in Latin America. (The same is true of North America.) Although many individuals join the ranks of *caboclos*, *criollos*, mestizos, Ladinos—as the Europeanized classes are variously called—and although some Indian communities substitute European languages and many European ways for their own, the population of "Indian" Indians may actually increase as such "losses" are compensated for by the population growth that modern medicine permits. As colonial-type class systems break before modern communications and democratic ideas, the Indians may be expected to maintain and increase their importance in the economy and politics of many Latin-American nations.

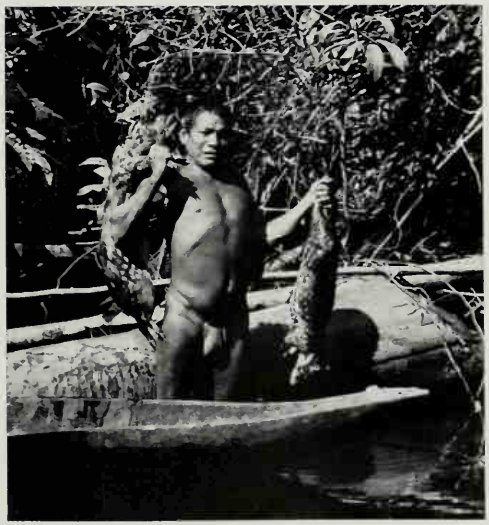
ABORIGINAL LANGUAGES AND TRIBES

It is generally agreed that Indians began to migrate across Bering strait 25,000 to 35,000 years ago, and continued to come in small numbers until about 4,000 years ago. Presumably they began from earliest times to spread over the whole hemisphere, and by 10,000 years ago there were migrant hunters in South America. (*See* Archaeology: *The New World: Early Man.*) When about 4,000 years ago agriculture, based mainly on maize (corn) and manioc, developed in the new world, and village life and city-states grew, extreme cultural variation resulted. In addition to differences based on ecological variations, there were those of cultural intensity or complexity, differences between nomadic tribes, for example, and urban civilizations. Movements of people and wars and conquests continued throughout history, so that—as pieced together from archaeological evidences and linguistic and ethnological distributions, as well as from what documentary evidences there are—the picture is one not only of extreme mobility but of

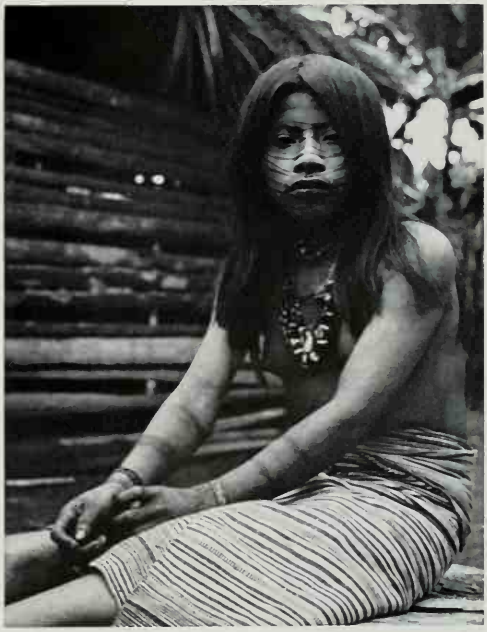
Oyana youth of French Guiana plays a bone flute; the plucked eyebrows and beads are typical of these Indians



Interior of Chocó hut on the Mogi river, Darién province, Panama. The hut stands on stilts high above the water; the roof is of lashed palm fronds, the floor of woven reeds



Cubeo hunter on the Vaupés river in Colombia holds two pacas, killed with a blowgun; a hollowed log serves as a canoe



Colorado girl from Ecuador. Painted designs on face and arms are for beautification and are typical of this group

FOREST TRIBES

PHOTOGRAPHS, (TOP LEFT) CARL FRANK—PHOTO RESEARCHERS, (TOP RIGHT) THOMAS HOLLYMAN—PHOTO RESEARCHERS, (BOTTOM LEFT, BOTTOM RIGHT) HECTOR R. ACEBES—PHOTO RESEARCHERS

INDIAN, LATIN AMERICAN

Peruvian boy plays a primitive reed pipe; the setting is the Andes near Cuzco, once the seat of Inca power

Quechuan-speaking tribal dignitaries lead the people to Mass at Pisca, Peru. The religion of most Andean Indians is a blend of paganism and Roman Catholicism

Traders at a market in Sololá, Guat.; they are descended from the founders of the Maya empire

Ica from the Sierra Nevada de Santa Marta mountains in northern Colombia

Aymara woman shops in La Paz, Bol. The typical native-made wool derby hat derives from earlier contacts with whites

MOUNTAIN TRIBES

PHOTOGRAPHS, (TOP LEFT) WERNER BISCHOF—MAGNUM, (TOP RIGHT) GEORGE HOLTON—PHOTO RESEARCHERS, (CENTRE LEFT) THOMAS HOLLYMAN—PHOTO RESEARCHERS, (BOTTOM LEFT) PAUL CONKLIN—PIX FROM PUBLIX, (BOTTOM RIGHT) HECTOR R. ACEBES—PHOTO RESEARCHERS

a patchwork. Mysteries like those of the Basques or the gypsies in Europe are common in aboriginal America. Despite this, and the relatively small amount of research so far done on South American archaeology and languages, anthropologists have brought remarkable order to the data.

About 1,700 mutually unintelligible languages appear to have been spoken by the Indians of the area. In the 20th century these languages have been ordered somewhat independently by Norman McQuown, by Joseph Greenberg and by Morris Swadesh. (*See* also AMERICAN ABORIGINAL LANGUAGES for description and discussion of their history and characteristics.) The accompanying table includes all languages about which linguists have substantial knowledge, classified mainly according to Greenberg. The number of independent groupings tends to be reduced with increasing research.

A "tribe" may be identified with a particular language, but it is an error to confuse languages with social units, especially where settled agricultural populations of a variety of language groups have been joined politically, or where single widespread language groups are socially distinct. Thus, in Guatemala, the Quiché-speaking villages have nothing more in common with one another than with neighbouring Cakchiquel-speaking or Zutuhil-speaking villages. One cannot therefore speak of "the Quichés" as though they were a tribe like the Yahgan or the Siriono. Generally only the marginal nonagricultural areas of South America, and some of the tropical forest groups, were organized in tribes identified by the linguistic name.

ABORIGINAL CULTURAL GROUPINGS

The Greater Southwest.—This region includes northern Mexico and the southwest area of the U.S. It would all have been part of Latin America if most of it had not been annexed by the United States. Because so little of it is now a part of Latin America, it need only be mentioned that at the time of the conquest it included a wide variety of tribal groups—the Navahos, the Pueblos, the Huichols and so forth. Many of these still exist, maintaining their distinctive cultures. Those which are in Mexico are included in the table.

Mesoamerica to the south included about 3,000,000 people in central and southern Mexico, the Yucatán peninsula, El Salvador, Guatemala and parts of Honduras, Nicaragua and Costa Rica. Among the many tribes of the region at least two, the Aztecs of Mexico and the Maya of Central America, developed what we think of as high civilizations. Both had hieroglyphic writing, complex political and religious systems, and great art and science. (*See* AZTEC.)

The classic Maya practised slash-and-burn agriculture; the cornfields cleared in the jungle were abandoned when they lost fertility and new patches were cleared. This system of shifting cultivation, involving gradual shifts in habitation, discouraged the development of true cities. Instead, the Maya built huge, monumental city ceremonial centres, populated largely by priests, around which the rest of the people were distributed for many miles in every direction. Classic Maya society was not oriented toward war; conquest, tribute taking and a warrior class were foreign to their way of life. The Maya priests, who had the highest status in the society, developed art, architecture and calendrical systems to a high degree of sophistication.

The Aztecs, flowering much later, based their civilization on intensive maize agriculture, which made possible the development of cities. The society which centred around these cities and their temples was rigidly stratified; at the bottom of the social pyramid were the commoners and at its apex, the priests. The temple cult was fundamental to Aztec life. Since the rites of the temple required frequent sacrifices of war prisoners, warfare was common, and the warrior had high prestige. The outlying peoples were forced to bring tribute to the Aztec rulers, but were never welded into an integrated empire.

The Tropical Forests and Southern Andes.—Numbering somewhat over 2,000,000, these forest peoples were scattered over a tremendous rain forest area, primarily the vast Amazon river drainage, and spilling over into the southern Andes. They lived in semipermanent villages, around which they carried on slash-and-burn cultivation of such crops as bitter manioc, yams, arrowroot, beans, squash and taro; the villages were moved every generation or so when the soil around ceased to be productive. Hunting and fishing were also important activities. Characteristically, each village was an independent unit, with no political allegiance to any other. Within the village, the main unit was the extended family or lineage. Where the village consisted of a single such family group, the village head was merely the family head; some multifamily villages had a hereditary chief, of limited powers, who was often also a shaman. Religious activities were often centred in the shaman, whose main functions as medicine man were to cure sickness, to prognosticate and to perform magic. Warfare was carried on to obtain human trophies and victims for cannibalistic feasts—not for conquest.

The tribes of the southern Andes, inhabitants of the northern edge of Chile and a small slice of northwest Argentina, were much like the peoples of the tropical forest, except that they had taken over many techniques from the more "civilized" peoples of the central Andes. They lived in widely separated villages, fortified for defense since warfare was continual in the area, and practised intensive farming of corn, beans, quinoa and potatoes. They also raised llamas and guinea pigs, and wove cloth of wool and cotton.

The Circumcaribbean and Subandean Regions.—The peoples of northern South and Central America and the Antilles numbered a little over 1,000,000 village-dwelling farmers. Although intensive agriculture was the main basis of the economy, along the coasts and in the Antilles the ocean was an important source of livelihood. The technology of these peoples included many items —like pottery, woven basketry, hammocks, thatch houses—characteristic of the tropical forests, and others—such as the use of metals, salt, the raising of guinea pigs—which were typical of the people of the high Andes. They produced enough material goods to allow local specialization and trade in such items as metals, salt, cloth and beads. They lived in permanent villages, which usually consisted of several extended family or lineage groups. Bonds between these kin groups were reinforced by strong political controls as society was characteristically divided into somewhat fluid classes. A group of hereditary chiefs constituted the upper class; nobility in general seems to have developed from an earlier class of warriors. Shaman priests performed religious rites in local temples, celebrating the powers of tribal gods. Many of the tribes entered into multicommunity states through federation and conquest, but none of these ever became completely consolidated like the state of the Inca in the high Andes. The subandean peoples differ from this general pattern largely in their greater approximation to central Andean culture; *i.e.*, in such items as copper smelting and construction of roads, stone houses, forts and bridges.

The Central Andes.—This region is fully comparable to Mesoamerica in complexity and general cultural achievement. A population of more than 4,500,000 lived in this thin strip of high mountain country, stretching from Colombia 2,000 mi. along the Andes to Ecuador. Intensive farming and herding supported the densest population and the largest and most permanent communities in South America. This population was integrated by a most efficient administrative system, and produced some remarkable technological achievements. The attainment of agricultural surpluses coupled with the construction of an elaborate system of roads and communications permitted the growth of truly urban centres. A strong centralized government developed which replaced traditional tribal custom by a complex code of laws and regulations enforced through a judicial system.

Religion was organized around a state temple cult, served by a graded priesthood. Social classes became hereditary, self-perpetuating castes; high-caste nobles took part in government and religious affairs while commoners tilled the soil or engaged in manufactures. Warfare was an implement of imperialist conquest rather than a source of slaves and ritual victims.

Marginal Regions.—In greatest contrast are the marginal peoples, a term referring to clumps of tribes widely scattered over different areas of South America. They include small tribal groups in the Chaco and in the interior forests of

Provisional Classification of Aboriginal Languages of Latin America

After McQuown (1955) and Greenberg (1956)*

Phylum	Stock	Family	Subfamily	Languages
Na-Dene	Dene	Athabaskan		Apache, Jano, Jocome, Toboso (*Mexico*)
Algonkian-Mosan	Algonkian-Ritwan	Algonkian		Kickapoo (*Mexico*)
Azteco-Tanoan		Uto-Aztecan	Taracahitian	Acaxee, Achire, Ahome, Aibine, Baciroa, Baimena, Bamoa, Batuc, Chinarra, Chinipa, Chizo, Cinaloa, Comanito, Comopori, Concho, Conicari, Eudeve, Guasapar, Guasave, Hine, Hio, Huite, Hume, Jova, Jumano, Macoyahui, Mayo, Mocorito, Nacosura, Nio, Ocoroni, Opata, Sabaibo, Suma, Tahue, Tarahumara, Tebaca, Tehueco, Temori, Tepahue, Topiame, Tubar, Vacoregue, Varohio, Xixime, Yaqui, Zoe, Zuaque (*Mexico*)
			Aztecoid	Alaguilac (*Guatemala*), Azteca, Bagaz (*Costa Rica*), Cazcan, Coano, Coca, Cora, Desaguadero (*Costa Rica*), Guachichil, Huaynamota, Huichol, Lagunere, Meztitlaneca, Nahuatlate (*Nicaragua*), Nicarao (*Nicaragua*), Pipil (*Guatemala, Honduras, El Salvador*), Pochutla, Sayulteca, Sigua (*Panama*), Teco-Tecoxquin, Tecual, Tecuexe, Tepaneca, Teul, Tolteca-Chichimeca (*Mexico; Guatemala?*), Totorame, Zacateca, Zayahueco (*Mexico* unless otherwise shown)
			Piman	Cocomacague, Colotlan, Himeri, Nebome, Papago (*Mexico, United States*) Piato, Potlapigua, Tepecano, Tepehuane (Norte), Tepehuane (Sur), Teul-Chichimeca, Ure, Yigitega, Yecora (*Mexico*)
Penutian	Mixe-Zoque	Zoquean	Zoquean	Mixe, Oluta, Popoluca (Sierra), Sayula, Texixtepec, Zoque (*Mexico*)
		Aguacateco II		Aguacateco II (*Guatemala*)
		Tapachulteco II		Tapachulteco I (*Mexico*)
	Huave			Huave (*Mexico*)
	Mayan	Mayoid	Huastecan	Chicomucelteco, Huasteco (Potosino), Huasteco (Veracruzano) (*Mexico*)
			Maya	Acala[1], Acalan, Bacalar, Bachahom, Chol (*Mexico; Guatemala?*), Cholti[1], Chontal (Tabasco), Chorti (*Guatemala, Honduras*), Chuj[1], Flores[1], Icaiche, Itza (*Mexico, Guatemala*), Jacalteco[1], Kanjobal, Lacandon (Chol), Lacandon (Yucateco) (*Mexico; Guatemala?*), Manche (*British Honduras; Guatemala?*), Mopan (*Guatemala, British Honduras*), Motozintleco, Puctun, Quehache[1], Santa Cruz, Solomeco[1], Tojolabal, Toquegua (*Guatemala, Honduras*), Tzeltal, Tzotzil, Yocotan, Yucateco ([1]indicates *Guatemala*; those not marked are *Mexico*)
		Quichoid	Mamoid	Aguacateco I, Mame (*Guatemala, Mexico*)
			Quichil	Cakchiquel, Ixil, Quiche, Rabinal, Tzutubil, Uspanteco (*Guatemala*)
			Unclassified	Achi (*El Salvador*), Kekchi (*Guatemala*), Pokomam (*Guatemala, El Salvador*), Pokonchi (*Guatemala*), Tapachulteco II (*Mexico*)
		Poton		Poton (*Salvador*)
	Totonacan	Totonaco		Totonaco (*Mexico*)
		Tepehua		Tepehua (*Mexico*)
Hokan-Siouan	Hokan-Tecan	Hokan	Esselen-Yuman	Akwa'ala[2], Alakwisa, Cochimi[2], Cocopa, Diegueno[2], Kamia[2], Kikima, Kiliwi[2], Kohuaoa, Laymon[2] ([2]indicates *Mexico and United States;* those not marked are *Mexico* only.)
			Salinan-Serian	Guayma, Salinero, Seri, Tepoca, Upanguaima (*Mexico*)
			Tequistlatecan	Chontal (Guerrero), Tequistlateco (*Mexico*)
		Supanecan		Maribichicoa (*El Salvador*), Subtiaba (*Nicaragua*), Tiapaneco (*Mexico*)
		Coahuiltecan	Coahuilteco	Carrizo, Comecrudo, Cotoname, Janambre, Olive, Pisone, Tamaulipeco (*Mexico*)
		Guaycuran		Aripa, Cora, Didu, Edu, Guaycura, Ica, Monqui, Uchita, Pericu (*Mexico*)
	Jicaque			Jicaque (*Honduras*)
	Yurumangui			Yurumangui (*Colombia*)
Macro-Oto-Manguean	Oto-Manguean	Otomiao	Otomi	Otomi (*Mexico*)
			Mazahua	Mazahua (*Mexico*)
			Ocuiltecan	Atzinca, Matlame, Matlatzinca, Ocuilteco, Quata (*Mexico*)
			Pamean	Chichimeca-Jonaz, Meco, Pame, Tonaz (*Mexico*)
		Popolocan		Chocho, Ixcateco, Popoloca (*Mexico*)
		Mazatecan		Guatinicamame, Mazateco (Guerrero), Mazateco (Oaxaca), Mazateco (Tabasco) (*Mexico*)
		Trique		Trique (*Mexico*)
		Chorotegan	Chiapaneco	Chiapaneco (*Mexico*)
			Manguean	Choluteca (*Honduras*), Dirja (*Nicaragua*), Mangue (*Nicaragua*), Nagrandan (*Nicaragua*), Nicoya (*Costa Rica*), Orisi (*Costa Rica*), Orotinya (*Costa Rica*)

*Greenberg's is the most comprehensive classification. He succeeded in bringing into relationship hundreds of previously unclassified languages. This chart systematically incorporates information in McQuown ("The Indigenous Languages of Latin America," *Amer. Anthrop.*, June 1955) into Joseph Greenberg's unpublished 1950 classification, and omits those on which information is too sparse to permit even local classification.

Provisional Classification of Aboriginal Languages of Latin America—Continued

After McQuown (1955) and Greenberg (1956)*

Phylum	Stock	Family	Subfamily	Languages
Macro-Oto-Mangnean —Continued	Mixtecan	Mixteco		Mixteco, Cuicateco, Amusgo (*Mexico*)
	Chinanteco			Chinanteco (*Mexico*)
	Zapotecan	Zapoteco		Zapoteco (Serrano Norte), Zapoteco (Serrano Sur), Zapoteco (Valle) (*Mexico*)
		Chatinoan		Chatino, Papabuco, Solteco (*Mexico*)
Tarascan				Tarasco (*Mexico*)
Macro-Chibchan	Misumalpan	Miskitoan		Baldam, Cabo, Mam (*Honduras*), Miskito, Tauira, Wanki (*Nicaragua; Honduras?*) (*Nicaragua* unless otherwise shown)
		Sumoan	Ulvan	Cucra, Guanexico (*Honduras, Nicaragua*), Prinzo, Ulva, Yosco (*Nicaragua* unless otherwise shown)
			Sumo	Bautihca, Boa, Carahuala, Coco[3], Huasabane, Lacu, Panamaca, Pispi, Sumo[3], Tatnahca[3], Tunqui ([3]indicates *Honduras and Nicaragua;* those not marked are *Nicaragua* alone)
			Unclassified	Cu (*Nicaragua; Honduras?*), Musutepes, Silam, Yasica (*Nicaragua* unless otherwise shown)
		Matagalpan		Cacaopera (*El Salvador*), Chato, Dule, Matagalpa (*Honduras, Nicaragua*), Pantasma (*Honduras* unless otherwise shown)
		Unclassified		Bambana, Cucalaya, Kiwahka, Sumo-Sirpe, Tungla (*Nicaragua*)
	Chibchan	Pacific-Chibchan	Isthmian	Burica (*Costa Rica, Panama*), Chaliva, Changuena, Chiru, Dorasco, Duy, Escoria, Move, Muite, Muoi, Murire, Nata, Penonomenyo, Valiente (*Panama* unless otherwise shown)
			Colombian	Aburra, Jamundi, Lile, Timba, Yameci, Yolo (*Colombia*)
		Talamanca		Boruca, Bribri (*Costa Rica, Panama*), Burucaca, Cabecar, Chiripo, Coto, Estrella, Guetar, Pocosi, Quepo, Quilla (*Colombia*), Suerre, Tariaca, Techbi (*Costa Rica, Panama*), Terraba (*Panama*), Tojar (*Panama*), Tucurrique, Turucaca, Voto (*Costa Rica* unless otherwise shown)
		Interandean-Barbacoan	Barbacoa	Cara[4], Cayapa[4], Coaiquer, Cocora (*Nicaragua*), Colima, Colorado[4], Cueva (*Panama*), Cuna, Paya (*Panama*), Gotane (*Costa Rica*), Guatuso (*Costa Rica*), Muellamues, Nigua[4], Patia, Sindagua ([4]indicates *Ecuador;* those not marked are *Colombia*)
			Paezan-Coconucoan-Popayanens	Coconuco, Guanaco, Moguex, Paez, Paniquita, Polindara, Popayan, Pubenaro, Purace, Totoro (*Colombia*)
		Eastern Chibchan	Cundinamarcan	Agata, Chibcha (Muisca), Duit, Sinsiga, Tuneho (*Colombia*)
			Arhuacoa	Atanque, Bintucua, Cagaba, Guamaca, Ica, Sanha (*Colombia*)
			Central American Chibchan	Melchora, Rama (*Nicaragua*)
	Yunca-Puruhan	Yuncan	Northern Yuncan	Canyari, Manabita, Puruha (*Ecuador*)
			Southern Yuncan	Mochica, Quingnam (*Peru*)
		Atalan		Manta, Puna, Tumbez (*Ecuador*)
			Caraquean	Caraque, Huancavilca (*Ecuador*)
	Jirajaran	a		Gayon (*Venezuela*)
		b		Ayoman (*Venezuela*)
		Xaguan		Xagua, Cuiba (*Venezuela*)
		d		Jirajara (*Venezuela*)
	Guaranan	a		Mariusa (*Venezuela*)
		b		Chaguan (*Venezuela*)
		c		Guaiqueri (*Venezuela*)
		d		Guarau (*Venezuela*)
	Chirianan	Guahariban		Chiriana (*Brazil*), Guahariho, (*Brazil, Venezuela*), Uaica (*Brazil, Venezuela*)
		b		Carime (*Brazil*)
		c		Pusaracau (*Brazil*)
	Muran	a		Mura, Matanani (*Brazil*)
		b		Piraha (*Brazil*)
		c		Jahahi (*Brazil*)
	Unclassified			Atacame (*Ecuador*), Choco (*Brazil*), Itonama (*Bolivia*), Lenca (*Honduras, El Salvador*), Xinca (*Guatemala*)

Provisional Classification of Aboriginal Languages of Latin America—Continued

After McQuown (1955) and Greenberg (1956)*

Phylum	Stock	Family	Subfamily	Languages
Ge-Pano-Carib	Macro-Carib	Caribao	Northern Cariban	Acawai (*British Guiana*), Acuria[b] (*British Guiana, Surinam*), Apalai[b], Aracuaju[b], Arecuna, Arinagoto, Atroahy[b], Azumara[b], Bonari[b], Caicuchana (*Colombia*), Calino (*British Honduras, Guatemala, Honduras, Dominica*), Calinya (*Surinam*), Camaracoto, Carib (*Honduras, British Honduras*) Caribice (*British Guiana*), Carijona (*Colombia*), Carinepagato (*Trinidad*), Catauian[b], Chacopata, Chayma, Chiquena[b], Core, Cuaga, Cumanagoto, Cumayena (*Surinam*), Cuneguara, Cunuana, Curasicana, Decuana, Diau (*British Guiana*), Galibi (*French Guiana*), Guagua (*Colombia*), Guaque (*Colombia*), Hianacoto (*Colombia*), Ihuruana, Ingarico (*British Guiana*), Jauaperi[b], Macussi (*British Guiana, Brazil*), Mahotoyana (*Colombia*), Maitsi, Maquiritare, Mapoye, Mayongong, Monoico (*British Guiana*), Mutuan[b], Oiana (*Brazil, Surinam, French Guiana*), Palenque, Paravilhana[b], Paria, Pariaguto, Patamona (*British Guiana*), Pauchi[b], Pauchiana[b], Pianocoto (*British Guiana, Brazil*), Piritu, Puricoto[b], Quenoloco (*Brazil, British Guiana*), Quiriquire, Riama (*Colombia*), Rucuyco (*French Guiana; Brazil*), Sapara[b], Tagare, Taparito, Taurepan (*Venezuela, Brazil*), Teueia[b], Tivericoto[b], Toto, Totomaco, Trio (*Surinam*), Tsahatsaha (*Colombia*), Uaica (*Venezuela, British Guiana*), Uaimiri[b], Uaiquiare, Uaiumare[b], Uaiuai[b], Upurui (*Surinam*), Urucuena[b], Xiparicot, Yabarana, Yacaoyana (*Colombia*), Yecuana (*indicates *Brazil;* those not marked are *Venezuela*)
			Southern Cariban	Apalaquiri, Aplaca, Arara, Bacairi, Etagl, Guicuru, Jaruma, Mariape, Nahucua, Naravute, Pariri, Timirem (*Brazil*)
			Northwestern Cariban	Ancerma, Antioquia, Arbi, Arma, Bubure[a], Buga, Burede[a], Buritica, Calamari, Camaniba, Caramanta, Carare, Carate, Carex, Cari, Carrapa, Cartama, Catio, Cenulana, Chanco, Chaque[a], Cima, Coanao (*Venezuela, Colombia*) Colima, Corome, Dabeibe, Empera, Evejico, Funucuna, Gorron, Guatica, Guazuzn, Macoa[a], Mape[a], Mompox, Muzo, Naura, Nauracoto, Nonama, Nutabe, Opon, Pacabueye, Panche, Pantagoro, Paparo (*Panama*), Pariri[a], Patagon (*Peru*), Paucura, Pemeno[a], Pemeo, Picara, Pijao, Pozo, Quimbaya, Quindio, Quiriquire[a], Tabuya, Tahami, Tolu, Tucuco[a], Turbaco, Uruba, Yapel, Yarigui, Zapara[a], Zendagua, Zopia (*indicates *Venezuela;* those not marked are *Colombia*)
		Peba-Yaguan	Peba-Yagua	Peba, Yagua (*Peru*)
			Yameo	Masamai, Yameo (*Peru*)
			Witotoan	Andoque (Norte), Andoque (Sur), Araracuara, Bora, Fitita, Muenane, Nonuya, Ocaina, Coeruna, Witoto, Miraoya, Orejon, Resigero (*Colombia*)
		Unclassified		Cucura, Palmela, Pimenteira (*Brazil*), Taruma (*Brazil, British Guiana*)
	Macro-Ge	Ge	Northwest Ge	Apanhecra, Apinage, Augutge, Caiamo, Caiapo (Norte), Caiapo (Sul), Caracatage, Caraho, Chacamecra, Craho, Creapimcatage, Crenge (Cajuapara), Cricatage, Cruatire, Cucoecamecra, Curupite, Duludi, Gorotire, Gradaho, Gurupy, Ira-Amaire, Macamecran, Mehio, Norocoage, Paicoge, Pau d'Arco, Piocobge, Poncatage, Purecamecran, Purucarod, Quencatage, Quenpocatage, Ramcocamecra, Suia, Uchicrin (*Brazil*)
			Central Ge	Acroa (Norte), Acroa (Sul), Aricobe, Arua, Chacriaba, Chavante, Cherente, Goia, Guegue, Ponta, Timbira (*Brazil*)
			Jeico	Jeico (*Brazil*)
		Caingangan	Caingang	Caingang (São Paulo), Caingang (Parana), Caingang (Rio Grande do Sul), Chiqui, Nhaclateitei (*Brazil*)
			b	Chocren (*Brazil*)
			Taven	Cabelludo, Chiqui, Guaiana, Gualachi, Ivitorocai (*Paraguay*), Tain (*Brazil* unless otherwise shown)
			d	Dorin (*Brazil*)
		Camacanian	Camacan	Camacan (*Brazil*)
			Cutachoan	Catethoi, Cutacho (*Brazil*)
			c	Menian (*Brazil*)
			d	Massacara (*Brazil*)
		Machacalian	a	Capocho (*Brazil*)
			b	Cumanacho (*Brazil*)
			c	Macuni (*Brazil*)
			d	Machacali (*Brazil*)
			e	Monocho (*Brazil*)
			f	Panhame (*Brazil*)
			g	Paraxim (*Brazil*)
		Purian	Coroado	Coroado (*Brazil*)
			Puri	Puri (*Brazil*)
			Patacho	Patacho (*Brazil*)
			Malali	Malali (*Brazil*)
			Coropo	Coropo (*Brazil*)
			Botocudo	Arana, Chonvugn, Crecmun, Gueren (*Brazil*)
			Gutucracan	Gutucrac, Minhagirun (*Brazil*)
			f	Nacreche (*Brazil*)
			g	Giporoc, Poica (*Brazil*)
			h	Anquet (*Brazil*)
			i	Nacnhanuc (*Brazil*)
				Aimore (*Brazil*)
				Aimbore (*Brazil*)
		Chiquito		Chiquito (*Bolivia*)
		Unclassified		Fulnio, Guato (*Brazil, Bolivia*), Oti (*Brazil* alone unless otherwise shown)

Provisional Classification of Aboriginal Languages of Latin America—Continued

After McQuown (1955) and Greenberg (1956)*

Phylum	Stock	Family	Subfamily	Languages
Ge-Pano-Carib —Continued	Borotuque	Bororoan	Bororo	Acione, Aravira, Biriune, Bororo (Cabasal), Bororo (Campanha), Orarimugudoge, Umotina (*Brazil*)
		Otuquean		Covareca, Curuminaca, Otuque (*Bolivia*)
			Coravecan	Coraveca, Curave (*Bolivia*)
	Carajan	Caraja		Caraja, Carajahi (*Brazil*)
		b		Javahe (*Brazil*)
		c		Chambioa (*Brazil*)
	Macro-Panoan	Panoan	Central Panoan	Amahuaca (*Peru, Brazil*), Aranaua, Arara, Busquipani[7], Cachinaua, Canamari, Capanahua[7], Carapacho[7], Catuquina, Caxibo[7], Chipinaua, Comobo[7], Conibo[7], Contanaua, Cuianaua, Culinu, Epetineri[7], Espino, Jaminaua, Jauanaua, Jauavo, Jumbanaua, Jura, Manamabobo[7], Manaua[7], Marinaua, Maspo[7], Mochobo[7], Niaragua[7], Nucuini, Pacanaua, Panobo[7], Pichobo[7], Poianaua, Puyamanahua[7], Remo[7], Ruanagua[7], Runanaua, Sacuia, Saninaua, Saninauaca, Sensi[7], Setebo[7], Sinabo[7], Soboibo[7], Tuchinaua, Xipibo[7] ([7]indicates *Peru;* all others are *Brazil*)
			Southwest Panoan	Arana, Atsahuaca, Yamiaca (*Peru*)
			Southeast Panoan	Capuibo, Caripuna[8], Chacobo, Jacaria[8], Pacaguara (*Bolivia; Brazil?*), Sinabo, Zurina[8] ([8]indicates *Brazil;* those not marked are *Bolivia*)
		Tacanan	Araonan	Araona, Capachene, Cavinya, Mabenaro, Machui (*Bolivia*)
			b	Arasa (*Peru*)
			Maropan	Maropa (*Bolivia*)
			Tacana	Tacana, Toromona (*Bolivia*)
			Tiatinaguan	Chama (*Bolivia*), Guacanahua (*Bolivia*), Tiatinagua (*Peru; Bolivia?*)
		Macro-Guaycuruan	Mataco-Maca	Abucheta, Axluslay (*Paraguay*), Chorotí[9], Enimaca (*Paraguay*), Guentuse[9], Guisnay[9], Huexuo, Lengua (*Paraguay*), Mataco, Mataguayo, Nocten, Pesatupe, Vejoz ([9]indicates *Paraguay and Argentina;* those not marked are *Argentina* alone)
			Guaycuruan	Abipon, Aguilot, Apaçachodegodegi (*Paraguay, Brazil*). Caduveo[10], Eyibogodegi[10], Gotocogegodegi[10], Guetiadegodi (*Paraguay, Brazil*), Gulgaissen, Lichagotegodi[10], Magach, Mepene, Mocovi, Opaie[10], Payagua (*Bolivia, Paraguay*), Pilaga, Sarigue (*Paraguay*), Toba (*Paraguay, Argentina; Bolivia?*), Yaancaniga ([10]indicates *Brazil;* those not marked are *Argentina*)
			Lule-Vilelan	Atalala, Chunupí, Lule, Malbala, Ocole, Pasain, Umuapa, Vacaa, Vilela, Yecoanita, Yooc (*Argentina*)
			Mosetenan	Chimane, Mosetene (*Bolivia*)
			Mascoian	Angaite, Caiotugui, Casquiiba, Enenslet, Lengua, Machicui, Mascoi, Sanapana, Sapuqui (*Paraguay*)
			Unclassified	Charrua (*Uruguay*)
	Nhambicuran	Nhambicuara	Northeast Nhambicuaran	Anunze, Cocozu, Congore, Nene (*Brazil*)
			Southwest Nhambicuaran	Cabichi, Tagnani, Tauite, Uaintazu (*Brazil*)
		Pseudo-Nhambicuara		Pseudo Nhambicuara (*Brazil*)
		c		Nhambicuara (*Brazil*)
	Huarpean	a		Allentiac (*Argentina*)
		b		Millcayac (*Argentina*)
		c		Huarpe (Puntano) (*Argentina*)
		d		Puelche (Cuyo) (*Argentina*)
		e		Pehuenche (*Argentina*)
Andean Equatorial	Andean	Araucanian-Chon	Araucanian	Chilote, Cuncho, Divichei[11], Leuvuche[11], Manzanero[11], Mapuche, Moluche[11], Pehuenche (*Chile, Argentina*), Picunche, Pichihuilliche, Ranquelche[11], Serrano, Taluche[11] ([11]indicates *Argentina:* those not marked are *Chile*)
			Tehuelche	Inaquen, Payniquen, Poya, Teuex (*Argentina*)
			Ona	Haux, Selcnam (Norte), Selcnam (Sur) (*Argentina, Chile*)
			Alacalufan	Aduipliin, Alacaluf, Caucahue, Enoo, Lecheyel, Yequinahue (*Chile*)
			Unclassified	Puelche (*Argentina*), Yahgan (*Chile*)
		Zaparoan	Coronadoan	Coronado (*Peru; Ecuador?*), Oa (*Peru*)
			Omurano	Pinche, Roamaina, Zapa (*Peru*)
			Andoan	Andoa (*Peru; Ecuador?*), Asaruntoa, Auve, Gae (*Ecuador*), Guallpayo, Guasaga, Iquito, Maracana, Murato (*Peru; Ecuador?*), Semigae (*Ecuador; Peru?*) (*Peru* unless otherwise shown)
			Sabelan	Sabela (*Ecuador*)
			Zaparo	Zaparo (*Peru, Ecuador; Colombia?*)
		Cahuapanan	Cahuapana	Cahuapana (*Peru*)
			Cheberoan	Ataguate, Chayahuita, Chebero, Yamorai (*Peru*)
		Quechu-Maran	Quechuan	Almaguero (*Columbia*), Ancax, Arequipa, Ayacucho, Cajamarca, Canelo (*Ecuador*), Cavina, Chachapoya, Chasutino, Chilque, Cuzco, Huanuco, Ingano (*Columbia; Ecuador?*), Junin, Lamanyo, Lare, Maina (*Ecuador, Peru*), Pancartampo, Quechua, Quechua (Argentino) (*Argentina*), Quechua (Boliviano) (*Peru, Bolivia, Chile, Argentina*), Quechua (Quitenyo) (*Colombia, Ecuador, Peru*), Quechua (Tuichi) (*Bolivia*), Quechua (Ucayali), Quijo (*Ecuador*), Santiago del Estero (*Argentina*), Vilcapampa, Yanahuara (*Peru* unless otherwise shown)
			Aymara	Cana[12], Canchi[12], Caranga, Charca, Colla (*Peru, Bolivia*), Collagua[12], Collahuaya, Lupaca[12], Omasuyo, Pacasa, Paña, Quillaca, Sicasica, Ubina[12] ([12]indicates *Peru;* those not marked are *Bolivia*)
		II A-4(Greenberg)		Catacao (*Ecuador*), Colan (*Peru*), Leco (*Bolivia*), Sec (*Peru*), Xibito-Cholon (*Peru*)

Provisional Classification of Aboriginal Languages of Latin America—Continued

After McQuown (1955) and Greenberg (1956)*

Phylum	Stock	Family	Subfamily	Language
Andean Equatorial —Continued	H-B (Greenberg)	Jivaroan	Jivaro	Aguaruna (*Peru; Ecuador?*), Bolona (*Ecuador*), Jivaro (*Ecuador; Peru?*)
			Paltan	Malacato (*Ecuador*), Palta (*Ecuador, Peru*)
			Candoa	Candoa (*Ecuador; Peru?*)
		Unclassified		Cofan (*Ecuador*), Esmeralda (*Ecuador; Colombia?*), Yaruro (*Venezuela*)
	Macro-Tucanoan	Catuquinean-Tucanoan	Catuquinean	Amenadiapa, Bendiapa, Burue, Cadiudiapa, Caduquilidiapa, Canadiapa, Canamari, Cataũichi, Cutiadiapa, Catuquina, Catuquino, Hondiapa, Marodiapa, Paraua, Pidadiapa, Tauare, Uadioparanindiapa, Uiridiapa, Ururudiapa (*Brazil*)
			Tucanoan	Amaguaje (*Colombia, Ecuador, Peru*), Arapaso[12], Ayrico, Bahuna, Baniua[11], Bara, Boloa, Buhagana, Carapana[12], Caxiita, Cieguaje, Coroua, Correguaje, Coto (*Peru*), Cubeo (*Colombia, Brazil*), Cucretu (*Colombia, Brazil*), Datuana, Dessana[12], Encabellado (*Colombia, Peru, Ecuador?*), Erulia, Guacinguaje, Hahanana, Hobacana[12], Holona, Julaimaua[12], Macaguaje (*Colombia, Ecuador*), Macuna, Neenua (*Colombia; Brazil?*), Omoa, Opaina, Pamoa, Palanoa, Pioje (*Peru; Ecuador?*), Piratapuyo, Sara, Sioni (*Colombia, Ecuador, Peru*), Tama, Tsola, Tsoloa, Tucano[12], Tuyuca[12], Uaiana (*Brazil; Colombia?*), Uaicana[12], Uainana, Uanana[12], Uasoua (*Brazil; Colombia?*), Uiua[12], Yahuna (*Brazil; Colombia?*), Yuhorca (*Colombia, Brazil*), Yupua ([12]indicates *Brazil;* those not marked are *Colombia*)
			Munichean	Muniche, Otanabe (*Peru*)
			Unclassified	Auaque (*Venezuela*), Caliana[12], Canichana (*Bolivia*), Macu (*Venezuela*), Movima (*Bolivia*), Tucuna[12], Yuri[12] ([12]indicates *Brazil*)
		Simacu		Simacu (Urarina) (*Peru*)
		Puinavean	Puinave	Guaipunave, Puinave (*Colombia*)
			Macuan	Macu (*Brazil, Colombia*), Nadobo (*Brazil*), Yapooa (*Colombia*)
	Equatorial	Arawakan	Northern Arawakan	Achagua (*Venezuela, Colombia*), Alile[13], Amarizana, Axagua[13], Cabre (*Lesser Antilles, Colombia; Dominican Republic?*), Cauuri, Caquetio (*Bonaire, Curaçao, Aruba, Venezuela*), Chapan, Chimila, Chucuna, Ciguayo (*Dominican Republic*), Cosina[13], Eperigua, Guaicari[13], Guajiro (*Colombia, Venezuela*), Guanebucan, Guayupe, Igneri (*Trinidad, Tobago*), Lucayo (*Bahamas*), Masivaribeni, Mitua, Matilun (*Venezuela, Colombia*) Paraujano[13], Piapoco, Sae, Subtaino (Cuba) (*Cuba*), Taino (Haiti) (*Haiti, Dominican Republic*), Taino (Puerto Rico) (*Puerto Rico*), Tairona, Tayagua[13], Tecua, Toa[13], Yaguai[13] ([13]indicates *Venezuela;* those not marked are *Colombia*)
			Northern Amazon Arawakan	Adzaneni (*Colombia; Brazil?*), Amariba (*British Guiana*), Arawak (*Venezuela, British Guiana, Surinam, French Guiana, Brazil*), Arequena (*Brazil, Venezuela; Colombia?*) Arua, Aruaqui, Atorai (*British Guiana, Brazil?*), Avani (*Venezuela, Colombia*), Barauna, Bare[13], Cariaia, Carutana, Catapolitani, Caua (*Brazil; Colombia?*), Cauichana, Cauyari (*Colombia*), Cuati (*Brazil; Colombia?*), Guaniare[13], Guinao[13], Huhuteni, Ipeca (*Brazil; Colombia?*), Itayaine, Jabaana, Jauarete, Jumana, Jurupari, Maiopitian, Maipuri[13], Manao, Mandauaca, Mapanai, Maraun (*French Guiana; Brazil?*), Mariate, Masaca[13], Matapi (*Colombia*), Moriuene, Palicur (*Brazil, French Guiana*), Passe, Quirruba (*Colombia*), Siuci, Tapitra (*Colombia, Brazil*), Tariana, Uainuma, Uapichana (*Brazil; British Guiana*), Uirina, Yavitero (*Venezuela; Colombia?*), Yucuna (*Colombia*) ([13]indicates *Venezuela;* those not marked are *Brazil*)
			Pre-Andine Arawakan	Antaniri, Anti, Cacharari[13], Camatica, Campa, Canamari[13], Catiana[13], Catongo, Catuquina[13], Chontaquiro, Chicheren, Cujisenaieri[13], Cuniba[13], Cutimana[13], Huachipairi, Inapari[13], Ipurina[13], Machiguenga, Mantteneri[13], Maraua[13], Masco, Pangoa, Piro, Quimbiri, Quirinairi, Simirinch, Sirineri, Tampa, Uaraicu[13], Uainamari[13], Ugunichiri, Unini ([13]indicates *Brazil;* all others are *Peru*)
			Southb Arawakan	Baure[13], Cachiniti, Chane[13], Cozarini, Custenau, Echualadi (*Paraguay*), Equiniquinao (*Bolivia, Paraguay, Brazil*) Guana (*Brazil, Paraguay*), Iranche, Izocenyo (*Paraguay*), Jaulapiti, Layana (*Paraguay*), Mehinacu, Mojo[13], Paiconeca[13], Paressi, Paunaca[13], Saraveca (*Brazil; Bolivia?*), Tereno (*Paraguay, Brazil*), Uaura ([13]indicates *Bolivia;* those not marked are Brazil)
			Chapacuran	Chapacura, Itoreauhip, Herisabocono, Jamara[13], Jaru[13], More, Napeca, Ocorono, Pacas Novas[13], Quitemoca, Sansimoniano, Tora[13], Urumi[13], Urupa[13] ([13]indicates *Brazil;* all others are *Bolivia*)
			Uanhaman	Abitana-Uanham, Cabichi, Cujuna, Cumana, Cutiana, Mataua, Urunamacan (*Brazil*)
			Arauan	Arauan, Cipo, Culina, Culinha, Culino, Curia, Jamamadi, Juberi, Madiha, Pama, Pamana, Paumari, Purupuru, Seuacu (*Brazil*)
			Chamicura	Chamicura (*Peru*)
			Unclassified	Amuexa (*Peru*), Apolista (*Bolivia*), Uru (*Peru, Bolivia*)

Provisional Classification of Aboriginal Languages of Latin America—Continued

After McQuown (1955) and Greenberg (1959)*

Phylum	Stock		Family	Subfamily	Languages
Andean Equatorial —Continued	Equatorial —Continued	1	Tupi-Guaraní	Guaranían	Apapocuva, Arechane, Avachiriya, Avabuguai, Caiúgua (*Brazil, Paraguay; Argentina*[2]), Canoeiro, Carima, Catanduva, Chane (*Bolivia*[2]), Cheiro[28], Chiriguano (*Bolivia, Argentina*), Chiripa[28], Guaraní (*Brazil, Paraguay, Argentina*), Guayana[28], Guayaqui (*Paraguay*), Guarayu (*Bolivia*), Itatín (*Brazil, Paraguay*), Ivapare, Moya (*Brazil, Argentina*), Oguiva, Paiguassú, Pauí (*Brazil, Argentina*[2]), Paranae (*Paraguay*), Pauserna (*Bolivia*), Sirionó (*Bolivia*), Taioba, Tanimbo (*Brazil, Bolivia, Paraguay*), Tapiete, Tarumá[28], Tobatín (*Paraguay*), Tora, Yvyrayigua (*Indicates Brazil and Paraguay; those not marked are Brazil alone*)
				Tupían	Aizuare, Amanaye, Amoipira, Auambe, Auta, Apaiande, Apiaca, Apoto, Araraendara, Araúne, Arauiti, Aricobe, Arupai, Asuriní, Aueto, Bonama, Caete, Caiabi, Caliana, Camacom, Camaiura, Catuquinaru, Cauaiua, Chipaia, Cocama (*Peru*), Cocamilla (*Peru*), Cubeneire, Cuperob, Curuaia, Curuáxari, Cussari, Emerillon (*French Guiana*), Guaiapi, Guaja, Guajajara, Guatacaiu, Hoeapue, Jacunda, Juruna, Mauitsaua, Maue, Mirathe, Mundurucu, Mutum, Nheengatú, Nhiarofa, Omagua (*Brazil, Peru*), Parana, Paraua, Paranauat, Parintintin, Parnaiua, Pauiana, Pavuna, Potiguara, Sabanaye, Tajeschi, Tamoio, Tapanhuna, Tembe, Timimino, Tobajara, Tupi, Tupiua, Tupinamba, Tupinambarana, Tupiniquim, Turiuara, Uaracaussu, Urafed, Urubu (*Brazil* unless otherwise shown)
				Unclassified	Ariqueme (*Brazil*)
			Culca Timote	Culcan	Culca (*Venezuela*)
				Timotean	Timote (*Venezuela*)
			Cariri	Cariri	Camuru, Cariri, Dzubucua, Pedra Branca, Quipea (*Brazil*)
				b	Sapuia (*Brazil*)
		2	Zamucoan	North Zamucoan	Cucarate (*Bolivia, Paraguay*), Guarayoca (*Bolivia*), Moro[28], Poturero (*Bolivia; Brazil; Paraguay*), Tsiracua (*Bolivia, Paraguay*), Zamuco[28], Zatieno[28] (*Indicates Paraguay*)
				South Zamucoan	Cayostorade, Ebidoso, Horio, Imoto, Tumereha, Tunacho (*Paraguay*)
			Mocoa	a	Sebondoy (*Colombia*)
				b	Quillacinga (*Colombia*)
				c	Patoco (*Colombia*)
			Salivan	a	Saliva (*Venezuela, Colombia*)
		3		Piaroan	Ature, Macú, Piaroa, Quaqua (*Venezuela*)
				Pamiguan	Pamigua, Tinigua (*Colombia*)
			Guahibo-Pamiguan	Guahiban	Chiricoa[28], Churoya, Cuiba[28], Cuninia, Guahibo[28], Guayavero, Sicuane, Vamu[28] (*Indicates Venezuela and Colombia; others are Colombia alone*)
			Otomaco-Taparita		Otomaco (*Venezuela*)
		4			Taparita (*Venezuela*)
		5	Yuracarean		Tuyuneri (*Peru*)
				c	Yuracare (*Bolivia*)
		6			Trumai (*Brazil*)
			Cayuvava		Cayuvava (*Bolivia*)

Brazil, shellfish gatherers of Chile, hunters of Patagonia and Tierra del Fuego. Their cultures differed greatly one from another; what they had in common was that they were all peoples of simple technology and rudimentary social organization; all told, they numbered about 750,000 people. They lived chiefly by hunting and gathering, although some of the northern groups practised a limited and not very efficient agriculture. Mostly these were nomadic bands, made up of a single kinship group or of several unrelated families or clans. Lineage groups were rarely larger than 60 persons; chiefs or formal government were usually lacking. With subsistence depending on the availability of wild foods, their life was materially meagre. Their cultures were able to develop only those elaborations possible under conditions of nomadism and simple technology; these were chiefly in the fields of personal adornment, dances, songs and games. Religion generally laid great stress on shamanism and magic. Warfare was unorganized and typically defensive.

These various areas differed from one another not only in the way of life of their peoples, but in the density of their populations. At one extreme, the marginal tribes of southern Argentina and Chile had exceedingly sparse populations—less than nine persons per 100 sq.km. —and naturally so, because of their nomadism and their subsistence on widely scattered wild foods. At the other extreme, the two areas of high civilization—Mesoamerica and the central Andes—had relatively dense populations, supported by intensive agriculture. Population density in the central Andes was about 720 persons per 100 sq.km. and in Mesoamerica 300. In between were the tropical forest areas, with a density of something like 10 to 50 persons per 100 sq.km., and the circumcaribbean area with a wide range including West Indian islands with densities over 500. Density of population, then, was closely correlated with cultural complexity, and with development of political systems integrating larger numbers of people.

THE INDIANS TODAY

Although there are still areas in the interior of South America

where Indians are hostile and virtually isolated, almost all Indians have been greatly affected by European contact and settlement; there are large areas in which Indians are no longer identifiable as such. Nevertheless it is no less true that Indians and Indian culture have been remarkably resistant to erosion. Many Indian techniques, especially in agriculture, food and household arts, were adopted by Europeans as soon as they settled in the new environment. Likewise, the Indians quickly accepted many items of European technology and merged the new religious and governmental systems with their own. In virtually all of Latin America, Indian and European cultural elements (and African wherever African Negroes had been imported) blended freely. Most of the interchange came in the first years of conquest and colonization, after which there was a long period of consolidation in which the cultural mixture became well established. In recent decades, with the improvement in communications, there appears to have begun a second great adjustment of Indians to the novelties of the world outside.

Perhaps it should be said not so much that Indian culture has been resistant as that Indians have adjusted to new circumstances within their own systems of values. One assumes then that where adjustment required major changes in values, the Indians either did not adjust or else they stopped being Indians. At least the approximately 7,000,000 Indians counted in censuses generally live by the values of their traditional cultures. There are other millions who share Latin-American culture, but these also identify themselves not as Indians but as nationals of the countries in which they live.

The fate of Indian communities in Latin America depended less on the nature of the conquest and colonization (which was fairly uniform) than on differences in aboriginal settlement and culture. Where Indians were populous and highly organized (as in Mesoamerica and the Andes) the Spaniards simply replaced the native religious and political central organization with their own bureaucracy; the Indians were exploited, as Indians, and retained their identity and large numbers. These are the areas that Elman Service calls Indo-America, including central and southern Mexico, Guatemala, the highlands of Colombia, Bolivia, Peru and Ecuador. At the other extreme the aboriginal marginal areas had sparse Indian populations of mobile independent tribes who generally were subjugated one by one and administered only with difficulty. As in North America, these tribes tended to maintain their identity and their ways of life, but as small islands in a sea of European culture (Service's Euro-America). Most of the erosion therefore occurred only in the tropical forest and circumcaribbean areas. There the Indians were settled in villages where Europeans could easily maintain contact and control; but since the Indians were relatively few in numbers and lived in somewhat independent communities, they lost many of their members to the European society, which became mixed European-Indian. Compared with those of Indo-America and of Euro-America, the Indians of this mestizo America have been losing their identity. But even there (except in the West Indies) they are far from being on the verge of disappearance; about 1,200,000 Indians—17% of the population of mestizo America—are considered and consider themselves Indians.

It would be rash to predict the disappearance of Indian identity and cultures. But perhaps for the first time in history there began in the second half of the 20th century a serious attempt to bring to the Indians the benefits of modern medicine and technology, to build highways so that they could move their goods by truck and to offer genuine opportunity to learn new techniques, including those of literacy and business institutions. Whether Indian communities which voluntarily accepted novelties (without building the resistances often engendered by attempts to apply pressure) would lose their community integrity and culture together with their isolation remained a question. The sympathetic "Indianist" movement is furthest advanced in Mexico, where the evidence tends to show that new "adjustments" can be made without necessarily changing Indian values or destroying community identity; but any conclusion had to await future developments. *See* also ANDEAN CIVILIZATION; INDIAN, NORTH AMERICAN; CENTRAL AMERICA; SOUTH AMERICA; CENTRAL AND NORTH AMERICAN LANGUAGES; SOUTH AMERICAN LANGUAGES; and articles on individual countries. *See* also references under "Indian, Latin-American" in the Index.

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INDIAN, NORTH AMERICAN. Men first penetrated the new world about 15,000–25,000 years ago when migrants came from northeast Asia; their camp sites have been excavated by archaeologists. By the time Europeans arrived in the 15th century the descendants of these and later waves of migrants had spread over the Americas and developed cultures adjusted to varying ecological conditions and ranging from nomadic families in the Nevada deserts to complex political states in Mexico and the central Andes mountains.

In the new world there were more than 400 major tribal groups speaking about 160 different language stocks, though the latter are being reduced to a few major superstocks by modern linguists. By contrast the physical type is relatively simple, with variations fundamentally around the Mongoloid, though early skeletal evidence suggests other forms as well.

In many important respects the development of culture in the new world parallels that of the old world, though the details are often quite different. Starting from a Mesolithic culture base, new world peoples domesticated a large number of wild plants, including maize, beans and squash; developed irrigation and terracing techniques; mined and smelted ores and made a number of alloys, including bronze; invented accurate calendars and such mathematical concepts as zero; and elaborated such highly original political structures as the Inca state. Whether these developments resulted from later Asian contacts, migrations across the Pacific ocean or were indigenous were controversial points in the 1960s. Despite growing evidence of recent contacts between Polynesia and the new world, notably through the dispersion of the sweet potato to New Zealand, the weight of evidence was still in terms of local development for the great bulk of new world culture.

There was fairly general agreement on the broad outlines of North American cultural development, buttressed by a growing number of radiocarbon dates. But an understanding of the details in particular regions awaited much more evidence: excavation of stratified sites, cultural analyses and linguistic comparisons. New applications of genetic studies, such as those of blood-group distributions, likewise promised to be of great assistance in unraveling the history of migrations and interrelations in the new world.

This article contains the following main sections and divisions:

I. Prehistory
  1. Asiatic Origin
  2. Glacial Age
  3. New World Beginnings
  4. Paleo-Indian Hunting Cultures
  5. The Desert Culture
  6. Later Developments
II. The People
  1. Physical Types
  2. Population
  3. Language
III. Culture Provinces
  1. Distributions
  2. The Southwest
  3. Hohokam
  4. Mogollon
  5. Southwest Periphery
  6. Intermountain
  7. California
  8. Northwest Coast

White Man Runs Him, Crow warrior and U.S. cavalry scout against the Sioux and Cheyenne in the 1870s. Ritualistic face paint also served as camouflage

Pawnee village, Loup river, Nebraska, 1871. Lodges of packed earth and crude timbers contained family compartments and pen for horses

Kwakiutl elder from British Columbia, dressed in ceremonial regalia, holds an elaborately carved stick, symbol of his chieftancy

Girl from the Acoma pueblo near Albuquerque, N.M. The Acoma herd sheep, speak a Keresan dialect

SCENES FROM INDIAN LIFE

BY COURTESY OF (TOP LEFT, TOP RIGHT) SMITHSONIAN INSTITUTION, BUREAU OF AMERICAN ETHNOLOGY (BOTTOM LEFT, BOTTOM RIGHT) THE CHICAGO NATURAL HISTORY MUSEUM

INDIAN, NORTH AMERICAN

Billy Bowlegs, Seminole chief and leader of the third Seminole war (1855–58). His cap, though Indian in design, has a silver headpiece made by European artisans

Sitting Bull, medicine man, statesman and war chief of the prairie Sioux against Gen. George A. Custer in 1876. Killed by Indian police during the Ghost Dance disturbances of 1890

Little Crow, Dakota chief who led a desperate effort in 1862 to regain tribal lands from the U.S.

Osage chief; the Osage are the most affluent of U.S. tribes, holding oil-rich land in Oklahoma

SOME REPRESENTATIVE INDIANS

BY COURTESY OF THE SMITHSONIAN INSTITUTION, BUREAU OF AMERICAN ETHNOLOGY

Chief Joseph who, in the 1870s, led the Nez Percé in a heroic but vain attempt to escape reservation life

Ute warrior and bride, about 1873. He wore a chest protector of porcupine quills, hooplike earrings, an armlet of animal skins at his elbow and painted earth colours and vegetable stains all over his body

Alaskan Eskimo. These are traditionally hunting and fishing people, living in small, independent groups

Sauk dignitary whose tribe lived along the Mississippi river and raised corn, squash, beans and tobacco

Geronimo (extreme right) and three of his Chiricahua Apache followers at a peace conference in the Sierra Madre mountains of New Mexico, 1886

SOME REPRESENTATIVE INDIANS

BY COURTESY OF THE SMITHSONIAN INSTITUTION, BUREAU OF AMERICAN ETHNOLOGY

INDIAN, NORTH AMERICAN

Wintun chief, McCloud river, California, about 1882, wearing animal skins and carrying a skin quiver for hunting

Hupa men perform the jumping dance in a village on the Klamath river, California, about 1897. Headdresses represent the redheaded woodpecker's bright plumage

Seminole girls in their traditional dress, an amalgam of Indian and Spanish design, Everglades area, Florida, 1928

Old Paiute woman weaves a basket before her crude brush shelter near the Grand Canyon, Arizona, 1873

SCENES FROM INDIAN LIFE

BY COURTESY OF THE SMITHSONIAN INSTITUTION, BUREAU OF AMERICAN ETHNOLOGY

9. Arctic Coast
10. Subarctic
11. Eastern North America
12. Plains Area
IV. Religion and the Arts
1. Native Arts and Crafts
2. Music and Dancing
3. Religion and Mythology
V. Indians in Contemporary Life
1. Colonial Policies
2. Proclamation of 1763
3. United States Policy
4. The Allotment Act

I. PREHISTORY

1. Asiatic Origin.—It is generally agreed among students of prehistory that the first human inhabitants of the western hemisphere did not originate there. The earliest remains of man found thus far in the Americas are essentially modern. They display none of the primitive characteristics of the humanoids found in Java (*Pithecanthropus erectus*) or China (*Sinanthropus pekinensis*) or the later Neanderthal man found widely in Europe and northern Africa. It is agreed also that the Americas never were inhabited by anthropoids that could have given rise to a parent human stock. Indians most probably migrated there from Asia. The level of technological advancement could not have been too high at the time of the first migrations into the new world and would tend to rule out long sea voyages or other hazards. The break between North America and Asia at the Bering strait is a matter of 45 mi., with islands lying at the midway point and, in the opinion of authorities, the only practical route. The view is also held that the migration was not a single incident but that small groups of migrants continuing over a long period of time were responsible for peopling the continents. At least partial confirmation of this hypothetical route is seen in the remains of various mammals that migrated to North America in the Ice Age and that have been found in Alaska, in the high mountain plateaus in the west, on the Great Plains and as far south as Mexico, but rarely in eastern Canada.

2. Glacial Age.—The probabilities are that this migration took place during the glacial advance and recession across the top of North America. The so-called Ice Age consisted of four intervals of maximum glaciation and three intervening nonglacial periods, or possibly two pairs of maximum glaciated periods with a long, middle, ice-free interval, in a total time span of about 250,000 years. The exact boundaries of these glacial patterns have not been plotted in all areas; neither is the timing stated too precisely. Geologists believe, however, that the central plain of Alaska (south of the Brooks range and east of the Coast range), and also the lowlands bordering the Bering sea and the Arctic ocean, were never glaciated. The great ice barriers formed, instead, on the Pacific slope of the Coast range and poured through mountain passes for some distance. A second (Keewatin) ice sheet spread eastward from the Hudson bay area during the last maximum but left an open corridor between for possible migration. The problem of chronology, then, is to determine the period of the last maximum glaciation and when openings between the two ice sheets were available for southward travel. The last maximum was dated by radiocarbon at about 10,000 years ago (*see* RADIOCARBON DATING).

Generally it is agreed that an ice-free land route extended along the arctic coast to the Mackenzie river and southward into what is now the U.S. as long ago as 20,000 years. This route also may have been open for a brief period about 40,000 years ago. The next prior ice-free period would have occurred during the Sangamon interglacial epoch about 75,000 years ago. The relation of sea level to land also may have had a bearing on the migration between the two continents. At the time of the last maximum glaciation sea level in the vicinity of the Bering strait was probably lowered by as much as 240 ft., as water froze. A certain amount of sinking of the land under the tremendous weight of ice was coincident with the dropping water level. As temperatures rose and ice melted, both the land and the sea level began rising, but not at the same rate. Enormous quantities of water would be needed to make an appreciable difference in sea level, while pressures within the earth would respond promptly to lessening weight. This leaves the possibility that a bridge of dry land actually existed for several millenniums following the last glacial epoch. Modern coast surveys reveal that much of the bottom between the continents is less than 20 fathoms (120 ft.) deep. The pattern of glaciation on the Asiatic side of the Bering strait is not clear in detail, but there seems to be some correspondence between the phases as these developed east and west of the strait. It seems likely, then, that an open land route from central Asia into central North America existed 20,000 years ago. At a later time the Yukon river valley offered an ice-free route, and still later (8,000–10,000 years ago) the Liard and Peace river systems were available for intramontane travel.

The Pacific coast slope was probably available for travel at about the same time. Some migrations may also have occurred by way of the Aleutian Islands, but this would have taken place at a considerably later date.

3. New World Beginnings.—Definite evidence that men were in North America between 15,000–25,000 or more years ago was gradually accumulating. The evidence in the 1960s was mainly limited to crude stone tools, sometimes found in association with remains of extinct species of horse, camel, elephant and other mammals and often with evidence of hearths or human habitation. Preliminary radiocarbon dates were few but fell generally within this period. No human skeletal evidence was yet available. Most of the sites were in western North America in Pleistocene (Ice Age) lake basins or in specific localities in Nevada, California and Texas. The artifact assemblages were varied in type, and it was expected that at least some might be shown to belong to an early "Lithic" (stone-tool) stage preceding more clearly defined tool types known, such as Folsom, Yuma and Clovis. (*See* FLINT AND OTHER STONE TOOLS.)

4. Paleo-Indian Hunting Cultures.—In 1926 specific types of projectile points were found in association with the bones of extinct bison near Folsom, N.M. Subsequent discoveries of early hunting cultures in the High Plains (southern portion of the Great Plains) and neighbouring regions (*e.g.*, Clovis, N.M.) are dated and well documented. The type tool from these sites is called the Folsom point and is a fluted projectile point used for spears, though stone knives and other artifacts are also found. Radiocarbon dates range generally between 9000–7000 B.C. with the Clovis sites being considered slightly older than those near Folsom. In addition to extinct forms of bison the camp sites show camel, horse, musk ox, giant sloth and other Pleistocene forms.

Related projectile tips known as Yuma points are found in the same region. These do not have fluting but are more finely chipped with diagonal flaking. The Folsom and Yuma types occurred contemporaneously, in part, but the Yuma technique apparently survived until more recently.

The bulk of the Folsom and related sites occur in the Great Plains from Canada to Mexico, though fluted points also occur in the region east of the Mississippi river and elsewhere. In the early 1960s fluted points had not yet been found in the old world. But in Sandia cave, near Albuquerque, N.M., Folsom points were found above an older stratum containing cruder flaked points with one corner notch. These Sandia points are reminiscent of some of the Solutrean forms found in Europe, dating from the end of the Paleolithic period. The Sandia level has a radiocarbon age of 30,000 years, though this is probably an overestimate of the age of the points.

For the Folsom period at least one human skull is available from a site near Midland, Tex. The reconstruction gives a long head within the range of modern forms. Another early find, from Tepexpan in the Valley of Mexico, is dated at a slightly earlier period.

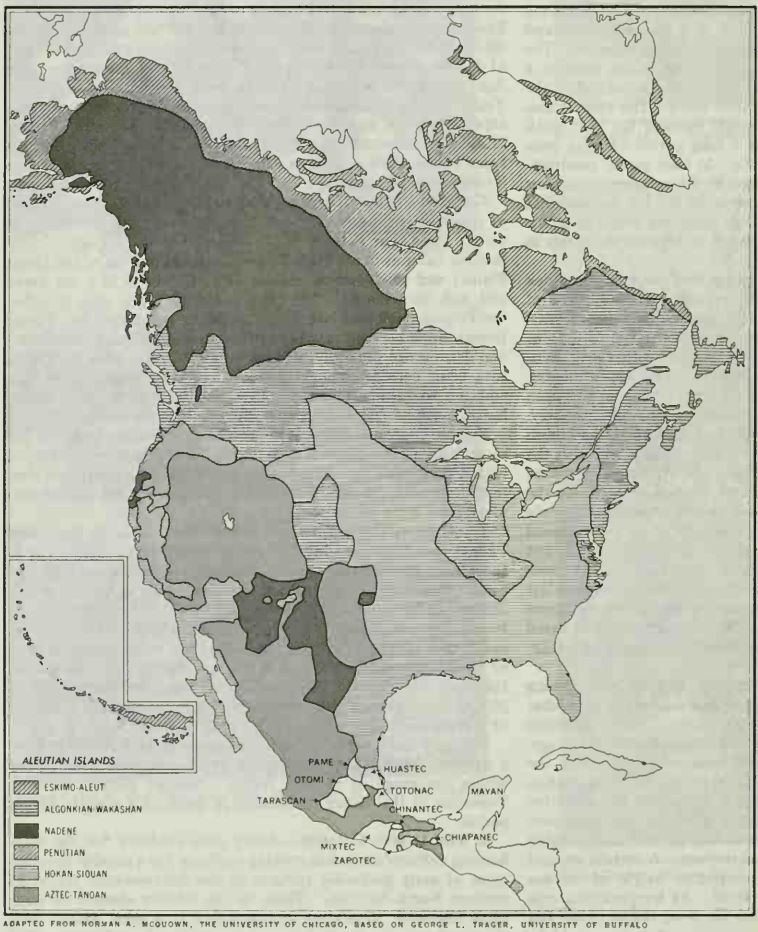
5. The Desert Culture.—Along with evidence for the early hunting cultures there was growing evidence for a parallel development of early gathering cultures in the intermontane region of western North America. There, in the relative absence of large game resources, vegetation was exploited to a great extent, with the development of grinding tools and related equipment. The Cochise Desert culture, named from Cochise county in southern

Arizona where it was discovered, ran from about 8000 B.C. through several stages, and gave rise to Mogollon (*q.v.*) culture, one of the basic culture types of the southwest. But related culture types have been found throughout the central basin and plateau areas to the north, and Danger cave in Utah has been dated by radiocarbon to 10,000–11,000 years ago.

Dry cave excavations yielded a rather full inventory of the Desert culture, particularly in its later phases. Settlements were sparse and often in caves. Subsistence involved intensive exploitation of the environment, with special emphasis on small-seed harvesting and preparation. Basketry and netting were important; the atlatl (throwing stick) was used with darts; projectile points were small and made from a variety of materials. Present in various sites were digging sticks; fire drills and hearths; flat, curved, wooden clubs; tubular pipes; sandals; and flat milling stones with manos (handstones).

6. Later Developments.—With the retreat of the ice sheets in the north, beginning about 10,000 years ago, the cool, moist climate gradually became hot and dry in the Great Plains and Great Basin regions, with consequent extinction or migration of Pleistocene animal life. The High Plains were largely deserted by man for a considerable period. In the eastern forest regions hunting and gathering continued, with dependence on shellfish, as evidenced by the great shell mounds along many of the rivers in Kentucky and Tennessee dating from the Archaic period. Gradually adaptation to forest resources developed, particularly to acorns and other seed crops, culminating in the Ohio valley in the Hopewell and Adena cultures that began about 400 B.C. and flourished for several centuries. The Hopewell peoples practised a limited amount of agriculture and developed elaborate funerary rites, the dead being cremated or buried with extensive offerings in large mounds. Following an interval of decline a new cultural development, stimulated by contacts with Middle America, arose in the Mississippi valley. This Mississippian culture farmed the bottom lands and built large-scale temple mounds that were still being used when the Spaniards first explored the region.

In the southwest the Desert culture was more directly influenced by the development of agriculture in Central America, but the climate limited its spread to favourable areas so that much of the seed-gathering complex survived in the basin region. Early forms of corn (maize) are found in Bat cave, N.M., dated about 2000 B.C., with beans being introduced about 1000 B.C., but agriculture made little impression until larger forms of corn were developed and introduced. By the beginning of the modern era two sedentary agricultural societies were established in southern Arizona and New Mexico, the Mogollon and the Hohokam, to be followed in a few centuries by the Basket Maker-Pueblo, or Anasazi, cultures to the north on the Colorado plateau. A continuous but complex record of cultural development in this region is available, dated principally by highly accurate tree-ring chronology (*see* ARCHAEOLOGY: *The Materials of Archaeology*). The modern Pueblos and other Indians of the southwest are descendants of these early culture types, with the exception of the Navaho and Apache tribes that entered the region from the north in the 13th or 14th century.



ADAPTED FROM NORMAN A. MCQUOWN, THE UNIVERSITY OF CHICAGO, BASED ON GEORGE L. TRAGER, UNIVERSITY OF BUFFALO

MAJOR TRIBAL AND LINGUISTIC GROUPINGS OF NORTH AMERICAN INDIANS (SPECIFICALLY LABELED GROUPS BELONG TO OTHER LINGUISTIC FAMILIES)

The primary development of agriculture in terms of maize, beans and squash undoubtedly took place in Central America. Preliminary excavations in the Tehuacan valley, southeast of Mexico City, present a fairly complete outline of agricultural development beginning between 6000 and 5000 B.C. Squash and chili were the earliest plants cultivated there, followed by corn and then beans and gourds, a sequence both earlier and somewhat different from that previously known from Tamaulipas in northeastern Mexico. By about 3000 B.C. the people of this region were full-time agriculturalists, and by 1500 B.C. they were beginning to live in ceremonial centres and building temples.

In northern North America hunting and fishing continued as the basis for subsistence. About the beginning of the modern era the Eskimo developed specialized techniques for sea-mammal hunting in the Bering strait region and

about A.D. 1000 spread eastward to Greenland (*q.v.*). Interior Indian populations expanded to the North Pacific coast, utilizing the salmon resources to build a highly elaborate social organization and a unique art. In the plains, as animal life repopulated the region, peoples moved out of the forests or deserts to pursue them but continued to farm the bottom lands along the rivers. Only with the introduction of horses brought by the Spaniards did the culture of modern Plains Indians (*q.v.*) develop.

II. THE PEOPLE

1. Physical Types.—American Indians are fundamentally Mongoloid, though considerable variation is found. Physically they are generally uniform; hair is usually straight, coarse and uniformly black; skin is reddish-brown, eyes dark and body hair scant; cheekbones are prominent and facial size is generally large. However, such features as cephalic index, nasal form and stature are extremely variable.

The uniform features are definitely Mongoloid; the variable features are more difficult to assess. A. Hrdlička proposed that the early migrant populations were essentially Mongoloid and that variations had come about through adjustment to environments. E. A. Hooton, on the other hand, following R. B. Dixon, argued that the new world was peopled by a variety of physical types, with later mixtures but some marginal survival in isolated regions.

Archaeologically, the earlier populations were generally long-headed (dolichocephalic) and show less Mongoloid characteristics. These early peoples were slight in build with well-developed brow ridges and may either represent a proto-Mongoloid type or an unspecialized early Caucasoid form related to the Ainu (*q.v.*) of Japan.

The distribution of blood groups among the American Indians will eventually aid greatly in solving the problem of their origins. Thus, blood type B is generally absent in the aboriginal population of the Americas (though its incidence is high among Asian Mongoloids), and type A is found mainly in North American Indians.

Modern genetic theory would explain much of the variation found in terms of such factors as mutation, selection, admixture and random genetic drift. In the small-scale groups involved in the early peopling of the new world relatively rapid changes were possible and could account for all of the variation found (*see* RACES OF MANKIND).

The morphological types found in the living populations had not been worked out in any detail by the early 1960s, but most authorities set off the Eskimo population as the most clearly Mongoloid. C. Coon had suggested that the Eskimos represent an adaptation to extreme cold that took place in northeast Asia during the Pleistocene epoch, but there was little skeletal evidence to show the early stages of Mongoloid development in Asia. Distinctive or recognizable subtypes are found on the northwest coast, in the plains, in the southwest, and among the Maya; but some of these, *e.g.*, the Plains type, are probably a hybrid of two or three neighbouring types. That these subtypes are in part adaptations to ecological conditions has been shown by Marshall T. Newman. Stature increases with distance from the equator, extremities elongate and faces and head shapes grow longer in terms of adaptation to heat and cold. Hence it is probable that longheads and broadheads do not represent separate migrations but rather the effects of selection.

2. Population.—Estimates of the aboriginal population are based on information supplied by explorers, traders, missionaries and other early reporters, and are only as good as the reporters' observations were trustworthy. A more serious impediment to a completely accurate count is that some tribes, by the time they were visited, had already been depopulated by European diseases and weapons. The estimates in Table I, it should be noted, are given an approximate dating.

A. L. Kroeber submitted an almost identical total for the area north of Mexico, since he used the same figures except for California, though he subgrouped the material to accord with subsistence areas rather than geographic boundaries. In addition he ranked the areas according to population densities, expressed in numbers of persons per square kilometre: California area 43.40; northwest coast 28.30; southwestern U.S. 10.70; Columbia-Fraser river area 7.15; eastern area 6.95; arctic coast 4.02; Great Basin 2.47; and northern area 1.35. While the agricultural areas of the east and southwest contained the greater population (about 405,000 in all), Kroeber believed the predominantly fishing economy of the Pacific coast (Bering strait to southern California) had greater relative density of population. His estimates were: Pacific coast 25.2 persons per square kilometre; agricultural areas 10.1; remaining area north of Mexico 2.2.

TABLE I.—*Aboriginal Indian Population North of Mexico*

Area	Date	Estimated Population
North Atlantic:		
(New England, New York, New Jersey, Pennsylvania)	1600	55,600
South Atlantic:		
(Delaware, Maryland, Virginia, West Virginia, the Carolinas, except Cherokee country)	1600	52,200
Gulf states:		
(Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, Tennessee, Cherokee country)	1650	114,400
Central states:		
(Ohio valley from Alleghenies to Mississippi, Chippewa in Canada)	1650	75,300
The Plains (Canada to Gulf):		
Northern	1780	100,800
Southern	1690	41,000
Columbia River basin:		
(Washington, most of Oregon, northern half of Idaho)	1780	89,300
California	1769	260,000
Central mountain:		
(Nevada, Utah, parts of surrounding states)	1845	19,300
New Mexico and Arizooa	1680	72,000
British America:		
(Eastern Canada, central Canada, British Columbia)	1600–1780	190,950
Alaska	1740	72,000
Greenland	1721	10,000
Total		1,153,450

Source: James Mooney, "The Aboriginal Population of America North of Mexico," Smithsonian Miscellaneous Collection, vol. 80, no. 7 (1928).

Analysis of these figures according to modern political divisions yields roughly the following subtotals as of dates given above:

United States (except Alaska)	849,000
Alaska	73,000
British America	221,000
Greenland	10,000

Estimates of population for the entire hemisphere have fluctuated widely, running as high as 50,000,000 to 75,000,000 for the period around A.D. 1200. Kroeber estimated the total at 8,400,000, divided about equally between the two continents, with 200,000 in the West Indies. This was thought (1960s) to be too low, and a figure of 25,000,000 was given as probably closer to the actual number.

3. Language.—The wide distribution of a few major languages is thought to be a development of comparatively late times in human history; contrariwise, it is believed that in ancient times a great number of languages flourished, each confined to a limited geographical area and to a small population. Such a condition describes to a large extent the linguistic situation among American Indians. The first identification of American languages and relationships among languages was accomplished by comparing vocabularies, and while this method may have resulted in overlooking many resemblances that later were discovered when grammatical structures were examined, nevertheless, the effort of J. W. Powell, who first published a complete classification of the languages of the U.S. and Canada, remained the foundation work. His nomenclature, adding the adjective termination "-an" or "-in" to a tribal name, was still followed in the 1960s. All related Sioux languages, for example, are grouped under "Siouan," the Shoshone languages under "Shoshonean," etc. Powell's classification and distribution map, as published in 1891, contained 58 language stocks, of which three (Beothukan, Esselenian and Karankawan) were already extinct, and two others (Adaizan and Palaihnihan) were subsequently combined with other stocks. This left a net of 53 living linguistic stocks in the Powell classification. Other students identified 29 linguistic stocks for Mexico and Central America and 84 for South America. These, it should be noted, are not separate languages; each is actually a language family with from 1 to as many as 50 component languages.

Subsequent workers in the area north of Mexico (Dixon and

TABLE II.—*Tribal List*
(Linguistic Stocks North of Mexico)

Powell classification (1891)	Sapir arrangement (1929)	Still spoken (Voegelin list)		
Language family	Type and component stocks	Type, stock and language	Population*	Location
	I. ESKIMO-ALEUT	I. ESKIMO-ALEUT		
		A. Eskimo		
ADAIZAN (Combined with CADDOAN)		1. Greenland	20,000	Greenland
		1. Central	7,700	Canadian arctic, north of Yukon
		2. Alaskan	16,000	South and west of Yukon
		B. Aleut (possibly two languages)	5,700	Aleutian Islands to Prince William sound
	II. ALGONKIAN-WAKASHAN	II. ALGONKIAN-WAKASHAN		
ALGONKIAN	A. Algonkian-Ritwan	A. Algonkian		
	1. Algonkin	1. Cree	15,000	James bay westward to Peace river
	2. Beothuk	2. Montagnais	1,550	North shore of St. Lawrence river from mouth of Saguenay river
ATHAPASKAN	3. Ritwan			
	a. Wiyot	3. Naskapi	...	Interior of Labrador
	b. Yurok	4. Menominee	2,500	Wisconsin
ATTACAPAN		5. Sauk and Fox	1,500	Iowa and Oklahoma
	B. Kootenay	6. Kickapoo	650	Kansas and Oklahoma
		7. Shawnee	730	Oklahoma
BEOTHUKAN (Extinct)	C. Mosan (Wakashan-Salish)	8. Potawatomi	5,500	Oklahoma, Kansas, Wisconsin, Michigan, Ontario
	1. Wakashan (Kwakiutl-Nootka)	9. Chippewa (U.S.) or Ojibwa (Canada)	32,000	Minnesota, Wisconsin, Michigan, North Dakota, Montana, across southern Canada
	2. Chimakuan	10. Ottawa	1,000	Oklahoma, Michigan, Lake Huron
CADDOAN	3. Salish	11. Algonkin	...	St. Lawrence river valley
		12. Delaware (including Munsee)	2,000	Oklahoma, Wisconsin, Ontario
		13. Penobscot	250	Maine
CHIMAKUAN		14. Abnaki	250	Lower St. Lawrence
		15. Malecite	150	Lower St. Lawrence
		16. Passamaquoddy	385	Maine
CHIMARIKAN		17. Micmac	3,800	Nova Scotia, New Brunswick, Quebec
		18. Piegan, Blood, Blackfeet (Siksika)	7,500	Montana and Alberta
CHIMMESYAN		19. Cheyenne (northern and southern)	4,000	Montana and Oklahoma
		20. Arapaho, Atsina	3,775	Wyoming and Oklahoma
CHINOOKAN		B. Wiyot	236	Northern California
		C. Yurok	960	Northern California
CHITIMACHAN		D. Kutenai	1,000	Montana, Idaho, British Columbia
		E. Quileute	280	Washington
CHUMASHAN		F. Wakashan		
		1. Nootka	1,600	Vancouver Island
		2. Nitinat	160	Vancouver Island
		3. Makah	450	Cape Flattery
COAHUILTECAN		4. Kwakiutl	1,100	Vancouver Island and coast of British Columbia
		5. Bella Bella	350	
		6. Kitamat	300	
		G. Salish		
COPEHAN		1. Lillooet	60	...
		2. Shuswap	45	...
		3. Thompson	130	Fraser river
		4. Okanagon	900	Okanagon lake
COSTANOAN		5. Flathead, Pend d'Oreille, Kalispel, Spokan	3,000	Western Montana, northern Idaho, eastern Washington
		6. Coeur d'Alene	600	Northern Idaho
ESKIMOAN		7. Wenatchi	100	Eastern Washington
		8. Tillamook	(identity lost)	Grand Ronde reservation, Ore.
		9. Chehalis, Cowlitz, Quinault	1,500	Western Washington
ESSELENIAN (Extinct)		10. Lummi, Songish, Clallam	1,760	Northwestern Washington
		11. Nanaimo	225	Lower Fraser river
		12. Squamish	200	Hood canal, Wash.
		13. Comox-Sishiatl	35	British Columbia
		14. Bella Coola	250	
IROQUOIAN	III. NADENE	III. NADENE		
	A. Haida	A. Athapaskan		
KALAPOOIAN		1. Northern group		
	B. Continental Nadene	*a.* Dogrib, Hare, Bear Lake	1,600	Mackenzie river and Great Bear lake
	1. Tlingit	*b.* Chipewyan, Yellowknife, Slave	1,620	Athabasca lake and Great Slave lake
KARANKAWAN (Extinct)	2. Athapaskan	*c.* Kutchin	1,260	Upper Yukon, Mackenzie rivers
		d. Tanana, Koyukon, Hao, Tutchone	1,200	Interior of Alaska
KERESAN		*e.* Sekani, Sarsi, Beaver, Stonies	960	East of Rockies, on Peace and Saskatchewan rivers
		f. Carrier, Chilcotin	1,600	Upper Fraser river
		g. Tahltan, Kaska	760	Stikine river
KIOWAN		*h.* Tanaina, Ingalik	600	Kenai peninsula
		2. Pacific group		
		a. Hupa	636	Hoopa reservation, Calif.
KITUNAHAN		*b.* Kuta, Wailaki	190	Round Valley reservation, Calif.
		c. Chasta-Costa	20	Siletz reservation, Ore.
		d. Mattole	20	Humboldt county, Calif.
KOLUSCHAN		*e.* Tolowa	115	Del Norte county, Calif.
		3. Southern group		
		a. Jicarilla	935	Jicarilla reservation, N.M.
KULUNAPAN		*b.* Lipan	(identity lost with Mescalero Apaches)	
		c. Kiowa Apache	388	Kiowa reservation, Okla.
KUSAN		*d.* San Carlos Apache	3,600	San Carlos reservation, Ariz.
		e. Chiricahua, Mescalero	1,065	Mescalero reservation, N.M.
		f. Navaho	65,000	Navaho reservation, Ariz., N.M., Utah
LUTUAMIAN		B. Eyak	300	Prince William sound, Alaska
		C. Tlingit	4,000	Southeastern Alaska
MARIPOSAN		D. Haida	1,000	Southeastern Alaska
	IV. PENUTIAN	IV. PENUTIAN		
MOQUELUMNAN	A. California Penutian	A. Yokuts		
	1. Miwok-Costanoan	1. Buena Vista	50	East central California
	2. Yokuts	2. Chukchansi		
	3. Maidu	3. Chauchila		
	4. Wintun			

*20th-century estimates by D'Arcy McNickle (1950).

TABLE II. *Tribal List (continued)*
(Linguistic Stocks North of Mexico)

Powell classification (1891)	Sapir arrangement (1929)	Still spoken (Voegelin list)		
Language family	Type and component stocks	Type, stock and language	Population*	Location
	IV. PENUTIAN (*Continued*)	IV. PENUTIAN (*Continued*)		
	B. Oregon Penutian	B. Maidu		
	1. Takelma	Nisenan (Valley, Foothill, Mountain)	170	North central California
MUSKOGEAN	2. Coast Oregon	C. Miwok		
	a. Coos	1. Coast Range	110	North central California
	b. Siuslaw	2. Sierra		
NATCHESAN	*c.* Yakonan	D. Wintun		
	3. Kalapuya	1. Wintu-Wintu	225	North central California
	C. Chinook	2. Patwin		
PALAIHNIHAN (Combined with SASTEAN)	D. Tsimshian	E. Klamath-Modoc	1,260	Klamath reservation, Ore.
	E. Plateau Penutian	F. Molale	...	...
	1. Sahaptin	G. Sahaptin		
	2. Waiilatpuan (Molala-Cayuse)	1. Tenino, Wallawalla, Umatilla, Palus, Yakima, Pswanwapam, Wanapam, Klikitat, Upper Cowlitz, Upper Nisqually	5,225	Oregon and Washington
PIMAN	3. Lutuami (Klamath-Modoc)	2. Nez Perce	1,530	Idaho
	F. Mexican Penutian	H. Takelma	(identity lost)	Rogue river, Ore.
	1. Mixe-Zoque	I. Lower Umpqua-Siuslaw	(identity lost)	Siletz reservation, Ore.
PUJUNAN	2. Huave	J. Alsea	(identity lost)	Siletz reservation, Ore.
		K. Coos	230	Oregon coast
		L. Kalapuya	...	Grand Ronde reservation, Ore.
QUORATEAN		M. Chinook		
		1. Lower	50	Dalles, Ore.
		2. Upper: Cascade, Multnomah, Wasco, Wishram	540	Oregon and Washington
SALINAN		N. Tsimshian	700	Annette Island, Alaska
	V. HOKAN-SIOUAN	V. HOKAN-SIOUAN		
	A. Hokan-Coahuiltecan	A. Washo	520	Douglas county, Nev.
SALISHAN	1. Hokan	B. Pomo		
	a. Northern Hokan	1. Clear Lake	860	California coast, north of San Francisco
	(1.) Karok, Chimariko, Shasta-Achomawai	2. Southwestern coast		
SASTEAN	(2.) Yana	C. Yuki		
	(3.) Pomo	1. Yuki	60	Round Valley reservation, Calif.
	b. Washo	2. Wappo	50	Sonoma county, Calif.
SHAHAPTIAN	*c.* Esselen-Yuman	D. Shasta-Achumawi		
	(1.) Esselen	1. Achumawi	275	Northeastern California
	(2.) Yuman	2. Atsuwegi	...	...
SHOSHONEAN	*d.* Salinan-Seri	3. Shasta	120	Northwestern California
	(1.) Salinan	E. Karok	90	Northwestern California
	(2.) Chumash	F. Yuman		
SIOUAN	(3.) Seri	1. Havasupai, Walapai, Yavapai	1,265	Arizona reservations
	e. Tequistlatecan (Chontal)	2. Mohave, Yuma, Maricopa, Kaveltchadom, Halchidhoma	2,275	Arizona reservations
	2. Subtiaba-Tlappanec	3. Kohuana, Halyikwamai, Cocopa	110	Arizona reservations
SKITTAGETAN	3. Coahuiltecan	4. Diegueno, Kamia, Akwaala	1,040	San Diego county, Calif.
	a. Tonkawa	G. Iroquoian		
	b. Coahuilteco	1. Seneca, Cayuga, Onandaga	4,500	Reservations in New York and Oklahoma
TAKILMAN	*c.* Karankawa	2. Mohawk	1,820	Saint Regis, N.Y.
	B. Yuki	3. Oneida	3,800	Reservations in New York and Wisconsin
	C. Keres	4. Wyandot	900	Oklahoma
	D. Tunican	5. Tuscarora	430	New York
TANOAN	1. Tunica-Atakapa	6. Cherokee	51,000	Oklahoma and North Carolina
	2. Chitimacha	H. Siouan		
	E. Iroquois-Caddoan	1. Catawba	375	South Carolina
TIMUQUANAN	1. Iroquoian	2. Iowa, Oto	1,535	Kaosas and Oklahoma
	2. Caddoan	3. Winnebago	3,000	Wisconsin and Nebraska
	F. Eastern group	4. Omaha, Ponca, Osage, Kansa, Quapaw	9,560	Nebraska and Oklahoma
TONIKAN	1. Siouan-Yuchi	5. Dakota, Assiniboin	42,730	Minnesota, North and South Dakota, Montana, Nebraska
	a. Siouan	6. Mandan	390	Fort Berthold, N.D.
	b. Yuchi	7. Hidatsa	930	Fort Berthold, N.D.
TONKAWAN	2. Natchez-Muskogean	8. Crow	2,780	Montana
	a. Natchez	I. Caddoan		
	b. Muskogean	1. Caddo	1,184	Oklahoma
UCHEAN	*c.* Timucua	2. Wichita	460	Oklahoma
		3. Arikara	682	North Dakota
		4. Pawnee	1,150	Oklahoma
WAILATPUAN		J. Keresan: Acoma, Cochiti, Laguna, San Felipe, Santa Ana, Santo Domingo, Zia		
		K. Muskogean		
WAKASHAN		1. Choctaw, Chickasaw	24,350	Oklahoma
		2. Alabama-Koasati	395	Texas
		3. Mikasuki, Hitchiti	(identity lost)	
WASHOAN		4. Creek, Seminole	12,900	Oklahoma and Florida
		L. Tunica	(few survivors)	Louisiana
		M. Natchez	(few survivors)	Merged with Creeks
WEITSPEKAN		N. Chitimacha	128	Louisiana
		O. Yuchi	...	Merged with Creeks
		P. Tonkawa	60	Oklahoma
WISHOSKAN	VI. AZTEC-TANOAN	VI. AZTEC-TANOAN		
	A. Uto-Aztecan	A. Uto-Aztecan		
	1. Nahuatl	1. Luiseno	1,100	San Diego county, Calif.
	2. Pima	2. Cahuilla	470	Riverside and San Diego counties, Calif.
YAKONAN	3. Shoshonean	3. Serrano	316	San Bernardino county, Calif.
	B. Tanoan-Kiowa	4. Cupeno	225	San Diego county, Calif.
	1. Tanoan	5. Tubatulabal	...	Kern river, Calif.
YANAN	2. Kiowa	6. Pima, Papago	12,400	Reservations in Arizona
	C. Zuni	7. Hopi	3,700	Hopi reservation, Ariz.
YUKIAN		8. Ute, Southern Paiute, Chemehuevi, Kawaiisu	5,400	Utah, Nevada, California, Arizona
		9. Shoshone, Comanche, Gosiute, Wind River, Panamint	6,200	Wyoming, Nevada, Utah, California, Oklahoma
YUMAN		10. Mono, Bannock, Snake, Northern Paiute	3,150	Idaho, Nevada, California
		B. Tanoan		
ZUNIAN		1. Tiwa (southern), Isleta, Sandia	1,650	Rio Grande valley
		2. Tiwa (northern), Taos, Picuris	1,070	Rio Grande valley
		3. Tewa: San Juan, Santa Clara, San Ildefonso, Tesuque, Nambe, Hano	2,450	Rio Grande valley, Hopi reservation, Ariz.
		C. Kiowa	2,700	Oklahoma
		D. Zuñi	2,760	Zuñi reservation, N.M.

*20th-century estimates by D'Arcy McNickle (1950).
Sources: *See* Bibliography.

Kroeber for California) began to study the morphology of the Indian languages and to discover relationships where none had appeared before. Edward Sapir then found that methods developed in the study of Indo-European languages could be applied equally to the unwritten American languages. Such linguistic phenomena as borrowing from other languages, grammatical developments, dialectic blending and social differentiation of speech all operated in the primitive language as in more sophisticated tongues. Sapir in 1929 suggested a regrouping of Powell's 50-odd language stocks into six major divisions. Sapir's principal contributions consisted of (1) proposing the Nadene stock, to combine Athapaskan, Haida and Tlingit, each of which had been classified separately by Powell; (2) extension of the term Hokan (first used by Dixon and Kroeber for certain California languages) to include the Coahuiltecan languages of Texas and a Central American group; (3) the Uto-Aztecan division, in which were brought together Piman, Shoshonean and Nahuatl; and (4) the Algonkian-Ritwan stock, grouping the extensive Algonkian languages with the Wiyot and Yurok of California.

The six linguistic groups proposed by Sapir, with brief descriptions of the salient features of each, are as follows:

1. *Eskimo-Aleut:* Polysynthetic and inflective; suffixes employed, but never prefixes; verb modified principally as regards mode and person and to distinguish between the transitive and intransitive actions.

2. *Algonkian-Wakashan:* Also polysynthetic; Algonkian employs inflection; suffixes, prefixes to a lesser extent; weak development of case; noun and verb stems markedly subject to suffixing with instrumental, adverbial and specifying elements.

3. *Nadene:* Strongly characterized as tone language, in which pitch of the voice is used to shade meanings; monosyllabic elements, prevailingly nominal and having fixed order with reference to each other, are combined into loose word forms; emphasizes voice and aspect rather than tense; distinguishes carefully between active and static verb forms.

4. *Penutian:* More tightly knit than preceding three, analogies with Indo-European languages; uses suffixes more formally; many types of inner stem changes; true nominal cases.

5. *Hokan-Siouan:* Prevailingly agglutinative; tendency to use prefixes rather than suffixes for formal elements; distinguishes active and static verbs.

6. *Aztec-Tanoan:* Moderately polysynthetic; many formal elements suffixed; sharp distinction between noun and verb; free use of reduplication, compounding of stems and nominal incorporation; many postpositions; pronominal elements differentiated by subject and object, but not for transitive and intransitive constructions.

Table II contains Powell's classification by linguistic stocks, Sapir's organization of the same material by major types and C. F. Voegelin's arrangement of languages still spoken north of Mexico. Voegelin estimated that more than half (slightly less than 150) of the aboriginal languages survived.

A notable feature of this linguistic situation was the preponderance of languages on the Pacific side of the continent. Of Powell's original list of 53 stocks, 37 were in territory draining into the Pacific and 22 were actually on that coast, while only 7 were found on the Atlantic coast. In terms of population, more than 70% of the population north of Mexico was represented by eight language stocks. These stocks, with respective populations (after J. Mooney), were: Algonkian 192,400; Eskimo-Aleut 89,700; Siouan 88,500; Iroquoian 71,700; Muskogean 66,500; Uto-Aztecan 63,100; Athapaskan 60,500; and Salish 57,900. Eighteen other language stocks had an average population of about 12,000, while 29 were spoken by from 500 to 5,000 persons, with an average of 2,000. *See* also AMERICAN ABORIGINAL LANGUAGES; CENTRAL AND NORTH AMERICAN LANGUAGES; INDIAN, LATIN-AMERICAN.

III. CULTURE PROVINCES

1. Distributions.—Reconstruction of American prehistory had not succeeded by the 1960s in filling in the details of dispersal and development that must have taken place during the long interval between the earliest occupation and the first evidences of sedentary cultures. Moreover, as new discoveries tended to push the first human horizons in North America further back into antiquity, the more precise dating made possible by tree-ring chronology and by radiocarbon disintegration tended to lessen the estimated age of later occurrences; the gap between the two limits grew and the difficulty increased. The year 1000 B.C. was once postulated as marking the beginning of civilization in the western hemisphere, this being the approximate time when agriculture began to replace hunting in the middle regions and when advances toward Maya architecture and the Maya calendar began. The beginnings of agriculture actually belong to a more remote period, as noted earlier, but in any case an interval of from 10,000 to 15,000 years must somehow be explained. In the opinion of some authorities a time span of 25,000 years might be required to account for ecological adjustment to the numerous climatic belts represented in the two American continents. As suggested by R. H. Lowie, in the long interval man was pushing toward a stage characterized by agriculture and pottery making. In the process a score of hunting and gathering societies may have evolved. Agriculture may actually have been the outgrowth of independent experimental plantings with manioc in the tropical lowlands, the potato in the Andes and maize in the north. Adjustments, strivings and solutions in the face of limited theory and scant technology tend to require considerable time.

The Cochise culture of southern Arizona spanned much of the period under scrutiny. Three stages have been distinguished for the Cochise development, the oldest of which, the Sulphur Springs stage, was tentatively dated at 10,000 or more years ago. The climate was then wetter and colder and the bones of extinct mammoth, camel, dire wolf, bison and horse were directly associated with man-made implements. These were not the implements of an exclusively hunting people, however; there were grinding tools, consisting of flat milling stones and small handstones, and implements for cutting, chopping and scraping. A second stage, occurring between 8000 and 3000 B.C., is designated Chiricahua. The grinding tools and chipped implements suggest an evolutionary development out of earlier types. The culture as a whole was first thought to have disappeared in the third, San Pedro, stage about 500 B.C. Pottery and presumably agriculture entered the southwest at about that time, but the original Cochise sites yielded no evidence of either. Ventana cave, on the Papago Indian reservation, yielded artifacts to suggest that the people responsible for this culture did not disappear. Three levels of occupation occurred in Ventana cave, the oldest of which contained flaked implements possibly related to the Folsom culture, together with bones of both modern and extinct animals. The next upward layer, in addition to animal remains, had a great number of grinding stones and flaked implements. The grinding stones resemble those identified with the Chiricahua stage, while the flaked instruments are similar to types established for the early cultures of the Pinto and Mohave basins in California. The upper part of this second stratum contained a number of projectile points of the type ascribed to the San Pedro stage. The third and top layer contained pottery of both the modern Papago Indians and the earlier Hohokam culture (*see* below). Types of grinding tools present in the Cochise culture persisted there, and a type of mano associated with maize grinding and flour making appeared. Apparently, pottery and agriculture arrived in the area during the last stage of occupation at Ventana cave and were taken over by a people who continued into modern times. The southwest, with its arid climate extending back over several thousand years and with numerous caves and rock shelters, offers the greatest likelihood of preserving the full story.

2. The Southwest.—The southwest, including the southern portion of Colorado, most of Utah, Arizona and New Mexico and northwestern Mexico, consists of several partly contemporaneous culture provinces. At least two, and possibly three, agricultural peoples are included, and these in turn are surrounded in a great arc by various peoples of a marginal agricultural and hunting economy. The area divides into three climatic zones: (1) high, moist (22–40 in. annual rainfall) and cool; (2) high, dry and cool; and (3) low, dry and hot.

Best known are the Pueblo Indians, whose ancestors built great cliff villages now seen in ruins and equally remarkable multiple apartment houses of adobe and stone masonry. Some of the latter are still occupied, and the Pueblo Indian inhabitants speak languages and observe ceremonies that are at least pre-Spanish in origin. The Pueblo culture was preceded in the same general area by a people to whom the term Basket Maker has been ap-

plied; because the occupation continued without interruption in a kind of evolutionary process, it has become customary to refer to the two as the Anasazi culture. The word is derived from a Navaho term meaning "the ancient ones." The central focus of Anasazi culture was in the northeastern part of Arizona and northwestern New Mexico, with contiguous portions of Colorado and Utah. In time, however, Anasazi traits ranged as far as the Idaho line, westward into Nevada and considerably southward and eastward from the points of beginning.

The origin of the Basket Maker Indians is not precisely known, but they very likely were related to the Desert culture noted above. When first settled in the northern portion of the southwest they were already excellent weavers of baskets, though not potters, and they were already supplementing hunting by growing maize and pumpkins. They sometimes sheltered in caves and also built shelters in the open, partly below ground and roofed over with poles and mud. Storage pits for food, often lined with stone slabs set on edge, were characteristic. The basic pattern continued into a following period (Modified Basket Maker), when agriculture occupied major interest, though hunting and wild-seed gathering were not abandoned. Beans had been introduced as an additional crop. Houses were joined in straight lines or crescents, and a new type of building emerged. This was a circular room, built partly underground. It was an enlargement of the old storage pit but was evidently used for ceremonial purposes and was probably the precursor of the kiva found in modern pueblos. The word kiva is Hopi for "old house." The most notable change from the previous period is the introduction of pottery, sun-dried at first, and sometimes made in basket molds.

The beginnings of Pueblo culture, as in the case of the early Basket Maker, are obscure. Some movement westward and northward occurred, and some new traits began to appear. The practice of flattening the back of the head became general, achieved evidently in infancy by fastening the child to a hard cradleboard. The same type of aboveground, straight-line or crescent-shaped multiple house was built, two rooms wide. However, stone masonry began to replace the earlier pole-and-mud and adobe construction. Agriculture, including several varieties of corn, may have been augmented at that time by the cultivation of a native long-staple cotton. Pottery was not much changed, but it included a greater variety of shapes and decoration. Basketry was much less common. The early phases of Pueblo culture, termed Developmental Pueblo, included the emerging features that were once designated Pueblo I and Pueblo II. Throughout that early period the area of occupation continued to expand. The kiva became larger and eventually was built entirely underground. Entrance was through an opening in the ground-level roof. Domiciliary houses became larger, but the basic character remained about the same. Pottery varied according to shapes, finishes and methods of decoration.

The great (Classic) Pueblo period (Pueblo III) followed (A.D. 1050–1300), a period most persons probably associate with the term Pueblo. It was the time of the great cliff houses, such as Mesa Verde (Cliff palace and Spruce Tree house), and the large apartmentlike structures in Chaco canyon (Pueblo Bonito) and elsewhere. An actual shrinking in area took place as inhabitants of the outer fringes moved in to build the large dwelling units. Also, since a number of outstanding structures were built in quite inaccessible canyons and mesa walls, there is the possibility that hostile strangers had reached the outlying districts. The most notable advance over previous periods was in architecture and pottery. Masonry walls were greatly thickened, dressed stones being used in many localities to bear the greater weight of massive structures. These community structures had from 20 to as many as 1,000 rooms, and from one to four stories. Each of the larger houses was in effect a single village. Windows and doors were quite small, and usually no openings were made in the lowest rooms that were entered by ladder through the roof. Floors were terraced or set back, and the terraces were much used as outdoor living space. Roofs were constructed to carry great weights by laying heavy beams covered with a mat of smaller poles and brush, then laying on a coat of adobe six to eight inches thick. Some kivas were greatly enlarged to as much as 80 ft. in diameter. Craftsmanship in pottery reached a high level, and specialization became so pronounced in the different centres, as in Chaco canyon, Mesa Verde, Kayenta and a number of others, that the style of each can be recognized easily. The earlier black-on-white and red-on-white designs were still used, but polychromes of three or more colours were produced and decoration was applied more lavishly. Cotton cloth, blankets and bags were woven, and yucca fibre also entered into various articles of clothing and utility objects such as mats. Feather-cloth robes were worn in cold weather.

Abandonment of the cliff houses and large community buildings marked the close of the great Pueblo period. In part this may have resulted from incursion into the northern part of the territory by nomadic Athapaskans (Navaho and Apache [*qq.v.*]) and a prolonged drought that examination of tree rings in the area shows to have existed from A.D. 1276 to 1299. It is also possible that lack of central leadership led to internal dissensions.

Pueblo IV period (A.D. 1300–1700), also called Regressive Pueblo, was characterized by a general movement southward and eastward, and new villages, some larger than those of Pueblo III, were built on the Little Colorado, Puerco, Verde, San Francisco, Rio Grande, Pecos, Upper Gila and Salt rivers. The great pueblo of Pecos dates from that period, as does Tyuonyi in Bandelier National monument. Pottery showed new developments; geometric patterns were largely replaced by naturalistic representations of birds, animals, insects and the human figure; glazing was frequently used. The modern period, Pueblo V, is usually dated from the beginning of permanent Spanish settlement at the close of the 17th century. From 1540, when the Spaniards first entered the Pueblo country, to the recapture of the country by Diego de Vargas in 1692–94, the number of Pueblo settlements declined from about 80 to 25 or 30. Much of the culture and many of the skills in agriculture and crafts continued down to modern times.

The beginnings of Anasazi culture are not too clearly established. As mentioned above, the Basket Maker people were already practising agriculture when they first appeared. It is usually assumed that a prior or nonagricultural stage preceded, but no evidence of such a stage had been discovered by the 1960s. Believing that agriculture was introduced in the southwest at about the beginning of the Christian era, writers have generally placed the beginnings of the Basket Maker culture at a time just prior to A.D. 1. Evidence discovered at Bat cave, N.M., in 1948 seemed to promise considerable revision of these dates. At that site, located on the shores of prehistoric Lake San Augustin, six levels of human occupation were identified. The most recent layer contained pottery fragments ranging in date between A.D. 500 and 1000. The oldest layer dates from 2500 B.C. Maize, including shelled cobs, separate kernels and other parts of the plant, was found at all levels, beginning at the bottom. The maize found at Bat cave contained specimens of the most primitive form of corn yet discovered.

3. Hohokam.—The term Hohokam, from the Pima ("those who have gone"), is applied to a cultural development that covered a long period of time. The area in general is south of that occupied by the Basket Maker-Pueblo people, extending into northern Mexico; it is primarily a hot desert area. The Hohokam were already practising agriculturists at the time of their earliest found remains. In later stages, irrigation canals were built and river water was brought to the fields. The absence of such canals in the first (Pioneer) Hohokam period suggests that planting was confined to river bottoms and relied on flood irrigation. Pottery was also made in that first period. Dwelling houses were partly excavated, but separate walls of poles and brush matting were erected within the pit, and similar material formed the roof. The Hohokam never built large community houses such as characterized the Anasazi people; their villages instead consisted of separate individual houses. The physical type cannot be ascertained, since the Hohokam practised cremation. The beginning date for this culture has generally been given as about the 1st century A.D., based on cross-dating with Mogollon sites, supplemented by stratigraphic analysis of pottery remains.

In the succeeding Colonial period a general expansion of the culture occurred into most of the southern half of Arizona. The

first irrigation canal, diverting water out of the Gila river near modern Sacaton, Ariz., was dug during that period (*c.* A.D. 500–900). Large excavated areas (maximum size 180 x 61 ft.) thought to be ball courts similar to those found frequently among the Mayas of Central America also date from that period. The Mayan ball game, described fully by early Spanish colonists, was played with a solid rubber ball; a similar ball was found in a Hohokam site. Such a relatively specialized trait helped confirm the impression that agriculture, perhaps pottery, and other features of Southwest culture derived from Middle America (*q.v.*) and even from South America. The Hohokam people on the Gila river and their relatives in the modern Mexican state of Sonora were on an ancient trade route that followed the coastal strip along the Gulf of Lower California to the Rio Grande de Santiago, ascended that stream to modern Guadalajara into the Valley of Mexico.

Hohokam pottery, even at the lowest level, reveals great technical skill. The finishing process was paddle-and-anvil, by which the clay walls are brought to the desired thickness by pounding or pressing. A round stone anvil is held inside the vessel to support the wall while a paddle is used on the outside. Among the Anasazi the prevailing technique was the coil method, in which the fingers press the walls to the approximate thickness while the clay is still wet, and afterward a sharp stone is used to scrape off excess when the clay has become leathery. Also, the Hohokam as early as the Colonial period began to use freehand drawings of birds, human beings, insects, snakes and other animals in pottery decoration, while the Anasazi did not depart from geometric designs until Pueblo IV, several centuries later.

The Sedentary period (*c.* A.D. 900–1100) added clay human figurines to the list of Hohokam traits. A more startling development was that of copper bells cast in wax molds. The copper appears to have been mined in the general area, but the derivation of the casting technique is obscure, and no other copper objects were found among the Hohokam. Casting of metals was practised in Central America and in the Andean region but nowhere in North America outside the Hohokam area.

The Classic, or final, period of Hohokam culture (A.D. 1100–1400) is notable for the peaceful intrusion of the Salado Indians, a branch of the Anasazi culture. The shifting of the Pueblo people southward as the great Pueblo period ended had the evident effect of displacing populations throughout the southwest. The Salado people came from the upper reaches of the Salt river, occupying an area within the modern Fort Apache Indian reservation until about A.D. 1200. They lived in Hohokam territory for several decades, then withdrew and disappeared. The principal effect of the presence of this people is revealed in architecture. Single-type houses clustered in villages continued to be built until the advent of the Salado people. Presently great community houses with massive walls of adobe (building stone was not available in the area) began to be built. The Casa Grande National monument near Coolidge, Ariz., is a survival of that period.

After the Salado Indians disappeared Hohokam culture seemingly declined immediately. Deeper invasions into the southern area by nomadic Athapaskans may have precipitated the change. In historic times the Pima Indians occupying the Hohokam area were much harassed by marauding Apache bands. Possibly the concentrations of people, with dependence on nearby lands, proved too vulnerable to raiding parties. By scattering over a wider area they could increase the safety factor for the group as a whole. The Pima Indians and their kinsmen, the Papago, who are presumed to be the direct descendants of the Hohokam, were living in just such scattered small villages when first encountered by Spaniards.

4. Mogollon.—This third southwestern area was formerly considered a local variation of the Anasazi culture. Investigation demonstrated, however, that it was distinct from both the Basket Maker-Pueblo and the Hohokam developments. The view was held in the 1960s that Mogollon represents one line of descent from the San Pedro stage of the Cochise culture (*see* above), the other line being the Hohokam. In other words it was felt that Mogollon and Hohokam shared a common origin in the old seed-gathering complex of southwestern New Mexico and southeastern Arizona. The Mogollon occupied the eastern half of that old region, in part at least a mountainous country lying east of the San Pedro river in Arizona.

The relationship to San Pedro is reflected particularly in stone implements found in the earliest Mogollon sites. Food was obtained principally from wild seeds, roots and nuts, although some evidence of beginning agriculture exists. Hunting was probably not important since arrow and spear points are rare and animal bones are not often found. Pottery was already being made in the earliest Mogollon period, designated Pine Lawn (*c.* 200 B.C.–A.D. 600), and it differs in type from either Anasazi or Hohokam. The people lived in small villages of separate circular pit houses, the floors of which were from one to three feet below ground level. The houses lacked fireplaces, and entrance was through a kind of tunnel. In these features the houses were peculiar to the area. Other periods for which diagnostic material was catalogued include the Georgetown, San Francisco River, Three Circle and Mimbres, each estimated to have a span of about 200 years in ascending order. Masonry walls began to appear in the houses of the Three Circle period, although the floors of these continued to be below outside ground level. In the succeeding Mimbres period the pit house disappeared and all-masonry houses were built aboveground. The villages were greatly expanded. Mimbres pottery, among the finest found in the southwest, is especially notable for the excellence of the freehand drawing of human, animal and insect forms used as decorative elements. The presumption is that Anasazi people entered the area during the Mimbres period (*c.* A.D. 1050–1200). Thereafter, for reasons not yet understood at mid-20th century, the dwellings on the Mimbres river were deserted and the people apparently drifted eastward to the Rio Grande and southward into northern Mexico. In Chihuahua state Mimbres-type pottery was produced. Community houses of several stories, built with massive adobe walls, echo the late development in the Hohokam country.

5. Southwest Periphery.—The Anasazi, Hohokam and Mogollon peoples were bordered on three sides, and at different times, by tribes practising marginal agriculture or no agriculture at all. On the southern, fourth, side were sedentary cultures not unlike their own. Whether the Athapaskan Navaho and Apache people entered the area as a disruptive force or as peaceful neighbours is not definitely known. It is possible that hostility characterized the early relations, but in time the Pueblos and their Navaho-Apache neighbours accommodated to each other. The Navahos evidently joined the Pueblos in driving the Spanish out of New Mexico in 1680, and following that some Rio Grande Pueblo families joined the Navahos and were incorporated into the tribe. It is believed that these Athapaskans came down from the north, possibly from as far as Canada, where the bulk of the linguistic stock was located in the 1960s. They were already in the southwest when Francisco Vázquez de Coronado entered the region in 1540, and the assumption is that the original immigration occurred at the close of the 13th century, coincidental with the abandonment of the great Pueblo communities in the San Juan river area. When they reached the southwest the Navahos were nomadic hunters and food gatherers, but in time they adopted agriculture from the Pueblos and made some pottery. By the beginning of the 18th century agriculture was the basic economy, and livestock raising (sheep and goats) had become established. Weaving of woolen blankets had also begun by that time. The Apache bands, with the exception of the Jicarilla and the Western Apache, seem to have borrowed less from the sedentary peoples of the southwest and more from the Plains tribes.

On the Colorado river a group of tribes belonging to the Yuman language family combined agriculture with wild-seed gathering and hunting. Three of these tribes were in the vicinity of the Grand canyon: Yavapai, Havasupai and Walapai. Of these the Havasupai derived at least half their subsistence from agriculture, and the others a lesser amount. The tribes at the lower end of the Colorado river, Cocopa, Yuma, Mohave and Maricopa (the latter joined the Pima Indians on the Gila river before 1700), were primarily agriculturists, utilizing flood irrigation. Their excellent pottery was derived from Hohokam types.

6. Intermountain.—The Great Basin and adjoining portions of plateau country north and south were more fertile and hospitable in glacial and postglacial times than in modern times and probably served as corridors for later migrations to the interior of the continent. Archaeological exploration brought to light a number of locations where occupations occurred at very early times. Gypsum cave in extreme southern Nevada, Lake Mohave and Silver lake in southern California are among the most ancient. Other caves in the Bonneville basin (which includes modern Great Salt lake) and Lake Lahontan basin (western Nevada) are considered to be quite old, ranging in age between 3,000 and 15,000 years. Classification of the culture found in the Great Basin proved rather difficult. Earlier writers were inclined to deny the existence of a separate culture for that area and to explain what was found there as the result of borrowing from such neighbouring regions as California, the plains, the southwest and the northwest. A later view was that a basic generalized culture was obtained in the area in ancient times and afterward spread and specialized in outlying areas like California. The problem of characterizing the basic culture for the area was intensified by the scarcity of materials. The many scattered remains, as those from the early sites mentioned, did not provide a sufficient range of associated types to allow qualitative judgment until recent research defined the complex as the Desert culture (*see* above, under *Prehistory*). Diffusion of Anasazi culture into the Great Basin began probably as early as A.D. 500 and persisted until some time after A.D. 1200.

Toward the end of that period a non-Puebloid hunting people designated Promontory (from Promontory point in Great Salt lake) appeared in the Salt lake basin. Various artifacts, such as moccasins, fur mittens, beaver-teeth dice and the sinew-backed bow, were suggestive of a northern origin. They were a nonagricultural people, although they produced pottery of a type found among several northern Plains tribes. Other traits were subsequently borrowed from Puebloid people occupying the area. Both peoples soon vanished and were succeeded by Shoshonean tribes, the modern occupants of the Great Basin and contiguous areas. These tribes, it is thought, expanded from locations previously occupied in western and southwestern Nevada. They continued to expand their territory somewhat, crossing the continental divide into Montana and Wyoming. After 1700 the Comanche split off from the Wyoming branch and presently were harassing other tribes in the southern plains. The Shoshoneans, following their first appearance, began to borrow traits from neighbouring areas, such as salmon fishing from the north, twined basketry, pottery, Plains-type skin garments and, eventually, the horse. This reconstruction offers a reasonable accommodation of the known facts.

7. California.—California was marked by a great complexity of languages (about 20 in Powell's classification) and tribal groups. In some instances a group of not more than 500 individuals, speaking a distinct language, would live near another group of similar size that spoke a quite different language, and neither seemed to impinge upon the other. If the presence of many separate languages is symptomatic of very early times, then California settlement should reflect great antiquity. The earliest migrating Asians probably found themselves brushed aside by later and larger aggregates speaking a common tongue and found in California a haven apart from the main stream of traffic. It is difficult to secure archaeological evidence in support of such a hypothesis, however. Mention has previously been made of the sites explored at Lake Mohave and Pinto basin in southern California. Unfortunately in these cases, while the geological features involved can be dated with reasonable assurance at 10,000 to 15,000 years ago, there is reason to doubt in each case whether the human remains are contemporaneous. On the coast of southern California camp sites of a people designated San Dieguito have been found. These were tentatively dated at 2000 B.C. In central California (valleys of the Sacramento and San Joaquin rivers), the earliest sites are: Borax lake, probably antedating 1000 B.C.; early Buena Vista, on the lake of that name, and Oak Grove, in the Santa Barbara area, both dating from about 1000 B.C. At mid-20th century northern California had not yielded archaeological material of value. In spite of the great complexity of linguistic and demographic factors, the California culture area presents no striking deviations. Agriculture was not practised except along the Colorado river, since throughout the vast central portion and southward along the coast an ingenious method of leaching acorn pulp and converting it into flour supplied abundant and constant food. Along the coast, fisheries and the hunting of sea mammals in the Santa Barbara region supplied the basic diet. Salmon were plentiful only in the northwest corner of the region. Pottery making was restricted to the desert area east of the Coast range in southern California until rather late in the prehistoric period when it appeared on the southern coast and in the upper San Joaquin valley. Basketry, however, was widely distributed; baskets produced by the Pomo Indians in the central region are especially notable.

8. Northwest Coast.—In the absence of archaeological evidence of antiquity, the Northwest Coast culture must be regarded as recent. It was, in fact, still expanding and diversifying when first contacted by Europeans. There was also an apparent lack of influence from Middle America and Mexico. On the other hand, influences from Asia are noticeable; *e.g.*, armour, made of closely articulated wooden rods, and hats. Recent archaeological excavations on the Fraser river suggest early Eskimo contacts. The region extends from northwestern California to the head of the inland waterway along the coast of southeastern Alaska, with the following geographical divisions: northern, including territories occupied by Tlingit, Haida and Tsimshian Indians; central, the Mibanke-Queen Charlotte sound region, occupied by the Kwakiutl, Nootka and Bella Coola; and southern, the Straits of Georgia and Puget sound, occupied by the coast Salish. The Columbia-Fraser river and adjacent interior regions are somewhat apart from this classification since they are partly transitional between the northwest coast and the plateau, or intermontane, areas. The economy depended almost entirely upon fish, particularly salmon, though it used nearly every kind of fish, sea mammal, shellfish, seaweed and bird available. To a lesser extent food resources of the land were used. So intensively was this natural food habitat utilized that the density of population, as calculated by Kroeber, was greater in the northwest coast area than in any other part of prehistoric North America north of Mexico. Great use was made of cedar and other woods in building plank houses, great dugout canoes, food vessels, boxes for storage and cooking, and in carving masks and various ceremonial paraphernalia. Clothing and other fabrics were made of the inner bark of spruce and cypress. By combining mountain-goat wool with this bark fibre, yarn was produced for weaving into blankets and robes. Organization was based on the village rather than the tribe. Each village had a permanent winter site but moved seasonally from salmon stream to halibut grounds, to hunt sea mammals or to follow other pursuits in the course of the year. The potlatch (*q.v.*) ceremony, with its emphasis on giving away wealth to acquire public standing, was perhaps the most distinctive trait in the culture.

9. Arctic Coast.—The Eskimo (*q.v.*) people quite likely represent the latest ethnic stock to migrate into the new world, probably about the beginning of the Christian era. The origins of the culture were not clearly defined in the 1960s, though recent exploration suggested certain lines of development. The earliest remains are found in the Bering strait and immediately adjoining Arctic ocean areas. The designation Old Bering Sea is used in describing these earliest remains, those of an already highly specialized Eskimo culture. A partly contemporaneous culture identified as Ipiutak centred at Point Hope on the arctic coast and shared a number of traits with the Old Bering Sea phase but also included some features that point to other comparisons. In stonework, particularly, including types of projectile points and cutting and thrusting implements equipped with stone blades inserted in bone and ivory heads, the Ipiutak material finds close parallels with related types of implements belonging to the Neolithic horizons across all of northern Eurasia. The possibility of establishing relationships for the Bering sea artifacts with lines of diffusion spreading from Lake Baikal in Siberia prior to the Christian era is thus suggested. It must also be concluded, however, that this

Siberian Neolithic is not the prototype of new world lithic industries, or at any rate that the Eskimos could not have been the carriers of the oldest stages of that culture. Bering strait and vicinity appear as the beginning point, and from there Eskimo traits developed through successive stages identified at Punuk, Birnirk, Post-Punuk and Thule. The Thule culture spread eastward to Greenland around A.D. 900–1000. The Dorset culture, found in the Hudson bay region, was still a puzzle but may reflect Indian Eskimo contacts.

Eskimo culture is notable for its versatility in adapting to a changing environment. In some areas seals were the main staple, and a variety of hunting methods was devised. In caribou country Eskimos came to depend entirely on upland hunting and never went near the sea. Elsewhere they became expert whale and walrus hunters and devised tools and equipment accordingly. They built housing out of driftwood, whalebone, sod or snow blocks. The latter structures were limited to the eastern areas (Coronation gulf, Baffin Island) or were built for seal hunting on ice at great distances from shore. Among the most typical Eskimo inventions should be listed two types of skin boat, the umiak, a heavy boat used in whaling, and the lighter kayak; the harpoon with detachable head and bladder or inflated skin float; snow goggles; stone oil lamp; tailored clothing; dog traction. The adaptation to environment is still further emphasized by the Eskimo of southwestern Alaska, the Alaska peninsula, Kodiak Island and Cook inlet, and by the Aleuts. The latter speak an Eskimoid language that is not intelligible to a Bering sea Eskimo, but otherwise they are related. The beginnings of the Aleutian settlements are dated at about 1000 B.C. by radiocarbon. The region has heavy rainfall, transportation is largely by boat, and the economy is limited to hunting sea mammals, fishing and taking birds.

10. Subarctic.—Below the arctic basin occupied by the Eskimos an area of tundra, giving way at last to extensive coniferous forests and great inland waterways, was utilized by tribes of hunters. Their specializations were not as striking as those worked out by the Eskimo, but they served their purpose. The climate being subarctic and wholly unadapted to agriculture, the population was severely limited by the animal-carrying capacity of the area. Subsistence was principally from caribou herds, though moose and deer and fish taken in rivers and lakes were also important. Because of the rigorous environment the people were not able to adopt or absorb cultural developments either from the Eskimo to the north or from the agriculturist-hunter tribes speaking similar languages in the south. Because snow in the interior was deeper and drier the toboggan was substituted for the Eskimo runner sledge, and snowshoes were distinctive. Extensive birch forests provided bark for canoes, cooking and eating vessels, and covering for the conical houses and shelters. The area divides roughly into two linguistic groups: (1) the Algonkian-speaking Cree (various divisions), Montagnais and Naskapi, Ojibwa (*qq.v.*), Ottawa, and Algonkin, occupying the region north of the Great Lakes and east of the Nelson and Churchill rivers; and (2) the Athapaskan-speaking Hare, Yellowknife, Dog-rib, Slavey and Chipewyan on the Mackenzie river; the Loucheux, Sekani, Carrier and Babine in the western mountain area; several tribes along the Yukon river; and the Beaver and other tribes in British Columbia.

11. Eastern North America.—The agricultural practices of the aboriginal population of the eastern part of the continent (approximately east of the 100th meridian) differed so markedly from those of the southwestern tribes as to suggest a different origin. The western practice was to grind corn on a stone metate with a mano, a cylindrical or rectangular stone rubbed against the metate. The meal was fashioned into flat tortillas or wafers and baked on hot stone. In the eastern area corn was pounded in a mortar of wood or stone, or made into hominy, and boiled rather than baked. In the west, moreover, agriculture tended to absorb full attention, and ceremonial life tended to revolve around the incidents of planting and prayers for a good crop. In the eastern zone less than 1% of potential crop land was actually cultivated, and agriculture seems to have been regarded as a supplementary means of livelihood. Surplus agricultural foods, moreover, seem to have encouraged warfare rather than the peaceful arts. The contrast in dietary practices suggests that the Southwest derived its tradition and technology from the central Valley of Mexico, since metate grinding is continuous between the two regions. Concerning the origin of the eastern practices recent evidence suggests the early development of local agriculture around the planting of sunflower and other seed sources, stimulated by developments to the south. Developed agriculture came somewhat later, in Hopewell times.

While a definite time period cannot be given for the earliest occupation of the eastern area, remains discovered up to mid-20th century were suggestive of the Folsom-Yuma artifacts of the Rocky mountain region. The first skeletal remains are those of a longheaded race. Settlement doubtless occurred, as in the west, in early postglacial times, and the earliest settlers were probably nomadic hunters. By about 500 B.C., according to tangible evidence, agriculture and pottery making had been introduced, and the building of burial mounds was spreading. The earliest examples of eastern pottery were found in Florida, Georgia and Alabama, and in certain northeastern sites. Pottery from the two regions differs in style and construction and apparently had different origins. Immediately preceding the introduction of agriculture into the eastern area, livelihood was centred on fishing, and the densest population was along the ocean shores, the rivers and freshwater lakes. This would account for the great shell mounds underlying sites occupied later by farming groups.

The most spectacular culture of the eastern area is the Hopewell, that flourished approximately 400 B.C.–A.D. 500. The name is derived from the Hopewell farm in Hamilton county, Ohio, where the first site was explored. It was to this culture that the term mound builders was once widely applied. The term is considered a misnomer, for later investigations revealed that the practice of constructing earth mounds was widespread in area and in time, and the purposes served by the mounds differed greatly.

Characteristics of the Hopewell culture, that centred in southern Ohio but reached also into Indiana, Illinois, Wisconsin, Michigan, Iowa, Kansas, Tennessee, Pennsylvania and New York, are those of a farming population still relying upon hunting and fishing and the gathering of wild nuts, fruits, seeds and roots. The amount of pottery and ornamental stone- and metalwork found in association with Hopewell villages suggests some division of labour. In addition the nature and size of the earthworks at many sites suggests that forms of public labour, whether voluntary or conscripted, may have been employed. The earthworks sometimes suggest defensive purposes, but more often they served as burial mounds or apparently formed the bases of temples or other structures. The best pottery was well made, with decoration applied by incised or stamped lines, often in naturalistic outlines. Even more notable are effigy pipes carved in stone and polished, representing birds, fish and various other animals. The metalwork has been called the finest in North America in pre-Columbian times. Copper sheet was used extensively; some silver and meteoric iron, and occasionally gold, entered into various ornaments and utility pieces. Metal casting was not known, and processing was limited to beating and annealing. Sheets of mica were also employed and help to characterize the culture. Trade routes were evidently well developed, for material from as far away as the Rocky mountains and the Gulf and Atlantic coasts are found in Hopewell sites, and articles identified as manufactured by the Hopewell people are found in localities as far distant.

Hopewell culture, with the contemporary Adena culture, represents the climax of a widely diffused early pattern of agriculture, pottery and mound building. It was followed by a period in which people were less sedentary and more loosely organized. This late Woodland culture depended on hunting to a greater extent and agriculture was limited. The pottery was likewise simpler and may reflect northern influences. It has been suggested that Algonkian-speaking peoples were responsible at least in part for this culture pattern. Still later, from about A.D. 1200 into early historic times, populations in the bottom lands of the Mississippi river and its tributaries developed a highly sedentary culture built around maize agriculture and large pyramidal temple mounds. This Middle

Mississippi pattern probably developed in the southeast and spread northward. It shows many suggestions of direct or indirect influence from Middle America, particularly in art forms. The Muskogean-speaking peoples among others are thought to be identified with this culture complex, and temple mound sites were still occupied at Hernando de Soto's last expedition in the 1540s.

As these eastern cultures flourished they extended their influences northward and westward, and movements of people were partly responsible for the diffusion. The Plains in this manner absorbed and adapted many traits from the east.

12. Plains Area.—The underlying pattern in the Plains, as elsewhere in aboriginal North America, was that of a hunting culture. In the High Plains the basic material was identified as Folsom (Lindenmeier site). A somewhat later level of occupation (*c.* 3000 B.C.) occurred at Signal Butte in western Nebraska, but this too was a hunting, prepottery culture. By about A.D. 1000 a less nomadic, though still primarily hunting, economy appeared in the Nebraska region, along with rude, grit-tempered pottery. Agriculture may have been limited to squash and gourds, as neither beans nor maize was found. The tools and other remains are similar to the Woodland traits of the eastern area. Evidences of this stage of culture are found in numerous sites in Nebraska, Iowa, Missouri, Kansas and (less certainly) Oklahoma. Scattered pottery remnants indicating Woodland influence have been found as far west as Colorado and the Yellowstone river, though the greatest concentration is east of the Missouri river.

Later, but still prior to Columbus' voyages, a second wave of people moved into the plains, again probably from the east. Traces of this second migration are widely dispersed, suggesting a fairly long interval of settlement. By this time horticulture including maize and beans had become the principal means of subsistence. Permanent buildings occur; the house type was a rectangular, semi-subterranean, earth-covered lodge. Pottery was abundant and better made than in the previous stage. Decoration was confined to incised lines around the neck or rim. Regional variations have been found and identified by local place names. The first to be studied was the Upper Republican (river) culture in southern Nebraska and related sites on the Loup river in central Nebraska. Characteristic small villages were built in the open along river terraces with 50 to 100 inhabitants. Agricultural tools consisted of planting-sticks and hoes made from the shoulder blades of bison. Surplus corn was stored in underground pits. Complete absence of the metate, or grinding slab, of the southwest suggests that maize was milled in a wooden mortar. Hunting was not abandoned since weapons and skin-working tools are still found. Various sites in Kansas yield artifacts that closely parallel the Upper Republican material, traces of which are found as far away as the Texas panhandle, eastern Colorado and Wyoming, and perhaps the Dakotas. A further variant, found in the Missouri river bluffs of eastern Nebraska and northeastern Kansas, is designated the Nebraska culture. No basic differences occur, but the sites yield a richer array of pottery types, ornamentation and tools. Cannibalism may have been practised, though the evidence is not conclusive. The inference is that Upper Republican and Nebraska were both regional specializations of a generalized culture that had spread over a rather wide area.

One possible route of diffusion from the southeast into the plains was through the Natchez (*q.v.*) people on the lower Mississippi and Caddo rivers and affiliated tribes along the Red river in Texas. Near there also were the related Pawnee and their affiliates, the Arikara, who in historic times drifted northward and became associated with the Mandan in North Dakota. The Red River pattern was based on agriculture. The pottery was excellent in design and finish, with intricate patterns of broad and fine incised lines. Tempering to ensure evenness of firing was accomplished by adding grit, sand, crushed shells and other materials. Villages abounded, composed of such domed circular houses made of thatch as Coronado reported seeing in Kansas. This basic house type eventually spread throughout the central and northern plains, though brush and earth were substituted as a covering away from regions where palmetto, reeds or other thatching material grew. This inferred route finds some confirmation near the mouth of the Platte river in northwestern Missouri. There, in association with house types resembling those of the Nebraska culture, were found quantities of pottery shards in which shell tempering was used, instead of grit or crushed rock as was used in the Nebraska and Upper Republican cultures.

Europeans entered the plains area in 1541 when Coronado marched from Pecos Pueblo (east of the Rio Grande) into the region near modern Wichita, Kan. The party reported meeting two types of native: one nomadic (possibly Apache), and the other dwelling in villages of round straw houses and raising maize, beans and melons. The latter were probably Wichita Indians, of Caddoan linguistic stock. Following that initial contact the plains remained relatively obscure, and Europeans were not aware of the profound changes and movements that took place. The acquisition of the domesticated horse in the decades following establishment of a permanent Spanish outpost in Santa Fe, N.M., in 1598 was responsible for the major displacements, though intruders from outlying regions supplied the initial incentive to move and to consolidate. Large villages, occupying up to 100 ac., had come into existence on the Loup and Platte rivers in east central Nebraska before horses were domesticated. These villages were on river bluffs for defensive purposes, and their inhabitants were probably ancestors of the modern Pawnee. Other concentrations took place in central Kansas and in the westward extensions of the Oneota culture (identified with Chiwere Sioux) that moved from the Wisconsin area into eastern Nebraska, Kansas and southwestern Missouri.

The horse inevitably speeded up the process and in many cases brought about complete abandonment of earlier pursuits. Thus, the Comanche and Kiowa (*qq.v.*) erupting out of the northwest at the beginning of the 18th century as mounted horsemen, started dislocations of sedentary tribes and European settlers alike. The Cheyenne and Arapaho (*qq.v.*), abandoning earth-covered lodges in Minnesota and North Dakota, gave up horticulture about 1750. Behind them, possibly crowding these two tribes into the northern plains, were various bands of Dakota (Sioux) who had also been living a sedentary village existence. They in their turn had been dislodged from the Great Lakes region by Chippewa Indians, who earlier had obtained European firearms from the French. Thus, most earlier tribes thought by Europeans to be typical nomadic, horse Indians were newcomers to the area and in some cases had been farmers and village dwellers not many generations before their first European contacts. Still other tribes, starting from a tradition of agriculture, made a kind of unhappy compromise with the changed conditions. Among these were the Pawnee and their kinsmen the Arikara, and the Siouan-speaking Mandan, Santee, Omaha and Oto. The tribes that apparently took to the horse culture with the greatest alacrity were those that came into the plains as northern hunters: the Blackfoot, Gros Ventres, Sarsi, Assiniboin, Comanche and Kiowa.

IV. RELIGION AND THE ARTS

1. Native Arts and Crafts.—Arts and crafts failed to reach the level north of Mexico that they did in Central America or the Andean area. The ceramic arts, textiles and basketry, metalworking and sculpture in stone or wood for the most part were utilitarian in pre-Columbian times and only occasionally rose to a high level of styling or technical perfection. Handmade pottery was widespread; decorative techniques mainly involved incising or painting, though a crude glaze was developed in the southwest about A.D. 1300. Southwest design also was the most distinctive; painting and geometrical forms dominated until the 13th and 14th centuries when a naturalistic style developed in the Mimbres region and later among the Hopi pueblos. A great variety of shapes and decoration was also present in the southeast and Ohio valley.

In the 1960s pottery making was maintained or revived for sale to tourists. Maria and Julian Martinez of San Ildefonso pueblo near Santa Fe, N.M., became world-famous for their decorated blackware pottery; and Nampeyo, a Hano potter, became equally famous for her singlehanded revival of Hopi Sikyatki yellowware. Their successors and imitators were enjoying a flourishing business.

The textile arts, weaving and basketry, show a parallel develop-

ment. Weaving was largely utilitarian; on the northwest coast the Chilkat blanket, finger-woven on a crude loom out of cedar bark and animal hair, was famous mainly for its designs. In the southwest native cotton was woven on portable looms and decorated by embroidery or painting. Basketry reached its highest perfection among the Indians of California and the plateau. Pomo women are acknowledged to have been the most skilful basket-makers, weaving both large and small baskets with a variety of techniques and decoration. Often the designs were outlined by feathers incorporated during weaving. The introduction of metal containers led to the decline of basketry, except where it has been revived or maintained for sale to tourists and others.

Carving in stone or bone occurs sporadically in North America, but a high degree of skill was reached only among the Eskimos and the Indians of the northwest coast. The Eskimos specialized in animal forms while their northwest coast neighbours also carved faces and masks. Carving in wood reached a high level of development among the Indians of the northwest coast, particularly after the 18th and 19th centuries. The famous totem poles are only one aspect of elaborate decoration in wood that involved animal and ancestral figures in highly stylized representations. (*See* IVORY CARVING: *North America.*)

Metalwork was limited to a few regions in pre-European times. In the Lake Superior region deposits of free copper were early used for implements, and at a later period the Hopewell people extensively made copper ornaments and weapons, but these were produced by cold hammering. A few copper bells also have been found in Arizona Hohokam sites but were probably manufactured in Mexico.

Europeans introduced metal ornaments to many tribes and in recent times silverworking on a large scale developed, especially among the Navaho and Pueblo tribes of the southwest. Generally silver is combined with such materials as turquoise for ornaments like bracelets, necklaces and brooches. Modern tools are used and many of the products have won prizes for excellence of design.

The use of dry painting or sand painting for altars is an old observance among the Pueblo Indians. The Navaho long ago borrowed the practice for their curing ceremonies and raised sand painting to a high artistic level. But custom requires the paintings to be destroyed at the end of rituals and few have survived, though accurate copies are available. The introduction of modern materials for painting led to the development of a number of Indian artists, particularly among the Pueblo and Navaho and also in the Plains. The subjects are primarily native life and ritual, but a few artists developed individual styles and subject matter.

Much of the credit for the revival of Indian arts and crafts must go to the Indian arts and crafts board established by the U.S. department of the interior in the mid-1930s. Through the efforts of the board and its staff, standards were raised, credit was made available and outlets for sale were established. The work has been of sufficient excellence and originality to attract world-wide competition and imitation.

2. Music and Dancing.—The study of aboriginal North American music and dancing was greatly handicapped by the relative lack of trained musicologists and choreographers, and by the rapid acculturation that took place in most areas. The situation improved with the development of modern recording devices and notational systems.

American Indian music was vocal rather than instrumental, with drums and rattles used mainly as accompaniment for singing during ceremonies or dancing. A variety of scales were in use, and such techniques as rhythmic pulsation of the voice were a common feature. Some groups, such as the Navaho, characteristically sang in falsetto; harmony was lacking, as in most primitive music, but rhythms were well marked and important. Although the words of the songs were sometimes meaningful they were often nonsense syllables.

Aboriginal musical instruments north of Mexico were primarily the drum and the rattle, though wooden rasps, made from notched sticks and rubbed with an animal's shoulder blade, were still used in the pueblos and elsewhere. Drum forms varied from the tambourine in the north (related to Asiatic forms) to the single-headed water-tuned drum in the east and the double-headed wooden drum of the southwest. Rattles in agricultural areas were made of gourds; elsewhere of wood or rawhide. Stringed instruments were generally absent when Europeans arrived (with the possible exception of the musical bow) though they spread rapidly after contact.

Individual and group singing flourished, with both men and women participating in many tribes. Group singing was largely restricted to ceremonies or dances held in connection with such events as calendric rituals; individual singing was both sacred and secular. The Navahos, in conducting their elaborate curing ceremonies, still sing many songs over the patient in hope of supernatural assistance; in riding across country they will also sing for pleasure.

The use of nonsense syllables in songs facilitates borrowing by neighbouring tribes and probably accounts for the unity of song styles over wide areas. Thus the eastern woodlands, plains, southwestern pueblos, and northwest coast regions each seems to have had a distinctive musical style, though additional research is necessary to delineate them in detail.

Dance forms in aboriginal Indian culture varied considerably, but early descriptions are not technical enough to permit their reconstruction. War dances, both before and after combat, were widespread, as were dances mimetic of mammals or birds. In the Pueblos aboriginal patterns of dancing survive in the Kachina dances, where masked and elaborately costumed figures representing spirits dance hour after hour in strongly controlled and rhythmic tempo. Plains dancing, by contrast, is more individualistic and may increase in tempo as excitement rises.

In many areas dancing was associated with secret societies, either in terms of initiation or display. On the northwest coast dancers masked as giant birds or other supernaturals; in the plateau they often identified with the owl or blue jay. In California wealth-displaying dances symbolized the prestige positions in the society, while among the Iroquois the dance groups represented the moieties on certain occasions.

In recent times the conditions of acculturation on U.S. and Canadian Indian reservations has reduced the variety of dances but diffused certain types very widely. The eastern woodlands-plains type of "stomp" dancing forms the basis for the modern type of Indian dancing seen at powwows and other secular celebrations. Oklahoma seems to have been the major centre for the development and spread of this style. There war dances, buffalo dances, eagle dances and many others are all performed with the same fast step, though gestures, costumes, and other details may vary (*see* SUN DANCE; DANCE, PRIMITIVE).

3. Religion and Mythology.—A great variety of religious practices and beliefs are found among Indians north of Mexico. In part these fall into regional patterns and are affected by ecological conditions and subsistence practices, but they also have been affected by diffusion from outside. Perhaps the most widespread characteristic of aboriginal North American religion is its close relation to the world of nature. Animals and other aspects of nature are frequently personified and given human characteristics. The creation of the world and various later transformations are explained in human terms in the mythology. Individuals secure power from guardian spirits in the guise of animals or birds, and social groups often develop special relations with animal or plant species (*see* TOTEMISM).

The major deities are usually associated with the sky and are seldom hierarchically arranged. The sun is an important deity among the Pueblos, on the northwest coast, in the plains and southeast, among other regions. Culture heroes and tricksters, such as the coyote, are given divine status. Supernaturals such as the thunderbird and the horned serpent are objects of belief in certain areas. The most widespread practice is for individuals who hope to secure a guardian spirit to fast and pray alone in the forest or mountains. Such spirits, coming in a vision, are said usually to promise aid in such emergencies as war or illness and frequently to teach the suppliant a song to sing on such occasions.

Religious functionaries are primarily shamans or priests (*see*

SHAMANISM). The shaman is found primarily in the hunting and gathering cultures in the north and west and is related to his Siberian counterpart. He is said generally to secure his powers from several guardian spirits and to employ them primarily for the curing of illness. In agricultural tribes with calendric rituals and a more elaborate religious system, the ceremonies are more standardized and are usually in the hands of a body of priests who learn their roles as apprentices. Thus the Zuñi and Hopi Pueblos in the southwest have an elaborate priestly organization and spend much of their time in ceremonial activity. The transition from shaman to priest can sometimes be observed as in the case of the Central Algonkian tribes where shamans were organized into a lodge with several degrees. This group had an annual ceremony involving the Midewiwin (grand medicine society) in which each member demonstrated his prowess. New members were selected when an incumbent, usually a member of the same family, died or retired. Each priest had a medicine bundle containing sacred objects. These bundles are widespread, and in some areas the resident powers can be bought and sold.

Mythology and folklore in North America has often been studied apart from ritual so that their close relationship has not always been appreciated. Myth motifs have been studied in terms of their distribution and dissemination for the most part (*see* FOLKLORE [AMERICAN INDIAN]), and it is clear that myth elements have spread widely. But in each region the particular combination is more than the chance meeting of diffused elements.

Mythology essentially furnishes an explanation of the world, its beginnings and present state, and encompasses the major values and teachings of the society. As such the major myths are frequently dramatized in the ceremonial calendar, and the songs and dances performed represent the "original" forms when the society was new. Thus the Pueblo rituals dramatize the mythological emergence of the people from the underworld and represent the teachings of ancestors as to the proper way to live. In the plains the sun dance dramatizes the unity of the tribe and the fertility of man and nature necessary for its survival. *See* MYTHOLOGY, PRIMITIVE.

V. INDIANS IN CONTEMPORARY LIFE

The great diversity that marked Indian cultures persisted in modern times. Some tribes disappeared by amalgamation with others, or by wars and epidemics, and some languages perished. The process of acculturation (*q.v.*) worked at varying rates within the Indian societies, transforming and devitalizing segments of custom and practice. Notwithstanding these factors, Indian populations north of Mexico continued to manifest an unexpected viability. It is estimated that more than half the languages spoken in that area at the time of discovery were still in use in the 20th century (*see* Table II).

A discussion of contemporary Indian population is complicated by lack of a consistent definition of the term "Indian," a condition that prevails throughout the western hemisphere. In the U.S. a person is commonly classified as an Indian if he is an enrolled member of an Indian tribe or a descendant of such an enrolled member and recognized by the tribe, regardless of degree of Indian blood. The situation in Canada is basically similar. In both countries many persons of varying degrees of Indian ancestry are not counted as Indians because they are not affiliated with a tribe. The U.S. government in 1950 recognized as Indians approximately 400,000 persons in the 48 states and an additional 35,000 Indians, Eskimos and Aleuts in Alaska. In the U.S. census of 1960, with 50 states in the union, more than 523,000 persons were counted as Indians. In Canada the 1950 estimate, including Eskimos, was about 140,000. By 1961 this figure had risen to more than 185,000. The population of Greenland, more than 25,000 in the 1960s, is predominantly Eskimo, with a European component of about 5%. The Indian population north of Mexico at mid-century was approximately one-half what it was at the time of the first European contacts. In the U.S. at least, this population was increasing faster than the general population. It is not possible, obviously, to state in quantitative terms the extent to which Indian attitudes, customs or values had continued to function. Neither is it possible to deny the existence of attitudes, customs and values identifiably Indian after the lapse of several centuries. It is clear that American Indians are not a vanishing race as was once thought.

The modern position occupied by Indians in the U.S. and Canada is not readily understood without some explanation of prior events. In both countries Indians are considered wards of the nation but not in terms of the usual relations of guardian and ward. In the U.S., for instance, Indians are full citizens and may vote in every state of the union. In Canada individual Indians may be enfranchised by meeting certain legal requirements, and many have taken advantage of the opportunity.

The beginnings of the relationship are found in some of the early colonial pronouncements of the Spanish crown. The discovery of the continents in the western hemisphere was an unforeseen event. Europe was quite unprepared for the problem of admitting into world society a human population not previously known. Questions were raised as to whether these people had the capacity to govern themselves or to own property.

Luckily for the new world inhabitants the questions fell to the Spanish theologian Francisco de Vitoria to answer. His lectures, delivered at the University of Salamanca in 1539, voiced a humanistic view of conquest and the rights of subject peoples that in time became the prevailing view in international law. More immediately, his opinion was reflected in the Laws of the Indies (1542) decreeing that Indians were free and not to be taken as slaves; that disputes among Indians should be settled according to their own customs; that property should not be taken from them except in fair trade. Vitoria denied that either the emperor of Spain or the pope was lord of the universe; even if they were, it would still not deny Indians the right to hold property. He reasoned that if Spain must administer on behalf of the Indians because of their lack of intelligence and experience, the administration must be temporary, until Indians were capable of governing themselves, and the administrator must work, not for his own profit, but for the welfare of the Indians. This, in essence, could be the justification given by the modern administrator of Indian affairs.

It does not detract from the importance of Vitoria to note that Spain in pursuing its colonial aims ignored him and the Laws of the Indies as well. Reformers such as Bartolome de las Casas made the world aware of the wrongs visited upon the Indians. In time a large part of western Europe was enthralled by the concept of the "Noble Savage," a phrase evidently first used by John Dryden in his *Conquest of Granada*. The moral views of such men as Vitoria in the Spanish world and William Penn and others in the English sphere were safeguards that in time brought public policy to erect barriers against racial injustice.

1. Colonial Policies.—The formulation of public policy was of concern to the major European colonizing powers. The Spanish tried assiduously to Christianize the natives and to remake their living patterns. Orders were issued to congregate scattered Indian villages in orderly, well-placed centres, assuring the Indians at the same time that by moving to such centres they would not lose their outlying lands. This was the first attempt to create Indian reservations. The promise failed to protect Indian land, according to the Franciscan monk and historian of Mexico, Juan de Torquemada, who reported about 1599 that there was hardly "a palm of land" that the Spaniards had not taken. Many Indians who did not join the congregations for fear of losing what they owned fled to remote mountain places and lost their lands anyway.

The Russians never seriously undertook colonization in the new world. When Peter the Great sent Vitus Jonassen Bering into the northern sea that bears his name, interest was in scientific discovery, not overseas territory. Later, when the problem of protecting and perhaps expanding Russian occupation was placed before Catherine II, she declared (1769): "It is for traders to traffic where they please. I will furnish neither men, nor ships, nor money, and I renounce forever all lands and possessions in the East Indies and in America." In keeping with her thinking that it was "for traders to barter and for kings to govern," Catherine granted monopolistic trading privileges to the Russian American company, and the Russian government never thereafter seriously reconsidered its position.

The Swedish and Dutch attempts at colonization were so brief that neither left a strong imprint on new world practices. The Dutch government, however, was probably the first (1643) of the European powers to enter into a formal treaty with an Indian tribe, the Mohawk (*q.v.*). Thus began a relationship, inherited by the British, that contributed to the ascendancy of the English over the French in North America.

France handicapped its colonial venture by transporting to the new world a modified feudal system of land tenure that discouraged permanent settlement. The first royal commission, issued to the marquis de la Roche in 1598, recited: "We have given him power to grant lands . . . to gentlemen and to those whom he shall consider persons of merit, in the form of fiefs, seigniories, chatellenies, countships . . . and other dignities." The first effort failed entirely, and while permanent establishment of the French in North America was effected by Samuel de Champlain in 1608, he is said to have issued only three seigniorial grants in the succeeding 20 years. Throughout the period of French occupation, emphasis was on trade rather than on land acquisition and development. So general was the failure of holders of large grants to encourage development that royal orders were issued in 1711 to provide that "at the expiration of a year, all seigniors who have shown conspicuous failure in developing and settling their seigniories should be deprived of their grants." Thus France, by trying unsuccessfully to transplant a system of land tenure that was falling out of use in Europe, made no contribution to the formulation of an aboriginal land policy.

French administration did, however, establish practices in trade relations with the various tribes. The French instituted the custom of inviting the headmen of all tribes with which they carried on trade to come once a year to Montreal, where the governor of Canada gave out presents and talked of friendship. The governor of Louisiana met southern Indians at Mobile. The English, reluctantly, found themselves competing on the same basis with annual gifts. Still later, U.S. peace commissioners were to offer permanent annuities in exchange for tribal concessions of land or other interests.

English colonies along the Atlantic seaboard were a threat to continued Indian occupation of the area. Realization of this fact led King Philip, the Wampanoag leader, to his death in a vain attempt to annihilate northern colonists in 1675. The English were interested in land and permanent settlements; at the same time, beginning quite early in their occupation, they felt an obligation to bargain with the Indians and to conclude formal agreements with compensation to Indian owners. The Plymouth settlers, coming without royal sanction, thought it incumbent upon them to make terms with the Massachusetts Indians. The 3rd Lord Baltimore in 1635 and William Penn in 1682, while possessing royal grants, nevertheless took pains to purchase occupancy rights from the Indians. It became the practice of most of the colonies to prohibit indiscriminate and unauthorized appropriation of Indian land. The usual requirement was that purchases could be consummated only by agreement with the tribal headman, followed by approval of the governor or other official of the colony. At an early date also, specific areas were set aside for exclusive Indian use. Virginia in 1656 and commissioners for the United Colonies in 1658 agreed to the creation of such reserved areas. Plymouth Colony in 1685 designated for individual Indians separate tracts that could not be alienated without their consent.

2. Proclamation of 1763.—In spite of these efforts by the separate colonies and English ministers to protect Indian lands, unauthorized entry and use caused constant friction through the colonial period. Rivalry with the French, who lost no opportunity to point out to the Indians how their lands were being encroached upon by the English; the activity of land speculators, who succeeded in obtaining large grants beyond the settled frontiers; and finally the startling success of the Ottawa chief Pontiac in capturing English strongholds in the old northwest as a protest against this westward movement, together prompted the king's ministers to issue a proclamation (1763) that formalized the concept of Indian land titles for the first time in the history of European colonization in the new world. The document prohibited issuance of patents to any lands claimed by a tribe unless the Indian title had first been extinguished by purchase or treaty. The proclamation reserved for the use of the tribes "all the Lands and Territories lying to the Westward of the sources of the Rivers which fall into the Sea from the West and Northwest." Land west of the Appalachians might not be purchased or entered upon by private persons, but purchases might be made in the name of the king or one of the colonies at a council meeting of the Indians.

This policy of quieting title continued up to the termination of British rule and was adopted by the U.S. The Appalachian barrier was soon passed—thousands of settlers crossed the mountains during the American Revolution—but both the Articles of Confederation and the federal constitution reserved either to the president or to congress sole authority in Indian affairs, including authority to extinguish Indian title by treaty. When French dominion in Canada capitulated in 1760, the English announced that "The Savages or Indian Allies of his most Christian Majesty, shall be maintained in the lands they inhabit, if they choose to remain there." Thereafter the proclamation of 1763 applied in Canada and was embodied in the practices of the dominion government. (The British North America act of 1867, that created modern Canada, provided that the parliament of Canada should have exclusive legislative authority with respect to "Indians, and lands reserved for the Indians." Thus both North American countries made control over Indian matters a national concern.)

3. United States Policy.—The first full declaration of U.S. policy was embodied in the Northwest ordinance (1787) that stated: "The utmost good faith shall always be observed towards the Indians, their lands and property shall never be taken from them without their consent; and in their property, rights, and liberty, they shall never be invaded or disturbed, unless in just and lawful wars authorized by congress; but laws founded in justice and humanity shall from time to time be made, for preventing wrongs being done to them, and for preserving peace and friendship with them." This doctrine was embodied in the act of Aug. 7, 1789, as one of the first declarations of the U.S. congress under the constitution.

The final shaping of the legal and political rights of the Indian tribes is found in the opinions of Chief Justice John Marshall (1755–1835) notably in decision in the case of *Worcester* v. *Georgia:* "The Indian nations had always been considered as distinct, independent, political communities, retaining their original natural rights, as the undisputed possessors of the land, from time immemorial . . . The settled doctrine of the law of nations is, that a weaker power does not surrender its independence—its right to self-government—by associating with a stronger, and taking its protection. A weak state, in order to provide for its safety, may place itself under the protection of one more powerful, without stripping itself of the right of government, and ceasing to be a state."

The first major departure from the policy of respecting Indian rights came with the Indian Removal act of May 28, 1830. For the first time the U.S. resorted to coercion, particularly in the cases of the Cherokee and Seminole tribes, as a means of securing compliance. The Removal act was not in itself coercive, since it authorized the president only to negotiate with tribes east of the Mississippi on a basis of payment for their lands; it called for improvements in the east and a grant of land west of the river, to which perpetual title would be attached. In carrying out the law, however, resistance was met with military force. In the decade following, almost the entire population of perhaps 100,000 Indians was moved westward. The episode moved Alexis de Tocqueville to remark in 1831: "Whilst the savages were endeavouring to civilize themselves, the Europeans continued to surround them on every side, and to confine them within narrower limits . . . and the Indians have been ruined by a competition which they had not the means of sustaining. They were isolated in their own country, and their race only constituted a little colony of troublesome strangers in the midst of a numerous and dominant people."

The territory west of the Mississippi, it turned out, was not so remote as had been supposed. The discovery of gold in California (1848) started a new sequence of treaties, designed to extinguish

Indian title to lands lying in the path of the overland routes to the Pacific. The sudden surge of thousands of wagon trains through the last of the Indian country and the consequent slaughtering of prairie and mountain game that provided subsistence for the Indians brought on the most serious Indian wars the country had experienced. For three decades, beginning in the 1850s, raids and sporadic pitched fighting took place up and down the western plains, highlighted by such incidents as the Custer massacre by Sioux and Cheyenne Indians (1876), the Nez Percé Chief Joseph's running battle in the same year against superior U.S. army forces and the Chiricahua Geronimo's long duel with authorities in the southwest, resulting in his capture and imprisonment in 1887.

Toward the close of that period, the Ghost Dance (*q.v.*) religion, arising out of the dream revelations of a young Paiute Indian, Wovoka, promised the Indians a return to the old life and reunion with their departed kinsmen. The songs and ceremonies born of this revelation swept across the northern plains. The movement came to an abrupt end Dec. 29, 1890, at Wounded Knee creek, S.D. Believing that the Ghost Dance was disturbing an uneasy peace, government agents moved to arrest ringleaders. Sitting Bull was killed (Dec. 15) while being taken into custody, and two weeks later units of the U.S. 7th cavalry shot down more than 200 men, women and children who had already agreed to return to their homes.

A further major shift of policy had occurred in 1871 after congressional discussions lasting several years. The president, with the advice and consent of the senate, had continued to make treaties with the Indian tribes and to commit the U.S. to the payment of sums of money. The lower house protested, since a number of congressmen had come to the view that treaties with Indian tribes were an absurdity (a view earlier held by Andrew Jackson). The senate yielded, and the act of March 3, 1871, declared that "hereafter no Indian nation or tribe" would be recognized "as an independent power with whom the United States may contract by treaty." Indian affairs were brought under the legislative control of the congress to an extent that had not been attempted previously. Tribal authority with respect to criminal offenses committed by members within the tribe was reduced to the extent that murder and other major crimes were placed under the jurisdiction of the federal courts.

4. The Allotment Act.—The most radical undertaking of the new legislative policy was the General Allotment, or Dawes Severalty, act of 1887. By that time the Indian tribes had been moved out of the main streams of traffic and were settled on lands they had chosen out of the larger areas they had formerly occupied. Their choice in most cases had been confirmed by treaty, agreement, act of congress or executive order of the president. The tribes that lived by hunting over wide areas found reservation confinement a threat to their existence. Generally they had insisted on annuity payments or rations, or both, and the peace commissioners in behalf of the U.S. had been willing to offer such a price in return for important land cessions. In time the view came to be held that reservation life fostered indolence and perpetuated customs and attitudes that held Indians back from assimilation. The strategy offered by proponents of this theory was the Allotment act authorizing the president to divide the reservations into individual parcels and to give every Indian, whether he wanted it or not, a particular piece of the tribally owned land. In order not to make the transition too abrupt, the land would be held in trust for a period of 25 years, after which a patent in fee simple would devolve upon the individual. With it would go all the rights and duties of citizenship. Reservation land remaining after all living members of the tribes had been provided with allotments was declared surplus, and the president was authorized to open it for entry by non-Indian homesteaders, the Indians being paid the homestead price.

A total of 118 reservations was allotted in this manner, but the result was not what had been anticipated. Through the alienation of surplus lands (making no allowance for children yet to be born) and through patenting of individual holdings, the Indians lost 86,000,000 ac. out of a total of 138,000,000 in Indian ownership prior to 1887. A generation of landless Indians resulted, with no vocational training to relieve them of dependence upon land. The strategy also failed in that ownership of land did not effect an automatic acculturation in those Indians who received individual parcels. Through scattering of individuals and families, moreover, social cohesiveness tended to break down. The result was a weakening of native institutions and cultural practices with nothing offered in substitution. What was intended as transition proved to be a blind alley.

Indian population had been dwindling through the decades after mid-19th century. The California Indians alone, according to Mooney's estimates, dropped from 100,000 in 1853 to not more than 30,000 in 1864 and 19,000 in 1906. Cholera in the central plains in 1849 struck the Pawnee. As late as 1870–71 an epidemic of smallpox brought disaster to the Blackfoot, Assiniboin and Cree. These events gave currency to the concept of the Indian as "The Vanishing American." The decision of 1871 to discontinue treaty-making and the Allotment act of 1887 were both founded in the belief that the Indians would not survive and hence it did not much matter whether their views were sought in advance of legislation or whether lands were provided for coming generations. When it became obvious after about 1920 that the Indians, whose numbers had remained static for several years, were surely increasing, the U.S. was without a policy for advancing the interests of a living people.

A survey in 1926 brought into clear focus the failings of the previous 40 years. The investigators found most Indians "extremely poor," in bad health, without education and lacking adjustment to the dominant culture around them. Under the impetus of these findings and other pressures for reform congress adopted the Indian Reorganization act of 1934, that contemplated an orderly decrease of federal control and a concomitant increase of Indian self-government and responsibility.

The essentials of the new law were as follows: (1) allotment of tribal lands was prohibited in the future, but tribes might assign use rights to individuals; (2) so-called surplus lands not preempted by homesteaders might be returned to the tribes; (3) tribes might adopt written constitutions and charters of incorporation embodying their continuing inherent powers to manage internal affairs; and (4) funds were authorized for the establishment of a revolving credit program, for land purchases, for educational assistance and for aiding the tribes in forming organizations. Moreover, the act could be rejected on any reservation by referendum.

The response of the Indian population to the 1934 act was indicative of their ability to rise above adversity. About 160 tribes, bands and Alaska villages adopted written constitutions, some of which combined traditional practices with modern parliamentary methods. The revolving credit fund helped Indians build up their herds and improve their economic position in many other ways. Beef cattle owned by Indians increased from about 170,000 head in 1932 to about 390,000 head in less than 20 years, the number fluctuating with the market. On a number of reservations the capacity of the land was reached, or passed, and no further increase was possible. It was estimated that about 12,000 Indian families were wholly or partly rehabilitated. The repayment record was especially outstanding. Borrowers from the fund were tribal corporations, credit associations and co-operative groups that loaned to individual Indians and to group enterprises on a multimillion-dollar scale.

Land purchase funds authorized by the 1934 act were used to buy 395,500 ac., and tribes used their own funds to acquire an additional 390,000 ac. By other means, such as the restoration of unentered Indian lands and the transfer of parcels of public domain, Indian holdings were increased by an additional 3,000,000 ac.

In education and health, increased professionalization of staffs, improved methods, modernization of plants and larger operating funds resulted in services more nearly comparable with those available to the general U.S. population. In these fields especially, one of the outstanding developments was the extent to which other agencies began serving the Indian population. Thus, at mid-century, more than half of all Indian children in school were attending public schools, under contract arrangements by which the federal government compensated the school district (because of

loss of revenue from tax-exempt Indian lands). Many contracts were made with private and public institutions for medical and hospital care and public health work. The bureau of Indian affairs completed an arrangement with the U.S. public health service to supply expert medical personnel and consultants.

Originally the U.S. exercised no guardianship over the person of the Indian; after 1871, when internal tribal matters became the subject of national legislation, the number and variety of regulatory measures multiplied rapidly. In the same year that the Indian Reorganization act was passed, congress significantly repealed 12 statutes that had made it possible to hold Indians virtual prisoners on their reservations. Indians were then able to come and go as freely as all other persons. The act of June 15, 1924, extending citizenship to all Indians born in the U.S., opened the door to full participation. Few Indians took advantage of the law, and because of their lack of interest a number of states excluded Indians from the franchise. Organization of tribal governments following the Reorganization act seemed to awaken an interest in civic affairs beyond tribal boundaries, and as Indians asked for the franchise, state officials usually found that an order by the governor or an opinion of the attorney general was sufficient to reverse prior interpretations. In only two states, Arizona and New Mexico, was court action necessary, with decisions favouring the Indians in 1948.

The courts of the U.S. consistently upheld the treaties made with Indian tribes, and also held that property may not be taken from Indians, whether or not a treaty exists, "except in fair trade," as Vitoria had maintained in 1539. The latter contention was offered by the Walapai Indians against the Sante Fe railroad. The company was required by the courts in 1944 to relinquish about 500,000 ac. it thought had been granted to it by the U.S. The lands had been occupied since prehistory by the Indians, without benefit of treaty recognition, and the supreme court held that, if the occupancy could be proved, as it subsequently was, the Indians were entitled to have their lands restored. In 1950 the Ute Indians of Utah and Colorado were awarded a judgment against the U.S. of $31,750,000 for lands taken without adequate compensation where the land had previously been recognized and defined in a treaty.

Indian tribes were long precluded from bringing action against the U.S. unless congress approved in a special jurisdictional act. This procedure resulted in so burdening the Indian affairs committees of house and senate with requests for separate bills, some of which remained on legislative calendars year after year, that a special Indian Claims commission was created by the act of Aug. 13, 1946. This legislation provided that all tribes must file their petitions within five years, and the commission must reach a finding on all cases filed with it in another five-year period. Awards on claims against the U.S. by the Indian Claims commission in the 1960s included about $14,789,000 to the Cherokee nation, $10,242,000 to the Crow tribe, $3,650,000 to the Snake-Paiute of Oregon and $3,000,000 to the Nez Percé. A large number of other tribes filed claims, the aggregate area amounting to more than the present size of the U.S.

With the election of Pres. Dwight D. Eisenhower in 1952, the department of the interior shifted its policy to one of termination of federal control over Indians and reservations. It was recognized that some groups were not yet ready to look after their own affairs, but others such as the Menomini of Wisconsin, the Klamath Indians of Oregon and the Utes of Utah were deemed ready, and were released from federal trust supervision in 1961. The termination program was coupled with aid in relocation of Indians to cities where jobs were available and with an intensified education program on the reservation and in off-reservation schools. The Navaho tribe, for example, was finally provided with adequate elementary schooling for its extensive reservation in Arizona and New Mexico. Initially efforts were made to force termination at too rapid a pace, but protests from both Indian groups and their fellow citizens modified the policy. New organizations, such as the Congress of American Indians, have arisen with authority to speak for the various tribal groups, and for almost the first time in U.S. history Indians were taking an active role in deciding their own futures.

On Sept. 26, 1961, Philleo Nash was sworn in as U.S. commissioner of Indian affairs, the first trained anthropologist ever to hold that position. His appointment by Pres. John F. Kennedy marked a sharp change from the policy under Eisenhower in which the government energetically had worked for termination of all federal responsibility for the Indians as a group apart from other U.S. citizens. The new policy was summarized by Secretary of the Interior Stewart Udall at Nash's swearing-in ceremony when he said: "Give the Indians proper development and growth on their own lands and termination will take care of itself."

See also references under "Indian, North American" in the Index. Discussions of aboriginal peoples may also be found in many articles including NORTH AMERICA and those dealing with specific geographic areas on that continent.

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INDIANA, one of the middle western states of the United States, is popularly known as the "Hoosier state," a term of uncertain origin. The second state to be carved out of the Northwest territory, Indiana entered the union as the 19th state on Dec. 11, 1816. The state capital is Indianapolis. Indiana is bounded on the north by Michigan and Lake Michigan, on the east by Ohio, on the south by Kentucky (from which it is separated by the Ohio river) and on the west by Illinois. In size it ranks 38th among the states, its total area being 36,291 sq.mi., of which about 106 sq.mi. is water. The tulip tree has been designated the state's official tree and the peony is the state flower. The state bird is the cardinal. The state flag is blue with a yellow border. In the flag's centre is a torch with six rays extending out from it. In a circle around this design are 13 stars; 5 other stars, representing the first 5 states to be admitted after the original 13, are grouped around the base of the torch. A large star above the flaming torch represents Indiana.

PHYSICAL GEOGRAPHY

Physical Features and Soils.—Indiana is located principally within the east central lowland (approximately between latitude 37° 47′ and 41° 46′ north, and longitude 84° 49′ and 88° 2′ west). Although from the air its surface would appear quite level, the state is actually an undulating plain, which reaches its peak altitude of about 1,250 ft. above sea level in Randolph county, in the east-central area of the state, and its lowest altitude of slightly more than 300 ft. in Posey county where the Ohio and Wabash rivers merge. About 90% of the surface of the state is between 500 and 1,000 ft. above sea level. In general, the surface slopes toward the west, but also toward the south.

Most of Indiana's major rivers flow in a southwesterly direction. The longest river, the Wabash, with a total length of about 475 mi., flows from west-central Ohio northwest, then southwest and south across the state to its junction with the Ohio; it forms much of the boundary between Indiana and Illinois. The principal tributaries of the Wabash are the Salamonie, Mississinewa, Eel, Tippecanoe and White rivers. Of these the White river, with its east and west forks, is the most important. The Whitewater, in southeastern Indiana, is another important river. All of these rivers, as well as the Kankakee, which has its source near South Bend and flows southwest into Illinois and eventually into the Mississippi river, are within the Mississippi basin. Part of northern Indiana, however, is drained by the St. Lawrence-Great Lakes basin; the Maumee, for example, flows northeast from Fort Wayne into Lake Erie and the St. Joseph flows from north-central Indiana into Lake Michigan.

The northern third of the state, with the exception of the sand dunes along Lake Michigan, is a generally rolling area in which the soil is mainly an extremely fertile loam with much humus. The northern region has numerous moraines and lakes of glacial origin. Among the largest and better known lakes are Lake James, Lake Wawasee, Lake Winona, Lake Maxinkuckee, Bass lake, and Lake Shafer.

Most of central Indiana is flat with glaciated soil which is principally a fertile loam. The southern third of the state, most of which was not leveled by the glaciers, has varied surface features. Except for the generally flat Wabash lowlands, next to the Illinois border, the soil is mainly clay which is much less fertile than the soil of central and northern Indiana. The central part of southern Indiana is scenic and hilly country. Southern Indiana has limestone formations which have resulted in sinkholes, lost streams and beautiful caves such as Marengo and Wyandotte, the latter among the most beautiful in the United States. There are also many mineral springs, the best known being those at French Lick and Martinsville.

Climate.—The climate of Indiana is invigorating; there is variety without harsh extremes. The mean annual temperature is about 53° F., varying from 50° in the north to 55° in the south. The coldest months are Dec. and Jan., during which period the mean monthly temperature is about 30°. July and August are the warmest months, at which time the mean monthly temperature is about 75°. The prevailing winds are from the west. The mean annual rainfall is about 40 in., varying from about 35 in. in the north to about 46 in. in the south. The growing season averages approximately 160 days in the north to approximately 180 days in the south.

Plants and Animals.—When the pioneers first arrived in Indiana the greater portion of the state was covered by forests. Oak, hickory, walnut, tulip, butternut, beech, elm, maple, mulberry, cherry, sassafras, sycamore and other trees were common. Important areas, notably in the northwest and around Vincennes, were prairies consisting largely of grasses and reeds. In places prairies and forest were intermingled.

Wild berries, fruits and flowers were abundant in the early days though they were unevenly distributed over the state. Strawberries, blackberries, raspberries, cranberries and huckleberries were gathered by the pioneers, as were grapes, persimmons, apples and plums. Wild flowers were numerous and widely scattered. Among the commonest were marigold, cowslip, sweet william, cyclamen, Indian paintbrush and buttercup. The Indiana dunes along the southern shore of Lake Michigan contained one of the most widely varied natural collections of flora in the world.

There were many kinds of game and fur-bearing animals in the early days, beaver, fox, deer, otter, bear, raccoon, rabbit, squirrel and muskrat being among the most valuable. Among the birds there were pigeons, blue jays, whippoorwills, ducks, geese, turkeys, grouse, quail and other song and game birds.

Some of the native trees, berries, fruits, flowers, animals, fish and birds have disappeared. Most of them remain, however, though in smaller numbers than in the early days.

Parks.—In 1919 the Indiana conservation department was established and the development of the state parks became one of its principal responsibilities. In addition to the parks, this department developed historical memorials, game preserves and sanctuaries, fish hatcheries, state forests and nurseries, and promoted conservation. The oldest state park, McCormick's Creek, was opened near Spencer in Owen county in 1916; later that year Turkey Run state park was opened in Parke county. During the 1920s the following state parks were established: Clifty Falls, overlooking the meandering Ohio river; the Dunes, along the southern shore of Lake Michigan; Pokagon, adjacent to Lake James in northeastern Indiana; Spring Mill in Lawrence county notable for its scenery and restored pioneer village; picturesque Brown County with its rustic surroundings; and Shakamak, which includes parts of Clay, Sullivan and Green counties. Additional parks were added in later years.

The Lincoln Boyhood National memorial at Lincoln City in Spencer county was established on Aug. 13, 1963.

HISTORY

Earliest Inhabitants.—Successive groups of Indians had lived in Indiana before the arrival of Europeans in the 17th century. Some of them were mound builders, and study of their remaining mounds has resulted in an ever-increasing knowledge of the life led by these early inhabitants. They were followed by others before Europeans appeared in Indiana. In 1800 various tribes of Indians lived in the area, the three leading tribes being the Delaware, Potawatomi and Miami; others included the Piankashaw, Kickapoo and Wea. The Indians were dependent upon crops, especially corn and vegetables, as well as upon hunting and fishing for their food. In 1820 most of the Delaware left Indiana for new homes west of the Mississippi. Most of the Potawatomi left during the late 1830s and early 1840s, and most of the Miami during the 1840s. The lesser tribes meanwhile had left the state; individual Indians from various tribes, however, remained in Indiana. In fact, the descendants of some of them still reside there, notably in the upper Wabash valley and along the tributaries of the river.

Exploration and Settlement.—The earliest Europeans to reach Indiana probably were anonymous and unlicensed French fur traders. Their penetration of the area was a part of the larger movement of French fur traders up the St. Lawrence river and into the vast region, rich with furs, including and surrounding the Great Lakes. Doubtless, the fur traders visited northern Indiana in increasing numbers during the last half of the 17th century.

Jesuit and other Roman Catholic missionaries soon followed the fur traders into the interior of North America. Father Claude Jean Allouez, who served the Miami Indians in the valley of the St. Joseph river in Michigan, possibly crossed into northern Indiana during the 1660s. Both trader Louis Jolliet and Father Jacques Marquette may have traversed the southern shore of Lake Michigan soon after their voyage of discovery down the Mississippi in 1673. In Dec. 1679 René Robert Cavalier, sieur de La Salle, and his party used the St. Joseph-Kankakee portage at South Bend in crossing from the Great Lakes to the Mississippi river. Some historians think that a decade earlier La Salle had proceeded from Lake Erie to the Ohio river and then descended this river at least to the falls at Louisville, but this possible early discovery of the southern boundary of Indiana remains doubtful.

The Maumee-Wabash route, with its short portage at Fort Wayne, proved more useful to the French than the St. Joseph-Kankakee route. Between 1700 and 1735 the French had established outposts at Miami (Fort Wayne), Ouiatenon (near Lafayette) and Vincennes. Vincennes became the leading French settlement in Indiana. Although some agriculture was engaged in at these centres, they were mainly outposts in the widely diffused fur empire of France.

Geographical location made Indiana an important link between French interests in the St. Lawrence and Mississippi basins. The portages at South Bend and Fort Wayne were astride the continental divide between these basins. The three centres on the Wabash-Maumee were located on perhaps the most desirable water route between the French colonies of Quebec and Louisiana. The St. Lawrence and Mississippi outlets indeed have always been important to inhabitants of Indiana; the completion of the St. Lawrence seaway in 1959 added to their significance.

During most of the 17th century, distance and the Appalachian barrier deterred conflict between the French colonies and those of the English along the Atlantic seaboard. But during the French and Indian Wars (1689–1763) colonies and trade of both countries expanded as the conflict expanded in scope and intensity. By the treaty of Paris in 1763, most of Canada and all of continental United States east of the Mississippi were ceded to England, and France lost all its mainland possessions. Thus the Indiana area, along with the entire region that soon came to be known as the Old Northwest, passed from France to England.

Most of the Indians had either been neutral or else had sided with the French. Their resentment of the English occupation resulted in Pontiac's War in 1763 during which the English garrisons at Ouiatenon and Miami were taken by the Indians, although the uprising was soon quelled. In the proclamation of 1763 the English reserved the Old Northwest for the Indians and forbade further white settlement, though the French already there were not to be molested. In 1774 parliament passed the Quebec act which annexed the territory to Quebec. This act supported religious freedom and other privileges for the native French, nearly all of whom were Roman Catholic.

Many persons in the English seaboard colonies, especially in Virginia, regarded both the proclamation of 1763 and the Quebec act as contrary to their charter claims to the land as well as to their interests in the fur trade of the region. English occupation of the Old Northwest was nominal; troops were not sent even to Vincennes until 1777. During the American Revolution, forces led by George Rogers Clark (*q.v.*) of Virginia captured Vincennes in 1778. It was recaptured by the English a few months later, but retaken by Clark's forces in Feb. 1779 as a result of Clark's remarkable march from Kaskaskia. (*See* also ILLINOIS: *History;* KENTUCKY: *History.*)

Territorial Period.—By the treaty of Paris of 1783 title to the Old Northwest territory passed from Great Britain to the United States and the first authorized U.S. settlement was made at Clarksville, between the present cities of Jeffersonville and New Albany, at the falls of the Ohio (opposite Louisville), in 1784.

From 1783 until 1816 the Indiana area was a territory of the United States. At first both the United States and several states, especially Virginia, claimed all or part of the territory. The question of who owned the region was soon decided in favour of the United States, which had promised to dispose of it for the common good and eventually to carve from it equal states.

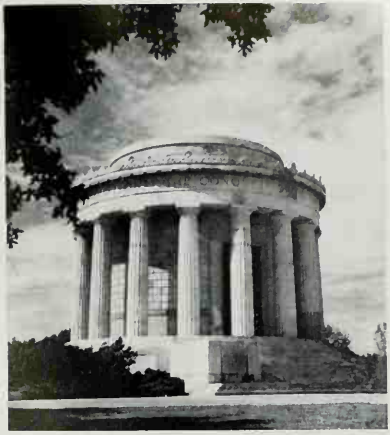
During the 1780s the United States established the following policies which were first tested in Ohio and Indiana: only the federal government was authorized to buy land from the Indians; such land must be surveyed by the federal government before it went on sale; land would be sold only by the federal government but it would be sold to individuals or to companies; and it was illegal to settle on land which belonged to the Indians or the federal government.

Following Clark's conquest of Kaskaskia and Vincennes, Virginia, the principal state claimant to the Old Northwest, organized the county of Illinois to include residents of these and other settlements. But there was little civil government in the region until the ordinance of 1787 became effective. This ordinance promised that 3 to 5 states would be carved out of the territory, and guaranteed new states equality with the original 13. The ordinance required that a territory pass through two successive territorial stages of government and have at least 60,000 residents before it would be eligible for statehood.

The Northwest territory was organized in 1787; the second, or representative, stage of territorial government was organized in 1799. The benefits of this second stage accrued mainly to the residents in the eastern area, which became Ohio. The residents of the remainder of the territory, who were largely French, preferred the return of the first, or nonrepresentative, stage of government. When the Northwest territory was divided in 1800 the larger western area became the Indiana territory and was thus returned to the first stage.

Indian opposition to American encroachments continued during the 1780s when various tribes unsuccessfully attempted to keep American settlers south of the Ohio river. As settlements north of the Ohio increased, Indian resistance stiffened and congress sent various expeditions to break it. Defeats were suffered by Gen. Josiah Harmar in what is now northwestern Ohio and northeastern Indiana (1790) and by Gen. Arthur St. Clair near Ft. Recovery, O. (1791). Stung by these defeats, the United States sent Gen. Anthony Wayne into the area. At Fallen Timbers in northwestern Ohio in 1794 Wayne defeated the Indians, and the next year, by the treaty of Greenville (O.), the greater portion of Ohio and a wedge-shaped slice known as the Gore, located along what was soon to be the Ohio-Indiana boundary, as well as scattered tracts of land were ceded to the United States.

Only about 2,500 whites lived in the present Indiana area in 1800, though about twice that number lived in the Indiana territory which then included nearly all of the present states of Indiana,



Memorial at Vincennes to George Rogers Clark (1752–1818) and his troops, who captured a nearby British fort during the American Revolution

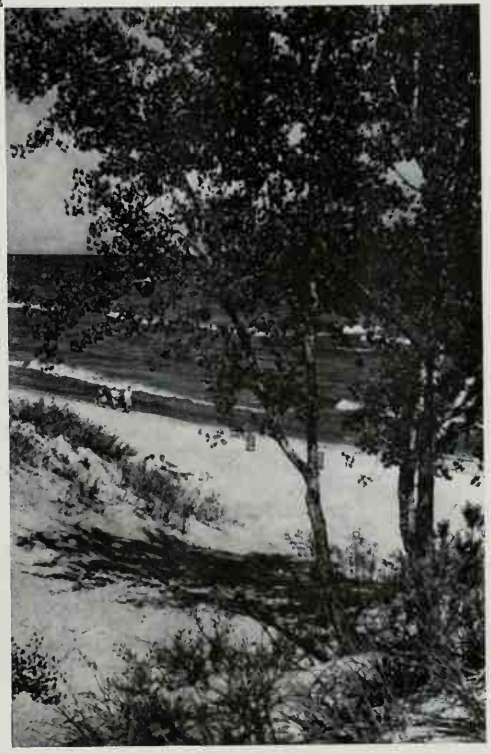
SCENES IN INDIANA

Left: Monument circle, centre of business district of Indianapolis. The 284-ft. monument is dedicated to the veterans of the Civil War

Below: View of the Indiana dunes along the south shore of Lake Michigan

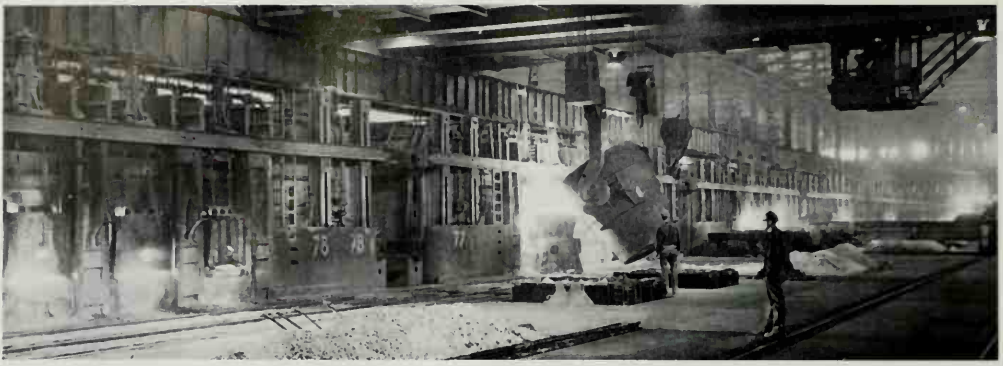
Barges on the Ohio river, southeastern Indiana

Gristmill and flume at Spring Mill State park, near Bedford. In addition to the mill, the park has reconstructions of other buildings used by early settlers of the area

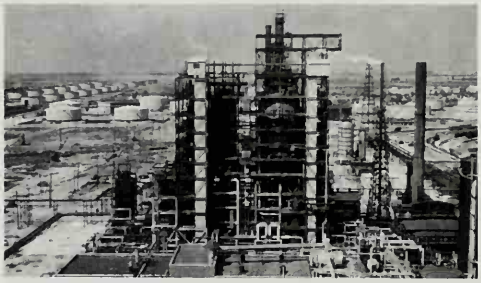


BY COURTESY OF (TOP RIGHT, CENTRE LEFT, BOTTOM RIGHT) INDIANA DEPARTMENT OF CONSERVATION; PHOTOGRAPHS, (TOP LEFT) FAIRCHILD AERIAL SURVEYS, INC., (BOTTOM LEFT) HARTLEY ALLEY

INDIANA



Pouring molten iron into one of the open-hearth furnaces of the U.S. Steel works at Gary. Metal production is the state's leading industry



Cracking unit for the conversion of gas oil into high-octane automobile gasoline at a Whiting refinery, part of the heavy concentration of industry in northern Indiana near the Lake Michigan shore

Cattle auction at a sale barn in Bloomington. Indiana is chiefly a farm state, its total farm receipts ranking among the highest in the nation

Miners packing explosive charges into a gypsum deposit in Martin county. Exploitation of the mineral was one of the post-World War II industrial developments of the state

Cutting and loading limestone at the quarries near Oolitic, southwestern Indiana. A particularly fine grade of rock, Oolitic limestone is shipped to all parts of the U.S. and to foreign markets as well

INDUSTRY AND OTHER ECONOMIC ACTIVITIES OF INDIANA

BY COURTESY OF (TOP) UNITED STATES STEEL CORP., (CENTRE LEFT) STANDARD OIL COMPANY—INDIANA, (BOTTOM LEFT) UNITED STATES GYPSUM COMPANY, (BOTTOM RIGHT) STONE SALES AND SERVICE, INC., PHOTOGRAPH, (CENTRE RIGHT) HARTLEY ALLEY

Illinois and Wisconsin, a part of Minnesota and the western half of Michigan. When Ohio became a state in 1803 the eastern half of Michigan and the Gore were added to Indiana territory. In 1805 a separate Michigan territory was organized and in 1809 Illinois territory was also detached; Indiana's present boundaries were not established, however, until statehood was attained.

Between 1801 and 1809 William Henry Harrison (*q.v.*), as first territorial governor of Indiana, obtained the surrender of Indian claims to approximately the southern third of Indiana and to even more of Illinois. After 1809, under the leadership of the Shawnee Tecumseh (*q.v.*), Indian resistance again stiffened against the advancing Americans. In 1811, however, the Indians were defeated by Harrison at the battle of Tippecanoe, near Lafayette, and in 1814 another treaty of Greenville confirmed the cessions obtained prior to the War of 1812 with Great Britain. By 1815 the Indians had ceased to be a major obstacle to white settlement.

Statehood.—The first general assembly of Indiana territory had convened at Vincennes in 1805. Indiana's population continued to increase, even during the War of 1812, and in 1816 it became the 19th state. In 1813 Corydon, which became the first state capital, had succeeded Vincennes as the territorial capital, and in 1825 Indianapolis became the permanent state capital.

Political democracy in Indiana had increased greatly during the years of territorial government. Membership in the council or upper house of the general assembly had been made elective, as was the office of territorial delegate to congress. Also, the property requirement for voting had been modified so that persons could vote either on the basis of property ownership or by paying a territorial tax.

Pioneer Life and Politics.—The half century from 1800 to 1850 was the pioneer period in Indiana. Settlement moved across the state mainly from south to north, but a large majority of settlers lived in the southern half of the state. The pioneer era was one of beginnings not only of homes, clearings, gardens and farms, but also of newspapers, churches, schools and libraries and of roads, bridges, streets, canals, steamboats, stages, railroads, the telegraph, household industries, trades and crafts, mills and shops. Equally important, the era witnessed the beginnings of town, township and county government, of political parties and party machinery and of state government. Indiana has had two state constitutions, both products of the pioneer era.

The pioneer period was characterized by extreme self-sufficiency and isolation. Not only were Hoosiers largely detached from older parts of the United States, but even neighbourhoods within the state were mainly self-sufficient and isolated from one another. Under these conditions the pioneers established the foundations from which Hoosier life and institutions developed, though they built mainly upon Anglo-Saxon ideas and practices which, like the English language, were an accepted and valued part of their heritage.

One of the more interesting American experiments in communal living flourished at New Harmony (*q.v.*), on the Wabash river in Posey county, a village originally settled by the followers of George Rapp in 1815. Rapp, a German, was a religious ascetic who, with his followers, was interested in forming a community patterned after the primitive Christian church. Remaining in Indiana only about ten years, Rapp sold his holdings to Robert Owen (*q.v.*) of New Lanark, Scot., who interested several well-known scientists in his settlement and with them went to New Harmony in 1826. Although the community had become a failure by 1827, its influence was great. Among the persons who lived at New Harmony were Owen's three sons; William Maclure, founder of the Academy of Natural Sciences in Philadelphia; and Thomas Say, the "father of descriptive entomology in America." Parts of the colony have been restored.

During the first quarter of the 19th century almost all Hoosiers were Jeffersonian Democrats (popularly known as Republicans up to about 1825). The state constitution of 1816 was a liberal Jeffersonian document. Between 1825 and 1850, however, political power in Indiana was disputed between the Democrats and the National Republicans (1825–34) and then the Democrats and the Whigs (1834–54). Although Indiana supported Democrat Andrew Jackson for the presidency in 1824, 1828 and 1832, the National Republican-Whig party was usually the majority party in state politics from 1825 to 1843. In the later year the Democrats elected their first governor and from that time until 1860 largely controlled the state.

During the 1820s and 1830s the problem of internal improvements became an absorbing issue in Ohio, Illinois and Indiana. This resulted in bipartisan support within Indiana for the internal improvements system of 1836. The subsequent failure of the system resulted in temporary bankruptcy for Indiana and contributed greatly to the Whig defeat in 1843. Previously the Whigs had chartered the second state bank (1834), which was successful until its closing in 1859. A new state constitution was adopted in 1851.

Later 19th Century.—From the prosperous 1850s until World War I agriculture was the leading pursuit of Hoosiers, though factories and mills grew in size and rapidly increased their output. In these decades, and especially the early ones, agriculture had an importance in Indiana which it never had before or after.

In 1854 the new Republican party was organized, succeeding the Whig party, but Indiana was one of the last of the northern states in which it gained support. In 1860 the Republicans elected Henry S. Lane as their first governor. They also elected their state ticket, a majority in both houses of the general assembly and 7 of the 11 congressmen. Shortly after the election, Lane was sent to the U.S. senate, and Oliver P. Morton succeeded him as governor.

When the Civil War began in April 1861, Indiana offered many more volunteers than could be accepted by the Union. About 200,000 Indiana men, mostly volunteers, served in the Union military forces. Morton was one of the most loyal of the war governors of the north, but his partisan zeal and occasional use of arbitrary methods helped to widen the gap between Indiana Republicans and Democrats. Very few Hoosiers were disloyal to the Union, though numerous Democrats and even some Republicans honestly disagreed with Morton's methods. But narrow partisanship, obstructionism and failure to vote needed appropriations can be charged against the Democrats. Morton's efforts to pin the label of treason on the Democratic party, however, by the so-called "treason trials" in the midst of the 1864 campaign were inconsistent with the support which Democrats generally gave the war. Certainly southern Indiana, the Democratic stronghold, vigorously opposed Gen. John H. Morgan, the Confederate raider, during his 1863 invasion. Moreover, Democratic counties did their part in supplying the men who did the actual fighting.

During the last half of the 1860s and most of the 1870s issues concerning reconstruction, the status of the Negro (both in Indiana and in the south) and related problems dominated state politics. Indiana was one of the first of the northern states to return the Democrats to power following the Civil War. In 1872 Democrat Thomas A. Hendricks (*q.v.*) was elected governor, and from then until the campaign of 1896 the contest between Republicans and the Democrats was usually very close. Benjamin Harrison (*q.v.*), Indiana's "favourite son" candidate, won the Republican presidential nomination in 1888 and defeated Democratic candidate Pres. Grover Cleveland's bid for re-election. From 1896 until 1908 Indiana gave the Republicans large majorities in both state and national elections. Though reforms were limited during the period 1865–1910, the Australian ballot was adopted in 1889 and state laws were enacted to improve working conditions, especially those governing the employment of women and children.

The influence of the Progressive party movement began to be felt about 1901. This bipartisan movement, especially championed in Indiana by Albert J. Beveridge, a Republican, permeated both major parties. Between 1901 and 1917 Indiana established a railroad commission and then expanded it into a utilities commission; adopted the direct primary for state and local nominations; supported the amendments to the federal constitution which resulted in the direct election of United States senators and federal taxes on personal as well as corporation income; expanded public education, especially vocational education; increased state regulation of banks, loan and insurance companies and the sale of stocks; created a legislative reference bureau and initiated the state board of accounts. An unsuccessful effort to revise the con-

stitution of 1851 was also made.

Modern Times.—By the time of World War I the value added to goods by the manufacturing process exceeded the value of farm products, and thereafter the disparity rapidly increased in favour of manufacturing. With the increase in manufacturing, Indiana became more urban than rural. Central and northern Indiana, which had surpassed southern Indiana in population and wealth before World War I, widened their lead over the region which had led in population and manufacturing in pioneer days.

The Republicans, who won control in Indiana in 1916, maintained it through the 1920s. Though agriculture was economically depressed, business prospered and the prevailing mood of the people was conservative. Racial and religious prejudice engendered by the Ku Klux Klan reached a peak during the period, and one governor was sent to a federal penitentiary while another pleaded the statute of limitations to escape what might have been a similar fate.

The economic depression which began in 1929 was a decisive factor in returning the Democrats to power with a wide margin of victory in 1932. During the administration of Gov. Paul V. McNutt (1933–37) a gross income tax was enacted, welfare and pension legislation was adopted and state aid to schools was substantially increased.

From 1940 until 1958 Indiana was controlled mainly by the Republicans, though the personal popularity of Henry F. Schricker, a Democrat, resulted in his serving as governor during 1941–45 and 1949–53; he was the only chief executive ever elected to two terms under the constitution of 1851. In the 1940s the welfare and pension legislation of the 1930s was expanded. Democratic victories in state and congressional elections after 1958 suggested Indiana was still a "doubtful state" and in 1964 the Democrats carried both state and national elections.

GOVERNMENT

The constitution of 1851, though frequently amended, remains the basic document of Indiana government. Written under the influence of Jacksonian democracy, it restricted the power of the general assembly and provided for the popular election of many state and local officials. Because of Indiana's costly experience with state loans for internal improvements during the 1830s and 1840s, the constitution prohibited state borrowing except for certain emergencies. An amendment to the constitution may be proposed by either branch of the general assembly; if a majority of both houses vote in favour of an amendment and it is favourably voted upon by the general assembly chosen at the next general election, the amendment is submitted to the people; a majority of the popular vote is necessary for ratification.

Although suffrage for white males had been attained in territorial days, it was not until 1881 that the barriers against Negro voting were removed from the constitution of 1851. All Indiana voters must be properly registered, be at least 21 years of age, be citizens of the United States and have been residents of Indiana for a minimum of six months, of their county for no less than 60 days and of their precinct for 30 days. General state elections are held on the first Tuesday after the first Monday in November in even-numbered years.

Executive.—The executive and administrative department of the state government is divided among elective officials and numerous boards and commissions. The governor, lieutenant governor and attorney general, as well as the clerk and reporter of the supreme and appellate courts, are popularly elected in presidential years for four-year terms. The secretary of state, treasurer, state auditor and superintendent of public instruction are elected for two-year terms. No governor may immediately succeed himself, and neither the secretary, treasurer nor auditor may serve for more than four in any period of six years. The governor has the veto power, but laws may be passed over his veto by majority vote of the assembly. Administrative agencies having important responsibilities include the state board of accounts, the public service commission, the alcoholic beverage commission, the state highway department, the state board of education and the state budget commission.

Legislative.—Indiana's general assembly has a senate of 50 members and a house of representatives of 100 members. Senators serve four-year and representatives two-year terms. The biennial sessions of the assembly begin on the first Thursday after the first Monday in January of odd-numbered years. Regular sessions are limited to 61 days and special sessions to 40. Two-thirds of the members must be present to make a quorum, and an actual majority of the members of each house is required to pass legislation. Although the state constitution requires reapportionment every six years, senate and house districts were reapportioned by the legislature in 1963 for the first time since 1921.

Judiciary.—The state's judicial department embraces a supreme court of five judges elected by districts by the state at large; an appellate court with northern and southern divisions, which virtually results in two appellate courts; and a system of local circuit courts. Supreme and circuit judges are elected for six years and appellate judges for four. Special courts, such as probate and juvenile courts, exist in some localities, and justices of the peace are elected in the townships.

Finance.—In the second half of the 20th century, the state's general revenue from all sources amounted to more than $500,000,000 annually. Of this sum, about 23% was derived from the federal government and about 77% from state tax sources. Revenue was provided mostly by general property taxes, motor fuels taxes, gross income taxes and the sale of motor vehicle and operators' licences. The state's expenditures totaled more than $500,000,000; Indiana's constitution prohibits the accumulation of a state debt. Approximately 31% of the state's revenues were being spent on education, about 24% on highways, slightly over 7% on health and hospitals and nearly 6% on public welfare. The state's income was nearly 3.5 times greater than it had been at the beginning of World War II.

Local Government.—Counties, townships, cities and towns are important units of local government within the state. Counties are governed by elected commissioners, various elected officials and a number of boards and commissions. Townships are governed mainly by township trustees and local advisory boards. Cities are divided into five classes or categories. The mayor-council type of government prevailed after a 1921 law, that would have permitted cities to adopt a commission or commission-manager form of government, was declared unconstitutional in 1929. Small towns are governed mainly by local boards. Special school, health, drainage and various other districts also exist as local governmental units.

POPULATION

That part of Indiana territory which became the state of Indiana had a population of about 2,500 inhabitants in 1800 and 147,178 in 1820, four years after statehood was achieved. Its population ranked 18th among the 27 states and territories that then composed the union and was classified as 100% rural. When the pioneer period ended in 1850 there were 988,416 people, making Indiana the seventh most populous state. At the beginning of the 20th century, the state was eighth in rank of population with a total of 2,516,462 persons by the census of 1900. The slowest population growth occurred between 1930 and 1940; in 1940 the population was only 5.8% greater than it had been in 1930. The 1950 population showed a total of 3,934,224 persons living within the state, making Indiana 12th among the states. There were part or all of eight standard metropolitan areas (Anderson, Evansville, Fort Wayne, Indianapolis, Louisville, Muncie, South Bend, Terre Haute) in 1959 and, together with Lake and Porter counties (which in 1959 were separated from the Chicago standard metropolitan statistical area as the Gary-East Chicago-Hammond standard metropolitan statistical area), they contained more than one-third of the total population. By 1960 these metropolitan areas housed nearly 50% of the total population. In 1960 Indiana had a population of 4,662,498, an increase of 728,274 or 18.5% over 1950.

No urban centres (that is, towns having at least 2,500 residents) were reported until the census of 1840, when New Albany, Madison and Indianapolis appeared. In 1850 these three towns were

*Indiana: Places of 5,000 or More Population (1960 Census)**

Place	Population				
	1960	1950	1940	1920	1900
Total state	4,662,498	3,934,224	3,427,796	2,930,390	2,516,462
Alexandria	5,582	5,147	4,801	4,172	7,221
Anderson	49,061	46,820	41,572	29,767	20,178
Auburn	6,350	5,879	5,415	4,650	3,396
Bedford	13,021	12,562	12,514	9,076	6,115
Beech Grove	10,973	5,685	3,907	1,459	—
Bloomington	31,357	28,163	20,870	11,595	6,460
Bluffton	6,238	6,076	5,417	5,391	4,479
Brazil	8,853	8,434	8,126	9,293	7,786
Cedar Lake	5,766	3,907	—	—	—
Charlestown	5,726	4,785	939	820	915
Clarksville	8,088	5,905	2,386	2,322	2,370
Clinton	5,843	6,462	7,092	10,962	2,918
Columbus	20,778	18,370	11,738	8,990	8,130
Connersville	17,698	15,550	12,898	9,901	6,836
Crawfordsville	14,231	12,851	11,089	10,139	6,649
Crown Point	8,443	5,839	4,643	3,232	2,336
Decatur	8,327	7,271	5,861	4,762	4,142
East Chicago	57,669	54,263	54,637	35,967	3,411
East Gary	9,309	5,635	3,401	813	—
Elkhart	40,274	35,646	33,434	24,277	15,184
Elwood	11,793	11,362	10,913	10,790	12,950
Evansville	141,543	128,636	97,062	85,264	59,007
Fort Wayne	161,776	133,607	118,410	86,549	45,115
Frankfort	15,302	15,028	13,706	11,585	7,100
Franklin	9,453	7,316	6,264	4,909	4,005
Gary	178,320	133,911	111,719	55,378	—
Goshen	13,718	13,003	11,375	9,525	7,810
Greencastle	8,506	6,888	4,872	3,780	3,661
Greenfield	9,049	6,159	4,821	4,168	4,489
Greensburg	6,605	6,619	6,065	5,345	5,034
Greenwood	7,169	3,066	2,499	1,907	1,503
Griffith	9,453	4,470	2,116	630	—
Hammond	111,698	87,594	70,184	36,004	12,376
Hartford City	8,053	7,253	6,946	6,183	5,912
Highland	16,284	5,878	2,723	542	—
Hobart	18,680	10,244	7,166	3,450	1,390
Huntington	16,185	15,079	13,903	14,000	9,491
Indianapolis	476,258	427,173	386,972	314,194	169,164
Jasper	6,737	5,215	5,042	2,539	1,863
Jeffersonville	19,522	14,685	11,493	10,098	10,774
Kendallville	6,765	6,119	5,431	5,273	3,354
Kokomo	47,197	38,672	33,795	30,067	10,609
Lafayette	42,330	35,568	28,798	22,486	18,116
La Porte	21,157	17,882	16,180	15,158	7,113
Lawrence	10,103	1,951	1,087	—	—
Lawrenceburg	5,004	4,806	4,413	3,466	4,326
Lebanon	9,523	7,631	6,529	6,257	4,465
Linton	5,736	5,973	6,263	5,856	3,071
Logansport	21,106	21,031	20,177	21,626	16,204
Madison	10,097	7,506	6,923	6,711	7,835
Marion	37,854	30,081	26,767	23,747	17,337
Martinsville	7,525	5,991	5,009	4,895	4,038
Michigan City	36,653	28,395	26,476	19,457	14,850
Mishawaka	33,361	32,913	28,298	15,195	5,560
Mount Vernon	5,970	6,150	5,638	5,284	5,132
Muncie	68,603	58,479	49,720	36,524	20,942
Munster	10,313	4,753	1,751	605	—
New Albany	37,812	29,346	25,414	22,992	20,628
New Castle	20,349	18,271	16,620	14,458	3,406
Noblesville	7,664	6,567	5,575	4,758	4,792
Peru	14,453	13,308	12,432	12,410	8,463
Plainfield	5,460	2,585	1,811	1,373	—
Plymouth	7,558	6,704	5,713	4,338	3,656
Portage	11,822	—	—	—	—
Portland	6,999	7,064	6,362	5,958	4,798
Princeton	7,906	7,673	7,786	7,132	6,041
Richmond	44,149	39,539	35,147	26,765	18,226
Rushville	7,264	6,761	5,968	5,498	4,541
Seymour	11,629	9,629	8,620	7,348	6,445
Shelbyville	14,317	11,734	10,791	9,701	7,169
South Bend	132,445	115,911	101,268	70,983	35,999
Speedway	9,624	5,498	2,325	—	—
Tell City	6,609	5,735	5,395	4,086	2,680
Terre Haute	72,500	64,214	62,693	66,083	36,673
Tipton	5,604	5,633	5,101	4,507	3,764
Valparaiso	15,227	12,028	8,736	5,518	6,280
Vincennes	18,046	18,831	18,228	17,160	10,249
Wabash	12,621	10,621	9,653	9,872	8,618
Warsaw	7,234	6,625	6,378	5,478	3,987
Washington	10,846	10,987	9,312	8,743	8,551
West Lafayette	12,680	11,873	6,270	3,830	2,302
Whiting	8,137	9,669	10,307	10,145	3,983
Winchester	5,742	5,467	5,303	4,021	3,705

*Populations are reported as constituted at date of each census.
Note: Dash indicates place did not exist during reported census, or data not available.

joined by Lafayette, Fort Wayne, Terre Haute, Evansville and Lawrenceburg as urban places, but each had fewer than 10,000 residents. In 1900 Indiana had 80 urban places, and in 1950 119. In 1850 between 4 and 5 of every 100 persons lived in urban centres; in 1900 the figure was about 34 and in 1950 60.

Indiana's urban population has always been widely diffused. No city except Indianapolis exceeded 100,000 residents until after 1900. Even Indianapolis, the largest city in the state, had not reached 500,000 inhabitants in 1960. At that time Gary, Fort Wayne, Evansville, South Bend and Hammond each had more than 100,000 inhabitants. Urbanization was especially rapid along the southern shore of Lake Michigan after 1900; Gary, second largest city in Indiana in 1960, was not founded until 1906. Much the greater portion of the population increase between 1850 and 1960 was in the urban element.

The population per square mile in 1960 was 128.5, as compared with 49.6 for the U.S. as a whole. The 1960 urban population was 62.4% of the total. In line with the rest of the U.S. the percentage of persons 65 years old or over was increasing (9.6% in 1960).

The pioneers of Indiana came principally from Virginia, Maryland, North and South Carolina, Kentucky, Tennessee, Ohio, Pennsylvania and New York, but more came from southern or slave states than from northern or free states. Only a limited number came from New England.

Immigration from other countries was not large during pioneer days (before 1850); of those who immigrated Germans and Irish were most numerous. After pioneer days these continued to be the leading immigrant groups, but beginning in the 1880s a considerable number also arrived from Italy, Poland, Belgium, Austria, Hungary and other parts of southern and east-central Europe. Immigration from other countries reached its peak in the generation immediately preceding World War I. There were 11,262 Negroes in Indiana in 1850, 57,505 in 1900, and 268,358 in 1960.

EDUCATION

Public Schools.—The constitution of 1816 made it "the duty of the General Assembly, as soon as circumstances will permit, to provide, by law, for a general system of education, ascending in a regular gradation, from township schools to a state university, wherein tuition shall be gratis and equally open to all." Although this mandate was much ahead of its time, Indiana had had public schools in pioneer days, but they existed on a local-option basis and generally had tuition charges. Most schools, at all levels, were under private or church sponsorship at that time.

The constitution of 1851 emphasized the importance of elementary or common schools, and the free school law of 1852 established the foundation for a state wide system of free elementary schools. Progress was slow, however, and school attendance was not made compulsory until 1897. In the 1850s elementary schools were often limited to annual terms of about 3 months; 100 years later, the minimum annual term was 8 months, though terms were often 9 to 9½ months, especially in the cities.

Dozens of academies and seminaries, generally short-lived, were founded in the pioneer era; except for county seminaries, these institutions were under private or church auspices. All of them received most of their support from tuition payments.

A few free public high schools were established in the 1850s, and they increased in number during the last half of the 19th century. Most of these at first offered only two or three years of instruction, but they developed with the free elementary schools and were regarded as part of the common school system. In 1900 relatively few elementary school graduates also completed high school; by 1950 more than half did so.

The Indiana school system is administered by a state superintendent, elected biennially, various state commissions and committees; by local superintendents and boards in the cities; and principally by township trustees in the township schools. Under permissive legislation passed in the 1940s and 1950s some towns and rural areas formed consolidated school units administered by superintendents and boards as in the city school system. Legislation passed by the 1959 legislature required all school systems in the state to be reorganized to equalize the tax base for the support of education. In the late 1950s Indiana was spending $291 annually per pupil or slightly less than the U.S. average. This was about three times the amount spent prior to World War II.

Higher Education.—*Indiana University.*—Indiana university, located at Bloomington in the southern part of the state, was chartered as a seminary in 1820 and its first instruction was given about 1824. By the second half of the 20th century the university's annual enrollment approached 25,000 and its teaching staff numbered more than 2,500. On the 1,850-ac. campus at Bloomington are located the college of arts and sciences, junior (freshman) division, school of education, school of business, graduate school, school of law, school of music, school of health, physical educa-

tion and recreation, division of university extension and division of optometry. The schools of medicine, dentistry and nursing, divisions of medical technology, dental hygiene, medical record librarianship, graduate dietetics, X-ray technology and occupational and physical therapy are at Indianapolis. University centres are found at Indianapolis, Gary, East Chicago, South Bend-Mishawaka, Fort Wayne, Kokomo, Jeffersonville-New Albany, Richmond (with Earlham college), Vincennes (with Vincennes university) and Evansville (with Evansville college).

The university is governed by a board of trustees of eight members, five of whom are appointed by the governor on recommendation of the state board of education and three of whom are elected by alumni.

Other State Institutions.—Purdue university, the state university of agriculture and mechanical arts, organized in 1869, is located at West Lafayette (*see* LAFAYETTE). The state-supported institutions for the training of teachers are Indiana State university (organized in 1870 as the State Normal school) at Terre Haute and the Ball State university (1918) at Muncie.

Private Institutions.—Other educational institutions of Indiana include Anderson College and Theological seminary at Anderson (Church of God; 1917); Butler university, Indianapolis (Disciples of Christ; 1850); DePauw university, Greencastle (Methodist; 1837); Earlham college, Richmond (Society of Friends; 1847); Evansville college, Evansville (Methodist; 1854); Franklin College of Indiana, Franklin (Baptist; 1834); Goshen college, Goshen (Mennonite; 1894); Hanover college, Hanover (Presbyterian; 1827); Indiana Central college, Indianapolis (Evangelical United Brethren; 1902); Manchester college, North Manchester (Church of the Brethren; 1889); Marian college, Indianapolis (Roman Catholic; 1937); Rose Polytechnic institute, Terre Haute (nonsectarian; 1874); St. Francis college, Fort Wayne (Roman Catholic; 1890); St. Joseph's college, Rensselaer (Roman Catholic; 1889); St. Mary-of-the-Woods college, Terre Haute (Roman Catholic; 1840); St. Mary's college (1844) and the University of Notre Dame (1842), the latter one of the leading Roman Catholic universities in the United States (both Roman Catholic, near South Bend); Taylor university, Upland (nonsectarian; 1846); Valparaiso university, Valparaiso (Lutheran; 1859); and Wabash college, Crawfordsville (nonsectarian; 1832).

HEALTH AND WELFARE

Indiana was one of the first states to establish schools for the deaf and the blind. The state school for the deaf, the school for the blind and the first state hospital for the insane were all opened in Indianapolis during the 1840s. The last became the Central State hospital in 1883; other similar institutions are the Logansport State hospital, the Richmond State hospital, the Woodmere State hospital, Evansville, and the Madison State hospital (North Madison). Norman M. Beatty Memorial hospital at Westville and the Larue D. Carter Memorial hospital at Indianapolis were built in mid-20th century. Institutions for the feeble-minded include the Fort Wayne State school and the Muscatatuck colony at Butlerville. Another hospital is the Village for Epileptics at New Castle. There is a state soldiers' home at Lafayette, a soldiers' and sailors' orphans' home at Knightstown, a state sanatorium at Rockville and the Indiana university hospitals at Indianapolis.

There are six correctional and penal institutions: the boys' school at Plainfield, the girls' school at Clermont, the prison for women at Indianapolis, the state reformatory at Pendleton, the state prison at Michigan City and the state farm at Putnamville. Indiana has a habitual-criminal law and a law providing for the sterilization of mental degenerates, confirmed criminals and rapists.

Relief for the poor is under township trustees. Welfare work is under county welfare boards and the state department of public welfare with its divisions of public assistance, services for crippled children, corrections and children's divisions.

THE ECONOMY

Agriculture.—Until about the time of World War I, agriculture remained the principal occupation in Indiana. The leading field crops in the early days were corn, wheat and oats, but especially corn. Minor crops included tobacco, rye, barley, buckwheat and flax, though most of the pioneers also raised various vegetables. The principal farm animals were hogs, horses, cattle and sheep, and most early farms also had chickens, ducks or geese. The combination of corn and hogs has always been the mainstay of Indiana agriculture.

The leading field crops of pioneer days have continued as the main crops. Corn retained its primacy, but beginning in the 1940s soybeans succeeded wheat as the second most valuable field crop. Until pushed into third place by soybeans, wheat ranked second in value, followed by oats, though oat production was often larger than that of wheat. Since the 1880s tomatoes have been a crop of considerable value. Minor field crops include tobacco, rye, barley, buckwheat, popcorn, melons, onions, Irish potatoes, strawberries and mint. Vegetables, berries and fruits have achieved commercial importance, as have clovers and grasses.

Hogs have always been the most valuable farm animal in Indiana, but cattle have increased in importance since pioneer days. Sheep decreased in importance during the 20th century, and horses have been displaced by machinery on most Indiana farms; by the 1950s the number of horses and mules was smaller than that of oxen in the 1850s. The value of poultry and poultry products exceeds the combined value of horses and sheep, including their products.

In the second half of the 20th century Indiana annually produced approximately 250,000,000 bu. of corn; 40,000,000 bu. of soybeans; 35,000,000 bu. of wheat; and 50,000,000 bu. of oats. On the farms there were about 4,480,000 hogs, 2,200,000 head of cattle and 547,000 sheep. The state had approximately 154,000 farms, about 94,000 of which were owned by their operators with an additional 31,000 partly so owned. Farm tenants totaled only 18.3% of the total. The average farm comprised 125.2 ac. The aggregate value of farm products surpassed $1,000,000,000 during most years. The value of crops greatly exceeded the value of products from livestock and poultry.

Manufacturing.—Pioneer manufacturing was limited in quantity, consisting almost exclusively of products of farms and forests such as clothing, food, utensils and furniture. Small factories began to increase in numbers during the 1850s, and by 1860 Indiana ranked tenth among the states in the value of its manufactured goods. In 1900 it had advanced to eighth place and had 18,000 plants producing goods aggregating $378,100,000 in value. In both intervals the four leading industries were meat processing, flour and grain milling, lumbering and liquor distilling. In 1900 the iron and steel industry ranked fifth in value of products, the manufacture of railroad cars sixth and foundry and machine products seventh.

In the second half of the 20th century Indiana remained high in place among the states in the value of manufactured products; it then had about 6,400 plants producing goods valued at $4,625,000,000. Indiana's leading manufacturing industries were primary metal products, transportation equipment, electrical machinery, machinery other than electrical, food and related products, chemicals and related products, fabricated metal products, stone, clay and glass products, petroleum and coal products and printing and publishing.

The steel industry, concentrated in the Calumet region along the shores of Lake Michigan in northern Indiana, is by far the state's leading industry, and the region is one of the most important centres of steel manufacturing in the world. The industry got its start in Indiana when a mill was established at East Chicago (*q.v.*) in 1893; in 1906 at Gary the industry began an expansion that had not ceased in the 1960s. Steel became the leading industry of the state about 1929. One of the world's largest oil refineries is located at Whiting, near Gary. East Chicago developed into a leading industrial centre and one of the greatest shipping points in the nation.

Other leading manufacturing cities are Indianapolis, South Bend, Fort Wayne, Evansville, Hammond, Anderson, Muncie, Michigan City, Mishawaka, Elkhart, Kokomo, Marion, La Porte and Terre Haute (*qq.v.*). Indianapolis is a centre of the slaughter-

ing and meat-packing industry and the printing and publishing of newspapers and periodicals; it is also an important centre of the motor-vehicle, furniture and foundry industries. Elkhart is a manufacturing centre for musical instruments, La Porte for harvesting machinery and South Bend for automobiles. Fort Wayne produces gasoline dispensing pumps, tractors, trailers and electrical apparatus. Evansville manufactures automobile bodies, refrigerators and excavating machinery. Muncie for many years was noted for its glass fruit-jar industry and Mishawaka for its rubber, woolen and leather goods.

Mining.—Much outranked by agriculture and manufacturing, mining contribution to the economy nevertheless has been significant and in some counties has exceeded agriculture and manufacturing in the value of its products. In the second half of the 20th century Indiana ranked about 20th among the states in the value of its minerals, coal, oil, stone and clay being the principal mineral products.

During the 1830s geological surveys indicated that the state had large quantities of stone and coal and a limited quantity of low-grade iron ore. Coal and stone production attained commercial importance during the last half of the 19th century. Indiana coal is of the bituminous type and of only fair quality, but Indiana limestone was widely used for public buildings because of the stone's beauty, workability and durability.

From about the time of the Civil War efforts to find oil resulted in occasional discoveries of natural gas, but the period 1886–1906 represented the height of the gas boom in Indiana. As the supply of gas waned that of oil gradually increased so that by 1950 oil ranked second to coal in importance.

Commercial manufacturing of pottery and other clay products early became significant. During the 20th century products such as crushed stone, sand, gravel, cement, peat, marl and gypsum gained in commercial importance.

Transportation.—During the early period the Ohio-Mississippi waterway was the principal route for exports and later, with the advent of steamboats, for imports. The internal improvements system of 1836 was an ambitious but unsuccessful effort to solve the transportation problem and end the isolation of east from west. The completion during the 1830s of the national road, which traversed the state, greatly aided internal improvement. Canals, which served an important purpose in their day, began to be replaced by railroads by 1850. About 2,000 mi. of railroads were built during the 1850s and mileage increased until the time of World War I when the state had approximately 7,400 mi. of track. After the war the railroads began to lose much of their traffic to trucks, buses, automobiles, pipelines and airplanes; revival of water transportation on the Ohio river and the continued increase of traffic on the Great Lakes also affected the railroads. By the 1960s mileage had dropped to about 6,750 mi. of main-line track.

At mid-20th century Indiana had more than 10,000 mi. of improved state and federal highways and nearly 75,000 mi. of county roads. Though the state refused federal grants-in-aid for certain welfare programs, it obtained substantial federal funds for highway construction under the national highway program initiated in 1956. There were more than 100 commercial and 75 public but privately owned airports. There were also several heliports and military air fields.

See also references under "Indiana" in the Index.

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Current statistics on production, employment, industry, etc., may be obtained from the pertinent state departments; the principal figures, together with the current history, are summarized annually in the *Britannica Book of the Year,* American edition. (D. F. CA.)

INDIANAPOLIS, the capital and largest city of Indiana, U.S., a port of entry and the seat of Marion county, is situated on the White river near the geographical centre of the state. One of the most populous cities in the world not located on navigable water, Indianapolis has exceptionally good facilities for other forms of transportation. It is the focal point of a number of federal and state highways, has an excellent municipal airport and has long been a rail centre. Pop. (1960) city 476,258, standard metropolitan statistical area (Marion, Hamilton, Hancock, Hendricks, Johnson, Morgan and Shelby counties) 916,932. (For comparative population figures *see* table in INDIANA: *Population.*)

The city is built on a level plain surrounded by low, gently sloping hills. It has wide, well-planned streets, winding streams, trees, lawns, gardens and shrubbery. In the exact centre of the original tract of four sections, surrounded by a circular walk, is Monument circle with the soldiers' and sailors' monument in the centre. It rises to a height of 284.5 ft. above the street level and is surmounted by a figure called Miss Indiana. An elevator runs to a balcony at the top, which commands a panoramic view of the city and many miles of surrounding country. At the base of the monument are fountains. From the downtown area four avenues radiate diagonally to the four corners of the city. The other streets run at right angles to one another. The main east-west street (Washington) is 120 ft. wide; most of the others are 90 ft. There are more than 30 public parks and about 50 playgrounds; boulevards include a 60-ft. driveway on the top of the concrete levee (40 ft. high), which was constructed (1914–16) along the west bank of the White river.

North of the circle is the World War I memorial plaza covering five blocks given by city, county and state and containing, among other public buildings, the national headquarters of the American Legion. The statehouse, constructed in 1881–88, in a square of eight acres, has a ground area of two acres and a central tower and dome 240 ft. high. Many of the public and business buildings are constructed of the famous Indiana limestone from the Bedford district in the southern part of the state. Northwest of the city is the motor speedway, where the 500-mi. race is held annually on Memorial day. A crowd of about 175,000 is attracted each year from all parts of the United States. The home of James Whitcomb Riley is a literary shrine.

Indianapolis was one of the first cities in America to adopt electric street lighting, in Nov. 1881. A city-plan commission (1919) and a zoning ordinance, adopted in 1922, outlined a scheme for residential, commercial and industrial districts.

The city has an excellent public library and is also headquarters of the state library. In the second half of the 20th century there were three daily newspapers: the *News* (1869) and the *Star* (1883) being jointly owned; and the *Times* (1888). Indianapolis also has an excellent symphony orchestra, a fine arts museum and a children's museum.

Indianapolis is the seat of the schools of medicine, dentistry and nursing of Indiana university and of a part of that institution's school of law, school of health, physical education and recreation, and division of adult education and public service. The city is also the home of Butler university (chartered 1850), related to the Disciples of Christ Church; Indiana Central college (1902), supervised by the Evangelical United Brethren church; the John Herron Art institute and school; and Marian college (1937), a Roman Catholic institution. Also located there are the Central State hospital for the insane, the state schools for the blind and deaf, the state prison for women (the first in the United States, opened in 1873), and (at Clermont, 10 mi. outside the city) the state reformatory school for girls, which was a department of the prison until 1899. Ten miles northeast of the centre of the city is Ft. Benjamin Harrison, a United States army post, named after President Harrison, whose home was in Indianapolis. The state fairgrounds and the state fish hatcheries are within the city limits.

Around the Indiana university school of medicine developed one of the important medical centres of the country. The school itself was formed in 1908 by the union of the Indiana Medical college of Purdue university and the earlier medical department of Indiana university, which together incorporated six institutions founded between 1869 and 1906 at several different points in the state. Its building is conveniently located on the spacious

grounds of the Robert W. Long hospital (completed 1914) which is a part of the school's equipment. Nearby is the James Whitcomb Riley Memorial hospital for children, built by private subscription and conveyed to the university on the day it was dedicated (1924); and the William H. Coleman hospital for women (opened 1927), also under the university's management.

The transportation facilities of Indianapolis and its position in the midst of the corn belt, near large coal fields, and with populous markets in every direction, have combined to make it an important commercial and industrial centre. It has a large trade in grain. In the early 1960s there were more than 1,100 industrial plants in the city, some of them the largest of their kind in the world, which produced approximately 1,200 different commodities. Chemicals and allied products, transportation equipment and electrical machinery were major products. Among the other items produced on a large scale were automotive engines; pharmaceuticals and biologicals; ferrous and nonferrous castings; phonograph records; radio and television sets; sound, electronic and electrical equipment; food products; canning and meat packing; power transmission devices; rubber products; road building and earth moving machinery; truck bodies; saws; wood products; heating and ventilating equipment; paper products; transportation equipment; and clothing.

History.—When Indiana was admitted to the union in 1816 congress gave it four sections of public land for its capital. The commissioners appointed to select the site placed it in 1820 almost exactly in the geographical centre of the state, at the cabin of John McCormick, on the White river, in the midst of dense forests and without any means of communication with the rest of the state. A town was laid out in 1821 (the "original mile square," bounded by North, East, South and West streets) and some activity in land speculation followed; but when the seat of government was moved there from Corydon in 1825, there was but a single street and 600 inhabitants. The legislature met in Indianapolis for the first time in 1825. It was incorporated as a town in 1832, with a population of 1,000; the name is from Indiana and *polis*, the Greek for "city." The first state capitol was completed in 1835.

Some impetus was given to the city's growth by the opening of the National road to that point in 1827, and later, beginning in 1847, by the coming of the railways, but development was slow until after the Civil War. The city was chartered in 1847, and in the same year a free public school system was inaugurated. In 1850 the population was only 8,091. By 1860 it had grown to 18,611, and in the following decade it increased to 48,244. In the next 20 years (1870–90), and again between 1890 and 1910, the increase was considerably more than 100%, and in the years 1910–30 it amounted to 56%. The increase from 1940 (386,972) to 1960 was 23.1%. The remarkably rapid expansion of the city after World War II led the Indiana general assembly in 1959 to authorize further growth by annexation across county lines.

In the years following World War I, Indianapolis, like many other midwestern communities, suffered from the influence of the Ku Klux Klan on political affairs. In the middle 1920s exposure of the Klan's methods (largely through the initiative of the *Indianapolis Times*) led to its collapse. While Indianapolis, like most industrial cities, was adversely affected by the depression of the 1930s, its recovery was facilitated by the diversification of its industry and its strategic location. The city's economy expanded greatly during World War II and this expansion continued steadily in the postwar era.

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(R. W. S.; D. RI.; H. H. HA.)

INDIAN ARCHITECTURE, in this article, refers to the Buddhist, Hindu and Jain architecture of the Asian subcontinent of India-Pakistan and of Ceylon, Malaysia and Indonesia, from earliest times to the 20th century. This article begins with a general discussion of the origin and forms of Indian architecture and then describes the successive periods and styles of each of these four geographic areas in the order listed. For the architecture of this area created under Islamic rule *see* ISLAMIC ARCHITECTURE; *see* also TAJ MAHAL. For the art of this area *see* INDIAN ART; INDONESIAN ARCHAEOLOGY AND ART.

INTRODUCTION

Origins.—Indian architecture, like Indian sculpture, may be regarded as essentially of native origin, but it has naturally absorbed many outside influences at different times. Although the Vedic ritual required neither images nor temples, the non-Vedic cults, such as those of the serpents (Nagas), the tree spirits (yakshas) and the goddesses, may have had permanent shrines with images and wooden temples. References to images and temples begin to appear in the literature from about the 4th century B.C., and numerous types are represented in the reliefs from the 1st century B.C. In Hindu worship (puja, the service of a personal deity with offerings of food, lights, incense, etc., as distinguished from Yajna, the Vedic sacrificial ritual) the first essential is an altar, with or without a symbol or image, serving to receive offerings of flowers. Such an altar beneath a sacred tree, for example, constitutes a yaksha chaitya. The term chaitya denotes a shrine of any kind. The next step is a god's house (devalaya, devagara, ayatana, etc.), a simple roofed enclosure containing the altar and symbol or image.

The fundamental elements of temple architecture are indigenous and of great antiquity. Early Indian architecture was almost entirely of wooden construction, and the forms thus established were later closely imitated in brick and stone. The various forms of domed and barrel-vaulted roofs, gabled windows and roof ends, pillars and cornices were developed from wooden prototypes; the Toda hut, for example, even in the 20th century presents a striking likeness to a barrel-vaulted, gable-ended temple.

A part of Indian architecture, especially at an early period when the use of impermanent building material was otherwise still general, may be described as monolithic; that is to say, the shrine was excavated in solid rock, either by hollowing out the necessary chambers (so that only an internal architecture was brought into being) or by cutting away the exterior rock so as to leave an entire temple of solid rock. Remarkable works of both kinds exist. The former, the cave temple type, is best illustrated by the early Buddhist chaitya halls (Karli, Nasik, Ajanta, Bagh, etc.), in which the interior of an apsidal temple of wooden construction was reproduced in stone in every detail, and by such great Hindu excavations as those of Elephanta, near Bombay. Examples of the latter are the famous Kailasanath at Ellora, near Aurangabad, the Masrur temple in Kangra, the Seven Pagodas at Mamallapuram south of Madras and the Vettuvankoyil at Kalugamalai in the far south. (*See* TEMPLE ARCHITECTURE.)

Arches and Domes.—Neither the arch nor the dome seem to have played any part as structural members in Indian architecture in pre-Muslim times; but vaulted and domed forms occur in monolithic architecture and are illustrated in early reliefs. (*See* ARCH AND VAULT; DOME.)

Special Forms.—Some special forms characteristic of Buddhist and Jain usage should be briefly described. The most familiar of these is the stupa (tope, dagoba), an elaboration of the old Indian funeral mound, later carried out in solid masonry, provided with enclosing walls or railings and decorated with sculptures. The essential parts of the stupa are the dome (anda or garbha), solid but for a small relic chamber near the ground level in the centre, and inaccessible after completion; one or more platforms, supporting the dome, sometimes provided with stairways for access and serving for circumambulation; a small pavilion (harmika) on the summit, and rising from this a mast (yashti) bearing one or more symbolic umbrellas (chatravalis); one or more railings (vedikas) surrounding the dome or the whole structure. The stupa is almost exclusively of Buddhist or Jain significance, and as a symbol represents the death or final release of the great teacher, the Buddha or Mahavira. In the earliest types of Buddhist stupa the dome was hemispherical; but a more aspiring type was gradually developed, until there evolved such tall pointed

forms as that of the beautiful Burmese Shwe Dagon. In some Burmese forms the basement was extended to a great height, and was provided with chapels within its mass, for which an Indian prototype can be cited at Mirpur Khas in Sind. At Borobudur in Java the basement platforms are seven in number, forming a massive pyramid; this plan in a somewhat simpler form occurred earlier in the Punjab, Kashmir and Turkistan.

Another characteristic form is the aisled apsidal worship hall best known from the early Buddhist rock-cut chaitya halls, but also represented by structural examples in brick or stone of Gupta and later date (Ter, Chezarla, Aihole; and in Pallava and later Dravida architecture, where the number of stories is increased, as the crowning member of a tower).

Also peculiar to India is the hypaethral tree temple, usually a pillared hall, square or circular, with a gallery and vaulted roof, but open in the centre and surrounding a sacred tree; nearly a dozen examples are represented in Buddhist reliefs, where the tree is the bodhi tree, the symbol of the Buddha's Great Enlightenment, but there is every reason to suppose that the type was a very ancient one, developed in connection with the worship of yakshas or tree spirits.

Doors and Windows.—Doorways of early buildings were provided with decorated tympanums, reproducing wooden forms, and with a gable or ogee arch above. Entrances to sacred areas were provided with torans (resembling Japanese *torii*, where there may be a genetic connection); these consist of upright pillars bearing one or more architraves, of which the elaborate examples at Sanchi afford the best instances, though many others are represented in reliefs. Applied to a wall surface, the same form was used in rock-cut or structural shrines (*e.g.*, Nasik, cave III), the pillars becoming jambs, the lower architrave the lintel, brackets still being represented, though no longer functional. In later southern architecture the gateway of the enclosing walls became an immense structural tower, called a gopura, often completely dwarfing the main shrine.

The gable or dormer windows (gavakshas, kudus), which are found to be most characteristic as constructional elements in the early architecture and as ornament in the later, have been commonly designated "horseshoe arches" from the form and chaitya windows from the large and conspicuous examples that pierce the façades of the early excavated churches. In many cases the two ends of the arch spring from a pair of makaras (crocodiles), situated immediately over the capitals of the supporting pilasters and constituting a makara toran. The summit of the arch may be pointed, making it an ogee arch. This dormer arch is not confined to India, but reappears in the earlier architecture of Cambodia and Java. Cusped forms were developed early and survive in Islamic usage.

Columns.—Indian columns are of two kinds according to use, either single pillars (stambhas or lats), each bearing a symbol appropriate to the deity of the temple beside which it was placed, or structural pillars (khambhas) of temples or secular buildings. Both occur in a great variety of forms, but as regards the shaft, chamfering and an octagonal section are highly characteristic. All types are monolithic. Capitals, too, are varied. The typical early form has three members: below, an inverted lotus bell; in the middle, four addorsed animals (generally bulls or lions); and above, a trapezoidal cushion with small corner volutes (Assyrian rather than Greek in character). Typical of later northern medieval types is a ribbed-cushion capital like an amalaka. Another common form would be rectangular, with the lower outer angle rounded and sometimes ribbed. A usual form in medieval art is that of the brimming vase or jar with overflowing foliage, often developed into arabesque. Brackets, often decorated with figures of yakshis, are characteristic at all times.

Walls.—A sacred structure was usually enclosed by a wall (prakara) or railing. Such a wall consisting of plain slabs mortised into pilasters has been found in connection with a Vaishnavite shrine of Sunga date at Besnagar; and others, similar but sculptured, and of the same period, are represented by fragments from Amaravati and Jaggayyapeta. The railings of the early Buddhist and Jain monuments are remarkable; these consisted of plinth, upright pillars, crossbars and coping, evidently based on wooden forms; the best preserved are those of the topes at Sanchi and that at Buddha Gaya, both of about 100 B.C.; the most elaborate was that of Amaravati represented by remains now mostly in the British and Madras museums.

Influences of Indian Architecture.—The architecture of Malaysia and Indonesia is largely of Indian origin, and this is particularly evident in the earlier phases (pre-Khmer, etc.); the forms appear to have been developed contemporarily with the Gupta and Pallava styles. Indian architectural forms are recognizable also in Gandhara, central Asia, China and Japan.

Technical Literature.—Before proceeding to a description of the architecture of successive periods and styles, it should be mentioned that there exists in India a vast technical literature (known as silpa shastra) on the subject. Such technical works date back in part to the Gupta period, perhaps much earlier; the medieval compilations are still in use by Indian architects, the sthapatis of modern buildings using either the Sanskrit originals or vernacular versions. A valuable contribution to the study of architecture as a practical art could be made by a detailed description of building methods still in use in India. It has been shown that the Indian silpa shastras must have been used by architects in Java and Cambodia.

INDIAN–PAKISTANI SUBCONTINENT

Indus Valley Culture Through the Gupta Period (*c.* 2500 B.C.–A.D. 600)

Pre-Maurya.—The oldest architectural remains in India are the remains of cities at Mohenjo-Daro and Harappa, dating from the middle of the 3rd millennium B.C. There the buildings are of well-burned brick, laid in mud or gypsum mortar. They include temples; a sacred tank lined with bitumen and provided with a drain over six feet high, with a corbel-vaulted roof; and substantially built and well-drained dwelling houses and shops. (*See* Indus Civilization.)

There is every reason to suppose that the forms which are represented so admirably in the reliefs of Bharhut, Sanchi and Amaravati were already current during many centuries before the Maurya period. Archaeological research beginning after 1950 seemed to indicate that the great brick ramparts at such cities of the Ganges valley as Kausambi, Vaisali and Sravasti, and such other cities as Ujjain, belong to the pre-Mauryan period. It was expected that further work would reveal much more information concerning the domestic and civic architecture of this time. The forms include storied buildings supported on pillars with volute capitals resting on addorsed animals (bulls or lions), often with pot-shaped bases, and having barrel-vaulted roofs with gabled or arched ends and windows; battlemented brick walls; circular shrines with double-domed roofs; pillared barrel-vaulted apsidal temples; hypaethral tree temples; monasteries of cells arranged around a central court; burial or memorial mounds (stupas) on platforms; monolithic pillars; and walls and railings.

Maurya (322–185 B.C.).—The most ancient excavated cave shrines, those of the Barabar hills, which are finely polished, date from the time of the emperor Asoka (*q.v.*). The entrance façade of the Lomas Rsi (Rishi) cave is the earliest example of a decorated tympanum with ogee arch, finial, curved beams, and resting on sloping jambs, all in imitation of purely wooden forms.

The remains of Asoka's capital at Pataliputra (Patna) have a rather special character, and perhaps reflect contemporary Persian influences. There have been excavated parts of a massive wooden city wall; a timbered flooring extending for 350 ft.; a series of wooden platforms apparently intended to support a stupendous superstructure; evidences of a pillared hall with 80 polished stone columns; a magnificent stone capital, a stone voussoir from an arch, a stone griffin bracket and other fragments. It is thought that the plan of the palace was identical with that of the Achaemenid palaces at Persepolis. Arrian speaks of Asoka's palace as no less magnificent than those of Susa and Ecbatana.

Sunga, Kushan and Andhra (185 B.C.–A.D. 320).—Numerous reliefs from Bharhut, Mathura (mod. Muttra) and Amaravati, foundations of ruined buildings and excavated churches

(chaitya halls) and monasteries (viharas) prove the existence of an architecture advanced in scale and magnificence. The most remarkable examples illustrated in reliefs are the Sudhamma Sabha and Vaijayanta palace from Bharhut, the exquisite early shrine from Jaggayyapeta, the tree temples from Bharhut, Sanchi, Mathura and Amaravati, and a little structural domed shrine from Amaravati.

Noted caves are the chaitya hall and vihara at Bhaja, the great chaitya halls at Karli and Nasik and the Jain monasteries of Udayagiri and Khandagiri in Orissa. Of stupas, those of Bharhut, Sanchi and Amaravati are notable; while in Gandhara, both at Taxila and in Afghanistan (extending thence to Turkistan a little later), there are countless remains of stupas richly decorated with Greco-Buddhist sculpture, and many ruined monasteries. Connected with the stupas are their railings and gateways, of which those at Sanchi are perfectly preserved and those of Amaravati are well known from the British museum series. A seal discovered at Patna, with a Kharosthi inscription of not later than the 2nd century A.D., represents a tall straight-edged sikhara (tower) shrine, doubtless of brick construction. A true arch above the entrance doorway is clearly shown, and the cella contains a seated image of Buddha. The representation closely resembles the well-known Buddhist temple at Buddh Gaya, and may be it.

A famous structure often referred to at a later date by the Chinese pilgrims was the stupa of Kanishka near Peshawar. According to the Chinese account the basement rose in five stages to a height of 150 ft., the wooden superstructure to 400 more and the iron mast with 25 copper umbrellas 88 ft. more.

Gupta (c. A.D. 320–600).—Of this period both Buddhist and Hindu buildings in stone or brick and excavated shrines are characteristic. The most distinctive temple type is that consisting of a square cella, with plain walls and flat roof, and either surrounded by a pillared hall, as at Bhumara, or preceded by a small and graceful pillared porch as at Sanchi, Tigowa, Pithaora and Nachna-Kuthhara. The little temple at Sanchi well illustrates the fine proportions and appropriate use of ornament characteristic of the early Gupta period. The most important related groups of excavated shrines are those of Udayagiri in Gwalior state (Hindu), Ellora (*q.v.*) (Visvakarma chaitya hall) and Bagh and Ajanta (*q.v.*) (caves XVI, XVII and XIX, especially the last with its well-known magnificent façade). Farther south, at Badami, Aihole and Pattadkal, three of the earliest Chalukyan buildings are of Gupta date or a little later. The Ladh Khan, *c.* A.D. 450, was constructed of slabs and pilasters in archaic style; the Durga temple, about 100 years later, is apsidal like a chaitya hall, combined with a northern Nagara sikhara. Very interesting apsidal brick temples survive at Ter in Sholapur district and Chezarla in Kistna district.

The northern sikhara shrines, usually brick towers with stone doorways, began to appear during this period. For the most part the earliest examples are straight edged, or nearly so, and with angle amalakas at every course or every second or third course. The example at Deogarh is entirely of stone; not less important is the brick tower at Bhitargaon, with a recessed frieze of carved brick and terra-cotta panels of Brahmanical subjects. A little later than the Gupta period, but suitably mentioned here, is the brick tower at Sirpur, probably the most exquisite example of a richly decorated brick structure to be found in all India. The monastic university of Nalanda was founded by Baladitya at the close of the 5th century. Hsüan Tsang saw there a great brick temple over 300 ft. in height. The great Hindu temple at Konch, near Buddh Gaya and similar in many details, though the spire is curvilinear, may well be of Gupta date.

Period of the Hindu Dynasties (7th–19th Century)

From the Gupta period onward it is convenient to describe the architecture in terms of the three great styles: Nagara (northern or Indo-Aryan); Vesara (later Chalukya, Hoysala and Solanki, of the Deccan, Mysore and Gujarat); and Dravida (southern Dravidian). Separate mention is made of Kashmir and the civil architecture of Rajputana.

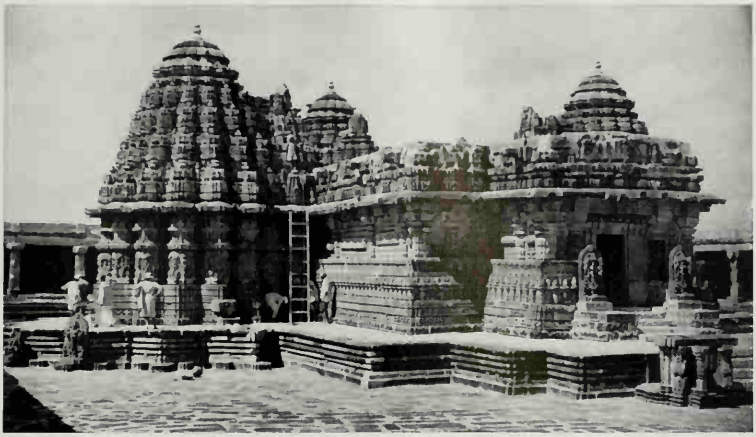
Nagara.—Here the most conspicuous feature is the curved outline of the sikhara, which is composed, as in the south, of many stories representing reduplicated cornices and roofs. Because of the great compression of each story, the vertical lines of the whole form are far more conspicuous, at least in the later types, than are the horizontal lines of the successive cornices. The tower, usually square, rarely circular in plan, is corbeled inward until the sides nearly meet, the whole is crowned by a huge ribbed lenticular stone, the amalaka which supports the usual vase finial. At successive stages along the edges of the tower will be found quarter or angle amalakas, one at each stage in early types, more widely separated later. These angle amalakas are clear evidence of the rooflike character of each stage; and, indeed, nothing is more characteristic of Indian architecture or more valuable for the elucidation of its history than that the ornamentation consists essentially of reduced, simplified or archaic forms closely related to those of the whole building. The porch or mandapa is usually open and pillared, sometimes roofed with a dome, more often with a pyramidal roof composed of repeated cornices. In the Nagara style a barrel-vaulted roof is very rare, but examples are to be seen at Gwalior (Telika Mandir) and in Orissa (Vaital Deul at Puri).

The early capital with addorsed animals disappears after the Gupta period, to be replaced by square cushion capitals of various kinds or by a development of the pot-shaped capital into a brimming vase (purna kalasa) with lotus flowers and foliage falling from the mouth onto the four corners; in cave temples, *e.g.*, the great Shiva (Siva) shrines at Elephanta, near Bombay, a globular amalaka capital is highly characteristic.

The most southerly extension of the style is found at Badami, where the apsidal Durga temple, perhaps of Gupta date, already has a northern sikhara. Here the two styles, the Nagara and the Dravida, can be seen side by side. It is however in Orissa, Bundelkhand and Rajputana that the finest and most continuous series is to be found. In Orissa the series shows a continuous development from the 8th to the 13th century; the Parasuramesvara and Lingaraja temples at Bhubaneswar (*q.v.*), the Sun temple at Konarak and the Jagannatha at Puri are most remarkable, and the beauty and grandeur of most of these would be difficult to exaggerate. At Khajuraho (*q.v.*) in Bundelkhand there is another magnificent series, dating between 950 and 1050. The Kandarya Mahadeo temple is the finest; the effect of height, actually 116 ft. over-all, is increased by the great depth of the basement and by the vertical lines of the reduplications of the main form upon itself. There, as well as in Orissa and elsewhere, the temples are covered with figure sculpture.

From Bengal and Bundelkhand the style extends through Rajputana (where the Siddhesvara at Nemawar, Indore state, is of prime importance and one of the best preserved medieval monuments extant) to the Punjab (Amb and Kafir Kot), Kangra and Kulu (Baijnath, Masrur and Bajaura). Modern temples in the Nagara style include the Visvesvara at Varanasi (Benares), the funeral chapels at Gwalior, the Jugal Kisor and Madan Mohan at Brindaban and, among the many alms halls, ghats, wells and temples built by Queen Ahalya Bai (1765–95), the Grstanesvara temple at Ellora.

Vesara.—After the recovery of the old Chalukyan territory by a later branch of Chalukyas or Solankis in 973, a new style of architecture came into being in the Deccan and flourished during the 11th and 12th centuries. Another branch of the Solanki family held Gujarat from the 11th to the end of the 13th century. During the 12th and 13th centuries the Hoysala dynasty ruled Mysore. The Vesara style of architecture is found throughout the area. Conspicuous features are low elevations (contrasting with those of the high Nagara and Dravida sikharas) and wide extension, the star-shaped plan of the cella, the grouping of three shrines about a central hall, low pyramidal towers, elaborated pierced windows, elevated basements with richly decorated courses and, in general, an excess of ornament. In the Dharwar district, the Dodda Vasavanna is perhaps the most elaborate building in western India. In Mysore the most celebrated shrines are those of Dodda Gadavalli, Somnathpur, Belur, Balagami and Halebid and the Jain bastis at Sravana Belgola.



Kesava temple at Somnathpur, Mysore, built in typical Vesara style. A.D. 1268

HINDU TEMPLES IN INDIA

Elaborate stone carving of the 17th-century temple of Vishnu at Srirangam, Tiruchchirappalli district, Madras state

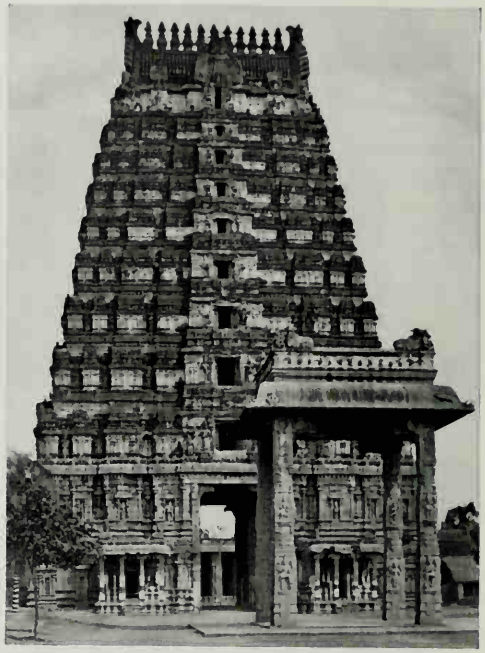
Lakshmi Narain temple, New Delhi (1939)

Lingaraja temple at Bhubaneswar, Orissa (*c.* 1000), a distinguished example of the Nagara style

PHOTOGRAPHS, (TOP, BOTTOM RIGHT) PAUL POPPER LTD.—PUBLIX, (CENTRE, BOTTOM LEFT) AVA HAMILTON

INDIAN ARCHITECTURE

The Shore temple at Mamallapuram in the Chingleput district, Madras state, India (8th century); early Dravidian style



Varadarajaswami Vaishnavite temple (15th century) at Kancheepuram, Madras state, India

The Great Stupa, Sanchi, India (3rd to 1st century B.C.)

Kailasanatha temple, Mylapore, Madras city, India

DRAVIDIAN AND OTHER TEMPLES

PHOTOGRAPHS, (TOP LEFT, TOP RIGHT, BOTTOM LEFT) PAUL POPPER LTD.—PUBLIX, (BOTTOM RIGHT) J. ALLAN CASH—RAPHO GUILLUMETTE

Kailasanatha rock-cut shrine at Ellora, India (8th–10th century); Dravidian style; Hindu

The pillars and carvings in cave 26, Ajanta, India, part of a great complex of Buddhist cave temples. Early 7th century

The Wata-da-ge shrine at Polonnaruwa, Ceylon (1153), Buddhist. Circular in form, it is one of the shrines in the Great Quadrangle, probably at one time the centre of the city

Detail of the stupa of Borobudur, Java, a Buddhist monument (probably 8th century)

HINDU AND BUDDHIST SHRINES

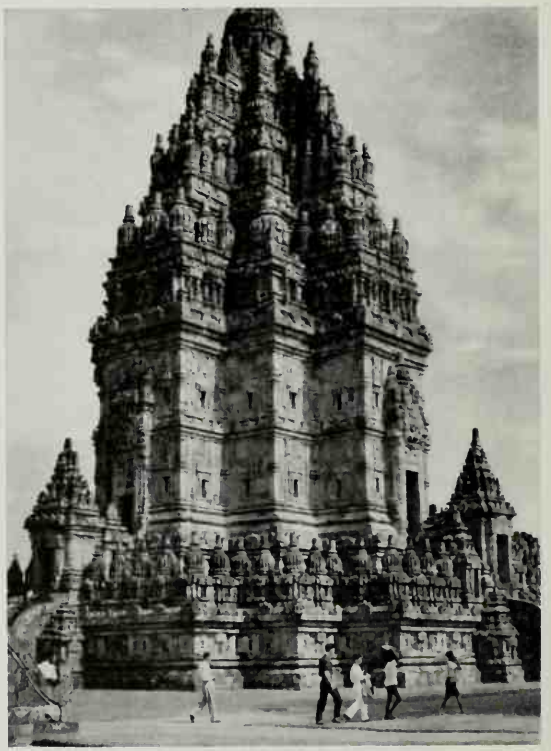
PHOTOGRAPHS, (TOP LEFT, RIGHT, CENTRE LEFT) PAUL POPPER LTD.—PUBLIX, (BOTTOM) W. SUSCHITZKY

INDIAN ARCHITECTURE

Candi Bhima temple (early 8th century), Dieng plateau, Java. Northern Indian Nagara style

The Ruanveli dagoba (2nd century) at Anuradhapura, Ceylon

Central monument and main stairway of the Angkor Wat temple (12th century), Cambodia



The Siva temple (latter part of 9th century), at Prambanan, Java; one of the three temples of the Candi Loro Jongrang group

INDIAN TEMPLE ARCHITECTURE

PHOTOGRAPHS, (TOP LEFT, TOP RIGHT) PAUL POPPER LTD.—PUBLIX, (BOTTOM LEFT) P.A.—REUTERS, (BOTTOM RIGHT) W. SUSCHITZKY

In Gujarat the most famous temple was that of Somnath (Kathiawar), wrecked by Mahmud of Ghazni in 1024. At Anahilpattana the greatest royal builder was Siddha-raj (1093–1143). There as at Vadnagar and Mudhera are the ruins of important shrines. A special characteristic of the local style is the erection of kirttistambhas, or "towers of glory"; the finest of these, in the Chittoor fort, was built in 1440–48 to commemorate the erection of the Kumbhasvami temple. More famous are the Jain temples at Mt. Abu in Rajputana, particularly those of Vimala Shah and Tejahpala, about 1032 and 1232 respectively. These are domed shrines with pillared halls, built entirely of white marble, carried with infinite labour up the mountain from the plains below. The most remarkable features are the domed ceilings, with deeply undercut, fretted marble which has been compared to "frozen lace," with a central pendant.

Deservedly famous too are the Jain temple cities of Girnar and Satrunjaya, with buildings ranging from the 13th to the 19th century. These cities of temples built on hilltops were exclusively places of pilgrimage, never otherwise inhabited. Of ordinary cities there are well-preserved remains at Dabhoi and Jhinjuvad. At the later capital of Ahmedabad the architecture is almost entirely Muslim, but it was executed in the same style and by the local craftsmen, adapted only to Muslim necessities by omission of figure work from the niches.

Dravida.—In southern India, according to the Mandagapattu inscription of the great Pallava king Mahendra-varman I (600–625), temples had been built of brick or timber, reinforced by metal and mortar; only from the 7th century onward are excavated monolithic and structural temples found in stone. It is difficult to characterize the style in detail because of the continuous development. Markedly contrasting with the Nagara style of the north are the conspicuous horizontal lines of the towers or spires, produced by a repetition of heavy roll cornices, dividing one story from the next; each story is decorated with little pavilions (pancarams) or dormer windows. The walls are often plain, with narrow pilasters, gradually elaborated as the style develops. The pillars are at first supported by lions, and polygonal in section, with a thin flat abacus and roll brackets, later a pendent lotus. The summit of the roof is always a square, circular or polygonal dome (stupika), or barrel-vaulted and apsidal, in the latter case appropriately designated as gajaprstha ("elephant's back"). The temple is always enclosed by a high wall or walls pierced by four gateways (gopuras); in some cases, as at Madura, the enclosure becomes a veritable sacred temple city wherein all the activities of life are carried on.

The early Dravidian style (Pallava, early western Chalukya and early Pandya) is admirably illustrated in the Pallava temples of Mamallapuram (the Seven Pagodas) and Kancheepuram (*q.v.*) in the east and early Chalukya shrines at Badami, Aihole and Pattadkal in the west. The earliest monuments are cave temples at Undavalla; then come the Seven Pagodas and cave temples in the 7th century and, in the 8th, the structural temples of Kancheepuram and the Shore temple at Mamallapuram, after which the style passes gradually into that of the Chola period.

In the west, at Badami and Aihole, there are six cave temples, two Jain and four Brahmanical, one dated 578. The structural Malegitti Sivalaya, *c.* 625, magnificently situated on the summit of a hill, is perhaps the purest and best example of the style; it is small and massive, but finely proportioned. Much larger and magnificent in both design and execution are the two great temples in honour of the queens of Vikramaditya II, dated about 740. Of these the Virupaksha, still very massive, was probably built by workmen brought from Kancheepuram, where the Rajasimhesvara (or Kailasanatha) temple had been built not long before the city fell to the Chalukyan invaders; it is known from an inscription that Vikramaditya was so much impressed by that great shrine that he not only refrained from destruction but himself made offerings and overlaid the images with gold. In 753 the Rashtrakutas invaded and occupied the Chalukya territory. No doubt as a result of this invasion workmen were carried off, and this probably explains the form of the great Kailasanath rock-cut shrine at Ellora which is evidently modeled closely on that of the Virupaksha at Badami. This wonderful temple, cut out of the side of a hill, is a complete model of a structural building and, together with the somewhat later and very similar Jain Indrasabha, also at Ellora, marks the farthest limit of the northward extension of the Dravida style. The Bhoganandesvara temple at Nandi, *c.* 800, affords another important example of a Rashtrakuta building in Dravida style.

In the Chola period (*c.* 907–1053) the tower of the central shrine is typically developed to a great height by a reduplication of the corniced stories, as in the great vimanas at Tanjore, the centre of Chola power, and at Gangaikondapuram, both of the early 11th century. The former is 190 ft. in height. There are also good examples of the style at Polonnaruwa in Ceylon, built during the Chola domination. The Pandya period (1251–1310) is characterized by the development of the great gateways, with a lower story of stone and superstructure of brick, covered with brick and stucco images plastered and painted. They have the aspect of veritable skyscrapers, and completely dwarf the main shrines.

These later phases of the southern style are characterized by the development of the great pillared halls (mandapam). The monolithic pillars are cut into groups of slender columns, or are provided with elaborate brackets, nearly the full size of the pillar itself and representing leogriffs (yalis) or horsemen on rearing horses attacking leopards or consisting of dancers, deities or effigies of founders.

Of the earlier series, the great shrines at Vijayanagar, Avadaiyar Koyil and Tadpatri are the most remarkable; of the later, the great buildings of the Nayaks of Madura, dating from the 17th century, are well known to all travelers in India. It is perhaps rather unfortunate that the Dravida style is best known by one of the latest examples, the Minakshi shrine at Madura; the whole complex is indeed impressive, but it gives little idea of the earlier purity of Dravida design.

Kashmir.—In Kashmir, which had been a dependency of the Kushan empire and later an independent kingdom, the prolific building period extended from the 8th to the 13th century. The style has local peculiarities: the double-pointed pyramidal roof, pediments enclosing a trefoil niche, lantern ceilings, fluted columns with Doric or Ionic capitals and large peristyles are very characteristic. The architecture here preserves a certain quasi-classical character derived from Gandhara and not seen in the rest of India, though often recognizable in central Asia. At Parihasapura a large Buddhist stupa with a double platform and stairways on each side is contemporary with the Javanese Borobudur; there are temples of extraordinarily massive construction, one flooring stone consisting of a single block 14×12×6 ft. The court of the Martand Sun temple is about 220×142 ft.; that of the Pandu-kund in Jammu about 191×121 ft. Related architectural forms are found at Malot in the Punjab and at Gop and some other places in Kathiawar. The trefoil arch, derived from the section of a chaitya hall, while confined to Kashmir as an important architectural form, occurs also at Sarnath, Sirpur and elsewhere.

Rajput Civil Architecture.—Twenty or thirty royal residences, a number of cities and ghats, surviving from the 15th century, show a civil architecture of extraordinary grandeur and beauty. The Rajput style is less intricately ornamented but of more monumental dignity than the better-known Muslim palaces of the 17th century.

The earliest well-preserved palaces are those of Chittoor and Gwalior, the latter magnificently situated on the edge of a great flat-topped hill, with several great gateways guarding the approach and a small palace, the Gujari Mahal, at the foot of the hill. Begun under Man Singh in the 15th century, it was completed during the Mughal (Mogul) occupation in the 17th century. Bir Singh Deo's 17th-century palaces at Datia and Orchha are almost equally splendid. The palace at Amber is more nearly like Mughal work, and so too the lovely marble pavilions by the lake at Ajmer. The whole city, palaces and island palaces of Udaipur (*c.* 1600–1740) are of romantic beauty. The Jodhpur palace, 17th century, is situated on the top of a rock dominating the city below and guarded by bastions of tremendous size. The modern city of Jaipur, the Varanasi ghats (with buildings mainly of the 18th century), the

ghats at Maheshwar and Ujjain, the modern work at Bulandshahr, Mathura, etc., and the cenotaphs of Rajput princes in many capitals are all evidences of an architecture by no means lost, but still practised.

CEYLON

Among the oldest surviving structures in Ceylon are the great stupas or dagobas of Anuradhapura, the capital of the island kingdom from the middle of the 3rd century B.C. to the end of the 10th century A.D. In Ceylon stupas are classified according to the shape of the dome, characterized as bubble shaped, bell shaped, lotus shaped or beap-of-paddy shaped, and are conspicuously simple in architectural form. The typical Sinhalese stupa is comprised of a threefold circular base, a dome and a superstructure of harmika and yashti. The strictest ritual governed the laying of the magical foundation stones and rigid systems of proportion fixed every dimension.

All of the ancient dagobas were built of brick and stone over a rubble core, and were covered with chunam plaster painted white. The main approach was always from the south, the direction associated with the sun at its zenith and with the supreme moment of the enlightenment of the mortal Buddha. The most important of the colossal stupas of the ancient capital is the Ruanveli dagoba whose dimensions are as great as all but the largest of the Egyptian pyramids. It was conceived as a giant replica of the universe and enshrined the largest collection of the relics of Buddha in the island. A unique and typical element of Sinhalese stupa design is seen in the four sculptured platforms (vahalkada) fixed around the base of this monument at the four cardinal points.

The Thuparama, built on a smaller scale, is surrounded by three consecutive rings of carved stone pillars which were once used to support a wood and metal dome, sustained by wooden rafters and completely enclosing the stupa. Structures of this type were designated as thupa-ghara and are related to ancient circular shrines in India proper, no longer extant. The temples associated with all of the great dagobas and known as vibares were characteristically rectangular in plan and usually had a single entrance on one long side. A single chamber was enclosed by walls of brick which, together with the pillars inside, supported a roof of wood and metal.

The Lohapasada or "Brazen palace," built by King Duttha Gamani as a royal monastery, was supported by 1,600 monolithic granite pillars standing in an area 250 ft. square. Originally a nine-storied pyramidal structure built of wood with fittings of precious jewels and ivory, it was destroyed by fire in the 4th century and rebuilt with five stories. It received its name from the roof, which was sheathed in copper.

In the 6th century the capital was temporarily moved to Sigiri, a great natural rock fortress, where a parricide king installed himself as a demigod in a splendid complex of palaces, apartments, galleries and pleasure gardens with which he clothed the entire summit and face of the cliff.

Repeated raids by the Tamil armies of south India forced the final abandonment of Anuradhapura late in the 10th century. After a brief period of Chola occupation, a new capital was established at Polonnaruwa. The greatest periods of building at the new site coincide with the reigns of the greatest of the Polonnaruwa sovereigns, Vijayabahu I (1059–1114), Parakramabahu I (1164–97 or 1153–86) and Nissamka Malla (1198–1207).

The most notable group of architectural monuments is that collection of shrines located in the Great Quadrangle, an area which at one time must have been the centre of the capital. There are found some of the most beautiful and perfectly realized buildings in all of the Indian world. The Sat Mahal Pasada, a seven-storied brick pyramid, conforms in shape to the imagined structure of the world mountain, Meru, and was thought of as a variant of the stupa. The Hata-da-ge, a rectangular structure built entirely of finely cut ashlar masonry, and the Wata-da-ge, a sublime circular shrine of stone and brick, face each other and share a common axis. The beauty of each derives from the subtlety of its proportions and from the sensitive contrasts of the plain and decorated surfaces. Nearby, a stone railing encompasses a unique cluster of granite columns carved in the shape of curling lotus stems with capitals formed like lotus buds.

The tiny pavilion, once canopied in wood, is called the Nissamka Lata Mandapaya, and was probably used as a shrine for the offering of flowers. Great rectangular Buddha halls, vaulted and decorated throughout with frescoes and stucco sculpture, and circular buildings of varying sizes are also among the dedications of the Polonnaruwa kings. A number of Hindu temples, built by the Tamils during the Chola occupation, display an exclusively south Indian character.

Later, the capital had to be moved again, finally, to Kandy, where an independent monarchy survived until 1815. No monument worthy of serious consideration, however, seems to have remained from the later periods. Some of the old architectural forms were continued in the wooden style of the Kandyan era and a certain feeling for complex ornamentation developed; yet few buildings of real artistic quality seem to have been produced after the final renascence under the Polonnaruwa kings.

MALAYSIA

There can be traced in each area of Malaysia and Indonesia, first of all, an Indianesque period, when the local art is closely related to that of India and the forms of Indian art were reproduced; then a classical period (A.D. 800–1200) in which local national formulas are evolved and crystallized; and finally a local national phase no longer in direct contact with India, and passing into a stage of folk art which has survived up to the present day. It is at all times an injustice to apply to the local schools the name of Indian colonial art, for although the structural and decorative elements are all originally of Indian origin, the originality and energy of the local forms derive from indigenous sources, and the expression of local ethnic character is everywhere apparent.

Burma.—Ruined buildings and sculptures of a Gupta type have been found at Tagaung, Prome, Thaton and elsewhere. Farther north, remains of the old city and a gateway dating from the 9th century can be seen at old Pagan. Among other structures dating from the 10th century at Pagan are the Nat Hlaung Gyaung Vishnuite temple (A.D. 931) and the cylindrical Ngakywe Nadaung, a stupa recalling the Dhamekh at Sarnath.

But it is only with the unification of Burma, accomplished by Aniruddha (Anawrata; 1040–77), that a great building era was initiated. Remains of no less than 5,000 "pagodas," mainly stupas but also Buddhist temples, can be traced in the Pagan area. Two types are especially characteristic. In one the basement terraces of the chapel or stupa are developed to a great height, giving a cubical effect, and provided with chapels and galleries in their mass, for which an early Indian parallel is afforded by the stupa at Mirpur Khas in Sind; the Ananda, Thatbyinnyu and Shwegugyi pagodas are examples. The other is that of a stupa supported by a high pyramidal terraced basement provided with four median stairways as a means of access, and often with smaller stupas at the angles, thus repeating a type already established at Borobudur, which in turn derives from the terraced stupas of the Punjab, Kashmir and Turkistan.

Other structures exhibit special peculiarities, for Aniruddha and his successors were in touch with all parts of the Buddhist world of that time, and built in various manners. Connections with northern India, Bengal and Nepal were especially close. The Mahabodhi stupa is clearly a direct imitation of the ancient Indian shrine of the same type at Buddh Gaya, described above, which was itself in turn restored by pious Burmese Buddhists in the 12th century. Active construction at Pagan continued well into the 13th century, after which the unity of the country was for a time destroyed by Shan invasion.

The unfinished Mingun pagoda, begun in the 18th century, was to have been the largest in Burma, and what remains is still over 140 ft. in height, though this represents only a third of the proposed elevation. It is highly characteristic that ancient stupas of small size were again and again enclosed within larger structures and thus lost to view, so that huge pagodas like those at Prome and Pegu, while really representing ancient foundations,

are in their present aspect comparatively modern.

Mandalay was founded only in 1857, and occupied by Mindon, the last great royal patron of Buddhism in Burma. The palace, a wooden structure in which material from an older palace at Amarapura (the previous capital, near Pagan) was employed, like most wooden palaces consists of connected halls, pavilions and galleries within a walled enclosure. The main features of the style are the use of immense teak columns, lacquered and gilt multiple roofs and spires with flamboyant crockets, and an interior decoration in which glass mosaic plays an important part. Other fine examples of late Burmese wooden architecture are afforded by monasteries such as the Myadaung Kyaung and the Sangyaung at Mandalay, monuments to the piety of various queens. Still more modern is the famous Shwe Dagon pagoda (stupa) at Rangoon; its tapering form, the outline of the spire almost continuous with that of the body, contrasts conspicuously with the more monumental hemispherical and cylindrical types of early Indian art. There is a general tendency to the development of more refined and aspiring, less massive types in all the later stages of Indian architecture wherever it is found. (*See* BURMA.)

Cambodia.—*Pre-Khmer or Khmer Primitive (5th–8th Century A.D.).*—The history of Indian architecture in southeastern Asia can be followed in Cambodia better than anywhere else; there, despite the disappearance of wooden architecture, once more abundant than that in stone, the sequence is relatively complete. In the Khmer primitive or pre-Khmer (as different authors interpret it) architecture of southern Cambodia, dating from the 6th and 7th centuries (when permanent materials such as brick, laterite and stone were just coming into use), are found a series of buildings which exhibit striking analogies with those of the early Chalukyas of the western Deccan, as well as with those of the Pallavas and even with the earlier style of the Andhras.

A slab-built cella at Hanchei recalls the small shrine on the roof of the Ladh Khan at Aihole; it was once perhaps surrounded by a pillared hall as at Bhumara. Another very elegant square cella at Prei Kuk has shallow pilasters and characteristic Indian cornices with dormer arches framing Gandharva heads, and is quite Pallava in appearance. There also, and at Bayang, there are high brick towers suggesting such Gupta types as Deogarh or Bhitargaon; at Maha Rosei there is a granite shrine of Pallava type.

Classic Period, Khmer (9th–15th Century).—From the 9th to the 12th century and even later, Cambodian architecture developed still in brick and laterite, but more characteristically in stone. Indian forms were abandoned or freely modified, and local features appeared, so that a truly national architecture came into being. Unlike anything in India are the half-vaulted arches with curved stone sloping roofs imitating tiles, and so too the huge faces or masks on the sides of the early towers of the Bayon and Angkor Thom gateways. On the other hand the later towers developed as in India by a reduplication of stories, vertically compressed, and many motifs, seemingly novel, for example the Garuda caryatids of the Prah Khan walls and the Angkor Thom terrace, have really older Indian prototypes.

The classic Khmer architecture is widely distributed in northern Cambodia, perhaps the original seat of the Khmers. The best-known monuments, out of hundreds still in existence, are the city of Angkor Thom and the neighbouring temple of Angkor Wat (Angkor is a corruption of Sanskrit *nagara*, "city" or "capital"; *wat* or *vat*, a later Siamese term for any Buddhist monument). The city, occupied about A.D. 900, is of great extent, and contained within a moat, crossed by four causeways with parapets consisting of gods and giants holding the body of a giant Naga; these causeways lead to triple gateways large enough for the passage of elephants, and from these proceed four roads to the heart of the city. Near the city are the previous capital of Prah Khan, and other shrines such as the Neak Pean, Phnom Bakheng and Angkor Wat, and many artificial lakes. The city is situated in the plains, among the rice fields and near the great lake, both necessary sources of food supply for a great population. Its most important structures are the temple of Phnom Bakheng, the Bayon, the Baphuon and the Phimeanakas. The Bayon, intended to be Buddhist, was adapted to Shiva usage before its completion, and ultimately contained the statues of Hindu and Buddhist deities, the Deva Raja (a linga representing the king's divinity) and statues of deified royal ancestors. Its most conspicuous feature consists of the towers with enormous masks (representing Lokeçvara) on each face; but equally interesting are the reliefs in which almost every aspect of contemporary life is depicted. The Baphuon, *c.* 1000, is a typical terraced, pyramidal structure (prang), with median stairways leading to a stone gallery above.

Of the many other temples built in less accessible sites, the Prah Vihear may be mentioned; it is magnificently situated on a spur of the Dangrek range, overlooking a rolling panorama of uninhabited jungle. Angkor Wat is the later Siamese designation of the most famous and most beautiful of Cambodian shrines, of which the true name is unknown, though there is reason to think the dedication was to Vishnu. The date is the early 12th century.

The 14th-century temple of Isvarapura at Bantei Srei is proof that the capacities of the Khmers were not destroyed by the earlier Siamese invasions. But the country had certainly been devastated and Angkor Thom abandoned by the 15th century, and when later inscriptions appear they belong to the Siamese period. Hinayana Buddhism replaced the mixed Mahayana Buddhism and Hinduism which formed the state religion of the Khmers in the classical period.

Thailand.—Siamese architecture, in its earliest periods, was little more than a provincial reflection of the Indian style. It subsequently came under the influences of Khmer, Burmese and Sinhalese modes of building, and finally developed in the direction of a richness of detail and an ornamentalism of form that is distinctively Siamese. Wat Mahadatu at Lopburi is a typical example of the Siamese temple of the Khmer period. In plan, it repeats the usual Indian formula of a sikhara with a closed mandapa, and in elevation it is strongly reminiscent of the 10th- and 11th-century buildings at Angkor.

Wat Kukut at Muang Lamphun, erected in the 12th century, takes the form of a terraced pyramid, with niches holding Buddha images, and thus recalls the Sat Mahal Pasada in Polonnaruwa. Wat Chet Yot, a dedication of the Thai period, is a copy of the Mahabodhi temple at Pagan and ultimately derives from the great temple at Buddh Gaya as it appeared in the Pala period. Among the ruins of Ayutthaya (Ayudhya), the capital from 1349 to 1767, are a number of examples of the typical Siamese stupa. Round, with multiringed bases and bell domes, they climax in tapering onionlike finials of peculiarly pointed form. The last phase of Siamese architecture is typified by the many shrines and palaces set up in Bangkok after 1782. These structures are built almost entirely of wood and are elaborately decorated with a mixture of forms borrowed from ancient Siamese and modern Chinese sources. They are characterized by an ornateness which produces an artificial splendour seldom equaled.

Champa.—Eastern Indochina, once the seat of great Cham (*q.v.*) kingdoms, must have been hinduized at an early date, for there are traces of Hindu kingdoms in both the north and south as early as the end of the 2nd century A.D. All the early and much of the later architecture was wooden. The remains are of two periods, one classic, from the 7th century to about 1100, the other that of the decadence.

The sacred city of Mi-son was founded about A.D. 400, but the great brick tower now surviving was built on the site of the original wooden shrine soon after 600. The plan is square, but the cella is twice as high as it is wide, and the effect of height is increased by the narrow decorated pilasters which emphasize the vertical lines; the pyramidal roof consists of three diminishing stories, repeating the form of the cella on a smaller scale. The decorative motifs include makara niches, geese with extended wings, both old Indian motifs, and acroteria silhouetted against the sky. The whole is reminiscent of Indian Gupta towers and the pre-Khmer towers of Cambodia. In addition to this main shrine there are six great halls for the accommodation of pilgrims, for Mi-son was a sacred city rather than a place of habitation. Later, about 800, a great temple and monastery, the only important Buddhist buildings in Champa, were erected at Dong-duong by Indravarman II; but the place was soon ravaged by the Anna-

mites, who were continually pressing downward from the north and ultimately accomplished the ruin of Cham civilization. Sanctuaries were built again near the new capital of Binh Dinh at the beginning of the 11th century; the colossal towers of Duong-long, and those known as the Towers of Gold, Silver and Copper, are striking monuments. But it was no longer possible to build up great temple cities in honour of the gods.

INDONESIA

Sumatra.—Indian colonists arrived in Sumatra probably before the 5th century when Mahayana Buddhism was officially adopted as a result of a royal mission from Kashmir. I Ching passed by Palembang about 690 and found there a great centre of Sanskritic Buddhist learning.

By this time the great Malay kingdom of Srivijaya, held for many centuries by the Sailendra dynasty, had been established with the capital at Palembang, controlling the Malay peninsula and probably Siam as far as Prapathom. This was the greatest maritime power in southeastern Asia. (Madagascar had been colonized by hinduized Malays early in the Christian era.)

An inscription at Vien Srah in the northern part of the Malay peninsula records the erection there of brick towers and stupas. That of Kota Kapur in Bangka speaks of a military expedition to Java and in fact from before the middle of the 8th century the whole of central Java was subject to the Sailendras. The buildings there erected, however, will be discussed under Java (*see* below); in Sumatra proper the architectural remains are little known and not well preserved. (*See* SUMATRA.)

Java.—The old Hindu kingdom of Taruma in western Java is known only by inscriptions of 5th-century date. The earliest architectural remains are those of the Dieng plateau, where in the 7th or early 8th century stone was employed in Java as a building material for the first time. The plateau was not an inhabited city, but a place of pilgrimage, a temple city comparable with Girnar and Mi-son. Out of many more, eight temples survive; they are known by the names of the heroes of the Mahabharata, but these appellations have nothing to do with their original dedication to Shiva. The Indian character of the architecture is conspicuous, and in all probability Indian architects were at work there. The construction is generally cubic, with strongly emphasized vertical and horizontal lines; the temples are two-storied, the roof repeating the form of the cella. The plan is square, and the walls are divided by pilasters into niches or panels with sculpture; a grotesque makara face crowns the doorways. This description applies to the four temples of the Arjuna group; but Candi Bhima is a pyramidal tower in the northern Indian Nagara style with successive horizontal stages repeating the fundamental forms, cornices with dormer arches framing Gandharva heads and angle amalakas at the fourth and fifth stages. A single amalaka crowned the now ruined summit. East and south of the plateau and at Mt. Ungaran there are numerous other small temples of the same period and style, but rather more freely and exquisitely decorated.

Among the great monuments of the Sailendra period is a lovely but ruined temple of Tara, at Candi Kalasan. It was the first Buddhist temple on Javanese soil and its date is 778. This is a building of the Dieng Arjuna type, but the lateral niches are developed into side chapels, the ornament is more elaborate and there are delicate strips of floral tracery between the plain pilasters. Nearby is the three-storied rectangular Candi Sari. Candi Mendut, which is near Borobudur, is similar in plan, but there are no side chapels; on the other hand there is an open sculptured vestibule, and the exterior walls of the cella are richly decorated with figure reliefs. (*See* JAVA.)

Borobudur ("the Vihara of the Secret Aspect") is wonderfully situated on an eminence commanding an extensive view of rice fields and more distant towering volcanoes; it is a hill that has been terraced and clothed with stone. It is in fact a low pyramid composed of successively receding platforms with re-entrant angles. The structure is thus exactly analogous with that of contemporary buildings in Kashmir, of earlier stupas in the Punjab and Afghanistan and of the Rawak stupa in Turkistan, which are similarly provided with extensive basements having median stairways on one or four sides, though none of the Indian examples has more than two terraces, so that Borobudur represents a more developed type. (For the sculptures *see* JAVA: *Archaeology.*) Borobudur cannot be exactly dated, but it was probably built at the close of the 8th century.

Candi Sewu Prambanam is a Buddhist temple which dates from the early 9th century. The large central shrine represents a further development of the Candi Kalasan design, with side chapels open to the exterior and niches containing images. Around it, within the large area enclosed by the pakara, are two double series of small independent chapels, about 250 in number. The order and formality of the design are conspicuous.

After the "restoration," *c.* 860, the Hindu kings of central Java erected other great buildings at Prambanam. The Candi Loro Jongrang group consists of three large terraced temples dedicated to Brahma, Shiva and Vishnu and some smaller shrines within the same enclosure. The Shiva temple is typical; the actual shrine occupies the summit of a steep truncated terraced pyramid with median stairways on three sides leading directly to the main shrine and side chapels above. The whole site may have been a royal mausoleum as well as a place of ordinary worship. Nearby is the Buddhist Candi Plaosan.

These temples were no sooner built than abandoned, for about 915 central Java was deserted, and the further development of Javanese architecture must be studied in the east and in Bali.

At Candi Lalatunda and at Belahan there are sculptured bathing places built by Udayana and by his great son Erlangga. The best-known monuments, however, belong to the 13th and 14th centuries, the time of the great capitals at Singasari and Majapahit. At Singasari, Candi Kidal is a Shiva, and Candi Jago a Buddhist temple, but there is a mixture of the two cults amounting almost to fusion, as was also the case in Cambodia; a like condition prevailed in Bali. In far eastern Java the great Buddhist shrine of Candi Jabung dates from 1354; the circular tower, unique in Java, stands on the usual high rectangular terraced basement, the transition from base to tower being skilfully effected. At Panataran near Blitar there is a large Shiva temple complex, recently excavated and partly restored; the basement of the main temple is square and terraced, with the usual recessed corners. The associated gates and the sculpture are already in a style forecasting that of Bali.

Bali.—The only place in Indonesia where Hinduism and Buddhism survived as practised cults, Bali most probably had early and direct relations with India; but the migration of Javanese exiles to Bali at the close of the 15th century, by which time practically the whole of Java had received Islam, must also be taken into account. In Bali the only important early remains are the royal tombs at Tampaksiring, dating from the 11th or 12th century, and the Pura ye Ganga temple, more or less in Panataran style, dating from the 14th or 15th century. The more modern temples of Sangsit, Bangli, Batur, Kesiman, Den Pasar, etc., consist of groups of small independent shrines enclosed by walls having high roofed gateways, with rich sculpture in limestone, in fantastic forms and high relief.

See also references under "Indian Architecture" in the Index.

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INDIAN ART, in this article, refers to the Buddhist, Hindu and Jain sculpture, painting and decorative art of the Asian subcontinent of India and of Ceylon, from earliest times to the present. The art of this area created under Islamic rule is discussed in ISLAMIC ART. For the art of adjacent areas, *see* INDONESIAN ARCHAEOLOGY AND ART; PERSIAN ART; and TIBETAN

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I. INTRODUCTION

1. Indian Art and Western Art.—It may be useful for western readers to begin the consideration of Indian art by examining a few likenesses and differences between Indian and western art. Some of the points will be dealt with at greater length below. Indian art may be described as theological or traditional, since, like the art of the middle ages in Europe, it was dedicated to revealing the divine nature of the gods and enhancing the dignity of the church. Its didactic purpose was to instruct men in the truths of religion. The function of art was the making of the objects of worship in a life given over to religion. The Indian artist was trained in canons of proportion and harmony calculated to produce images which, in their abstract perfection, would suggest the divine nature of the original.

Indian images are abstractions of the human form. Unlike the Greek artist, who sought to suggest divinity by the idealized perfection of the physical anatomy, the Indian artist strove to create a supernatural ideal often presented in terms only abstractly related to an actual physical body or its proportions. The Indian artist composed his figure according to canons of proportion intended to endow his idol with more than mortal impressiveness and beauty. The nude is not used in Indian art for its own sake, as in the western tradition, but in order to suggest the sensuality of fertility spirits or the yogic control of the Jain ascetic by means appropriately specific and abstract. In every period of Indian art painters and sculptors suggested the warmth and fullness of the fleshly body and the presence of enlivening breath by abstracting the swelling planes of which the body is composed. Some Indian figures of the nude, such as those of Jain ascetics, have a certain superficial resemblance to such western types as the early Greek Apollo or *Kouros* in the very abstraction of the anatomical form. But it must be remembered that in the Indian image this abstraction is intended to represent the body as a symbol of spirit and an expression of withdrawal from material being, whereas in the Greek statues abstraction is employed to express youthful beauty throbbing with physical life.

The real differences between Indian and western art are more apparent in the comparison of such characteristic types as the Aphrodite of Greek art and the yakshi or fertility goddess of India. In the classical statues the erotic charm and function of the goddess are suggested by the artist's literal imitation of a body in marble, while the Indian image achieves the same iconographic end by means that are essentially abstract and at the same time completely plastic and appropriate to the medium. It might be pointed out that in an exactly similar way, even in portraiture, there is a complete suppression of individuality. In Indian art, portraits, just as much as representations of gods, are symbols of general ideas, a point of view in which reference to the particular has no place.

It could be said that the principal link between Indian and western art is the employment of the human figure to reveal the imagined shapes of the gods. The main differences between the Indian and western approach have already been mentioned. It might be added that, whereas the western artist in the Greco-Roman tradition sought to create an ideal with reference to the beauty of actual human models, the Indian artist worked in what might be described as a metaphorical mode; that is, a representation of parts of the body and features in shapes suggested by similar forms in the world of nature, such as the lotiform eyes of the deities—shapes regarded as more final and perfect than anything to be found in the merely transitory appearance of human models. It must be remembered that the Indian gods were always portrayed as supermen. Such attributes as the multiple heads and arms of Hindu divinities, which would seem monstrous according to the western classical tradition, were entirely necessary to display the manifold attributes of their power, and invariably these multiple arms are disposed in such a way as to enhance the dynamic and rhythmic conception of the figure.

2. Significance and Character.—Indian religion and ritual exist in two forms, known to Indians as the Vedic and the Agamic traditions, but the Vedic is more often designated by western scholars as Aryan and Brahmanical, and the Agamic as Dravidian (southern) and popular. Vedic (Aryan) religion consisted in a worship of the great powers of nature by means of hymns and sacrifices (Yajna), without any use of temples or images, or any devotional cult properly so described. On the other hand, the much older and quantitatively predominant element of the population worshiped local and tutelary deities, powers of nature conceived as personal beings; these deities included the yakshas (genii, tree spirits, sources of life and abundance), Nagas (dragons, spirits of springs and lakes) and innumerable goddesses of fecundity or disease, the Shaktis of later Hinduism. To this Agamic tradition belonged an elaborate cosmology, many myths, the doctrines of reincarnation and acts (samsara and karma), the practice of asceticism (sannyasa) and ecstatic meditation (yoga), which appear only late in Vedic literature.

The indigenous divinities were worshiped with devotion (bhakti) as personal beings and with a ritual (puja, a non-Aryan word referring to the anointment of sacred objects) which included offerings of flowers, food, lights and incense; and for this ritual images and temples, though of impermanent materials, wood and clay, must have been in use from a very early period.

The Vedic culture was gradually penetrated by indigenous belief and closed with the reactionary teachings of the Upanishads and Buddhism, where Yajna is discounted, puja not considered; the goal is release, the means is knowledge. Meanwhile, there was developing a higher and inclusive devotional theism, in which the indigenous deities were fused with those of the Vedas, and interpreted in the light of philosophic and psychological speculation. The great system (*see* HINDUISM) thus built up, sanctioned on the one hand by scripture and on the other by popular belief, became a truly national vehicle of thought; Hindu theology and myth, in verbal and visual expression, provided means of statement for all that was felt and thought about the soul of man and the nature of the universe. At the same time, new divinities came into being, among others the Buddha himself; for the prevailing tendency involved in iconolatry, cult and ritual even such systems as those of Buddhism and Jainism, which had originated as purely psychological and ascetic disciplines.

For several centuries before and after the beginning of the Christian era the dominant mode of creative thought was theological. All the arts were governed by a great enthusiasm like that of the cathedral builders of medieval Europe, and in all enduring aspects and in their greatest splendour, they were in the service of the churches, upon whose endowment and adornment enormous wealth was lavished.

Long after the first creative impulses had been crystallized in the medieval period, there were developments of thought and feeling and modifications and elaborations of the older iconography that can still be traced. India, despite the destruction wrought by Muslim invaders, is even today covered with magnificent temples and a wealth of sculpture in which the spiritual and material history of two millenniums is visibly recorded. Further, the same initial impulses, translated to other lands and molded by the imagination of other races, Pyu, Thai, Khmer, Malay and Polynesian, created other and scarcely less significant and varied cycles of art in southeast Asia and influenced profoundly the spiritual and artistic development of central Asia, China, Korea and Japan.

3. Hieratie Art.—Thus Indian art is essentially a hieratic art devoted to the exposition of the personality and acts of deities, and providing for their service. Authoritative texts declare that the making of images of deities leads to heaven, not the making of likenesses of men; that only that which accords with the canons is beautiful in the eyes of the discerning, not that which pleases individual fancy. While Indian works evoke aesthetic experiences when beheld by alien eyes, Indian art and European art are not identical in kind; the intention is different. Nor is there identity of method. In its main development, sculpture and architecture, Indian art was not produced with a view to aesthetic experience, nor even regarded as "art." Images, in particular, were not regarded as works of art but as means (sadhana) of edification.

An image is a piece of apparatus (yantra) employed in personal devotions, the object of which is an identification in consciousness of worshiper and deity. In the words of a well-known text, the deity can be worshiped (in spirit and in truth) only insofar as the worshiper becomes the deity. For this spiritual exercise yantras of two kinds are employed, one purely geometrical and linear, the other three-dimensional and more or less anthropomorphic or theriomorphic. Both types are alike in kind; both are equally externalizations of mental visions evoked in dhyana (meditation) with a view to samadhi (superconsciousness). The obtaining of this mental visualization (which is more essential than its material realization) is a process of yoga.

Such a visualization differs from those present in normal vision: it is more vivid; it fills the whole field of view; all parts are equally and simultaneously present; the relation of these parts is not organic, nor on the other hand accidental, but ideally determined; such an image can represent only a condition of being or, to use a more strictly Indian term, a type of activity.

Such an image is not a memory image, which is the foundation of all realistic art, inasmuch as time passes between the moment of vision and that of execution. What may at first sight look like the observation of nature at Amaravati or Ajanta is simply the most vital and the most felt part of Indian art; where the worshiper attains the most complete samadhi, the artist is most completely and literally identified with his subject. Critically examined, this art reveals no knowledge of anatomy, but rather a deep understanding of life, of emotion and of the language of gesture, long codified in the *Natya Shastra*. (*See* DANCE: *The Orient: India and Pakistan.*) Nor are its themes confined to those set forth in terms of human life; beside these are dogmatic and mythological forms unparalleled in nature.

4. Narrative and Decorative Art.—A part of Indian art is secular. There exist, beside the cult image, both narrative arts and an industrial art, or arts and crafts. The narrative art such as is used to illustrate Jatakas or the epics or the Krishna legend is not hieratic to the same degree as the cult image, but is a dramatic presentation comparable to the stage. It is nevertheless governed by principles similar to those which determine the nature of the cult image: the use of formulas is general, and the part of the spectator quite distinct from that of mere perception. A typical peculiarity of Indian (and in general oriental) art is the kind of perspective known as vertical projection, whereby the landscape is presented as seen from a height, so that the horizon almost reaches the upper edge of the frame; the planes are differentiated in the sense that an object or figure behind another is represented as above it, while the atmosphere, apparently reduced to the narrow space remaining above the horizon, is really brought forward to embrace the whole representation together with the spectator.

Although in Sanskrit literature much is heard of portraits of individuals recognized as likenesses, these are invariably drawn from memory, in the absence of the model, so far at least as the actual references inform us. Further, Indian art reveals nothing like genre. The nude, for example, while sometimes represented with a frankness disconcerting to European eyes, is never studied or treated for its own sake, as in European art, and appears only as symbolism or narrative may require. In the same way landscape is never represented for its own sake.

Thus, the narrative art of India is of the same kind as the purely hieratic art. All true pattern is of this kind; this is especially evident in its repetitive character and in a mathematical rather than organic relation of the parts. Accordingly, the industrial and "decorative" arts in India cannot be sharply divided from the "higher" arts. In both, design and formula, rather than imitative shapes, are found; definite meanings are present in both, for oriental ornament is never originally without, and very rarely loses, a precise significance, and is never "merely" decorative.

5. A Theory of Beauty.—India developed, as a means of literary criticism, a theory of aesthetic experience of considerable importance in the history of aesthetic theory. A work of art is a statement informed by flavour (rasa); there are nine such flavours, the erotic, heroic, odious, furious, terrible, humorous, wondrous, pathetic and peaceful. The component elements of a work of art (physical stimulants of aesthetic experience) are determinants (vibhava, theme, etc.), consequents (anubhava, deliberate actions), moods (bhava, 33 transient [*e.g.*, joy, impatience] and 9 permanent [viz., the 9 rasas listed above]) and involuntary emotional conditions (sattvabhava). Aesthetic experience (rasasvadana) is the tasting of rasa, and depends mainly on the innate and acquired sensibility of the spectator (rasika).

6. The Artist.—A general term covering sculpture, reliefs and painting is citra; this word can also be used in a more restricted sense with reference to painting only. Silpa is the practical activity of the craftsman, rather than "art" in a modern sense. The artist or craftsman is designated as silpin, sthapati karmara, rupa-kara, citra-kara, etc. The higher craftsmen practise many arts; an architect, for example, will also be a sculptor, bronze founder and goldsmith. On the other hand workers in iron, weavers, potters and the like are restricted to a single craft. No artist is solely a designer, like a modern architect; the Indian architect is, during the greater part of his life, a manual worker.

II. INDIA

A. Prehistoric (Before *c.* 1500 B.C.)

1. Paleolithic and Neolithic.—Rough chipped-stone implements have been found abundantly in southern India. But a great gap, ethnic and cultural, seems to separate them from those of the Neolithic period. Neolithic implements, both chipped and polished, some antedating and some coeval with the knowledge of copper, have been found all over India. They exhibit a great variety of forms, including pygmy types. Most of the forms are identical with those of western Asia and Europe; but a peculiar chisel-shaped, high-shouldered celt is found in Chota Nagpur, Assam and more abundantly in Burma, Indochina and the Malay peninsula. Indian culture must have had a continuous history from prehistoric times; this must be borne in mind in a discussion of the earlier history of Indian religion and art, especially in connection with the beginnings of sculpture and design.

2. Prehistoric Painting.—Primitive ruddle paintings have been found in natural caves in various parts of north central India, and have been regarded by some authors as of Neolithic or even Paleolithic date. Those from the Mirzapur district in the Vin-

Three steatite seals from Mohenjo-Daro, Sind, 2400–2000 B.C. *Left*, rhinoceros and inscription; *centre*, unicorn and inscription; *right*, dewlapped bull and inscription

Male torso, limestone. From Harappa, West Punjab, 2500 B.C.

Bearded man, limestone bust. Mohenjo-Daro, 2400–2000 B.C.

Yakshi, polished sandstone. Didarganj, Patna, Bihar, 100 B.C.

Bull capital, polished sandstone. Rampurva, Bihar, 300 B.C.

Yaksha, sandstone. Patna, Bihar, 200 B.C.

ART OF THE INDUS VALLEY CULTURE (c. 2500 B.C.–c. 1600 B.C.) AND THE MAURYA PERIOD (322–185 B.C.)

BY COURTESY OF (TOP RIGHT, CENTRE) CENTRAL ASIAN ANTIQUITIES MUSEUM, NEW DELHI, (BOTTOM CENTRE, BOTTOM RIGHT) INDIAN MUSEUM, CALCUTTA, (BOTTOM LEFT) PATNA MUSEUM, AND (ALL) THE ROYAL ACADEMY OF ARTS, LONDON

INDIAN ART

Fragment of an arch, showing the adoration of the Buddha and Bodhisattva, alms bowl and hairlock of Buddha. Kushan period, Mathura school, from Jamalpur; 2nd century A.D.

Scenes from the married life of Prince Siddhartha and Yashodhara. Kushan period, Gandhara school, from Jamrud; 2nd–4th century A.D.

Woman and child, girl above looking over drapery; red sandstone railing pillar. Mathura school, from Mathura; late 1st century A.D.

Bodhisattva, schist. Gandhara school, provenance unknown; 2nd–4th century A.D.

Frieze of worshippers carrying lotuses, serpentine. Gandhara school, provenance unknown; 2nd–4th century A.D.

SCULPTURES OF THE KUSHAN PERIOD (c. A.D. 50–241) AND LATER ANDHRA PERIOD (c. A.D. 50–320)

Nativity of the Buddha, limestone. From right to left: above, the Dream of Maya and its interpretation; below, the miraculous birth in the Lumbini garden, and the presentation before Yaksha Sakyavardhana. Later Andhra period, from Amaravati; 2nd century A.D.

Head of the Buddha, lime composition. Gandhara school, 3rd–5th century A.D.

BY COURTESY OF (BOTTOM CENTRE) THE TRUSTEES OF THE BRITISH MUSEUM, PHOTOGRAPHED ESPECIALLY FOR ENCYCLOPÆDIA BRITANNICA, INC., (BOTTOM RIGHT) THE VICTORIA AND ALBERT MUSEUM, PHOTOGRAPHED ESPECIALLY FOR ENCYCLOPÆDIA BRITANNICA, INC., (TOP LEFT, TOP RIGHT) CURZON MUSEUM, (CENTRE) PESHAWAR MUSEUM, AND (EXCEPT BOTTOM CENTRE, BOTTOM RIGHT) THE ROYAL ACADEMY OF ARTS, LONDON

Seated Buddha, painted sandstone. Buddh Gaya, Bihar; early 4th century

Mahavira Jina, seated figure in black basalt. Warangal, Hyderabad; 4th century

Vishnu, red sandstone. Provenance unknown; 5th century

Vishnu seated on the serpent of eternity and Brahma seated on a lotus, terra cotta. Bhitargaon, Uttar Pradesh; 5th century

Buddha, copper. Sultanganj, Bengal; 5th century

Post-Gupta relief of Parsvanatha, sandstone. Gyaraspur, Madhya Pradesh; A.D. 700

Standing Buddha, red sandstone. Mathura, Uttar Pradesh; 5th century

ART OF THE GUPTA PERIOD (A.D. 320–c. 600)

BY COURTESY OF (BOTTOM LEFT) THE VICTORIA AND ALBERT MUSEUM, PHOTOGRAPHED ESPECIALLY FOR ENCYCLOPÆDIA BRITANNICA, INC., BY C. M. CANNINGS, (BOTTOM RIGHT) THE MUSEUM AND ART GALLERY, BIRMINGHAM, (TOP LEFT, CENTRE LEFT, BOTTOM CENTRE) INDIAN MUSEUM, CALCUTTA, (TOP RIGHT) CURZON MUSEUM, (TOP CENTRE) GOVERNMENT MUSEUM, HYDERABAD, AND (EXCEPT BOTTOM LEFT, BOTTOM RIGHT) THE ROYAL ACADEMY OF ARTS, LONDON

INDIAN ART

The god Shiva (Siva), bronze. Kilippandam, Madras, *c.* A.D. 900

The Hindu deity Padmapani; bronze. Kurkihar, Bihar, 9th century

The monkey god Hanuman, bronze. Southern India, 11th century A.D.

The goddess Parvati, bronze. Jambanodai, Madras, *c.* A.D. 1000

The Buddhist goddess Tara, enameled and gilded copper. Nepal, 16th or 17th century A.D.

Bodhisattva Vajrapani, basaltic trap. Lalitgiri, Orissa, 8th century A.D.

STATUES OF THE 9TH TO 17TH CENTURIES

BY COURTESY OF (BOTTOM CENTRE) VICTORIA AND ALBERT MUSEUM, PHOTOGRAPHED ESPECIALLY FOR ENCYCLOPÆDIA BRITANNICA, INC., (TOP LEFT, TOP RIGHT, CENTRE LEFT) GOVERNMENT MUSEUM, MADRAS, (TOP CENTRE) PATNA MUSEUM, (BOTTOM RIGHT) INDIAN MUSEUM, CALCUTTA, AND (EXCEPT BOTTOM CENTRE) THE ROYAL ACADEMY OF ARTS, LONDON

"The Emperor Shah Jahan," painted by Bichitra in 1631

"Attendant Leading a Black Buck," painted c. 1615 by Manohar during the reign of the emperor Jahangir

17TH-CENTURY MUGHAL PAINTING

BY COURTESY OF VICTORIA AND ALBERT MUSEUM, LONDON, PHOTOGRAPHED ESPECIALLY FOR ENCYCLOPÆDIA BRITANNICA, INC

INDIAN ART

"Prince With Ladies," from the Punjab Hill state of Basohli, *c.* 1720. Illustration to the musical mode Vinoda Raga

"Lady With a Hawk," from the Punjab Hill state of Guler, *c.* 1760. Illustration to the Indian musical mode Saveri Ragini

"Lady Chasing a Cat Which Has Seized Her Pet Parrot," Kangra style, *c.* 1810

18TH- AND 19TH-CENTURY RAJPUT PAINTINGS

BY COURTESY OF VICTORIA AND ALBERT MUSEUM, LONDON; PHOTOGRAPHED ESPECIALLY FOR ENCYCLOPÆDIA BRITANNICA, INC.

dhya mountains include a representation of a rhinoceros hunt. This animal is now extinct in this area. The hunters are shown with barbed spears, suggesting certain of the ancient Indian copper weapons.

Cave paintings from the Hoshangabad district are said to include representations of a giraffe. Those from the Kaimur range show stag hunts. Those from Singanpur include an animal rather like a kangaroo and also some representations of a horse and of deer which present an extraordinary resemblance even in details to the Paleolithic paintings of Cogul in Spain.

The literature of the subject is cited by Herbert Kühn, who discusses the Singanpur examples and their resemblance to Spanish drawings. Those from Hoshangabad are referred to in the *Annual Report* of the Archaeological Survey of India, part 1, p. 25 (1917–18).

3. Chalcolithic: Indus Valley Culture.—Excavations at Harappa in the Punjab and Mohenjo-Daro and Chanhu-Daro in Sind have revealed the existence of ancient city sites belonging to a Chalcolithic culture, known as the Indus Valley culture or, from its relation to the near east, the Indo-Sumerian period.

The dating of the Indus civilization depends on comparison with vestiges of similar architectural and sculptural remains in Mesopotamia and on the discovery of objects of Indian type in pre-Sargonid and Sargonid sites. Indic seals have been found at Ur, Kish and Tall al Asmar datable from about 2500 to 2350 B.C., so that the beginnings of the Indus civilization have been fixed in the middle of the 3rd millennium B.C. This culture lasted until the 17th century B.C., when it was succeeded by an obscure and inferior culture known as the Jhukar which endured up to the time of the Aryan invasion of 1500 B.C.

The buildings at the Indus sites are of a well-burned brick. This method of construction and the existence of lofty citadels like the ziggurat platforms of Mesopotamia suggest a connection with the architecture of the ancient near east. Among the examples of sculpture, two figures, one of a nude male from Harappa, the other a dancer, perhaps Shiva (Siva), from Mohenjo-Daro, belong to a definitely Indian style of expression with their emphasis on the fullness and softness of the body suggested abstractly through the interlocking of the smooth convex planes of the surface.

Sculptures in marble include a bust of a man, possibly a shaman, and a bearded head wearing a skullcap. The masklike quality of these heads is distinctly Mesopotamian in character. In terra cotta, there are many figurines of a nude goddess with an elaborate headdress, girdle and the body ornament (channavira) characteristic of later Indian art; in terra cotta and in faïence, admirable figures of animals, including the bull, rhinoceros, dog and cock. All these are sculptures in the round. But the most abundant and not the least remarkable works of art are the square seals of faïence or ivory which bear in relief figures of animals, usually a bull, elephant or rhinoceros, with a cult object, apparently a wicker crib or manger, and pictographic signs, partly related to early Sumerian forms and even more similar to pre-Sumerian forms found at Kish but so far undecipherable. Some scholars believe that the later Indian Brahmi (Sanskrit) script was developed from this early pictographic type. One seal bears a seated cross-legged figure attended by snake-hooded Nagas, as in much later, Buddhist, art; another a sacred tree (the bo tree or pipal, *Ficus religiosa*, later a symbol of various deities, particularly the Buddha) with a horned dragon projecting from the trunk; another, a row of men bearing totem standards like those of predynastic Egypt. One earlier seal from Harappa represents a tiger hunt.

Among personal ornaments are finely wrought gold, silver, and copper gilt jewelry, chank and carnelian beads, faïence bangles. Other metals known included tin and lead, but not iron; some utensils and ornaments are made of bronze. India has no Bronze Age properly so-called but the alloy is found already at that early date and has remained in use to a limited extent ever since, though most of the so-called Indian bronzes are really of cast copper. A copper model of a hooded two-wheeled cart obtained from the lower strata at Harappa is evidence of the very early use of wheeled vehicles. Few weapons have been found.

The pottery is wheel made, and includes painted types; the shapes are varied, but types with handles are rare. The painted designs are usually in black on a dark red slip and consist of advanced geometrical patterns, foliar motifs and occasional figures of animals.

The dark red and black ware has been found abundantly at Nal in Baluchistan, associated with copper implements, also on the Waziristan frontier and in Seistan. The style bears some relation to that of Anau and of Susa II.

When the Indus culture was flourishing, the valley was better watered and more wooded than now. The same culture, perhaps in more provincial forms, may have extended to other parts of northern India, over an area reaching from Baluchistan to Kathiawar and through Rajputana to the Ganges valley, as indicated by the Gungeria hoard and other finds of copper and Neolithic implements.

The Indus Valley civilization and culture show close resemblances on the one hand with those of early Sumer and Babylonia (especially with the proto- or pre-Sumerian of Kish), and on the other with that of historic India. Apart from these archaeological evidences, there has gradually accumulated a mass of evidence tending to show that the early Indian and Mesopotamian cultures represent cognate developments. This applies especially to considerations derived from a study of the history of design (particularly in connection with the animal style and architecture), and to the analogies between Babylonian mythology and cult and those of the Dravidian (Agamic) tradition in India, such as the use of the same formulas in representing mountains, clouds and water; the motif of animals with long necks interlaced, and of heraldic and fabulous animals generally; the representation on Babylonian seals of dragons with serpentine bodies and human busts, like Indian Nagas; the cult of the waters connected with the symbol of the flowing vase in Babylonia and the brimming vessel or vase of plenty (purna kalasa) of India—the former significantly spoken of by Léon Heuzy as the marvelous symbol that was like the Holy Grail of the Chaldean epoch, and both of importance in connection with the origins of the Grail cult. To these may be added similarities of technical procedure, as in the process of decorating carnelian by calcining and in the similar composition of Indian and Assyrian glass.

Neither the archaeological nor the mythological evidence suggests that the Mesopotamian and early Indian cultures were derived from each other, or that either borrowed extensively from the other at any one period, but rather that both developed *in situ*, though not without intercourse and contact, on the common basis of the early Chalcolithic culture which in the 5th and 4th millenniums B.C. extended from the Adriatic to Japan. It has been suggested that the numerous small cultures developed in Iran and Anatolia in the 5th millennium B.C. began to spread southward and southwestward into the plains of the great rivers. This movement produced Mesopotamian civilization in the late 4th millennium, and the Indus culture, not a Mesopotamian colony, was a later product of similar stimuli in the 3rd millennium. The original focus of this culture may have been Armenia, a country rich in metals and possibly the starting point for the many early race movements across the highlands of Iran—in one direction toward Elam and southern Mesopotamia, in the other toward central Asia and India. The Indus culture presumably ended with the Aryan invasions.

B. Vedic and Pre-Maurya (*c.* 1500–322 B.C.)

It will be assumed that the Aryans entered India from the northwest about 1500 B.C. and, occupying the Punjab, gradually passed on to the Ganges valley. They probably brought with them a knowledge of iron and a superior breed of horse, and it may have been these advantages that enabled them to subjugate the existing peoples who already possessed cities and forts and a more developed material civilization. After the first period of conflict, the Aryans (as with the later invaders, Scythians, Huns and Mughals or Moguls) ceased to be foreigners and became Indians; long before 500 B.C. northern India had become the seat

of a mixed culture in which—and especially in its art, both as regards motifs and technical achievement—the non-Aryan element predominated. The conquerors had been conquered by the conquered.

Vedic literature, mainly in the relatively later texts, reveals a knowledge of tin, lead, silver, gold and iron, of cotton, silk, linen and woolen garments, sometimes embroidered, vessels of gold and silver, iron needles, bedsteads, thrones, turbans, jewelry, earthenware, round and square huts and storied buildings and wheeled vehicles. Some or all of these arts may have been known to the Aryans before they entered India, but probably the use of bricks, and certainly everything connected with maritime or purely Indian products (chank, ivory, cotton, pearls, indigenous dyestuffs, etc.), they must have found in India for the first time. The sulvasutras show a knowledge of principles now known as those of dynamic symmetry. Vedic culture shows little or no evidence of Babylonian or Semitic connections.

Some terra-cotta figurines, most of them of the mother-goddess type, from Mathura (mod. Muttra) and elsewhere have been dated in the pre-Maurya period. The greatest number of pre-Mauryan antiquities have been obtained at the Bhir mound, Taxila; most notable among these are the finely wrought polished sandstone disks, with bands of concentric ornament, in which are found cable, cross and bead and palmette motifs, the taurine symbol, elephants, fan palms and the nude goddess. It is also certain that the cutting and polishing of hard stones and the technique of glassmaking had attained, as early as the 4th and 5th centuries B.C., a perfection that was never afterward surpassed; and when in the Maurya period stone sculptures are first found, the surface of the hard stone is highly polished. One other important type of early art is represented by the punch-marked coin symbols; these coins were in use from about 600 B.C. to A.D. 100. The marks include several hundred types; among the commonest are the mountain (usually with three or more peaks—the so-called chaitya of older numismatists), river or tank with fish, sacred tree, elephant, horse, bull, sun, moon, caduceus and taurine; the lion, rhinoceros, makara (crocodile) and human figure are rarer. No linga (phallic symbol), thunderbolt, footmark or stupa is represented. These signs (rupa), forming an extensive symbolic repertory, appear to have been those of issuing and ratifying authorities. Many of the symbols are those of particular deities; for example, the three-peaked mountain with crescent moon is otherwise known to have been a symbol of Shiva, and so also the bull. Few or none of the marks are exclusively Buddhist. Some are connected with particular cities, and in their day identified the issuing mints.

As regards design the same forms which are found in the reliefs of the Maurya, Sunga and Andhra periods were already current during many centuries before the 4th B.C. These forms include meanders, palmettes, vases with flowers, sacred trees, diapers, spirals, frets, twists and the like, animals addorsed or affronted and fantastic animals of all kinds. Many or all of these characteristic forms are clearly related to, but not identical with, Mesopotamian types, Assyrian or older. They constitute a common ground of early Asian, and in India are cognates of the Mesopotamian forms, not late borrowings. The fact that they are found extant only in the stone sculpture when it first appears in the Maurya period is of course no proof of their late origin; some of the most ancient survive most characteristically in quite modern folk art, and may well have been current during three or four millenniums. Thus, the motif of animals with interlacing necks, known in Ceylon, where it is one of the commonest motifs of folk art, as puttuva, was already current in Sumerian art of the 4th millennium B.C., and many other instances of the same kind could be cited.

As regards sculpture, late Vedic literature, in which a large non-Aryan element had been absorbed, affords evidence for the making of images of popular deities in impermanent materials; and it is certain that the earliest known stone figures (after the Indus Valley types), viz., the yakshas of the Maurya and Sunga periods, despite their retention of primitive qualities (frontality, etc.), are not first efforts in any sense; they represent an already advanced stage in stylistic and technical development. There is also the evidence of pre-Maurya terra cottas representing the nude goddess and some other types. The latter are of very great importance for the history of art, for though they belong to a stylistic cycle older than that of the stone sculpture, and are still too little known, they provide connecting links in style, technique and costume between the oldest Indo-Sumerian art and that of the historical period. In their sense of the inseparability of beauty and fruitfulness, and in details of ornament (the body ornament later known as the channavira, and the broad auspicious girdle, the mekhala), as well as in some facial types, they are related to the earliest sculptures in stone.

C. Maurya, Sunga and Early Andhra Periods (322 B.C.–c. A.D. 50)

1. Maurya (322–185 B.C.).—With the Maurya period, and especially the reign of Asoka (*q.v.*), from about 274 to 232 B.C., sculptural and architectural monuments in stone are found for the first time. These fall more or less definitely into two groups: (1) the court art of Asoka; and (2) the popular and perhaps more purely native art. The chief monuments of the court art are the remains of the great palace at Pataliputra (Patna) and the monolithic pillars on which Asoka's well-known edicts are inscribed. The six edict pillars, distributed over an area including Meerut, Allahabad, Benares (Varanasi) and the Nepal Terai, have round polished monolithic shafts and are provided with elaborate capitals consisting of a lotus bell, an abacus decorated with geese, palmettes or Buddhist symbols and a crowning sculpture in the round consisting of one or more animals; they average from 40 to 50 ft. in height. The finest has been excavated at Sarnath, the old "Deer park" at Benares, where the "Turning of the Wheel of the Law" (the Buddha's first sermon) took place. There are four addorsed lions supporting a wheel (the Dharmacakra, "Wheel of the Law and of Dominion"); the abacus is decorated with four smaller wheels and a bull, lion, elephant and horse. Other pillars bear a single lion, a bull or an elephant. The naturalistic treatment of these animals, the technical accomplishment of the work and the fact that this is evidently a stylistically late art all distinguish these sculptures from the contemporary religious sculptures to be referred to below. It has been argued that the court art of Asoka owes much to western sources, and even that it was produced by imported craftsmen. It is certain that close and friendly relations were maintained between the Maurya and Seleucid houses. The problem, however, is far from simple. All that is beyond doubt novel at that period is the use of stone to a limited extent for architectural purposes and probably the use of stone for large sculpture. Nor can the Maurya period, with its invaluable but very imperfect record, be considered alone; early Indian art as a whole and the folk art up to the present day bear an intimate relation to western Asian art. This relation is more obviously Babylonian-Assyrian than Persepolitan. Indian bell capitals, for example, are very different from those of Persia. Indian shafts are smooth or octagonal, and monolithic; Persian, fluted and segmented. The use of animal standards as symbols of deities is at once Indian, Chaldean and Assyrian, but not Achaemenid or Seleucid. The so-called Persepolitan capital with addorsed bulls (often horses, elephants or lions) again is so widely distributed and so much an integral part of the whole architectural style in the 2nd century that it could hardly have been introduced only a century earlier. So too with the civil architecture represented on the reliefs, showing walled cities with towers and battlements like those of Assyria, with the mythical monsters and with the elements of the decoration; in all, the relationship to western Asia is conspicuous, but the individual character is equally unmistakable. Nor is it possible to suppose that no art of any kind existed in India before Asoka, or that there existed some different sort of art just before Asoka, of which no trace can be found in the abundant reliefs just after him. Thus, Maurya and Sunga art directly continue the traditions of pre-Maurya art; Indian and early Persian art are both late phases of a tradition common to all western Asia.

2. Sunga (185–72 B.C.).—The early Indian stone sculpture in

the round of Maurya and Sunga date is represented by a number of colossal figures in royal costume, apparently statues of independent or attendant yakshas and yakshis, two of these having been found at Parkham, near Baroda, and at Besnagar, one at Deoria near Allahabad, one in Mathura and three at Patna; all are in sandstone, and some are polished. The figures are distinguished by great mass and volume. There is no conscious effort toward grace, but a statement of an ideal concept in a technique that is still primitive; for the form is frontally conceived, and the transitions from one plane to another are somewhat abrupt. The style achieved its perfection several centuries later in a Buddha figure set up at Sarnath.

Bharhut.—From this time onward the history of Indian sculpture is richly documented. The great stupa of Bharhut (175–150 B.C.), of which the extant remains are now all in Calcutta, had an elaborately decorated railing (vedika) and gateways (toranas). The rail coping bears a continuous floral meander, the flowers and leaves being partly vegetative, partly consisting of jewelry; in the interspaces of the meander are represented many of the Buddhist Jatakas and other edifying legends. The railing medallions are developed as expanded lotus flowers, or occupied by Jataka subjects or scenes from the life of Buddha. On the upright pillars of the gateways and some of the railing pillars are found representations of various devatas, yakshas and yakshis, many of which are provided with inscriptions recording their names, as, for example, Kubera; thus, Buddhism made use of the popular divinities as guardians and worshipers. The reliefs are all more or less compressed between the surface plane and that of the background, lacking equally the plastic volume of the Bhaja types and the technically more advanced relief of Sanchi; but the costumes, though modified, are closely related to those of Bhaja. The various decorative motifs, floral and geometrical, are indicative of a highly evolved art. Of the same date are some of the railing pillars of stupa II at Sanchi and the remains of early sculptured walls at Jaggayyapeta and Amaravati.

Bhaja.—To the same school of art belong the reliefs of the early vihara (monastery) at Bhaja—this is apparent in their volume and in details of the costume, particularly the enormous turbans and the pearl-fringed bracelets, which last are found also on some early Sunga terra cottas. One of the most remarkable of these reliefs seems to represent Indra, seated on his cloud-elephant Airavata. Sacred trees (chaityavrkshas), guarded by railings and adorned with garlands and umbrellas, are to be seen, and on one side a horse-headed yakshi and a man, perhaps with reference to the Padaku-salamanava Jataka. On the opposite side of the doorway, which divides what are evidently two parts of a single grandiose conception of earth and sky, is represented the sun in a four-horsed chariot.

Iconography.—Prior to the Sunga period the major Indian deities seem to have been represented mainly or exclusively by symbols. Since Asoka speaks of engraving edicts on already existing columns, it is possible that the Mauryan bull and elephant capitals were originally erected in honour of Shiva and Indra. Garuda and makara standards of Sunga date at Besnagar refer to Vishnu and Kamadeva; the fan-palm capitals, perhaps to Baladeva. Shiva is represented on early coins by a bull or by a mountain of three peaks surmounted by a crescent; later, in the Kushan period, he appears in person together with the bull and other symbols; Indra and Agni appear on the coins of the Pancalas in the 2nd century B.C.; the abhiseka (lustration) of Sri-Lakshmi, on those of Azilises in the 1st (as well as on the earlier Bharhut reliefs and on terra cottas); other forms of Sri, on coins of Amoghabhuti. Indra and Brahma are freely represented in Buddhist art at Bharhut and Sanchi wherever the narrative requires; the former with his vajra (thunderbolt) and a vessel containing the "Water of Life" and usually with a cylindrical metal headdress, the first appearance of any kind of crown in Indian art (the original royal headdress is a turban).

Patanjali, commenting on Panini, *c.* 200 B.C., refers to the public exhibition of images of Shiva, Skanda and Visakha; and there is evidence enough in the later Brahmanas, lawbooks, epics and Buddhist and Jain literature to show that the use of images and temples (*q.v.*) had come into general prominence from about 400 B.C. onward. Probably the oldest surviving anthropomorphic representation of a deity, forming a cult image, is that of Shiva on the Parasuramesvara linga, from Gudimallam in eastern India a little above Madras; there the deity stands on a dwarf yaksha vehicle, and in this respect and stylistically, though more developed, recalls the Kubera of Bharhut. This early figure of Shiva is a great and powerful work, fortunately preserved from a period when a majority of Hindu images were still made of wood or clay. There is an interesting, though later, reference to such images in the Divyavadana, where Upagupta, worshiping an appearance of the Buddha created by Mara, explains that he is bowing, not to the object before him, but to the Master himself, "just as people venerating images of Gods do not revere the clay, but the immortal ones represented by them."

Orissa.—Datable in the 1st century A.D. are the excavated monasteries of Udayagiri and Khandagiri in Orissa. The best sculptures are reliefs forming a frieze in the upper story of the Rani Gumpha; the subject, which includes the hunting of a winged deer as a part, has not been identified. The monasteries there are, so far as can be determined, all Jain; but many of the motifs familiar to Buddhist art (*e.g.*, the lustration of Sri-Lakshmi and the sun drawn in a four-horsed chariot) are found. Above the arches of the cell doors are found three-headed serpents (Nagas), and below the frieze a series of small Garuda brackets, both features that were later on extensively developed in Khmer art.

3. Early Andhra (75 B.C.–A.D. 50).—*Sanchi.*—The most perfectly preserved Buddhist monument in India is the great stupa at Sanchi in Bhopal. Enclosed and hidden within it is an earlier brick stupa dating from the time of Asoka, but the stupa itself, as enlarged and cased with masonry, dates from the 2nd century B.C., the plain railing from the same time and the gateways from the first half of the 1st century A.D. Stupa II at Sanchi is to be dated in the 2nd century B.C. and stupa III belongs to the 2nd century A.D.

The reliefs of the great gateways of the main stupa, occurring on the upright pillars and on the horizontal architraves, illustrate Buddhist legends, including Jatakas and scenes from the Buddha's ultimate incarnation. They are executed with a delicacy and wealth of detail suggestive of ivory carvings, and indeed a votive inscription records that some were carried out "by the ivory workers of Bhilsa." Apart from their original intention they afford a veritable encyclopaedia of manners, weapons, decoration and symbolism. At the base of the upright pillars are beautiful figures of guardian yakshas; and the architrave brackets are yakshis represented as dryads clinging to their trees and leaning outward. On the tops of the uppermost architraves are Buddhist symbols guarded by cauri-bearing yakshas.

Just as at Bharhut, and in early Indian art generally, in the scenes from the Buddha's life, though they tell their story with perfect clarity, the Buddha himself is never represented in human form but only by symbols—footprints (padukas) and umbrella (chatta) or wheel (chakra) or tree. These symbols indicate the presence of the Buddha wherever required in the representation, and some refer to specific episodes in the life, including most of those which were afterward grouped together in panels illustrating the Four (or Eight) Great Events. Thus, the wheel designates the First Preaching of the Law; the sacred tree (Bodhi-druma) with its altar or railing, the Great Enlightenment. Where the tree is represented with guardian yakshas on either hand, the prototype of the later Buddha triads, where the Buddha is seated between a pair of attendant Bodhisattvas, can be recognized, for there is no doubt that the principal Bodhisattvas, especially Padmapani (Avalokiteshvara) and Vajrapani, were originally guardian yakshas.

Further, the art of Sanchi, though Buddhist in theme, is scarcely Buddhistic in content: the legends illustrated are always edifying, but the manner of treating them and the feeling for the human form are far from ascetic or introspective. And this becomes especially evident in connection with the accessory figures, such as the dryads, filled as they are with the abundance and joy of life.

A very important school flourished at Mathura from the 2nd

century B.C. to the 6th A.D. The early fragments are in a manner closely related to that of Bharhut. More important are those which cover the period of transition from the old aniconic to the later anthropomorphic representation of the Buddha figure: these are of Kushan and perhaps somewhat earlier (Indo-Parthian or Ksatrapa) date and will be discussed below.

D. Kushan (*c.* A.D. 50–241)

Assuming a date of A.D. 50 for the invasion of the Kushans, it can safely be said that the first century and a half of the Christian era represents the most critical period in the history of art in India, the 2nd to the 4th century that of highest achievement. For the earlier period, and only to a somewhat lesser extent the later, the prolific school of Mathura is of primary importance, for types were evolved there that can be traced in all the later development. It must be remembered that at all times "Buddhist India" was equally and at the same time a Hindu India; the so-called Hindu renaissance of the Gupta period does not represent a reaction, but rather the flowering and culmination of a previous development. So far as cult and literature are concerned, this is self-evident; as regards the art, while Buddhist monuments are at first much more abundant and magnificent, this probably means that Hindu cults adhered longer to the use of impermanent materials such as wood and clay for buildings and images, as in southern India up to the beginning of the 7th century.

The period of florescence of Buddhist art at Mathura coincided with the period of the great Kushan dynasty. These Scythian invaders were established in northwestern India as early as the 1st century A.D. The dynasty came to an end in A.D. 241 with an invasion of Shapur I of Iran. The greatest ruler and patron of Buddhism was Kanishka, whose regnal dates are disputed: although some scholars believe his reign began as early as A.D. 78, others suggest a date as late as A.D. 144.

1. Buddha Types.—Within the first century and a half of the Christian era the Buddha figure for the first time replaced the old symbols, which nevertheless remained in use both in Gandhara and at Amaravati considerably later. Images of other deities had long existed, and the influence of current devotional tendencies acting on Buddhism and Jainism must have led to a similar development. The fixing of a date for the earliest images of Buddhas or jinas is more difficult. Paleographic evidence would seem to place those of jinas from the Kankali Tila, Mathura, as early as the middle of the 1st century. The only certain date for an early image of Buddha is that of the colossal image set up by Friar Bala at Sarnath in the third year of Kanishka's reign. It should be noted that this Buddha type is distinguished by certain peculiarities not found after the Kushan period (with one exception of 5th-century date), and rarely met even after the middle of the 2nd century. The seated figure is always on a lion throne, never on a lotus. Many other images, both standing and seated, in the same vigorous style derived from that of the early yaksha types, have been found at Mathura or are of Mathura manufacture, exported and set up at sacred sites widely distributed in the Punjab and the Ganges valley.

The earliest Buddha (and jina) type shows the ends of the shorn hair forming a single conical spiral on the top of the head, bearing no resemblance to the ushnisha in the sense of a cranial protuberance such as characterizes the Buddha figure at Amaravati, in the Gupta period, and subsequently both within and beyond the boundaries of India proper. When this cranial protuberance appears, it, together with the rest of the head, is covered with innumerable short and tight curls, curling to the right. According to the Buddha legend, the Bodhisattva, when first adopting the homeless life of an ascetic, cut off with one stroke of his sword both his long hair and the turban which covered it, and these were received by the gods and worshiped by them as the Great Crest relic (cuda maha); the remaining hair, two inches in length, curled tightly to the right, and so remained throughout the Buddha's life, never again needing to be shorn. This could have been understood to mean either a single curl or many curls; the ambiguity seems to be reflected in the two varieties of the Buddha type referred to above, the interpretation in the sense of many curls very soon supplanting the other.

The question of the cranial protuberance is more involved. As in the case of other images of deities (the Buddha even in his own lifetime is more than man, he is recognized as "God of gods" when, at the Presentation, the tutelary yaksha of the Sakyas bows before him, and as the object of a cult he must be called a deity), the Buddha image represents a dogmatic conception; the essential element in this conception is that of the idea of the mahapurusha ("great male," also a designation of Vishnu) and chakravartin ("universal emperor" or, alternatively, "world teacher"). Buddhist texts take over from Brahmanical sources the lists of physical peculiarities which characterize such a being; for example, the soles of his feet and palms of his hands bear stigmata of the wheel, and there is a tuft of hair (urna) between his eyebrows; all these peculiarities are commonly found in Buddha images. Most of the other marks are relatively inconspicuous or not externally visible. One is of particular importance for the present inquiry: the infant Bodhisattva is said to be unhisosiso, ushnisha headed. In interpreting this and other of the marks (in all 32 major lakshanas and 80 minor signs), it should be borne in mind that they must originally have been conceived as characterizing an adult.

Now ushnisha in early Indian literature is the regular word used for the turban, which headdress is a mark of rank, worn by kings or by others on special occasions. Ushnisha headed can mean only: (1) having a head like a turban; or (2) having a turban on his head. Inasmuch as the 32 marks really characterize a chakravartin as an adult being, and as the turban is actually a mark of rank, the latter interpretation is to be preferred, in the sense "destined to wear the turban," as we have to do with a child. But as the Bodhisattva became not a universal emperor but a Buddha and abandoned his turban and long hair, he had to be, as always, represented (with the exception of certain crowned types which may be Dhyani Buddhas) as bareheaded. In the early Mathura figures the problem seems to be ignored. It would appear that after these had been in vogue for some time a necessity was felt to embody the unhisosiso idea in the canonical image, and this was done by making the ushnisha a cranial protuberance; this took place (in the 2nd century A.D.) at the same time that many curls were substituted for one.

The figure of Indra as Santi, of the Buddh Gaya railing (*c.* A.D. 100), has the hair represented in schematic curls, with the appearance of a cranial protuberance, and many representations of yakshas have curly hair; the existence of such prototypes may have contributed to the formation of the Buddha image as ultimately accepted.

2. Hindu Types.—Next in abundance to the Buddhist remains are those of the Jains. The site of the Vodva stupa, founded in the 2nd century B.C., has yielded figures of jinas, similar to those of the Buddha except that in the case of Parsvanatha the jina's head is sheltered by the hoods of a Naga rising above it. Highly characteristic for Jain art are the ayagapatas, or votive slabs bearing reliefs representing stupas or elaborate designs, with a central seated jina, quadruple trisula symbol and the Eight Auspicious Symbols.

Figures of Hindu deities are found chiefly on the coins of Gondophares, Kadphises I and II, Kanishka, Huvishka and Vasudeva. The variety of types of Shiva is especially noticeable. Many-armed and many-headed types appear for the first time in the 2nd century; Shiva is then four armed and sometimes three headed (Mahesa), the latter type being evidently very popular since it spread quite early to Gandhara and central Asia, where it occurs in sculpture and painting. Many of the Yaudheya coins bear a six-headed Skanda. On coins of Kanishka a great variety of deities appears: Greek, Zoroastrian and Indian. The figure of the running wind-god is original and remarkable. The Buddha appears first on a coin from Ujjain, then in three types on coins of Kanishka. The Brahmanical temple site at Mat has yielded the famous inscribed statue of Kanishka and other royal effigies.

3. Gandhara (Greco-Buddhist) Sculpture.—The prolific Greco-Buddhist school of the former North-West Frontier (Afghanistan and part of the Punjab, including Peshawar and the site of Taxila) has always attracted the attention of archaeologists.

Its subjects, as in Indian Buddhist art, are drawn from the Buddha legend, and there are countless images of Buddhas and Bodhisattvas and of other deities such as the Tutelary Pair, Kubera and Hariti. The influence of the school is widely extended in central Asia, affecting China, Korea and, to a lesser degree, Japan.

Very few Gandhara images bear dates, and no one of these dates is in a known era. According to some interpretations these dates indicate a beginning of the art in the 1st century B.C., but at Taxila, where excavations have been scientifically conducted, Greco-Buddhist art is entirely absent from the Scytho-Parthian and very early Kushan levels of the city of Sirkap, and appears only a little before the time of Kanishka. In any case the period of greatest production coincides with the reigns of Kanishka (A.D. 120) and Huvishka, in the 2nd century A.D. A. Grünwedel dates Kanishka A.D. 78 and makes the Gandhara school begin in the 2nd century, thus later than the establishment of the Mathura type. But the Buddha image may have come into use, as the result of a common religious necessity, simultaneously in both areas, though the priority for Gandhara, even if established, would not affect the fact that the Indian Buddha image of the Gupta period is derived directly from the early Mathura type, as this in turn is derived from that of the yaksha types of the earliest Indian school. It may be safely said that the influence of the Greco-Buddhist school in India has been much exaggerated.

The Gandharan type differs from Indian types in more than one way; iconographically by a different treatment of the hair, and in the seat, which in Gandhara is nearly always a lotus, in India at first always a lion throne, despite the fact that the lotus seat as a divine symbol had been long known. Stylistically, the differences are more profound. Gandharan is "late," and belongs to an age of aesthetic decadence in its own cycle; it is naturalistic by intention, although its appearance of realism is no longer based on any structural reality; its graces are deliberate and languid; the solid folds of the drapery are carefully represented. The Indian type still has all the energy and volume of primitive art; it makes no pretensions to grace, is without naturalistic intention, and the drapery is schematic and clinging. It would hardly be possible to juxtapose two contemporary styles more distinct in kind. The Gandharan art in its own environment is gradually indianized, and its productivity ends with the Hun invasions of the 5th century. The finest, most "spiritual" examples of Gandharan sculpture are the stucco reliefs of the 3rd century.

E. Later Andhra (*c.* A.D. 50–320)

The reliefs of Amaravati, dating from the early 2nd century A.D. and later, adorned a great stupa, with the largest and most richly decorated stone railing ever constructed, surrounding it. This stupa was one of numerous Buddhist monuments erected or enlarged by the later Andhra kings in the Kistna-Godavari delta, their seat of government. This later Andhra art is the most intimate and most enchanting of any in India. Just as in literature epic form was passing into "poetry" (*kavya*), so for the first time sculpture was becoming "art."

The subject matter of the reliefs did not change. The principal compositions represent Jatakas and scenes from the life of Buddha (in accordance with traditions earlier than that of the Lalita Vistara). Vital monuments of the Buddha epic are more dramatically and emotionally conceived; the gestures, especially those of women, possess a peculiar poignancy, reminiscent of such contemporary Buddhist literature as the Bodhicaryavatara and the work of Santi Deva. This poignancy survives indeed at Ajanta, and Gupta art is very closely related to that of the Andhras in the 3rd century; but very soon, insofar as it belongs to life, it passes into the formalities of chivalry, and insofar as it belongs to art, into deliberate emphasis and even exaggeration. The same is true of the decorative motifs; a sense of organization already long perfected is applied there to traditional motifs, with an inimitable delicacy and firmness. The ornament, in fact, is of precisely the same quality, and has the same value as the reliefs with figures. An art which had been entirely corporeal now acquires a spiritual content, becoming Buddhist in a more than formal sense.

As regards the Buddha figure of Amaravati, and the similar early types found in Ceylon, the use of a cult image was still new, and the figure therefore retains more of the austerity and massive individuality of primitive art than do the reliefs and ornament.

F. Gupta (A.D. 320–*c.* 600)

In early Gupta art the spirit is still at the height of its vitality, but maturer, more intellectually conscious, more introspective; at the same time the expression is less reserved. Gupta art is characteristically logical, sophisticated, gracious and sensuous. Early Gupta art is important in the history of Indian art as representing a completely unified national style within the limits of India proper, and at the same time embodying the types of which the influence predominated in the southeastern and far eastern developments of Indian iconography and architecture. The Gupta style is unmistakably recognizable in the sculpture and architecture of 5th- to 7th-century date in Burma, Siam and Cambodia.

The Buddha figure of the Gupta period is characterized by its definition and refinement; the diaphanous robe covering one or both shoulders clings closely to the body, almost without folds ("wet drapery"); the hair is invariably arranged in short curls, the ushnisha is indicated as a cranial protuberance; and there is a lotus or lion pedestal, usually with figures of donors. The finest examples have been found at Sarnath and Mathura and in relief at Ajanta. One colossal copper figure, weighing more than a ton, found at Sultanganj, is in the Birmingham Museum and Art gallery. Brahmanical sculpture is represented by mukha lingas (Shiva) of admirable workmanship from Bhumara, Khoh and other sites in Bundelkhand; reliefs of Vishnu, Narasimha and Durga, and the magnificent Varaha Avatar at Udayagiri, Gwalior; Ramayana scenes from the basement of the late Gupta temple at Deogarh; sculptures of the Ramesvara cave, Ellora; and the stucco reliefs of the Maniyar Matha at Rajagriha.

The famous paintings of Ajanta and Bagh, all on the walls of excavated Buddhist temples and monasteries, the so-called caves, belong for the most part to the Gupta period, though none appear to be immediate products of Gupta patronage. Those of caves IX and X date about the beginning of the Christian era or even later; those of caves XVI and XVII, about A.D. 500; those of cave XIX, about the middle of the 6th century. Those of caves I and II date from the 7th century, and thus are early medieval. The subjects are all Buddhist, representing Jatakas and scenes from the life of Buddha, with the popular mythology of yakshas and Nagas as incorporated in Buddhism.

G. Early Hindu Dynasties (*c.* 600–*c.* 850)

1. Nalanda.—Harsha (*q.v.*) in the first half of the 7th century revived the glories of the diminished Gupta empire. He may be regarded as responsible for the restoration of the great monastery at Nalanda, and for the transition from Gupta to medieval art in Magadha generally. He also took possession of the Valabhi kingdoms of Kathiawar and Gujarat, but was defeated by the Chalukyan king Pulakesin II. A more detailed account can be given of early medieval art in the Deccan and the far south.

2. Pallavas.—The Pallavas originated in the Kistna-Godavari area, inheriting the artistic tradition of the eastern Andhras, and were forced to move southward about 600. The sudden appearance of architecture and sculpture in stone is due to the accomplished Mahendra-varman I (600–625); it is known from one of his inscriptions that up to that time structural temples had been built of brick, timber, copper and mortar, and the implied absence of stone construction corresponds to and explains the appearance of Pallava art already fully evolved in the 7th century. All the sculpture at Mamallapuram, including that of the excavated and monolithic temples (the "Seven Pagodas"), and also the great rock-cut relief representing Bhagiratha's penance and the Descent of the Ganges, belong to the first half of the 7th century. The sculpture there, Pauranik in theme for the Pallavas were Hindu kings, is of a very high order. In the early 8th century the sculpture develops in more strictly architectural application, in connection with the great structural temples at the

Pallava capital, Kancheepuram, passing in the 9th into that of the Chola period. Painting which has been assigned to the time of Mahendra-varman I has been found in a Jain excavation at Pudukkottai.

3. Early Chalukyan.—Some temples with sculptures at Badami antedate Pulakesin I (550–566), founder of the dynasty. Later artistic history shows a mixture of northern and southern elements, but is mainly a development of Pallava forms. The Brahmanical caves at Badami and Aihole (especially cave III, A.D. 578) contain a series of large and important reliefs illustrating Pauranik mythology and legend. Worthy of special mention also are the sculptured roofing slabs from Aihole, dating from the early 7th century, in the Prince of Wales museum, Bombay. The Virupaksha, most important of the structural temples at Pattadkal, was built about 740, probably by architects and masons brought from Kancheepuram, and shows a corresponding Pallava character in the sculptured reliefs. The Buddhist caves at Aurangabad, dating from the late 6th and early 7th centuries, contain many important figures. At Ellora, the Das Avatara, Ravana ka Khai, Dhumar Lena and Rameswara caves appear to range from 650 to 750.

4. Rashtrakuta.—The Rashtrakutas succeeded the Chalukyas in the western Deccan in 753. Their most important monuments are at Ellora and Elephanta; the latter are easily accessible from Bombay. At Ellora the famous rock-cut Kailasanath temple, a huge and complete monolithic shrine excavated in the side of the hill, is in a purely Dravidian style, immediately derived from that of the Virupaksha at Badami. Of the very numerous sculptures illustrating Shiva subjects, the finest represents Shiva and Parvati seated on Mt. Kailas, with Ravana imprisoned within the mountain below, endeavouring to cast it down and succeeding in causing a tremor. This, and the Varaha Avatar of Udayagiri, alluded to above, are the finest examples of reliefs which deal with what may be described as cosmic or geotectonic themes. Remains of painting on the ceiling of the porch of the upper story are of two periods, in part no doubt of the 8th century and nearly contemporary with the actual shrine. These are the oldest surviving Brahmanical frescoes, but literary references show that painting had been practised both as a religious and secular art from time immemorial.

At Elephanta the most famous and perfectly preserved sculpture is a colossal relief in the main excavation, a three-headed bust which has often, though incorrectly, been called a Trimurti. It is actually an icon of Shiva in the form known as Mahesa, and many other examples exist, of which one of the best is a later relief in the University of Pennsylvania museum, Philadelphia.

5. Kashmir.—The old town of Vijrabror has yielded early sculptures in which the influence of the Greco-Buddhist art of Gandhara is still apparent. The most interesting of these are representations of the goddess of fortune, Lakshmi, seated with a cornucopia, and these types can be followed well into medieval times, gradually becoming completely indianized. The remains of a tiled cockpit of about the 5th century at Harvan are unique. The devices on the molded tiles represent men seated and in balconies, equestrian archers in chain armour, deer, fighting cocks, lotuses and a fleur-de-lis motif; in technique they recall the so-called Han grave tiles of China.

The Vantipor temple sites of early 9th-century date have yielded small and admirably executed stone figures of Vishnu in a style peculiar to Kashmir and the neighbouring Chamba and Kulu, and with these there appear also Shiva types, including a three-headed Mahesa and an Ardhanarisvara. Similar Vishnuite images of brass inlaid with silver and copper have been found in Kulu, together with a Buddha image in the same technique but of earlier (late Gupta) date. Buddhist "bronzes" found in Kashmir, and ranging from the 6th to the 11th century, show that Buddhism survived to a late date, although it had already declined by the end of the 8th century, all the foundations of Avantivarman in the 9th being Brahmanical. The stone sculpture architecturally associated with the great temples in Kashmir is unfortunately almost all in a ruined state.

II. Later Hindu Dynasties (From *c.* 850 Onward)

Later Hindu art again falls into three main divisions, corresponding to the geographical classification of the architecture, as Nagara (northern and eastern), Vesara (south central and western) and Dravida (southern). The character of Indian art had by this time definitely changed and hardened. The sculpture is no longer distinguished by plastic volume, but has acquired a linear character; that is, the form appears to be conceived from the standpoint of outline, and all the features are sharply defined. Its application is primarily architectural and one might say decorative, were it not for the fact that it retains a precise significance in all its details. Its forms are more complicated, partly because the theological development has brought in a greater variety of many-armed forms (these appeared first in the 2nd century, and were already common in early medieval work), and partly because of the tendency, innate in all late art, toward great intricacy and elaboration of detail and an overvaluation of merely technical skill, displayed as an end in itself.

1. Northern and Eastern.—The main schools are those of Bihar and Bengal (Pala dynasty); Orissa; and Bundelkhand and Rajputana. Under the Palas (750–1200) the main centre of production was at the important monastery and university of Nalanda in Bihar. The characteristic Buddhist images, together with Buddhist and Brahmanical examples from other sites in Bihar and Bengal, are executed with the utmost technical proficiency in a kind of black slate, and are represented in all large collections. Numerous and exquisitely made copper images have been excavated there or found elsewhere in Bengal (Rangpur and Chittagong). The themes were at first Buddhist, but the Buddhism was greatly mixed with Hindu elements and acquired as time passed a more and more tantric character. The names of two painters and sculptors, Dhiman and Bitpalo, are mentioned by the historian Taranatha as having been masters in the eastern school in the 9th century. The Bihar school exercised a powerful iconographic and stylistic influence on Nepal, Tibet, Burma and Java and Sumatra. Not only sculpture but also painting was practised; a number of Buddhist palm-leaf manuscripts from Bengal and Nepal, with painted wooden covers and illustrations in the text, have been preserved from the 11th and 12th centuries. The style is most closely related on the one hand to the slightly later painting of the Gujarati school, and on the other to the contemporary frescoes of Burma (Pagan). The Pala school of painting in the 12th century was known even to the Chinese.

Sculpture in Orissa is typically Brahmanical, and occurs in connection with the series of great temples at Bhubaneswar, Konarak, Puri, etc., ranging in date from the 8th to the 13th century. The monumental horses and elephants and the erotic architectural sculptures of the Sun temple at Konarak are especially noteworthy.

2. Bundelkhand and Rajputana.—The magnificent temples of Khajuraho are literally covered with Brahmanical sculpture in a hard creamy sandstone, and isolated fine examples have been found at Mahoba, another Chandel capital. Jain sculptures too occur in abundance, but Buddhist works are relatively rare. To enumerate the sculpture in Rajputana would be impossible; there is much of quality.

3. South Central and Western.—An enormous revival of building and sculpture took place in the Deccan under the later Chalukyas after 973, under the Hoysalas of Mysore in the 12th and 13th centuries and in Gujarat under the related Solanki dynasty (10th to 15th century). The sculpture of the Deccan and Mysore is executed in a fine-grained dark chloritic schist, which is comparatively soft when first quarried, and lends itself to an unlimited elaboration of detail more appropriate to metalwork than stone. Almost all the work is of architectural application, and unbelievably rich in quantity and detail. Especially characteristic are the elevated temple basements, with tier upon tier of sculptured friezes, and the huge turned cylindrical pillars of the porches, with luxuriously developed bracket figures of dancers. In Mysore, Belur, Halebid, Dodda Gadavalli, Somnathpur and Sravana Belgola are among the most famous sites. At the latter place there is a remarkable monolithic image of Gommatesvara (son of the first of the 24 jinas of the Jain mythology), one of

the largest freestanding figures in the world, 57 ft. in height. This was carved *in situ* for Camunda Raja in A.D. 981. Another figure at Ilivala is more than 20 ft. in height.

In Gujarat, Kathiawar and parts of Rajputana there existed another extensive development in a related style. In Gujarat proper, most of the temples are in ruins. At Girnar, Palitana and Taranga, Jain temple cities and places of pilgrimage, there is much sculpture still *in situ*. The most remarkable examples of the style, however, are to be seen at Mt. Abu (Dilwara, in southern Rajputana), in the temples of Vimala Shah (*c.* 1032) and Tejahpala (*c.* 1232); these are domed shrines with pillared halls.

4. Gujarati (Jain) Painting.—A Gujarati school of manuscript illustration flourished from the 13th to the 17th century, after which it was more or less modified by Mughal and Rajput influences. One manuscript dated 1237 is on palm leaf, all others are on paper; the earliest date is 1427. The majority of the manuscripts are Jain scriptures, but there is one secular example, a Vasanta Vilasa, dated 1451. Although the colouring is brilliant, the style is really one of pure draftsmanship; the outline establishes all the facts and this outline, though very facile and almost careless, is extremely accomplished.

5. Rajput Painting.—The tradition of mural painting, exterior and interior, even at the present day survives sporadically all over India; a good deal may still be seen in Rajputana, for example in the old palace at Bikaner. Paintings on canvas and illustrated manuscripts are very rare, but as paper gradually came into use, the older methods of painting on walls and panels or cotton cloth were employed on the new material. The technique of Hindu painting on paper is in fact identical with that of the older mural art as seen at Ajanta and described in the technical treatises. The themes of Rajput painting are religious (dealing especially with the Krishna cycle, but also with Shiva and Vishnuite mythology in general), epic (*Mahabharata* and *Ramayana*), lyrical and rhetoric (Rag-malas) and, less typically, secular (portraiture). The Krishna cycle and themes illustrating treatises on rhetoric (classification of heroines and emotional analysis), given a contemporary environment in court and village life, permit an exquisite delineation of every phase of love. The epic subjects, especially in early Jammu works, are treated on a large and almost mural scale. Especially characteristic are the sets of illustrations of the Rag-malas, vernacular poems describing the situations which are appropriate to each of the Ragas, or musical modes; these are usually 36 in number, and each has its particular hour and specific sentiment (*see* INDIAN MUSIC). Stylistically, Rajput paintings can be classified both geographically and in historical sequence. Very few examples show any approximation to the Gujarati style. The early ones from Rajputana and/or Bundelkhand are most distinctive; they show a robust analytical method of drawing, an indication rather than a representation of forms and an intensely brilliant colouring, like that of enamel or stained glass, by which the planes are established. A modified tonality gradually appeared, partly the result of Mughal influences; but the work of Jaipur artists, even from the 18th century when the outline had become more meticulous, can be recognized by its brilliancy and by its marvelous decorative treatment, especially of flowers and trees. The earlier Jammu productions too are strongly coloured, while the drawing is more provincial throughout. In some respects the most exquisite, and certainly the most refined if not the most powerful, phase of Rajput painting is that of the Kangra school, developed in the latter half of the 18th century under Raja Samsara Cand. Connected with this school are its offshoot in Tehri-Garhwal and its early 19th-century secular development in Sikh portraiture. The Kangra school declined during the 19th century and became to all intents and purposes extinct. Related schools existed in Bengal and Orissa. By far the finest collection in the world is in Boston, Mass.; other examples are in the Lahore and British museums, and in private collections.

6. Miniature Painting.—It is highly likely that miniature painting in India is as old as the tradition of monumental painting. The earliest examples of Indian miniatures belong to the Pala period (8th–13th century). The technique and composition of these Buddhist illuminations reveal a perpetuation of classical prototypes such as Ajanta wall paintings. The Jain manuscripts of Gujarat, of the 13th century, have charm in wiry drawing and gay colouring, but are generally stereotyped in execution.

Rajput miniature painting is the work of artists attached to the courts of the Rajput princes from the 16th to the 19th century. Geographically it may be divided into a number of local schools in Rajputana, the Deccan, the Punjab, the Himalayas and Garhwal. The themes painted by the artists include Raginis or the personifications of musical modes connected with phases of love, illustrations of Indian epics and the romantic legends of the gods Vishnu and Krishna. Rajput painting is a combination of folk art and hieratic classic traditions and, more often than not, a reduction of the themes and techniques of mural painting to an intimate scale. Whereas the early miniatures of Rajasthan are primitive in conceptual presentation and decorative pattern, some of the later painting, like the 18th-century illuminations of the Kangra school in the Punjab, display a sophisticated combination of realism and lyric grace. Invariably, as in monumental painting, sacred legend is presented as contemporary experience.

The styles of illumination that flourished under the patronage of the Mughal emperors, from the 16th to the 19th century, differ from Rajput work in the complete absence of mystical and religious elements and in their emphasis on the picturesque and the natural. Although early Mughal painting was an outgrowth of the Persian miniature style, in the great period under the emperors Jahangir and Shah Jahan the artists produced illuminations of an extraordinarily realistic character—perhaps under European influence—blended with elements of Persian and Indian origin. In Mughal painting it is possible to differentiate between the work of local schools at Delhi, Lucknow, Jaipur, etc. The themes of the Mughal artists were events from the life of the court, portraits and occasional subjects drawn from the world of the Hindu epics. Among the great masterpieces of the school are the paintings of birds and beasts executed by Jahangir's painter, Mansur.

7. Later Developments.—During the 19th century little of note in sculpture was produced in northern India. In southern India the indigenous tradition was preserved in greater purity; copper images, sometimes of large size and little inferior in quality to those of the 17th and 18th centuries, continued to be made, and hereditary craftsmen continued to work in stone.

In the 20th century a reaction against western mannerisms took place, especially in Calcutta where a considerable (Bengal) school of painters arose, and a very large number of pictures, mostly water colours, were produced. The pictures are delicate and often very charming, but hardly powerful; the movement is comparable in some respects to that of the Pre-Raphaelites in Europe. Among the chief artists of this school may be mentioned Gogonendronath Tagore, mainly a worker in monochrome, who flirted with Cubism; Nanda Lal Bose; Asit Kumar Haldar; Samarandranath Gupta; and many younger men and some women.

III. CEYLON

1. Sculpture.—The artistic culture of Ceylon is at all times very closely related to that of southern India, but can be more conveniently treated as a consecutive development. One of the oldest documents is a carnelian seal representing a seated king, probably of the 2nd century B.C., from the Yatthala dagoba in the south, now in Manchester. It is difficult to say whether any or how much of the sculpture surviving at Anuradhapura dates before the beginning of the Christian era; the greater part in any case belongs to the period ranging from the 1st to the 9th century. Among the finest sculptures in Ceylon, previous to their restoration and virtual destruction by pious Buddhists, were the Buddha figures, and one traditionally known as Duttha Gamani (reigned 1st century B.C.), at the Ruanveli dagoba site; the Buddha figures show a close relation with those of Amaravati and must date from about A.D. 200. Relief sculpture may date back to the 1st century A.D. or but little later; this applies especially to the Naga reliefs and formal trees rising from lucky vases, represented on stelae at the Eastern (so-called Abhayagiriya) and Ruanveli dagobas, for these are still in flattened relief and distinctly related in style to the Sanchi and early Sarnath reliefs of the 1st

century A.D. The "moonstones," or stone doorsteps of monasteries or palaces, are of various dates, and consist of half-lotus medallions with friezes of animals (horses, lions, elephants and hulls, or geese carrying floral sprays). The steps above them are flanked by solid balusters (alamba bahu, hasti-hasta) consisting of heads and trunks of elephants, or makara heads spouting vegetation, while at each side stand reliefs representing Nagas holding lucky vases and cornucopias. The rock-cut reliefs of elephants at the Isurumuniya Vihara and the elephant reliefs by the Tissawewa lake are in Pallava style and evidently of 7th-century date.

At Polonnaruwa, the rock-cut statue traditionally regarded as a representation of Parakrama Bahu I (1153–86 or 1164–97) is magnificent. Not so fine, though impressive in scale and design, are the seated and reclining Buddha figures of the Gal Vihara, where there is also a colossal standing figure of the Buddha in prayer. Some of the brick and stucco figures of the Northern temple are extremely elegant. There exist colossal Buddha figures, also of the Polonnaruwa period, at Seseruwa, Awkana and Kon Wewa.

A limited number of small bronzes, or, more accurately, copper images, of very high quality have been found in Ceylon. One of the largest is a fine seated Buddha from Badulla, of about 6th-century date, but the finest of all are a well-known seated Avalokiteshvara and figures of Vajrapani and Jambhala, of 8th- and 9th-century dates, in Boston. There is a fair collection of similar figures in the British museum. Brahmanical bronzes apparently of Chola date have been excavated at Polonnaruwa.

2. Painting.—Remains of painting have been preserved at a number of sites. There are a few traces of decoration at Anuradhapura, including some figures of dwarf yakshas. More remarkable are the Apsarases of the painted rock pockets at Sigiri, dating from the 5th century and still in excellent preservation; these are voluptuous female figures, cut off by clouds at the waist in accordance with a characteristic convention, and casting down a rain of flowers upon the mortal world below them. At Hindagala near Kandy there is a fragment of fresco regarded by some as of rather early date, but probably medieval. By far the most extensive remains, though almost destroyed by neglect since their first discovery, are those of the inner walls of the Northern temple at Polonnaruwa; these illustrate Jatakas, but can be only inadequately studied in the bad copies exhibited in the Colombo museum. The Sinhalese chronicles (Mahavamsa) contain innumerable references to painting, but nothing more survived until the 18th century, when Kirti Sri Raja Simha, one of the last Kandyan kings, restored many shrines in the Kandyan provinces. Mention must also be made of the admirable decorated ceilings of Kelaniya, Kandy and some other places; these are often masterpieces of design. *See* also INDIAN ARCHITECTURE; also references under "Indian Art" in the Index.

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INDIANA UNIVERSITY, the state university of Indiana, at Bloomington, was founded in 1820. Several of the university's professional schools are located at Indianapolis, and a number of university centres are maintained throughout the state. *See* INDIANA: *Education.*

INDIAN HEMP (HEMP DOGBANE), a North American plant, *Apocynum cannabinum* (dogbane family), found in fields and thickets in southern Canada and throughout the United States. It is a branched perennial up to five feet tall, with smooth opposite leaves, milky juice and small greenish-white flowers. The elongate pods (follicles) contain numerous down-tufted seeds. Fibres from the stem were used by Indians for making bags, mats, nets and cordage. The milky juice or latex yields rubber. The dried roots of Indian hemp and a related plant, *Apocynum androsaemifolium,* constitute the drug apocynum, which, being a substitute for digitalis, acts as a heart stimulant. True hemp (*q.v.; Cannabis sativa*) is sometimes called Indian hemp. (J. W. TT.)

INDIAN LANGUAGES. The main languages of peninsular India are the 14 mentioned in the eighth schedule to the constitution as modified to Sept. 1, 1951, which are as follows:

Hindi, Urdu, Panjabi (totaling, with Pahari, 149,944,311 speakers); Telugu (32,999,916); Marathi (27,049,522); Tamil (26,546,764); Bengali (25,121,674); Gujarati (16,310,771); Kanarese (Kannada) (14,471,764); Malayalam (13,380,109); Oriya (13,153,909); Assamese (4,988,226); Kashmiri (1,438,021); and Sanskrit (*qq.v.*). According to the constitution of India, English was to remain the official language until 1965, while Hindi in the Devanagari script was to be progressively established in its place. An Indian commission on the possibility of setting up a certain number of states on a linguistic basis reported in 1948. In consequence, Andhra state, to include Telugu speakers, was established in 1953; Kerala (Malayalam speakers) in 1956; Mysore was reorganized to unite Kanarese-speaking people also in 1956; while Maharashtra (to include Marathi speakers) and Gujarat (for Gujarati speakers) were constituted in 1960.

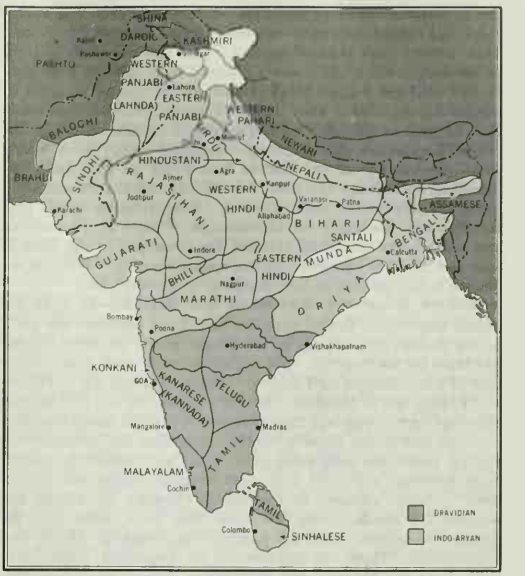
In Pakistan, Urdu (West Pakistan) and Bengali (East Pakistan) are the principal languages. English is much used for official purposes and for higher education. Lahnda (western Panjabi with 8,566,051 speakers); Sindhi (4,006,147); Pashto and Balochi (the last two both Iranian languages) are also spoken in West Pakistan.

All the above languages fall into two great families, Indo-European and Dravidian. A list follows of groupings of those of them which belong to the Indo-Aryan group of the Indo-Iranian branch of the Indo-European family including certain minor members: (1) northwestern group: Lahnda and Sindhi; (2) southern group: Marathi and related dialects; (3) eastern group: Bengali, Oriya, Assamese, Bihari (*q.v.*, including Bhojpuri, Maithili and Magahi, totaling 37,000,000 speakers); (4) east-central group: Eastern Hindi and dialects; (5) central group: Hindi, literary Urdu, Eastern Panjabi, Gujarati, Rajasthani (*q.v.*, with 13,897,896 speakers); Bhili dialects (2,110,410); (6) northern or Pahari group: Eastern Pahari, Nepali (or Gorkhali, about 6,000,000 speakers); Garhwali and Kumaoni (1,055,662); Western Pahari (*see* PAHARI LANGUAGE); (7) extra-Indian groups: Sinhalese (4,000,000); and gypsy dialects of western Asia and Europe. The Dardic group of the far northwest are also Indo-European languages of Indian type and include Kashmiri and Shina (68,199). These tongues are all sometimes described as Sanskritic, since their affinities can to some extent be measured with reference to Sanskrit. This, the greatest classical source for most of modern India, has also made loans to the Dravidian languages. Its close relationship with Greek and Latin was boldly stated by Sir William Jones in 1786. S. K. Chatterji calls it the "great Aryan speech of India, our great spiritual and cultural link with the west." (*See* also INDO-ARYAN LANGUAGES; DARDIC LANGUAGES.)

The four great literary Dravidian languages of south India are Tamil, Telugu, Kanarese and Malayalam. There are besides a number of nonliterary Dravidian languages such as Tulu (*q.v.*, with 787,624 speakers); Kodagu (40,000); Gondi (1,232,886); and Brahui (*q.v.*, 225,000). All are in the south except Brahui, which is far to the northwest in Baluchistan. (*See* also DRAVIDIAN LANGUAGES.)

Most of the other languages of India are allotted to two families of lesser significance, the Munda and the Tibeto-Burman (*qq.v.*). The Munda languages (sometimes called Austroasiatic or Austric) are thought by some to be related to the Mon-Khmer group of southeast Asia. They include Santali, which is spoken by more people (2,811,578) than any other so-called aboriginal language. Other related languages are Mundari (650,000); Savara or Sora (256,259); and Khasi (292,923). Manipuri (Assam) and Newari (Nepal) have been described as belonging to the Tibeto-Burman family, along with a number of other languages such as Lushai and Garo of the Bodo group.

Sanskrit, the sacred and classical language of Hindus, is written in the Nagari or Devanagari script, accepted all over India. Hindi and Marathi are written in it, Gujarati, Bengali, Assamese in modified forms of it, and even the Dravidian languages of the south in closely related forms of it. Urdu employs the Persi-Arabic script and its classical sources are Persian and Arabic. It has been said that Urdu and High Hindi are based on one form of speech (Hindustani) split by two different classical traditions



J. R. FIRTH

GEOGRAPHIC DISTRIBUTION OF PRINCIPAL INDIAN LANGUAGES

and two totally different scripts. Hindustani (if this name may still be used) "acts as the most natural inter-provincial link among speakers of the Aryan languages of the north. This is a sort of *lingua Indica*." (S. K. Chatterji, *Languages and the Linguistic Problem*, Oxford Pamphlets on Indian Affairs, no. 11, 1943.)

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INDIAN LAW. The general history of law in India is a well-documented case of reception as well as of grafting. Foreign laws have been "received" into the Indian subcontinent; *e.g.*, in the demand by the Hindus of Goa for Portuguese civil law, and the enactment by independent India of statutes such as the Estate Duty act, 1953, the Copyright act, 1957, and the Merchant Shipping act, 1958, which substantially reproduce English models. They have frequently been "grafted" upon indigenous laws, as both Anglo-Muslim and Hindu law testify. Legal institutions introduced by foreign governments were accepted readily by the Indians, either because they fell in with existing trends or because they met new needs. Independence (Aug. 15, 1947) brought an intensification of these processes, the only apparently retrograde motion being that of increasing the legal powers of *panchayats* (village committees; see *History*, below).

Sources of Law.—Indian law utilizes a multiplicity of sources. The Hindu system began with the Vedas and contemporary non-Aryan customs 3,000 years ago. Slowly, it evolved through blending, comparison and analysis. After the Arab invasions in the 8th century A.D. Islamic law was introduced in some areas, particularly in the north. The English common law is the residual law in the high courts of Bombay, Calcutta and Madras, the successors of the old (king's) supreme courts (where much that was held inapplicable to Indian conditions was supplemented and amended by many Indian and provincial statutes); and, at times with the aid of relevant British statutes, it is the residual law also in all other jurisdictions representing the old East India company's courts, where, since 1781, "justice, equity and good conscience" has supplied the rule of law where no Indian statute or

rule of personal law (*e.g.*, Hindu law) covers the point. The Portuguese and French used their own laws in their colonies. In British India some British statutes applied, and a few were still in force in the early 1960s. All powers adapted their laws to local conditions, and the famous Anglo-Indian codes, passed in India at intervals from 1860 to 1882, reflected the influence of French and U.S. as well as English and Anglo-Indian models. During that period Roman law and continental juridical theory were widely cited, particularly in the Madras high court, to give India the benefit of the best law available; but through codification and other influences this source soon dried up. Interpretation of the constitution has resulted in the introduction of some U.S. principles, and welfare and industrial statutes are construed in the light of case law decided elsewhere in the commonwealth. Western influence is also present in the treatment of personal law.

History After the Advent of the British.—In 1765 the Mogul emperor of Bengal gave the East India company the grant of the *diwani*, empowering it, for a fixed yearly payment, to collect taxes for the emperor. Out of this naturally grew its secondary task of administering civil justice. It applied Hindu law to Hindus and Islamic law to Muslims. But by a regulation of 1772, Warren Hastings (*q.v.*), who was then governor of Bengal, made company servants and native experts jointly responsible for administering justice, restricting indigenous systems to "suits regarding inheritance, marriage and caste and other religious usages and institutions." Legal advisers to the courts (*pandits* for Hindu and *maulvis* for Muslim law) continued until 1864; after that the British themselves assumed judicial knowledge of Hindu and Islamic laws. There was no provision for Armenians, other Christians, Jews and Parsees, who were few in Bengal, and no attempt to supply a *lex loci*, a "law of the land." Here was a vacuum that naturally attracted English law, which already had a foothold in Bombay and in the supreme courts. In the latter, by the Government of India act, 1781, both Hindu and Muslim personal laws were confined to "inheritance and succession to land, rent and goods and all matters of contract and dealing between party and party," while where the parties were of different communities the laws and usages of the defendant should apply. Other matters of personal law, *e.g.*, divorce, were generally left to the *panchayats*. In practice the scope of the personal laws and the rules applied tended to become nearly the same in both sets of courts.

Hastings intended that the Islamic law as applied by the Moguls should fill the gaps between the "religious" topics he preserved, along with commercial custom and the company's regulations. Islamic criminal law and the law of evidence continued, subject to ever-widening modifications, and was applied to Hindus and Muslims alike until 1861 and 1872 respectively. Since the Hindus were used to living partly under the Islamic law and custom in northern and eastern India in particular, this arrangement was no novelty. In western India the Hindu law of crime was in use until 1827; and the Hindu law of contract and torts was applied until the 1870s. However, these laws were not fully treated by the later European authors.

Hindu Law.—This is the personal law which applies to 85% of the population and which constitutes the main juridical product of Indian civilization. The word Hindu does not imply a strict religious orthodoxy, and is more ethnic than creedal in its emphasis.

Texts and Translations.—The classical sources of the *dharmashastra*, or "science of righteousness," are the Dharma Shastras or *smritis*, treatises from the post-Vedic age (*see* SANSKRIT LITERATURE). Although they embody many Vedic ideas and precepts, the Vedas themselves are never quoted as a source of law.

The most important *smritis* are those of Manu (*q.v.*), Narada, Yajnavalkya and Katyayana. Between the 12th and 17th centuries many commentaries and digests on the *smritis* were compiled in various parts of India; each came to prevail in its own area, and from differences of interpretation arose the many schools of Indian law. The *Mitakshara* of Vijnaneshvara (*c.* 1125) is an elaborate but succinct commentary on the *Yajnavalkya-smriti;* the system of law it propounds was generally accepted throughout India except for Bengal, where the *Dayabhaga*, written by Jimutavahana *c.* 1100, prevailed over the *Mitakshara* when the two differed. These are the root texts of the two great systems of Hindu law. The *Mitakshara*, however, was not followed evenly throughout the huge area in which it was the principal system, and it was overruled on various points by later commentators; *e.g.*, in the Madras school by Devanna-bhatta's *Smritichandrika* (*c.* 1225), and in the Bombay school by Nilakantha-bhatta's *Vyavaharamayukha* (*c.* 1635). A leading work of the Mitakshara school was Mitra-mishra's *Viramitrodaya* (*c.* 1630). A wide literature was also referred to, including the Mahabharata and various Puranas, "genuine" and ancient, recent and "spurious." When first known to Europeans each school of Hindu law was complete with family, commercial, fiscal, criminal and other laws, substantive and adjectival, with many details which would hardly be classified as law today, covering all the duties of the four castes and mixed castes and of each stage of life within the caste (*see* CASTE [INDIAN]). The Sanskrit authors were aware of the distinction between a religious or moral obligation and a mandatory injunction, and the doctrine *quod fieri non debet factum valet* ("what ought not to be done, when done [in fact], may well be valid") was well known in Bengal.

The extreme complexity of the personal law thus afforded scope for diverse interpretations; also, it was suspected that the *pandits* were open to corruption. Sir William Jones, judge of the supreme court of Calcutta from 1793–94, by his work in translating classical oriental texts intended to bind specialists so that the European judges might check their reports. He compelled a supreme court *pandit* to certify a copy of "Halhed's code" as correct. This English version of a Persian text originally translated from Sanskrit had been compiled by a committee of *pandits* at Hastings' request. It was valued mainly by the orthodox public; the British knew that it was incomplete and doubted whether it was accurately rendered. A new code on inheritance and contract was commissioned from Trivedi Sarvorusharman, but was never published. Jagannatha Tarkapancanana, an aged *pandit*, compiled the *Vivadabhangarnava* on the same topics; it was translated by H. T. Colebrooke (*q.v.*) and is known as *Colebrooke's Digest*. Because it was printed as if it were a commentary upon *smriti* texts, a false impression arose as to the author's intention. Here was a remarkable digest of law, complete and modern, inspired by a juristic ability which was overlooked by British critics seeking for a certainty and conciseness incompatible with the character of the *shastra*. For, as mentioned earlier, authorities differed widely in the application of common rules and particularly in the resolution of apparent conflicts between the fundamental sources; some differences were irreconcilable, such as the outlooks of the schools of Bengal and Mithila on the nature of inheritance, the acquisition of property, the law of capacity to marry and the duty to perform *shraddhas* (propitiatory rites for the benefit of deceased relations). Colebrooke and F. W. Ellis (*c.* 1780–1819) alone among Europeans had an orthodox training in the *shastra*, and gained a contemporary and practical, as contrasted with an archaeological, knowledge of it. Besides the *Vivadabhangarnava*, the former translated the inheritance portion of the *Mitakshara* and the whole of the *Dayabhaga*. Translations by J. C. C. Sutherland of works on adoption completed the very few texts that were available to the judges in the formative period of Anglo-Hindu law.

Development.—After 1864 the courts relied on the reports of specialists recorded up to that date and the decisions based thereon, and on the textbooks of W. H. Macnaghten and Thomas Strange, and much later on that of J. D. Mayne, which were compiled from such sources and from the slowly growing list of translated texts. The original authorities appear artificial and fossilized in the judgments even of enthusiastic scholars like Raymond West, because of the selective and interpretive techniques of the British and British-trained judges and because of the inevitable discouraging of native specialists.

The many subschools of law and the frequent disagreements between the high courts were legacies of this early period. The power of the privy council (and later the supreme court of India) to unify and reduce the chaos was limited. Westernized Indians were no longer content with the ancient rules in all respects. Stat-

utes in Baroda and Mysore codified and reformed the law (1930–37); then Bombay (1946–49) and Madras (1949) introduced judicial separation and divorce, and compulsory monogamy. The central Hindu Women's Rights to Property act, 1937, was the culmination of a short series of statutes passed since 1850 which had modernized the system in isolated respects; it elevated the widow to the status of a son as an heiress to her husband. Piecemeal reforms created new problems, and since independence India has aimed at abolishing the personal laws in favour of a civil code (constitution, art. 44) which would unify, as far as practicable, the diverse schools and customs applicable to the various communities. The first step was the Special Marriage act, 1954, which repealed and re-enacted with amendments the act of the same name of 1872. Any couple may marry, irrespective of community, in a civil, western-type manner, and their personal law of divorce and succession automatically becomes inapplicable. In the new divorce law they have in addition a right of divorce by mutual consent after they have lived apart for a year and have waited a further year. Marriages solemnized under a personal law may be registered with retrospective effect as if they had been solemnized under the act.

The Hindu "Code."—Modern Hindu law is the creation of the Hindu Marriage act, 1955, and of the Hindu Minority and Guardianship act, the Hindu Succession act and the Hindu Adoptions and Maintenance act, all of 1956. Until 1955–56 Hindus were entitled to claim exemption from the personal law if a custom could be proved of sufficient certainty, continuity and age and was not contrary to public policy. In the Punjab they were governed in common with other peasants by regional customs which had common roots with Hindu law but had developed independently. Very little scope is now allowed to custom. Numerous rules of Anglo-Hindu law are retained, but there is little reference to, or reliance upon, *dharmashastra*. Resemblances to western laws are for the most part marginal. Dowries were prohibited in 1961.

Marriage.—Formerly a man might have several wives at once except, since the 1940s, in those states where it had been expressly forbidden; since the Hindu Marriage act a Hindu who marries polygamously incurs a penalty and the second marriage is void. A marriage between children (*i.e.*, where the boy is under 18 or the girl under 15) may give rise to prosecutions, but is still not void. Formerly, according to both the Mitakshara and the somewhat stricter Dayabhaga law, *sapindas* (relations within five degrees inclusive of the common ancestor on the mother's side or seven degrees on the father's side) could not marry; nor could those bearing the name of the same *gotra* (patrilineal family; Hindu law is strongly patrilineal) or claiming the same *pravara* (ritual formula naming sages supposed to be remote ancestors). A list of prohibited relations was enacted in 1955 and the degrees of *sapinda*-ship were cut down to three and five, marriages within both limits being possible if formerly sanctioned by custom. The other prohibitions were abolished in 1946. Before the Marriage act a difference of caste, though not of subcaste, prevented a marriage except under the Special Marriage act; this bar was also removed, the "code" seeking to eliminate caste as a factor in the choice of law.

In Hindu law a marriage, being a *samskara* (sacrament), could not be annulled for nonconsummation, lack of consent or nonage, though since the 1930s it might be annulled in cases of impotence or lunacy. A marriage may now be annulled also if the required consent was obtained by force or fraud, or for pregnancy by someone other than the petitioner, subject to certain safeguards, such as, for example, that the proceedings be commenced within a limited time. Judicial separation is available on the grounds of desertion for two years, cruelty, leprosy, insanity and adultery. Divorce, which was unknown to higher-class Hindus until the legislation in Bombay and Madras, is now available, after the marriage has lasted three years (except in cases of hardship), on the grounds of living in adultery, ceasing to be a Hindu, incurable insanity, renunciation of the world, disappearance for seven years, not resuming cohabitation for two years after judicial separation, not complying for two years with a decree of restitution, and, under certain conditions, venereal disease and leprosy. If the husband had married again in the first wife's lifetime while it was still lawful for him to do so, this is an additional ground for the wife. Remarriage may take place one year after the divorce decree (assuming there is no appeal). The children of a voidable marriage are protected, after the marriage is annulled, by a statutory status of legitimacy for limited purposes. In any matrimonial proceedings a husband may be granted alimony against his wife, and either may obtain maintenance, including the expenses of the proceedings, from the other during litigation. The whole scheme is anathema to orthodox Hindus but serves a wide demand. The remarriage of widows, equally inconsistent with the *shastra*, has been legal since 1856. The code does not interfere with the jurisdiction of *panchayats* to grant divorces where this was customary in 1955.

Guardianship.—In the Hindu Marriage act ample provision is made for guardians in marriage, since traditionally the right to give a minor girl in marriage has been socially, and often economically, important. In the absence of all the listed guardians she can apparently arrange her own marriage without even the court's consent; but the question may never actually arise for decision. Other aspects of guardianship are left largely unaffected by the Hindu Minority and Guardianship act. The natural guardians of the person and property remain the parents, including the adoptive parent or parents of an adopted child; but where the minor is a coparcener (joint heir) the *karta* (manager) of the joint family remains guardian of his interest in joint family property. Since 1956 testamentary guardians can be appointed by the father without the mother's consent only in restricted cases. A minor husband is no longer the guardian of his wife's property. The putative father may be the guardian of his illegitimate child. Rights of guardianship terminate if the guardian ceases to be a Hindu. Whereas formerly even a *de facto* guardian could bind the ward's property because of necessity or for the benefit of the ward, now even natural guardians must secure the consent of the court before they can alienate the ward's immovable property for any purpose, unless it be a lease under five years in duration or extending less than a year beyond the ward's majority.

Adoption.—Before the Hindu Adoptions and Maintenance act (1956), only a male could be adopted. The *shastra* originally made provision for a number of substitute sons who could attend to a sonless adopter's secular and spiritual needs, particularly in carrying out the *shraddha* rites. This was held to be so important by the orthodox that even widows, as the "surviving halves" of their husbands, came to adopt sons. In the *dattaka* (normal, complete form of adoption) the adopted son became heir or coheir as from the adoptive father's death, without upsetting the latter's will as to private property. This was inconvenient when joint family property had to be divested long after the adoptive father's death. When in competition with an *aurasa* son (one legitimately born subsequent to the adoption) the adoptee was allowed a one-fourth share. An adopted son could not be given in adoption, and this rule remains in force.

The code has introduced adoption of daughters, subject to an age difference of 21 years between the parties (as when a woman adopts a male child), and adoption of children of both sexes by an unmarried woman, widow or divorcée for her own benefit. The old rule that only one child can be adopted has been altered to allow for one at a time of each sex; as before, no one who has a legitimate Hindu son, grandson (son's son) or great-grandson can adopt a son—since these can effectively make the *shraddha* offerings; and by a new, but analogous, provision a daughter cannot be adopted by one who has a legitimate Hindu daughter or a son's daughter. The rights of the adoptee are equated with those of a legitimate child. A man must normally obtain his wife's consent to take a child in adoption, and the mother's consent to give his child. All possibility of divesting has ceased since 1956. Many traditional forms of adoption less effective than the *dattaka* have gone out with codification.

Illegitimate Children.—These are no longer, as formerly, entitled to maintenance for life out of the putative father's joint family property. They are, however, entitled to claim as dependents against their parents or their estates; they can also claim as intestate heirs of their mother and, it seems, of their mother's

kindred. The ancient right of Mitakshara law of the son of a *shudra* (a member of the lowest and most numerous caste) by his permanent concubine to a half of an *aurasa's* share at a partition, and in some cases to the entire estate, ceased in 1956. India knows no legitimation by subsequent marriage.

Under the earlier system an illegitimate son, notwithstanding his other privileges, could not be given in adoption because the principal giver had to be the father (if alive and sane), and paternal rights were not held to exist fully without a valid marriage. Since 1956 illegitimates may be adopted, though not, it seems, by their own mothers.

Maintenance.—Traditionally, a concubine who lived chastely after her paramour's death had the right to be maintained out of his joint family property, a right which has ceased. Maintenance was also available to the wife and widow out of her husband's property or interest in joint family property; to the disqualified coparcener out of the latter source; to other coparceners and their unmarried sisters and daughters similarly; and to the widowed daughters-in-law, who were entitled to be maintained also out of the separate property of their deceased fathers-in-law until their remarriage. In the case of an unmarried female they included a dowry, where appropriate, and marriage expenses. These rights were of great value and their incidence sufficed to prevent coparceners, however few in number, from claiming to be full owners of the estate. In general these rights still exist. Rates of maintenance, prospective and in arrears, may be fixed by the court with reference to the means and status of the family. It was a defect formerly that the manager might decide to pay a minimum, or refuse to give separate maintenance, the alternative being residence in a disagreeable atmosphere. The code improves the position of females generally. First, it seems that children, parents, widow and widowed daughter-in-law may claim maintenance even out of property disposed of by will when they have been passed over in it, provided that the estate in question is the appropriate one to resort to. Second, close relations, including the widow and daughter (even if married), the mother and the widowed daughter-in-law and the predeceased son's daughter are now sharers on intestacy along with sons and other male issue, such as predeceased son's sons.

One defect remains in the system, namely, that transfer of the property to one who has no notice of the claims of the dependent would defeat the latter's rights, unless it be a gratuitous transfer or unless an equitable charge has been created over the estate previously in the dependent's favour.

The joint family, referred to already, is the basic element of Hindu society. It is built round a common male ancestor and his descendants in the male line and includes their dependents (wives, unmarried sisters and daughters, widowed daughters-in-law). The coparceners are agnatic male relations within four degrees inclusive (*i.e.*, son, son's son, son's son's son) from the owner of the property in question, and they are presumed to be joint in food, worship and estate until the contrary is proved (though jointness in respect of the last is possible between those who are separate in the other respects). At Mitakshara law, no coparcener owned specific items, and his presumptive share fluctuated with the births and deaths of coparceners; birthright operates in fact from conception, so that even before a coparcener is born, providing he is born alive, a right may exist to question an alienation of joint family property not justified by necessity, by the benefit of the family or, within limits, for pious purposes; a woman could never be a coparcener until after the act of 1937, when the widow stepped into the rights and liabilities of her husband. In Dayabhaga law, the share devolves as such and, even in a state of indivision, the share is transferable like any other property; there is no birthright and the child or children have rights to the property only on the death of the father; a widow might hold property if there were no male heir. Unless a coparcener had separated his property, the *shastra* assumed that it would all pass to the others, by survivorship in Mitakshara and by succession in Dayabhaga law. Only at a partition could the net assets be predicated to belong to particular coparceners subject to the rights of the immediate dependents of each.

This characteristic system of property ownership and management was steadily undermined during the British period; for example, since 1930 (Hindu Gains of Learning act) earnings from an occupation (other than commercial) entered into even as a result of joint family expenditure or investment have been considered "self-acquired property"; from 1863 property earned without detriment to joint family funds began to pass at death as if the acquirer had been separate from his coparceners. A dissatisfied coparcener must sever his share, when it is obtainable, the amount being determined per stirpes (on the basis of familial stock) and then per capita between the members of one branch of the same generation; and, for the first time, he may also obtain accounts of the state of the property. Only in south India can a coparcener alienate his undivided interest, in which case the purchaser must work out his rights in equity by a general partition suit.

Property of Females.—Until 1956 this was divided into *stridhana*, property at a woman's free disposition, including certain items which could be alienated only with the husband's consent; and other property, usually inherited under the act of 1937 or otherwise and held subject to the "woman's limited estate." In both Mitakshara and Dayabhaga law succession to *stridhana* is governed by rules different from those governing property owned by males. Unless it were her *stridhana* she could transfer property absolutely only for necessity, for the benefit of the estate and for spiritual benefit to the deceased male owner; otherwise she could create a title which would endure only until her death, surrender or remarriage. This property then passed to the reversioner of the late owner, the next heir; while on her death her *stridhana* passed to specially selected heirs who varied according to the source of the property, the school of law and the form of marriage, if any, she had undergone. The Hindu Succession act has, with retrospective effect, turned all property possessed by a Hindu female into her absolute property. This passes on intestacy to a new line of heirs, in which the husband appears higher than formerly. Variations are permitted for those who would have been governed by Marumakkattayam or Aliyasantana, the characteristic legal systems of Kerala, which give great prominence to matriliny.

Testamentary Succession.—To effectuate the reforms mentioned above, the Mitakshara coparcener, as well as the member of a matrilineal joint family, has since 1956 been enabled in most cases to transfer his undivided interest by will as if he had separated immediately before his death. But dependents cannot be entirely disinherited, and there are limits on legacies to unborn persons and restrictions on legacies purporting to create lines of descent inconsistent with the Hindu law. Wills are undoubtedly more common than they were, on account of the reform of the law of intestate succession.

Intestate Succession.—This differed sharply from school to school and even between subschools, although the very complicated orders of priority hardly differed in their discrimination against females and the preferences given to agnates (descendants by male links from the same male ancestor) and to kindred connected through paternal ancestors. However, agnates could not take if they were beyond 14 degrees, and, it seems, cognates (in its sense of "descendants from a common ancestor through one or more female links") if they were beyond 5 degrees, in both cases including the common ancestor; now, however, there is no limit to degrees. Agnatic preference is still visible in the scheme enacted in 1956. Persons disqualified on religious grounds and as a result of social prejudice have been progressively admitted to the succession from 1850 (Caste Disabilities Removal act) to 1956. The special law of succession relating to hermits, in which spiritual kindred replace the natural, appears to be untouched by the codification. Matrilineal joint families are disrupted by the rule that every death must sever a share determined per capita, which will pass by succession.

Debts.—Damdupat, thought unconstitutional by some, is an ancient but not very important rule that the debtor cannot be forced at any one time to pay more interest than the principal amount. The pious obligation of the male issue enables the creditor to obtain out of their interests in joint family property the

amount of the private untainted debts of their ancestor, "taint" implying an immoral or illegal cause of indebtedness. Where the ancestor has alienated to pay an antecedent untainted debt, the male issue cannot dispute the propriety of his alienation of the joint family property.

Religious Endowments.—Notwithstanding the various religious trusts acts, the personal law regulates the powers of the *mahants*, incumbents of orthodox colleges (*mathas*), and *shebaits*, trustees of the property of idols; also the descent of their offices, and all questions of transfer to a successor. In general, rights of worship and management involving valuable perquisites and exercises of discretion are not supervised under the personal law unless persons interested in an endowment allege misappropriation. Alienations are valid if for the benefit of the idol or the estate, and in the case of *matha* property the *mahant* who does not observe similar limits cannot bind the estate for longer than his own incumbency. Succession to a *shebaiti* follows the unamended Hindu law of succession unless the founder provided otherwise; that to a *mahant*-ship follows the course indicated by custom and the proper initiation of a disciple by the previous incumbent. Notwithstanding the breadth of the Hindu religion, the court has the power to declare a bequest "superstitious" and invalid if the purpose is not known to sacred literature or normal sectarian practice.

Conclusion.—Since the introduction of the Hindu code, the ancient system, which sometimes bears a distinct family likeness to the Roman law of the republican period, has remained only partly in force. It continues under the guise of the Anglo-Hindu law in Pakistan, Burma, Malaya and east Africa. Study of the Hindu period has thus become mainly comparative. Yet it remains rewarding: the Indians were the first comparative jurists to leave an adequate trace of their reasonings, and many of their results have been unrivaled in longevity.

Minorities.—Jews are governed by their customary law in some points of marriage and divorce; Parsees (*q.v.*) have their own marriage, divorce and succession laws by statute; and Christians are governed by the Indian Christian Marriage act, 1872, the Indian Divorce act, 1869 (both based on obsolete English statutes), and the Indian Succession act, 1925, or the Travancore Christian Succession act, 1917. Parsees and Christians cannot plead custom in derogation from their statutory laws.

The Muslim Personal Law (Shariat) Application act, 1937, brought under Islamic law for most purposes many Muslims who had been governed in the law of the joint family and succession by Hindu law as their custom, but otherwise in the early 1960s Indian Muslims could still plead custom. Islamic law as in force in India differs from the pure shariat (*shari'a*), the Muslim personal law, in some respects. Indian Muslims retain many characteristics reminiscent of their pre-Islamic past, and are unmoved by the substantial reforms which that legal system has developed in the middle east. Anglo-Muslim law has developed little through judicial decision, though British administration has changed it, sometimes unwittingly. Occasionally it was found impossible to follow orthodox ideas. After the famous *waqf* (property dedicated to religious purposes) case, the law as stated in the privy council (*i.e.*, that illusory or hypothetical dedications to God were void) was reversed in the Mussalman Wakf Validating act, 1913.

Most Indian Muslims are of the Sunni sect and it is presumed in law that a Sunni will follow Hanafite law, as the majority of their sect in India do. Shi'ites (or Shi'as), members of the second great Muslim sect, belong either to the Ithna 'Ashariya or Isma'ili schools of law, and are governed accordingly although they are very much in the minority. In 1939 the Dissolution of Muslim Marriages act allowed that desertion (for four years) by the husband, failure of the husband to maintain his wife (for two years), and cruelty were grounds for divorce, thus introducing certain doctrines from the Malikite school, another of the four Sunni schools of law and the one which is prevalent in north Africa and Spain.

Some advances have been made since the 1930s in the publication of Muslim texts, but the court refuses to investigate Hanafite sources other than those in use in Mogul times, such as the *Hidaya* and the *Fatawa-i Alamgiri*. The traditional freedom of *mutawallis* (trustees of *waqfs*) has been somewhat curtailed by the administrative organization imposed by the Wakf act, 1954. (*See* also ISLAMIC LAW.)

The position in Kerala state was confused even after the codification of Hindu law in 1955–56. The major communities, except the Jews, had statutes amending but not codifying their personal laws and customs, amounting to more than a dozen in number, and these differed from group to group and between the former constituent regions that made up Kerala in 1956.

Criminal Law.—In India this has been very little changed since the Indian Penal code was enacted in 1861. Lord Macaulay's original draft of that code, which remains its nucleus, was not based on the contemporary English law alone, and many of the definitions and distinctions are unknown to English law, while later developments in the latter are not represented. Yet Indian courts frequently consult English decisions in order to construe sections of the code. In spite of the fact that the wording of the code, when strictly construed, enables many wrongdoers to escape, India has modified it in only marginal respects. This is remarkable in view of the extreme rarity of the code's coincidence with the criminal laws in force in India prior to 1861. The Criminal Procedure code, 1898, by contrast, is a true Anglo-Indian amalgam, and has been amended further to suit peculiarly Indian conditions and the climate of opinion.

See also INDIA: *Administration and Social Conditions.*

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INDIAN LITERATURE. This article outlines the evolution and development of the literatures of India and their relationship to one another; further information will be found in the articles on SANSKRIT LITERATURE; PRAKRIT LANGUAGES; PALI LITERATURE; ASSAMESE LANGUAGE; BENGALI LITERATURE; BIHARI LANGUAGE; GUJARATI LANGUAGE; HINDI LITERATURE; KANARESE LITERATURE; KASHMIRI LANGUAGE; MALAYALAM LITERATURE; ORIYA LANGUAGE; PANJABI LANGUAGE; RAJASTHANI LANGUAGE; TAMIL; URDU LITERATURE.

All the modern Indian literatures depend greatly on the ancient Indian background, the basic material in their formative periods being that of the Sanskrit epics, the *Mahābhārata* and *Rāmāyaṇa*, the Krishna story as told in the *Bhāgavāta-purāṇa*, the other Purānic legends, and the fable anthologies. In addition the Sanskrit philosophies were the source of philosophical writing in the later literatures, and the Sanskrit schools of rhetoric were of great importance for the development of court poetry in many of the modern literatures. Only in Urdu and Sindhi (*see* SINDHI LANGUAGE) with their essentially Islamic background, and to a lesser extent in Panjabi, is this Sanskrit background not indispensable.

Dravidian Literatures.—The earliest Indian literature to be independent of Sanskrit was that of Tamil, which alone of the languages under discussion has an "ancient" or "classical" period, reaching back to perhaps the 5th century B.C., with, in consequence,

a greater range of difference in the languages of its early and modern literatures than elsewhere in India. Its specifically south Indian character was not without influence on the literatures of the other non-Sanskritic languages, Telugu, Kanarese (*Kannaḍa*) and Malayalam. The last named has a form of literature almost unknown elsewhere in India, the *Maṇipravāla* style, macaronic verse in Sanskrit and Malayalam. While the earliest Malayalam and Tamil literature is secular, that of Kanarese and Telugu is religious. The first literary works in Tamil, written in the first four centuries A.D., were short poems on love or on kings and their wars, although one anthology, the *Paripāṭal*, is devotional. Later came ethical works, *e.g.*, the *Tirukkuṛal*, possibly written by a Jain. The "twin epics," *Maṇimēkalai* and *Cilappatikāram*, are verse romances of about the 6th century, the former a Buddhist work. The *bhakti* movement (*see* HINDI LITERATURE) was at first Śaiva, from the 7th century, with Vaiṣṇavism in the hymns of the 12 Alvārs, not far behind. The influence of Sanskrit increased considerably during this period and is reflected not only in the language but also in the themes of Tamil literature, for example. Kamban's *Rāmāyaṇa*, by no means a simple translation of the Sanskrit epic, appeared in the 11th century and an adaptation of the *Mahābhārata* in the 12th. In Kanarese, the Jain writings of the 9th–13th centuries give way to those of the Vīraśaivas (a Śaiva sect) and the Vaiṣṇavas, the religious controversies of the time being reflected in the literature.

This does not mean, however, that these four great Dravidian literatures remained independent of the dominant Sanskrit, nor that there was no literary development in the other languages at a comparable period.

The Northern Languages.—Each of the northern languages developed from a Prakrit ancestor through an Apabhraṃśa (*see* PRAKRIT LANGUAGES) and the surviving remnants in these languages must be considered as part of their literary tradition. The Sanskrit writings in each linguistic area must also be included, for Sanskrit was cultivated for literary purposes long after it had ceased to be a viable spoken language.

Religious Origins.—The origins of most of the modern literatures are connected with the spread of particular religious ideas: thus while Pali, an early Prakritic language, was developed as the linguistic vehicle for the Buddhist canon, and Jain doctrine was committed largely to Ardha-māgadhī Prakrit and Apabhraṃśa, early Hindi expounds the faith of the Jains and the *siddhas* (*émigré* Buddhist monks, particularly in Bhutan) and the teachings of the *Nāth Sampraday* (a school of philosophy re-established in the 10th century) are formulated in early Marathi, although some of the earliest Marathi works are writings of the Mahānubhāva sect, from *c.* A.D. 1280. Early Panjabi is concerned with the doctrines of other *nāths*, early Kashmiri with Tantric works, and early Bengali, whose earliest known works are the *Cāryyapadas* (Buddhist lyric poems of the 10th century) with a Hindu-Buddhist syncretistic sectarianism. The earliest Urdu is in prose, in the late 14th century, and starts with a treatise on *sufi* mysticism. The literary forms of this early period are not many: the song, used for religious expression, is the most obvious, depending directly on the popular folk song and ballad; the old Rajasthani literature used the epic ballad; in the southern literatures the long philosophic poem was a favourite style and also the *campu*, an epic largely in verse with prose interludes.

Muslim Influence.—The major development of the modern languages and literatures, especially in the north, has taken place in the present millennium. The advent of Islam from the 12th century onward brought some literary and much linguistic adjustment. Kashmir, the old stronghold of Hindu orthodoxy, was radically changed by the flood of conversions to Islam, and Persian became dominant there and its influence persisted until modern times even among the Kashmir Hindus (*see* KASHMIRI LANGUAGE). The settled power in the north used Persian as its administrative language although, besides the cultivation of Persian and to a smaller extent Arabic as a literary vehicle among Muslims, some interest was taken in the local languages; for example, at the turn of the 13th century Amir Khusrau (*q.v.*) wrote light Hindi verse in addition to his major Persian works. (*See* also PERSIAN LITERATURE; ARABIC LITERATURE.) A lingua franca, the Delhi dialect of Hindi enriched with a considerable Persian vocabulary, evolved, and was taken south to Gulbarga and Bidar under the Bahmani sultans (*see* BAHMANI); a varied literature in this early (Dakkhani) Urdu, mainly verse but with a little prose, developed in the Deccan and was flourishing by the mid-16th century. Urdu literature in the north developed later, in the 18th century, after which the north remained the principal area of Urdu literature, although under the rejuvenating northern influence the southern schools remained active. Both north and south developed the *ghazal*, a short love lyric, already a well-established form in Persian, which most Urdu poets knew well and in which many also wrote with distinction. In the north the Islamic influence, on the vocabulary in particular, extended to all the major linguistic areas.

The earliest phase of these modern literatures is strikingly uniform, representing Hindu revivalism in the face of pressure from Islam. The hymns of the Tamil *bhakti* preachers inspired similar creation in the northern literatures, and in general the northern literatures show two streams of devotional poetry, one devoted to Krishna (*q.v.*), the other to Rāma. Bengali has a distinct third stream in its *Mangalkāvyas* (long and episodic narrative poems which honour deities, their dealings with each other and with man, and which combine two distinct strata, a popular, possibly pre-Aryan, and a later Brahmanical one), while in Hindi, particularly, a further stream is provided by the works of *sufi* inspiration and the impersonal deistic devotion of poets like Kabīr (*q.v.*) and Dādū. Much of this early literature represents a period of direct or partial translation from Sanskrit models, and a frequent appendage consists of works of hagiography.

At roughly the same period, the 14th to 16th centuries, there was a distinct genre of composition, the heroic or romantic cycle, especially in Rajasthani and western Hindi, in Awadhī (eastern Hindi), Panjabi and Oriya. The Marathi ballad, glorifying particularly the popular leader Śivaji, came somewhat later (the 17th century onward), while in Bengal such cycles are of a somewhat different character, woven into the *Mangalkāvyas*. The substance of Muslim myth and legend is similarly treated in the "Islamic" literatures, Urdu, Dakhani, Panjabi and to some extent Bengali and Gujarati.

From the 13th to the 18th century the streams of lyrical and narrative verse continued in the south; Tamil in particular saw translation and adaptation of the *Purāṇas*, great prose commentaries on earlier works, and many works on Śaiva theology, including the development, in verse, of the Śaiva-siddhānta philosophy, which has no exact North Indian counterpart.

The new literary genres which developed in North India about the 17th century include the *bāra-māsa* poems, depicting the sufferings of separated lovers in each of the 12 months of the year, and the acrostics based on the Devanagari and Persian scripts (*cawtīsā* and *sīharfī*). By far the greatest part of all this literature is in verse, although the prose history (*buranji*) was early developed in Assamese and in the 16th century Jain and Sikh biographical and narrative literature appeared in early Gujarati and early Panjabi respectively.

With the growth of Muslim power, Indian writing evolved in two ways, depending on whether the poets were, or were not, within the patronage of the new regimes. On the one hand the decline of the old powers called forth its denouncers in the form of satirists all over India. On the other, the poets secure in their patronage cultivated a neoclassicism, reviving old forms and elaborating new ones with decoration (often extreme), and vitality comes only when attempts are made at realism, as in some of the latest Bengali *Mangalkāvyas*, the later romantic ballads of the Panjab, and the Kanarese poets Tirumalarya and Cikupadhyaya. Hindi shows a tendency toward courtly rhetoric based on the Sanskrit science of poetics, while a formalized poetry on Persian themes is apparent in the Urdu poets of the Muslim court at Lucknow. But indigenous folk metres were used for literary purposes besides the Sanskrit patterns, especially in Marathi and Kanarese, while the Persian *ghazal*, *masnavī*, *qasīda* and *marsiya* spread from Urdu to other Indian literatures.

19th- and 20th-Century Developments.—Such were the con-

ditions when western influence began to be felt in the early 19th century. As education in the vernacular increased, primers, readers and other pedagogic works generated writings in modern prose. The Serampur missionaries with their printing presses were the first journalists, Indian reformists like Ram Mohun Roy (*q.v.*) inspired their compatriots to accept western models, and literary societies came into being; the Hindi littérateur Bharatendu Harischandra developed his own literary coterie like a Joseph Addison, his own talent being not unlike Oliver Goldsmith's. Authors and the growing literate public were introduced to western literary forms in English. Gradually translation gave way all over India to imitation, and from imitation arose original, creative writing. The impact of the change was epitomized by Asadullah Khan Ghalib: "They brought me in the dark night news of the dawn; they snuffed the candle, but showed me the sun." Prose emerged as a literary medium, and the novel and the short story were discovered as art forms; the older traditions, however, died hard, and most of the older forms of verse writing persisted until well into the 20th century. Certainly in Urdu the *ghazal* remains the favourite verse form. Realism displaced the conventional outworn patterns of metaphor and hyperbole (although in some cases this was succeeded instead by the development of a personal symbolism), and social and psychological treatments of a literary theme multiplied. The period from about 1880 to 1920 was a time of acute national awareness generally—a phase which began somewhat earlier in Bengali where it culminated in the genius of Rabindranath Tagore (*q.v.*).

In general the modern phase shows three main trends. On the one hand the modern romantics, faithful to what is best in the legacy of the past, sometimes touch the sublime heights of musical insight and mystic vision; they have been influenced in varying degrees by the English romantic poets, as have the writers of the second group, the progressives, in whom late romanticism and marxian dialectic mingle. The work of some progressives is convincing, but the majority of such writing depicts stock characters in stock situations. The third trend shows the growth of scientific humanism in India, breaking away from both the subjectivity of the romantics and the doctrinaire objectivity of the progressives, and often introducing experimental forms. The extensive growth of the Indian press and the more modest development of broadcasting have encouraged this latest class of writing.

While these trends are common throughout India, their developments have occurred at different times in the individual literatures, and similarly the genres in use have varied locally; thus the Marathi and Bihari drama is active and depends on popular support, while in Hindi dramatic writing is almost completely confined to one-act plays or the more cerebral "play for private reading," and in Urdu there is scarcely any drama at all. In Tamil the drama has been cultivated since the late 19th century, and performances of modern plays illustrating historical themes or purveying social criticism are common; in general they are inclined to be prolix. The Indian film, which tends to be of heroic proportions, is a great rival to the drama, but rarely achieves a high literary standard. In some literatures prose still lags behind poetry, and some linguistic regions have still to produce a convincing novelist or short-story writer. Indian authors are aware of these deficiencies, and the popularity of widespread and intelligent literary criticism guarantees the future vitality of Indian literature.

See V. K. Gokak (ed.), *Literatures in Modern Indian Languages* (1957); *Contemporary Indian Literature*, a symposium from Sahitya Akademi (1957, 2nd ed. 1963). (J. B.-P.)

INDIAN MUSIC. History and tradition require that the music of the Indian subcontinent be viewed as a whole. Over a period of about 6,000 years numerous peoples have flowed into this region. Some tribal melodies and rhythms preserve elements of ancient origin, and a wealth of more developed folk music has always been connected with the agricultural year. Such elements can have changed little in their essential character over long periods. Certain higher cultures also appeared in prehistoric times, like that of the artistic people, who, related to the Sumerians, brought an early harp to the Indus valley (2500–1500 B.C.).

Vedic and Early Classical Tradition (c. 1500–c. 250 B.C.). —The Aryans reached India from western Asia with sacred teachings and rituals that they later wrote down in four Vedas (*veda*, "knowledge"); each of these books (Rig, Sama, Yajur and Atharva) had its own style of recitation. The Rigveda ("Knowledge of Hymns"), for instance, where the words are all-important, is austerely chanted on three pitch accents, its basic forms still being used in Hindu temples; whereas the Samaveda ("Knowledge of Chants"), using words as little more than a vehicle for the voice, employs more or less elaborate melody. The Vedic tradition, crossed with the traditional songs of the south where the dark Dravidian peoples already enjoyed something of a higher culture, helped the development of a secular art of music about 2,000 years ago, and these beginnings underlie the familiar classical *raga* music of later times.

Bharata, India's first known musical theorist, in his work on the arts of the theatre, *Natya Shastra* (*c.* 6th century B.C.), devotes six chapters to the subject of music. Called *Samgita* in Sanskrit, the classical art consisted of *gita* or vocal music, always of primary importance in India; *vadya* or instrumental music, for long very subordinate; and, dependent upon these, *nrtya*, dance. The Bharata Natyam (*q.v.*), the classical temple dance of south India, goes back to Vedic origins, while *Kathakali*, the dance-drama of Kerala, though later in its form, is no less inspired by the ancient Hindu epics, *Ramayana* (*c.* 5th century B.C.) and *Mahabharata* (400 B.C.–A.D. 400).

The Classical System of Ragas and the Middle Ages.—After a period of Hellenic and Buddhist predominance (*c.* 250 B.C.–A.D. 600), during which the classical tradition was somewhat overshadowed, a period of religious revival followed and India once again became Hindu. Many forms of the drum had long been popular though the basis of music remained vocal. Temple sculptures show many new instruments including those of the lute and fiddle classes. Despite their variety these instruments were played not as orchestras but as solo instruments or in small ensembles. Musical theorists and writers began to appear and important works on classical theory include Matamga's *Brihad deshi* (8th century or earlier), Narada's *Naradiya Shiksha* (10th century or earlier) and Sarngadeva's *Samgita Ratnakara* (early 13th century).

Theory.—Indian theory recognizes the octave (*saptaka*, "set of seven," *i.e.*, seven intervals) as a complete cycle of sounds, comprising, as in the western scale, seven main steps, or notes (*svaras*), called for short: *sa, ri, ga, ma, pa, dha, ni.*

The octave is further divided into 22 more or less equal *srutis*, microtonal steps used in various groupings of two, three and four to form the intervals of the various scales and modes. In classical theory there are two fundamental seven-note (*sampurna*, "complete") scales (*grama*), which also have six-note and five-note forms. These, conceived as a sequence of ascending intervals measured in *srutis*, are the *Sa Grama* (4 3 2 4 4 3 2) and the *Ma Grama* (4 3 4 2 4 3 2). The first figure (4) in these scales represents the number of *srutis* not between *sa* (tonic) and *ri* but between the note below *sa* and *sa*. A scale has seven modal forms according to which one of its seven notes is considered the tonic. From the two scales of *sa* and *ma*, therefore, 14 theoretical *murchanas* ("extensions") were formulated, 7 of which were deemed suitable for practical use. From these were formed 7 principal (and 11 mixed) *jatis*, or species of melodic germ cell, each having its own special hierarchy of notes.

Raga.—The *jatis* form the basis for more complex structures called *ragas*, of which there are normally considered to be 132. The *raga* is a characteristic oriental melody type, and each *raga* is defined by its scale, melodic *tessitura*, characteristic melodic contours and the emphasis given to a particular note (*vadi*) that forms a contrast with the tonic, as well as by the choice of subtle ornaments (*gamakas*) that give the melody its flexibility. Each *raga* ("colour," "feeling") is conceived with a view to exciting and (when performed at length) sustaining a particular mood in the listener. The name is first found in the 8th century though the idea is much earlier for the moods were already classified by the Aryans in antiquity. The *ragas* came to express moods appropriate to different hours of the day and night, and later they acquired an extensive mythology illustrating their right and wrong use, as well

as allusions to the planets and the elements. The reality of such associations in the Indian mind is indicated by the traditional paintings conveying the essence of the *ragas* in pictorial form.

Tala.—In performance any given *raga* needs a time measure. This is called *tala*, and in south Indian tradition there are seven main *talas*, each having five forms. A given *tala* has a fixed number of beats arranged in distinctive groupings determined by stress and quantity (longs and shorts). Some are simple, like western common time, others asymmetrical. The *tala* is thus a point of departure for the music's rhythm and, as such, is normally played on the drums. Within a given complete period of a *tala*, two performers (singer or instrumentalist and drummer) may go their own way with rhythmical variants, but they have to coincide on the first beat (*sam*) of each new period.

In the formal basis of a musical performance the first element heard is the *alapa*, a prelude in free but slow time, without drumming, where the performer feels his way into the mood of the *raga* material and establishes its main features. Then follows the main body of the work, called *ghat*, when the drum comes in with the *tala;* this section usually is predominantly in a moderate tempo. Here the recurrent period of the *tala* underlies the formal structure. The proportion of *alapa* to *ghat* is no more definite than the length of a single *raga* performance, which varies from a few minutes to two hours or even longer.

Drone.—The two elements, *raga* and *tala*, together representing music's rhythmitonal structure, are completed by a drone that acts as a tonic measuring note (or notes) throughout the piece; since there is no modulation in Indian music, the drone is regarded as immovable. It is often played by a long-necked unfretted lute called *tambura*, whose four strings are normally tuned to the fifth (occasionally the fourth), the octave, the octave, and the fundamental. When played in cyclic sequence the strings, having a considerable reverberation time, give the impression of a continuous sound. This sound, rich in harmonic partials, provides a harmonic reference frame for the art of *raga* and *tala*. The addition of further harmony would completely destroy the fine melodic-harmonic balance of the system.

Having selected a *raga* appropriate to the hour, the performer subordinates his individual creative tendencies to its laws but exercises all his ingenuity and skill in extemporizing within the prescribed framework. He must indeed be more creative than the modern western musical performer.

Muslim Influence and the Traditions of North and South (c. 1000–c. 1700).—The *raga* principle belongs to the whole of India, but the style of performance, as well as the choice of actual *ragas*, differs much in north and south. The differentiation began in early times, since racial movements always tended to push the earlier inhabitants southward. Moreover, the north was successively influenced by the Indus valley and Greco-Buddhist cultures; the Persian empire (5th and 4th centuries B.C.); the Parsees; and the Arab occupation of Gujarat (8th century A.D.). Thus Persian and Arabic influence was no new thing at the time of the Muslim conquest. The new rulers were, moreover, devoted to music, and this art reached a high point at the late Mogul courts, especially under the emperor Akbar (1542–1605). Muslim influence was never comparable in the south; indeed the music of the south, Carnatic music, Aryan in form and largely Dravidian in content, remained architectural, sublime and restrained, whereas that of the north, Hindustani music, already a blend of Aryan and Hindu, absorbed new melodies and styles from Persia and the middle east and reached a new elegance and vitality, as well as becoming more secular in atmosphere. It also favoured certain instruments.

Instruments.—Many Indian instruments have ancient origins and some are indigenous, but most of those in 20th-century use are either of middle eastern origin or are the result of a fusion of older Hindu instruments with new Persian and Arabic forms.

Stringed instruments include the plucked stringed instruments vina (especially in the south), sitar and sarod (especially in the north); and the bowed reedy-toned fiddles, sarangi and *esraj*, and the more recently adopted European violin (in the south). Wind instruments include the cross flute and the vertical flute, and the shawms, *shahnai* (north) and *nagasuaram* (south); the ceremonial conch shell; and the snake charmer's reed pipe. Drums are very numerous, including the classical *tabla* (north), consisting of two drums (*daina* and *bayan*); the *mridamga* (south); the hourglass drum, *damaru;* the stick-struck drums *dhol* and *dholak;* and the kettledrums *naqira*. Idiophones are represented by various cymbals, bells and clappers.

Modern Developments.—While the Mogul empire declined, British influence in India grew, and the British raj (1757–1947) saw great changes in India's musical life. A decline in feudalism and hence in musical patronage led to a fall in the musician's status and ultimately in his artistry. The process was accelerated in the 19th century owing to misguided attempts to foist western harmony onto an already fully developed modal system and by the introduction of instruments tuned in equal temperament like the harmonium, whose principle is found in the *sruti*-box, which now often replaces the traditional *tambura* as a drone.

With the adjustments of modern life Indian musicians work somewhere between the extremes of preserving their own tradition and of following western ideals. On the popular level the influence of western dance and film music seriously threatens the integrity of traditional music. The fate of the classical *raga* music, however, is still in the balance. Some of its leading exponents are influenced by what they heard on visits to the west. Some Indian musicians were trained in western methods of composition and they write music of various hybrid types; others are engaged in finding forms suitable for radio and concert hall.

Heritage.—Indian music periodically influenced that of other regions. During the early centuries of the Christian era it traveled with Buddhism into Tibet, China, Korea and Japan, where surviving forms still attest its influence. Hindus in southeast Asia and Indonesia, especially from the 8th century, stimulated the development of music in those regions. Its influence survives in Burma and Siam (Thailand) in the boat-shaped harp and in Bali in certain musical forms. The gypsies carried Indian *ragas* to Arabia and Europe. In the middle of the 20th century Indian classical musicians began to visit Europe and the U.S., and a growing number of recordings provided a means of study. Indian classical music forms an important part of the great surviving eastern traditions and is beginning to invite study by western musicians.

See also ORIENTAL MUSIC.

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INDIAN MUTINY, the great revolt of the Bengal native army in 1857 which led to the loss of Delhi and Lucknow and to widespread civil rebellion from Bihar to Delhi, gravely threatening British rule in India. It was effectively suppressed by the end of 1858, in which year the government of India was transferred from the East India company to the crown.

The mutiny of about 70,000 sepoys and the collapse of British authority over large areas of northern India dramatically revealed to what stresses Indian society had been exposed by British rule. In the 19th century British respect for India's institutions, interest in its thought and literature and sympathy for its people had waned. Conscious of western power and progress, Englishmen indulged either a doctrinaire, utilitarian desire to reorder Indian society, or an evangelical zeal against Muslim and Hindu. Their confident energy, insensitively applied, eventually provoked a violent Indian reaction.

The Bengal native army had previously shown its discontent in a series of mutinous incidents. The sepoy was aware that the victories by which he extended British power to the Afghan and the Burmese borders diminished his prospects of prize money and campaign pay, while increasing the periods of absence from his family and the transport and messing charges he had to bear. Peace precluded any early promotion, whatever zeal or merit he might display. Even as a subahdar (chief native officer) with 30

years of service he could expect to exercise no real authority. He saw the best officers of his regiment leave to take up civil appointments and felt in those who remained, the young and inexperienced or the old and disappointed, an increasing disdain. Pride in the company's unbroken success no longer sustained him; he had witnessed its utter defeat in Afghanistan and near disaster in the Sikh wars, and had heard of British failures in the Crimea. The annexation of Oudh in 1856 had deprived the many recruited there of a privileged position. If he was a Hindu (perhaps of high caste) he shared the orthodox dislike of the company's abolition of suttee (*q.v.*), the granting of permission for Hindu widows to remarry and care for the convert's legal position, and he objected to the regulation which made all new recruits liable to service overseas. Hindu or Muslim, he resented Christian missionary attacks upon his faith and the proselytizing activities of certain British officers and officials.

Religious fears provided the immediate occasion for mutiny. For several years before 1857 trial had been made in India of the new Enfield rifle, the cartridges of which were heavily greased. A worker at the Calcutta arsenal told a sepoy in Jan. 1857 that the grease which was used contained the fat of both cows and pigs, thus defiling the Hindu or Muslim sepoy when he bit off the end of the cartridge. The news spread at once to Barrackpore, headquarters for the Bengal presidency, where disaffection was soon reported. Letters and troop movements rapidly spread reports of the defiling cartridges to other cantonments. The explanations given by Gen. John Hearsey and the granting of permission for the sepoys to use their own materials checked the unrest, but on Feb. 26 the 19th native infantry at Berhampur refused the cartridges and, when threatened, broke into disorder. The regiment was ordered down to Barrackpore for disbanding. News that European troops had been summoned from Rangoon to enforce the punishment increased the general alarm. On March 19, noncommissioned officers at the musketry school at Ambala reported that they were being treated as outcastes for handling the greased cartridges; they were reprimanded and the drill continued. On March 29, at Barrackpore, Mangal Pande, a sepoy of the 34th regiment, killed his adjutant and called on his comrades to rise. In April the 3rd native cavalry at Meerut refused to accept even the old cartridges. In May the troops at Lucknow were compelled by force to use the new cartridges.

Meanwhile the 19th regiment and then, after a long inquiry, the 34th were disbanded, the men being left free to carry home their story of the cartridges. About 85 men of the cavalry at Meerut who, fearing public opinion, had refused their cartridges, were condemned to long terms of imprisonment on May 9. They were fettered on parade and placed in the cantonment jail. Next evening they were released by their comrades; the remaining two sepoy regiments rose, killing many of their officers, and after some hesitation set off for Delhi. They were not pursued. They entered Delhi on May 11, won over the regiments there and made themselves masters of the city, with its great arsenal and powder stores. There were no European troops at Delhi, except for a gallant handful of artillery officers and warrant officers who tried to blow up the arsenal. The mutineers forced their way into the palace and made Bahadur Shah II, descendant of the Mogul emperors, their unwilling figurehead. A focus was thus given for what had so far been merely sporadic outbreaks, prompted by fear and suspicion.

The governor general, Lord Charles Canning, for the moment could do little; the British troops were outnumbered by five to one and were awkwardly disposed. Up the 750 mi. of the Ganges valley from Barrackpore to Agra there was only one European regiment. Moreover neither Canning nor Gen. George Anson, the commander in chief, who was at Simla, had the transport ready for large-scale movement of troops and supplies. There was also uncertainty about what should be done. An early, dramatic success at Delhi was obviously required, but what of the other sepoy regiments who throughout May 1857 remained quiet? At many stations there were no European troops with which to coerce them and Canning feared to disarm or disband the sepoys lest he provoke mutiny and so endanger the upcountry civilian population. Few officers yet believed that their regiments could be disloyal; the task of disbanding about 85 Bengal regiments, of undoing the work of a century, was not yet seen to be essential. From Simla, Anson moved three European regiments down to Karnal and called for troops from Meerut. Anson died on May 27 and was succeeded by Sir Henry Barnard. Only after several stiff engagements did this scanty force reach the low, bare ridge overlooking Delhi on June 8, and their hurried plan for an assault miscarried (June 12). The risk of an assault upon the fortified city and of fighting through its tangled streets, without reserve forces, seemed too great for any second attack to be attempted.

Meanwhile rumours multiplied in the sepoy regiments and fears grew as it became known that Canning had ordered troops up from Madras and Ceylon, and had ordered to Calcutta the troops returning from Sir James Outram's Persian gulf expedition. The 17th native infantry rose at Azamgarh in June, capturing a treasure convoy; most of the garrison at Benares (Varanasi) broke out on June 4, after a bungled attempt to disarm them; the Ludhiana Sikhs rose at Jaunpur on June 5; and the troops at Allahabad rose on June 6, followed by the whole city. The contagion spread still further up the Ganges valley to Cawnpore (Kanpur). The veteran Sir Hugh Wheeler had reported in May that the Cawnpore sepoy force was beset by fear and uncertainty. This he had sought to dispel by a display of trust, but yet felt compelled to make some provision for the many civilians in the town by throwing up some weak defenses. He had also appealed to the Nana Sahib, the son of the last Maratha peshwa, who lived nearby at Bithur. Two sepoy regiments mutinied and made off on June 4, and after Wheeler had fired upon the hitherto loyal 53rd and 56th regiments, most of them followed. Having persuaded, or forced, the Nana Sahib to lead them, they returned to besiege Wheeler's weak entrenchments (June 5). Three weeks later, his troops and supplies exhausted, Wheeler accepted the safe conduct offered by the Nana Sahib and surrendered. He was betrayed, his men killed, and the women and children taken captive.

At Lucknow, the capital of the kingdom of Oudh, events nearly followed a similar course. Sir Henry Lawrence had prepared the residency for a siege since mid-May, while still seeking, like Wheeler, to avoid precipitating a crisis. The regiments at Lucknow mutinied on May 30, to be followed within a month by all 11 Bengal and Oudh irregular regiments at the outstations. Lawrence, with the Europeans and 700 loyal sepoys, made good his withdrawal to the residency, but many Europeans were killed in the countryside and British administration was overthrown everywhere. In Oudh indeed, mutiny led at once to a general rebellion; the recent dispossession by the British of the king, a faithful, if incompetent ally, was seen as an act of treachery. The talukdars, the great landlords of Oudh, often tribal chiefs, many of whom had lost prestige and lands after the annexation, rose to claim their former possessions. The peasantry, suffering from the high British taxation, gladly followed their old leaders. All found in Birjis Qadr, a son of the former king, now proclaimed nawab-vazir, a rallying point for their loyalty.

Still farther north, in Rohilkhand and the Doab, the people at times even anticipated the mutiny of the sepoy regiments, as at Saharanpur or Muzaffarnagar, or at Moradabad where Nawab Niamatullah Khan long appealed in vain to the 29th regiment to join him in rebellion. At Farrukhabad, across the Ganges, there was a general rebellion at the end of May, a month before the 10th native infantry mutinied and put Husain Khan on the throne. Wherever the risings occurred there followed the destruction of government records, the burning of law courts, the hunting down of the moneylenders and those who bought up estates—the instruments, that is, of the overthrow of the old social order. The police and revenue officials were driven out, Europeans, Bengalis, and those friendly with the British were killed. In their place, men like the Rohilla chief, Khan Bahadur Khan, installed an administration, backed by local levies, based on the old Mogul model.

The loss in June of Cawnpore, Lucknow, Bareilly, Fatehgarh and Aligahr, all but cut communications between the small British forces outside Delhi and Calcutta. Fortunately their links with the Punjab remained intact. The cis-Sutlej Sikh states, saved by

Lord Gilbert Minto from Ranjit Singh's grasp, kept the roads open through their territories. In the Punjab under John Lawrence, there was a body of officials accustomed to responsibility and with sufficient European and local troops to take the initiative against the regular sepoys. At Lahore the judicial commissioner, Robert Montgomery, surprised the native regiments on parade and disarmed them on May 13. The fort at Amritsar was surprised by European troops hurried there by night in pony carts. The arsenals at Ferozepur (Firuzpur) and Philour were in similar fashion made safe. At Peshawar 8,000 sepoys were safely disarmed on May 22. On May 23 Gen. John Nicholson began the hunting down of the 55th native infantry at Nowshera and Mardan who, knowing their loyalty was doubted, had fled for fear of punishment. For their folly in fleeing, about 40 manacled prisoners were executed by being shot at the cannon's mouth.

British vigour impressed both Pathans and Sikhs, who came in increasing numbers to join the irregular levies which were being raised. John Lawrence, accepting the risk of a possible Afghan attack, felt free in June to begin the dispatch of troops to Delhi. The first to move were the guides from Mardan. They covered the 580 mi. to Delhi in 22 hot-weather days. There followed the movable column formed under Nicholson which, successfully disarming some garrisons and destroying others such as that at Sialkot, which had risen, pushed through to Delhi by Aug. 14. With his arrival, reinforced as he had been with Baloch, Sikh and Punjab infantry, and the arrival of the siege train, the British forces on the Delhi ridge were able at last to turn from defense to attack. For two months there had been repeated sepoy assaults on the ridge as successive bodies of mutineers poured into Delhi. Nicholson with about 5,000 troops, one-quarter of them Indian, forced a way into the city on Sept. 14. The hard-won foothold was nearly thrown away next day when the British force indulged in an orgy of drunkenness, but the slow advance through the bitterly contested city was resumed on the 16th and 17th. The losses in street fighting were so heavy that the British wavered, but the palace was taken on Sept. 19 and the next day the whole city fell. Major William Hodson seized Bahadur Shah; he then seized the Mogul princes and shot them. Great numbers of the townspeople were killed and much property looted, while the official prize money amounted to nearly Rs. 3,500,000. Delhi as a cultural centre suffered a blow from which it never recovered.

The first important blow had been struck at Delhi. The second was to be at Cawnpore and Lucknow. Col. James Neill had secured Benares and Allahabad early in June and prepared to relieve Wheeler at Cawnpore. He was delayed by lack of transport, for the villagers fled before his wholesale hangings, and it was Gen. Henry Havelock (*q.v.*) who, after victories at Fatehpur and Aong, fought his way into Cawnpore (July 17). He found that the women and children held captive by the Nana Sahib had been savagely murdered; their bodies, some still breathing, were thrown down a well. Havelock's troops, wild with drink, took a savage revenge upon the townsfolk. With his tiny force Havelock then made three abortive attempts to relieve Lucknow. He could do no more without reinforcements. The road to Calcutta was cut by the mutiny of three regiments at Dinapur, which had foolishly not been disarmed, and by a subsequent rising at Arrah led by the Rajput chief Kunwar Singh, who routed the first relieving force. Not till August was the road reopened and Outram able to bring up the reinforcements with which Havelock was able to effect a junction with the residency garrison at Lucknow on Sept. 25. Even then their combined forces were too weak to force a way out with the women, children and wounded. That had to await the arrival in November of forces from Delhi and of those brought up from Calcutta by Sir Colin Campbell (*see* CLYDE, COLIN CAMPBELL, Baron). The troops summoned by Canning, including a naval brigade diverted from the China expedition, had arrived by Nov. 1857. After bitter street fighting the residency was reached (Nov. 17); the whole garrison was then evacuated, an observation corps only being left outside the city under Outram. Campbell was just in time to save Cawnpore from the skilful and determined attacks of Tantia Topi, the Nana Sahib's henchman, who led mutineers from Gwalior. That danger disposed of, however, he was able, with converging columns, to clear the Doab of mutineers and of the forces of the nawab of Farrukhabad and the raja of Mainpuri and so to establish control of the line from Allahabad to Delhi and Lahore.

The Jumna and Ganges Doab had been secured, but south of the Jumna yet another campaign was needed. The two great Maratha princes, Sindhia and Holkar, had remained loyal to the British, but their armies had not. In Gwalior, Sindhia's contingent, 8,000 regular sepoys and 10,000 local levies, had all mutinied, regiment after regiment (June 4–14), and marched toward Agra in September, being joined by Prince Firuz Shah and the refugees from Delhi. When the news from Gwalior reached Indore on July 1 Holkar's troops also rose, attacking the British residency. Moreover the sepoys at Jhansi had risen (June 6), killing their officers. Jhansi had lapsed to the East India company, but the widowed rani still lived there. She bought off the turbulent mutineers, restored order and, while writing for British assistance, beat off attacks by Bundela chiefs. She fell under suspicion, however, of complicity in the massacre of the English women who had been killed there and received no reply to her requests. When, therefore, the Bombay column under Sir Hugh Rose approached Jhansi, the rani chose to resist. Rose opened the siege (March 22, 1858) and after boldly driving off a relieving force brought by Tantia Topi, he stormed Jhansi on April 3. The street fighting was bitter and the palace was defended room by room until the rani fled (April 4) to join the peshwa at Kalpi. After a brutal sack of the town Rose marched toward Kalpi, which, despite its natural strength, fell on May 23. The brilliant, exhausting campaign seemed to be over. Then came the startling news that the rani and Tantia Topi had marched on Gwalior, won over the troops, expelled Sindhia and seized the fort and treasure. Rose had to march on with his weary troops at once, and it was only after combined operations that Gwalior was retaken on June 20. The rani had already died fighting with her cavalry but Tantia Topi escaped.

While any danger of the mutiny spreading to the Deccan was thus checked, Campbell was preparing to take and hold Lucknow with 30,000 troops. One column moved up the Gumti river through Sultanpur, driving such leaders as Mehndi Husain before it; Campbell himself moved down the Doab; while Gurkha troops, already used successfully at Azamgarh, closed in from the northeast under Jung Bahadur. The rebels, already dispirited by their failure to dislodge Outram's small force, made but ineffective use of their numbers and of the elaborate defenses of Lucknow. The city fell on March 21, 1858. The pacification of Oudh did not, however, follow; 70,000 men escaped the ill-drawn net round Lucknow, and worse still, Canning's proclamation, offering no more than life and liberty to the talukdars who submitted, roused many of them to new resistance in defense of their lands. A long autumn campaign was required, and much patient reassurance by Outram, then chief commissioner, before the skilful guerrilla resistance organized by men like Beni Madho and Kunwar Singh was overcome, the last rebels driven into Nepal and the talukdars persuaded to submit. By the end of Dec. 1858 the mutiny was effectively at an end, though some minor operations continued into 1859. A general amnesty had been proclaimed and the government had been transferred from the company to the crown.

The mutiny, though it had so strained British resources, had never extended much beyond the area garrisoned by the troops of the Bengal army of which the bulk—all but 11 regiments—rose or were disarmed, though there had been excitement at Hyderabad and stirrings among the southern Maratha chiefs. The great ruling chiefs, Sindhia, Holkar, the nizam, the Rajput and Sikh rulers, had all stood firm. The new middle class, the English-educated, had been actively pro-British. Many landowners, the business community, even the Mogul emperor, having suffered the lawlessness and plundering of the sepoys, wished to see British administration restored. Nearly half of the Bengal sepoys never took part in the mutiny; about 30,000 actively helped to suppress it. Many who did revolt did so from fear that all were to be destroyed; many sepoys were not allowed to prove their loyalty and until late in 1858 all suggestions for an amnesty were turned

down, even for those not implicated in violence: better then to fight than to be hunted down unresisting.

The sporadic, unco-ordinated sepoy revolt was made dangerous because it received popular support. In Oudh there was much loyalty to the unjustly deposed ruling house, and a general sense of grievance among the talukdars, which was only increased by Canning's proclamation. There was also support for the emperor (though none of the chiefs responded to his call) and in the Doab an attempt was made to restore an administration in his name. Both at Lucknow and Delhi effective appeals were made to the landowners, oppressed by overassessment and British legal procedure, to the merchant suffering from unfair British competition, to the artisan broken by British machine-made goods, to the learned who saw their Muslim educational system being destroyed, and above all to the upper classes who found all honourable positions of authority reserved exclusively for Europeans.

Such grievances were scarcely met during the half century which followed the mutiny. Indians in the army were given no more scope: instead religious differences were emphasized, to provide for British security. There was much suspicion of Muslims and some discrimination against them. The princes and feudal landowners were preserved as a bulwark against disorder. There was also a new fear of reform, so that those Indians who were struggling against the static, orthodox elements in their own society could no longer hope for general British support. British and Indians alike were burdened with memories of betrayal, cruelty and hate. *See* also INDIA-PAKISTAN, SUBCONTINENT OF: *History;* and references under "Indian Mutiny" in the Index.

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INDIAN OCEAN, the name applied to the region bounded on the north by India, Pakistan and Iran (Persia); on the west by the Arabian peninsula and Africa; on the east by the Malay peninsula, the Sunda Islands of Indonesia, and Australia; and on the south by Antarctica. An arbitrary separation from the Atlantic is made at the longitude of Cape Agulhas (20° E.) and from the Pacific at the longitude of Tasmania (147° E.).

The ocean is more than 6,200 mi. wide between the southern points of Africa and Australia and narrows steadily toward the north, where it is separated by India and Ceylon into the Arabian sea and the Bay of Bengal. Two adjoining seas connect with the Arabian sea, the Red sea through the Strait of Bab el Mandeb and the Persian gulf through the Strait of Hormuz. Because of the concentration of maritime traffic in low latitudes, the Indian ocean is often considered to be a tropical ocean but actually it extends to latitude 70° S. and the Red sea and Persian gulf reach to 30° N.

The Indian ocean has an area of 28,400,000 sq.mi. and is one of the smaller oceans, comprising only 20% of the ocean-covered portion of the earth. The two adjoining seas included in these figures are relatively small, the Red sea covering 169,100 sq.mi. and the Persian gulf 92,300 sq.mi.

The Indian ocean receives few large rivers, the chief being the Zambezi, the Shatt-al-Arab (formed by the junction of the Tigris and Euphrates), the Indus, the Ganges, the Brahmaputra and the Irrawaddy. J. Murray estimated the total land area draining to the Indian ocean at 5,050,000 sq.mi. (1.3 the area of Europe), more than two-thirds that draining to the Pacific. The Pacific, however, is more than twice as large as the Indian ocean. In addition to the rivers mentioned, the southwestern and northwestern monsoons in the tropical regions on the eastern side of the Indian ocean bring heavy rains, and there is heavy rainfall also in the neighbourhood of the equatorial calms. Therefore, the salinity of the surface water in these regions is relatively low, particularly in the Bay of Bengal into which flow the great rivers from the mainland.

Relief of the Ocean Floor.—Large portions of the ocean bed remain unexplored. In the latter part of the 19th century, H.M.S. "Challenger" and the German "Gazelle" and "Valdivia" provided a general understanding of the topography which was later expanded by the expeditions of the "Sealark" and many British cable ships. The "Discovery II" made extensive cruises, beginning in 1929, in high latitudes and in the western part of the ocean. The oceanographic vessels "Willebrord Snellius" and "Dana II" worked in the open ocean, and the "Ammiraglio Magnaghi" in the Red sea. The "Mabahiss" explored the northwestern part of the ocean in 1933–34, the Swedish "Albatross" the equatorial regions in 1948 and the Danish "Galathea" selected deeper waters in crossing from southern Africa to India to Indonesia in 1951.

A longitudinal ridge, the mid-Indian ridge, extends from India to Antarctica and separates the Western Indian and Eastern Indian troughs. Although similar in general location to the Atlantic ridge, it is much wider and does not extend so near the surface. In the northwestern part of the ocean the ridge is divided with two elevations extending toward the coast of Africa and separating the Arabian, Somali and Mascarenes basins. The longitudinal ridge is continuous at depths less than 13,000 ft. Although the western part of the ocean is divided into a series of basins, the Eastern Indian trough extends from the Bay of Bengal to Antarctica with but one major break at depths of less than 13,000 ft. This transverse ridge occurs near 50° S. and lies between the mid-Indian and Macquarie ridges. The latter is continuous at depths less than 13,000 ft. over most of the distance from Tasmania to Antarctica and is one of the barriers separating the deeper waters from those of the Pacific. West of the Kerguelen ridge, which forms the southern part of the longitudinal ridge, there is deepwater connection with the Atlantic. These features influence the deepwater circulation and the distribution of properties.

The greatest depths are found in the Sunda trench, a narrow depression paralleling the Sunda Islands, where soundings of 24,442 ft. have been obtained. Depths of about 21,300 ft. exist in the central part of the Eastern Indian trough (Wharton deep, 19° S., 100° E.). The Red sea, with an average depth of about 1,600 ft. and maximum depth of 9,200 ft. is separated from the open ocean except for a narrow channel only 330 ft. deep. In contrast, the Persian gulf is a shallow sea with an average depth of only 80 ft. The mean depth and volume of the Indian ocean are 13,000 ft. and 70,000,000 cu.st.mi.

Islands.—Madagascar, the largest of the ocean's islands, rises from a plateau about 4,900 ft. deep extending out from Africa. Ceylon and Socotra are continental islands. The Laccadive, Maldive and Chagos islands rise from the central part of the Indian ridge, while those extending from the Seychelles to Mauritius rise from the westward extension of the ridge and are separated by deep water from Madagascar. The Andaman and Nicobar islands rise from a ridge extending southward from Cape Negrais. Between the ridge and the Malay peninsula lies the Andaman basin opening only to the south. Many oceanic islands, such as Mauritius, Crozet and St. Paul's, are volcanic. Those in tropical seas are often coral formations or possess coral reefs.

Bottom Deposits.—The characteristics of sea-bottom sediments are described in OCEAN AND OCEANOGRAPHY: *Marine Sediments* because they are common to all oceans. The greater part of the Indian ocean north of 50° S. is covered with globigerina ooze. At depths greater than 16,000 ft. the calcium carbonate content is small and the deep basins, especially the Eastern trough, are covered with red clay. However, sediment cores up to 36 ft. long collected by the "Albatross" show a considerable quantity of globigerina ooze even at the greatest depth, and also pronounced stratification of sediments near the equator. Radiolarian ooze is found in some of the deeper basins, and diatom ooze covers a broad band in higher southern latitudes. Eighty-six per cent of the main basin (excluding adjacent seas) is covered with pelagic sediments, globigerina ooze covering 47%, red clay 22%, diatom ooze 17% and radiolarian ooze 0.4%. The remaining 14% of the bottom and the adjacent seas are covered with terrigenous sediments or shallow-water calcareous deposits (coral sands and muds). Glauconite is abundant in sediments off the African coast and calcareous sediments predominate in the Persian gulf and on many of the coasts and oceanic islands in tropical latitudes. Southeast of Ceylon an extensive flat area is apparently underlain by lava.

Compared with the Atlantic and the Pacific oceans, the high

proportion of pelagic siliceous oozes is quite striking, but this is the result of the shape of the ocean and the relatively large extent of the diatom ooze band in the south.

Meteorology.—In no oceanic division does the regular half-yearly alternation of all the factors in weather conditions and particularly the winds play such an important part as in the monsoon regions from 10° S. northward of the Indian ocean. From Oct.–Nov. to March–April northeast winds prevail in the north latitude and northwest winds in the south latitude; from May–June to Sept.–Oct. south and west winds prevail. In the Arabian sea between Socotra and the Maldives these southwest monsoons are very violent and are dangerous even to modern steamship traffic. From the earliest times the voyages of the native sailing vessels between India and Africa have been regulated by these alternating winds. The southwest monsoon brings rain to the whole of India; the northeast monsoon is predominantly dry. Southward from the latitude of the Seychelles-Chagos-Cocos islands, the southeast trade wind prevails throughout the year, and south of 30° S. the west winds which are generally particularly strong between 40° and 55° l., and of which in the 19th century the fast sailing ships bound for Australia and China took advantage.

The tropical storms, especially of Mauritius, are much dreaded; they follow a parabolic course from east to west then southward and back to the southeast, and occur in the summer season. In the Arabian sea and the Bay of Bengal these hurricanes are, fortunately, rare and occur only once or twice a year, in April–May and Oct.–Nov., that is to say, at the periods when the monsoons change. In the Hooghly delta off Calcutta the high waves which accompany the storms are dangerous and have caused the loss of thousands of lives.

Surface Currents.—Over the northern part of the Indian ocean the surface currents change with the monsoon. During the northeast monsoon the currents flow toward the southwest and west, crossing the equator, and between the easterly current maintained by the monsoon and the westerly current maintained by the southeasterly trade wind a strong countercurrent flows east in about 10° S. The southwest monsoon appears as a continuation of the southeast trade wind of the southern hemisphere which in crossing the equator turns from a southeasterly to a southwesterly direction. In the season of the southwest monsoon westerly currents prevail to somewhat north of the equator and turn then around toward the north. A strong northerly flow is found particularly off the Somali coast and the southeast coast of Arabia, where upwelling lowers the temperature near shore.

In the southern part of the Indian ocean a counterclockwise circulation prevails with westerly currents to the north of 20° S. and easterly currents maintained by the prevailing winds to the south of 40° S. These easterly currents represent part of the large antarctic circumpolar flow. The south equatorial current divides when reaching the coast of Madagascar, sending one branch north and another branch to the south. The northern branch turns around the northern end of Madagascar and flows south through the Mozambique channel and continues as the Agulhas current to Cape of Good Hope. Only a small fraction of the waters of the Agulhas current continues into the Atlantic ocean, and by far the greater body of water mixes with the waters of the circumpolar current and is carried to the east with that current. In the region of mixing, the surface temperature shows a great variability with alternating streaks of cold and warm water.

Deep Water and Its Circulation.—No large amount of deep water is formed in the Indian ocean by sinking of surface water, but the deep basins are filled by water which enters the Indian ocean to the south of Africa and is therefore similar to the deep water of the South Atlantic.

The deepwater circulation appears to be very slow compared with that of the Atlantic. Along the bottom the coldest water advances to the north and at a depth of about 3,300 ft. Antarctic intermediate water of low salinity also flows north and can be traced nearly to the equator. Between these two northerly flows deep water returns to the south and rises toward the surface near the antarctic continent. To the north of the equator the movement of the deep water is probably extremely slow.

Conditions are somewhat complicated by the outflow of high salinity water from the Red sea along the bottom of the Strait of Bab el Mandeb. This Red sea water sinks, mixes with the surrounding water and spreads at depths of 3,300 ft. to 4,900 ft. To the north of the equator it can be traced as far as Ceylon, and to the south of the equator to about 25° S. off the coast of Africa. The Red sea water corresponds to the Mediterranean water in the Atlantic ocean, but since the outflow from the Red sea is relatively small it exercises a less widespread influence upon the salinity distribution at moderate depths.

Below a depth of about 6,600 ft. the temperature of the deep water decreases from about 3° C. (37° F.) to about 1.5° C. (35° F.) at the bottom and the salinity remains nearly constant at 34.8 $^{o}/_{oo}$ (per mille).

Temperature.—North of the southern tropics the temperature of the surface waters is at all times higher than 20° C. (68° F.) and in the equatorial latitudes over 25° C. (77° F.); in the eastern half it is generally above 27.5° C. (81.5° F.); in the Red sea and the Persian gulf the temperature often rises to above 30° C. (86° F.). South of 40° S. the water quickly cools so that off Kerguelen (49° S.) even in summer the temperature has been found to be no more than 2° C.–3° C. (36° F.–37° F.). The isotherms run mainly from west to east, and their course is not diverted by currents to so great a degree as in the Atlantic.

Salinity.—The saltiest surface water is found in the Arabian sea and along a belt extending from southwest Australia to south Africa, the highest salinity in this belt occurring at the Australian end. In both regions the salinity exceeds 36 $^{o}/_{oo}$ (per mille). In the monsoon region west of Sumatra and throughout the Bay of Bengal, because of rainfall and the inflow of rivers, the salinity is diminished to 34 $^{o}/_{oo}$ and at the mouth of the Hooghly channel, below 30 $^{o}/_{oo}$. In the northern portions of the Red sea and the Persian gulf, on the other hand, the salinity is sometimes as high as 40 $^{o}/_{oo}$. South of New Amsterdam and St. Paul the salinity, as also the temperature, quickly diminishes, and south of Kerguelen as far as the antarctic shelf there is a uniform antarctic water of salinity 33.7 $^{o}/_{oo}$.

Ice.—In the extreme southern part of the Indian ocean, pack ice and icebergs from the Antarctic are encountered in all seasons. In October the northern limit of the pack ice lies in about latitude 58° S. and in March it closely follows the coast of the antarctic continent in about latitude 65° S. The average northern limit of icebergs lies in about 45° S.

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(H. U. S.; R. H. Fg.; C. A. Bs.)

INDIAN PHILOSOPHY is a singularly manifold philosophic development. It is impossible to touch in this article on all the special points of interest or doctrinal variations. For these the student must consult special works (see *Bibliography*).

It is not possible to determine exactly the dates of the Indian

systems of philosophy, but for the broad divisions the dates may be taken as follows: for the Vedic period, *c.* 1500–600 B.C.; for the Epic period, 600 B.C. to A.D. 200; and for the period of the Six Systems, A.D. 200.

VEDIC PERIOD

The Vedic literature comprises (1) the four Vedas, which consist of hymns, prayers and spells addressed to the gods; (2) the Brahmanas (*q.v.*) or ritual treatises; (3) the Aranyakas, or the forest treatises, the concluding portions of the Brahmanas; and (4) the Upanishads, which form the basis of much of the later Indian philosophy. The religion of nature of the hymns, the religion of law of the Brahmanas and the religion of spirit of the Upanishads correspond in a very close way to the three great divisions in the Hegelian conception of the growth of religion. (*See* also VEDIC RELIGION.)

THE RIGVEDA

The Rigveda represents the thought of successive generations of thinkers, and so contains different strata of thought. In it may be seen the development of religious ideas from the animistic to the absolutistic stages. "Where is the sun by night?" "Where go the stars by day?" "Why does the sun not fall down?" "Of the two, night and day, which is the earlier, which the later?" "Whence comes the wind, and whither goes it?" These are some of the questions which harassed the mind of the early Aryan. His first efforts to answer them resulted in naturalistic polytheism. There is a deity which makes the strong wind to blow, the lightning to flash and the thunder to roll. While some of the chief Vedic deities like Indra and Varuna are completely emancipated from connection with the phenomena of nature which originally suggested them, others, such as Surya (Sun) and Agni (Fire), are conceived on the lines of the actual phenomena whose names they bear. In some later hymns appear abstract deities which show no traces of connection with natural phenomena, as Prajapati ("lord of creatures"), or personifications of pure abstractions, as Faith and Wrath. The conception of Varuna, the lord of physical and moral order, reaches a high level and is majestic enough both in its cosmical and ethical aspects. Varuna is the lord of *rita*, the physical order in the universe, the order of the sacrifice and the moral law of the world. On account of *rita*, the sun pursues his daily, and the moon her nightly, journey across the sky, and the silent procession of the seasons moves regularly in light and shadow, in cloud and sunshine across the earth. The doctrine of *karma* (discussed under *Ethics* below) is a reformulation of this principle of *rita*.

When mythical conceptions from beyond the limits of the Aryan world belonging to a different order of thought entered into the Vedic pantheon skeptical tendencies developed. There were men who were harassed by doubts: "Who is Indra? whoever saw him?" "To what god shall we offer our oblation?" (x, 121). Some men were devoid of faith. An undercurrent of satire may be noticed in some of the hymns (ix, 112; x, 119; vii, 103).

Monotheism.—The crowding of gods and goddesses proved a weariness to the intellect. Attempts were made to identify one god with another or to throw all the gods together. The close connection of the elements in nature helped the growth of syncretism. An orderly system of nature signified by the conception of *rita* has no room for miraculous interferences in which alone superstition and confused thought find the signs of polytheism. Besides, religious consciousness is naturally inclined to believe that the supreme is one. What is called henotheism, or the worshiping of each divinity in turn as if it were the greatest and even the only god, is the expression of the logic of religion. When the same functions of establishing the earth and sustaining the air and the sky are assigned to the different deities we tend to drop the peculiarities and make a god of the common functions. This becomes easy when the several gods are not clear-cut individuals but cloudy and confused concepts. The supreme is identified with Prajapati (x, 85. 43, 184. 4, 189. 4), sometimes with Hiranyagarbha (x, 121), sometimes with Brihaspati (x, 72).

Monism.—Those dissatisfied with monotheism argue that there is one impersonal reality of which Agni, Indra, Varuna are the names or forms. "The real is one, the learned call it by various names." This one is the soul of the world, the reason immanent in the universe (x, 129. 2). "Priests and poets with words make into many the hidden reality which is but one" (x, 114). Our minds seem to be satisfied with inadequate images of this reality, "the idols which we here adore."

Cosmology.—At the pluralistic stage the deities are looked upon as the authors of the universe who create it by a process of manufacture or organic development or through the power of the sacrifice (x, 123. 1). When we rise to the monotheistic level the one god creates the world with the help of pre-existent matter (x, 121). Sometimes the dualism of the creator and the pre-existent matter is overcome and God is said to create the world out of his own nature. In the Purusha-sukta (x, 90) the world is produced by the gods from the sacrifice of a primeval *purusha* (person). This person is all that has been, is, and shall be. But the most advanced theory of creation is suggested in the Nasadiya hymn (x, 129). It starts with the assertion that in the beginning there was neither being nor nonbeing, neither air nor sky, neither death nor immortality, neither night nor day. There was nothing else save the one which breathed breathless, of its own power. This is the poet's way of describing the primal unconditional ground of all being, which is beyond our categories. The third verse states that through the power of *tapas* (austerity), the first antithesis of being and nonbeing, the active energy and the passive matter is produced. Through desire (*kama*), which is the germ of mind (*manasoretah*), the rest of the development takes place. Desire, which is the sign of self-consciousness, is the bond binding the existent and the nonexistent. We cannot say why the original being develops into an active creator and the passive chaos. The hymn concludes with an expression of doubt. Creation is a mystery. *Ko veda?* ("Who knows?")

Future Life.—A healthy joy in life dominates the Rigveda. The worshiper asks not for immortality or heaven but a long life for a full 100 years. There is belief in future life, a heaven for the good and a hell for the wicked. Reward follows righteousness and punishment misconduct.

THE UPANISHADS

The Upanishads form the concluding portions of the Veda and are therefore called Vedanta or the end of the Veda. Their aim is not so much to reach philosophical truth as to bring peace and freedom to the anxious human spirit. They represent free and bold attempts to find out the truth without any thought of a system. Notwithstanding the variety of authorship and the period of time covered by them, a unity of purpose and a vivid sense of spiritual reality may be discerned in them. They are distinguished from the Vedic hymns and the Brahmanas by their increased emphasis on monistic suggestions and subjective analysis as well as their indifference to Vedic authority and ceremonial piety.

Metaphysics.—The Taittiriya Upanishad (iii) gives an account of the gradual evolution of ideas regarding the ultimate basis of things. The seeker tries to find out the one comprehensive principle from which "all things are born, by which they are sustained and into which they return at death." His first answer—that matter (*annam*) is the basic principle—is discarded in view of its inadequacy to vital phenomena. The second answer of life (*prana*) is found unsatisfactory when sentient entities are considered. The third suggestion of mind (*manas*) is incapable of accounting for logical phenomena. The fourth formula of logical intelligence (*vijnana*) cannot be regarded as the highest reality, since there are aspects of being which cannot be reduced to intellectual terms. Thought as ordinarily understood deals with objects viewed as beyond or other than the process of thinking. Reality can be reached in the state of highest immediacy which transcends thought and its distinctions, which is *ananda* or bliss. Ananda is Brahman.

Subjective Analysis. Atman.—The Chandogya Upanishad (viii, 3. 12) institutes an inquiry into the nature of the self. The

body which is born, grows up, decays and dies cannot be the true self which persists throughout the changes of birth and death. The dreaming self, subject as it is to the accidents of experience, must not be confused with the true self. The self is not the unity of the evergrowing and changing mental experiences. The self in dreamless sleep cannot satisfy our need, since it is empty of all content and is a bare abstraction. The true self is said to be the universal consciousness existing both in itself and for itself. The Mandukya Upanishad observes that the three states of the soul—waking, dreaming and sleeping—are included in a fourth (*turiya*) which is intuitional consciousness, where there is no knowledge of objects, internal or external. It is the unchanged identity which continues in the midst of all change. It is the Atman.

Brahman and Atman are one. The inmost being of universal nature is the same as our innermost self. *Tat tvam asi:* "that art thou." The nature of this ultimate reality cannot be defined. It can be grasped, however, through intuition. This intuition is not objective like perceptual experience or communicable to others like inferential knowledge. A formal exposition of it cannot be given. To any suggested definition of reality we can only say, "not this," "not this" (Brihad Aranyaka, iv, 2. 4). Contradictory accounts are given to show that negative descriptions do not mean negation of all being but only the poverty of intellect.

We cannot, however, remain long at this high level. We insist on framing intellectual pictures of the absolute. When the Atman is identified with the self-conscious individual, Brahman is described as a personal being (Ishvara). When the Atman is identified with the mental and the vital self, Brahman becomes the cosmic soul (Hiranyagarbha). When the Atman is taken for the body, Brahman is taken for the cosmos (Virat). Brahman is the sole and the whole explanation of the world, its material and efficient cause. The metaphors of the spinning of the web by the spider, the bearing of the child by the mother, the production of notes from musical instruments point to the oneness of Brahman and the world. There is, however, no logical deduction of the world of multiplicity from the ultimate cause. At the theistic level the world is regarded as the self-limitation of the Supreme. The power of self-expression possessed by the personal Ishvara (God) is sometimes called maya.

The Doctrine of Maya.—There is hardly any suggestion in the Upanishads that the entire universe of change is a baseless fabric of fancy. The dominant note of pantheism goes against this view. The assertion of the sole reality of Brahman denies duality and traces all change to Brahman but does not suggest that change is illusion. The frequent emphasis on the oneness of the world and Brahman need not be repudiated as a mere concession to common-sense ideas. The texts which declare that the variegated universe is due to the development of name and form from out of the one Brahman warn us against getting lost in the world of multiplicity. The passing semblance of life is in no wise its immortal truth. The theory of the world-illusion is inconsistent with the conception of degrees of reality, or, to be more accurate, unreality which is found in the Aitareya Aranyaka (ii, 3. 2 *et seq.*). When Yajnavalkya contends that duality is necessary for empirical consciousness and suggests that the world of duality is not real by the use of the particle *'iva'* (Brihad Aranyaka, ii, 4. 14; iv, 3. 31), he refers to the non-ultimate character of the world of duality.

Ethics.—*Moksha* is release from the bondage to the sensuous and the individual. The morality of the Upanishads is, in a sense, individualistic as it emphasizes self-realization. The term "individualistic," however, ceases to have any exclusive meaning. To realize oneself is to identify oneself with a good that is not private to any one. Insistence on the knowledge of God (*jnana*) is tempered by the recognition of the need for moral life.

When the moral striving ends in religious realization the individual is said to be freed from all moral laws. This does not mean that the free can do what they choose with perfect impunity. Laws and regulations are necessary for those who do not naturally conform to the dictates of morality. For those who have risen above the selfish ego and who have died to sin, morality is the very condition of their being.

Those who have not reached the highest perfection will have other chances for striving. *Samsara* offers a succession of spiritual opportunities. The hypothesis of rebirth is formulated in this period (Chandogya Upanishad, v, 3. 10; Brihad Aranyaka, vi, 3.), though there are still compromises with the Vedic views. Good and evil actions experience a twofold retribution, once in the other world and again by a renewed life on earth.

Moral striving is governed by the law of *karma* (*q.v.*). Our life carries within it a record that time cannot blur or death erase. The soul that sinneth, it shall decline. Though we cannot efface the results of our acts on the outer universe, its effects on us can be wiped away by strenuous exertion. *Karma* emphasizes individual responsibility. It is more favourable to self-culture and meditation than to prayer and petition.

In every sphere the Upanishads indulged in inconsistent compromises with the Vedic views. The chaos of the Brahmanical religion reached its climax in the post-Upanishad or pre-Buddhist, period when truth hardened into tradition and morality stiffened into routine. The need for reconstruction was clear.

EPIC PERIOD

The systems of materialism, Jainism and Buddhism, belong to the Epic period, which is the age of reconstruction.

Materialism.—Materialism is called *lokayata* (directed to the world), as it holds that only this world (*loka*) is real. According to it, perception is the only source of knowledge. Inference which assumes universal relations, testimony and analogy are all defective. Matter is the only reality, of which the elements are earth, water, fire and air. Consciousness is a function of matter. There are different opinions about the nature of the soul. It is identified with the gross body or the senses or breath or thought. There is no future life. As the soul is an attribute of the body, it comes into being when the body is formed by the combination of the elements even as the power of intoxication arises from the mixture of certain ingredients. When the body is destroyed the soul disappears. The world is born of itself. God is a myth which we accept—thanks to our ignorance and incapacity. Pleasure and pain are the central facts of life. Virtue and vice are conventions.

Jainism.—Vardhamana (*see* MAHAVIRA, VARDHAMANA JNATRIPUTRA), the founder of Jainism, is a slightly older contemporary of Buddha. He is said to have systematized the faith held by a succession of 23 other sages, of whom the chief was Parshvanatha (d. *c.* 776 B.C.). (For the historical development *see* JAINISM.)

Jainism assumes that truth is relative to our standpoints. The Jains are fond of quoting the old story of the six blind men who each laid hands on a different part of the elephant and tried to describe the whole animal. The man who caught the ear thought that the creature resembled a winnowing fan; the holder of the leg imagined that he was clinging to a big round pillar, and so on. It was he who saw the whole that perceived that each had only a portion of the truth. The doctrine of *nayas* (particular ways of looking at things) brings out this relativity of thought. The most important application of this doctrine is the theory of *Syadvada* or *Saptabhangi*. Every proposition gives us only a perhaps, a may be or a *syat*. We cannot affirm or deny anything absolutely of any object, owing to the endless complexity of things. Being is not of a persistent unalterable nature. Every statement of a thing is necessarily onesided and incomplete. If we take it as true and complete we make a mistake. There are seven different ways of speaking of a thing or its attributes according to the point of view. All things, *i.e.*, substances (*dravya*), are divided into lifeless (*ajiva*) and living (*jiva*). The former are again divided into (1) space (*akasa*); (2) and (3) two subtle substances called *dharma* and *adharma;* and (4) matter (*pudgala*). Space, *dharma* and *adharma* are the necessary conditions for the subsistence of all other things, viz., souls and matter. Space affords them room to exist; *dharma* makes it possible for them to move or be moved, and *adharma* to rest. Time is recognized by some as a quasi-substance beside those mentioned. Matter is eternal though it may assume forms as earth, air and so on. It exists in the two forms of atoms (*anu*) and aggregates (*skandha*). The changes of the physical universe are traced to atomic aggregation and disintegration. The atoms

are not constant in their nature but are subject to change or development (*parinama*), which consists in their assuming new qualities. There are not different kinds of atoms answering to the different elements of earth, water, fire and air. Homogeneous atoms produce different elements by varying combinations. While things which we perceive are made of gross matter, there is matter beyond the reach of our senses in subtle form which is transformed into the different degrees of *karma*. This kind of matter fills all space. The soul by its commerce with the outer world becomes literally penetrated with the particles of this subtle matter. *Karma* works in such a way that every change leaves a mark which is retained and built up into the organism to serve as the foundation for future action.

The characteristic essence of the soul is consciousness (*cetana*), which is never destroyed, however much it may be obscured by external causes. The souls are said to possess size, which varies with the nature of the bodies with which they happen to be connected. Subtle matter coming into contact with the soul causes its embodiment. Being then transformed into eight kinds of *karma* and forming, as it were, a subtle body, it clings to the soul in all its migrations. The individual soul (*jiva*) is a composite of consciousness and matter or body. Jainism believes that there are souls even in inorganic objects, though they lie dormant in them.

Jainism does not believe in God, though the souls can reach a divine status. The souls and the world are self-existent and eternal. The chief means to the end of *nirvana* is the performance of austerities. By it we destroy the old *karma* and prevent the formation of the new. Right faith, right knowledge and right conduct are recommended. The peculiarity of the Jain ethics is its insistence on avoidance of taking life of any kind.

Early Buddhism.—This also falls within the Epic period. *See* BUDDHISM. For the Bhagavad Gita (part of the epic Mahabharata) *see* BHAGAVAD GITA.

SIX SYSTEMS

The revolt of Buddhism and Jainism helped to bring about a critical point of view and led to the great movement of philosophy which produced the six systems of thought, where criticism and analysis take the place of poetry and religion. The different systems are not antagonistic but are complementary. They are regarded as an evolutionary chain, a single series, rather than as destructive of one another. Each of them is a metaphysics and a religion, an explanation of the world and a method of salvation.

NYAYA

Logic as epistemology may be called a critical reflection on metaphysics. The Vaisheshika, which deals with the analysis of nature, is earlier than the Nyaya, which discusses the problem of knowledge; yet we start with the latter, as it gives the main logical principles assumed by the Vaisheshika as well.

Assuming that the account of the world which our minds afford us is, in the main, a trustworthy one, the Nyaya analyzes the different ways in which our knowledge is acquired. They are said to be intuition (*pratyaksha*), inference (*anumana*), comparison (*upamana*), and verbal testimony (*sabda*). Though *pratyaksha* originally meant sense-perception, it soon came to cover all immediate apprehension whether through the aid of the senses or otherwise. It is knowledge whose instrumental cause is not knowledge (*jnanakaranakam jnanam*). In inference, comparison, etc., we require a knowledge of premises or of similarity, but such knowledge is not an antecedent condition of intuition. The word is used for the result or the apprehension of the truth as well as the process or the operation which leads to the result.

Sense-perception follows on the modification of the self produced by the contact of the senses with their objects. Two kinds of perception are distinguished, determinate (*savikalpaka*) and indeterminate (*nirvikalpaka*), which correspond roughly to knowledge about and acquaintance with an object.

Inference.—Inference operates "neither with regard to things unknown nor with regard to those known definitely for certain; it functions only with regard to things that are doubtful." It derives a conclusion from the ascertained fact of the subject possessing a property which is constantly accompanied by another. We ascertain that the hill is on fire from the fact that the hill has smoke and smoke is universally accompanied by fire. Inferential reasoning is stated in the form of a syllogism of which the five members are (1) proposition (*pratijna*): the hill is on fire; (2) reason (*hetu*): because it smokes; (3) example (*udaharana*): whatever shows smoke shows fire, *e.g.*, a kitchen; (4) application (*upanaya*): so is this hill; and (5) conclusion (*nigamana*): therefore, the hill is on fire. The first member states the thesis to be established. It is only a suggestion. It contains a subject or what is observed, which is generally an individual or a class, and a predicate which is to be proved. The subject is the minor term (*paksha, dharmin*) and the predicate the major (*sadhya, dharma*). The second member of the syllogism states the presence in the minor of the middle term called ground (*hetu*). The third takes us to the basis of inference, the major premise. Though Gautama Buddha and Vatsyayana may not have regarded the example as the illustration of a general rule, later Nyaya looks upon it as the statement of an invariable concomitance between the mark and the character inferred (*vyaptipratipadikam vakyam*). The conclusion restates the proposition as grounded. Nagarjuna is given the credit for dispensing with the last two members of the syllogism as superfluous.

Induction.—Universal propositions are reached through enumeration, intuition and indirect proof. Uninterrupted agreement (*niyata sahacarya*) reinforced by absence of exceptions (*avina-bhāvarūpasambandha*) leads to unconditional concomitances. Nature does not always supply us with positive and negative instances of the necessary type. In such cases indirect proof (*tarka*) may be used. By pointing out the absurdities in which we are landed if we deny a suggested hypothesis, we indirectly prove its validity. Even when we observe all possible cases and strengthen our conclusion by indirect proof we cannot reach absolute certainty. Experience of sensible particulars, however thorough and exhaustive, cannot give rise to universal relations. Gangesa recognizes the nonsensuous (*alaukika*) activity involved in the apprehension of universals (*samanyalakshana*).

Causation.—A cause is that which invariably precedes the effect. It is not merely accessory to but is necessary for the production of the effect. Two things cannot be causally related unless there is the positive-negative (*anvayavyatireki*) relation between them, such that the presence of the cause means the presence of the effect and vice versa. Three different kinds of causes are distinguished, material (*upadana*), nonmaterial or formal (*asamavayi*) and efficient (*nimitta*). The appearance of plurality of causes is traced to defective analysis. When the effect is understood in its uniqueness (*karyavisesha*) it will be seen to have only one cause.

Comparison.—By means of comparison (*upamana*), we gain the knowledge of a thing from its similarity to another thing previously well known. Hearing that *gavaya* (wild ox) is like a cow, we infer that the animal which we find to be like the cow is the *gavaya*. This argument involves knowledge of the object to be known and perception of similarity. Comparison relates to the problem of identification. The problem of *sabda* or verbal knowledge is mainly of theological interest. Certain questions of logical value are incidentally discussed. Regarding the import of words, the Nyaya holds that a word denotes an individual (*vyakti*), or a form (*akrti*) or a genus (*jati*) or all these. It depends on our interest at the moment. The validity of knowledge is not self-established but is proved by something else (*paratah pramana*). If every cognition were self-evident there would be no possibility of doubt. We discover the truth by the test of action.

Metaphysics.—The individual self is a real substantive being possessing the qualities of knowledge, feeling and desire and aversion. It is different from the body, the senses and the understanding. It is all-pervading though it does not cognize many things simultaneously on account of the atomic nature of *manas* or the inner sense. It is unique in each individual, and we have an infinite number of souls. The soul is an unconscious principle capable of being qualified by consciousness.

The Vaisheshika

The system takes its name from *vishesha* or particularity. It is in the particulars of the world, pre-eminently in the particular imperceptible souls and atoms, that true individuality is found.

Categories.—The Vaisheshika adopts a sixfold classification of *padarthas* (objects which can be thought and named) into substance (*dravya*), quality (*guna*), movement (*karma*), generality (*samanya*), particularity (*vishesha*) and inherence (*samavaya*), to which later thinkers add a seventh, nonexistence (*abhava*). That something is, is the first principle; but nothing can *be* without possessing certain qualities. Some of the qualities reside in a plurality of objects, while others are confined to individuals. The former are general qualities (*samanya*), while the latter are distinguished into permanent (*guna*) and transitory (*karma*). Inherence is a special kind of relation distinct from occasional or separable conjunction. When the scheme became logical in scope, nonexistence was included. Later Nyaya develops this idea with great subtlety. The first three categories possess a real objective existence, while the other three are products of intellectual discrimination.

Atomic Theory.—The atomic theory is developed in connection with the substances of earth, water, light and air. The things that we experience are made up of parts. They are therefore noneternal. Noneternal has no meaning apart from eternal. The component particles are eternal. The atom marks the limit of division. If it were endlessly divisible, then material things would be products of an equally endless number of constituent parts, and differences in the dimensions of things could not be accounted for. Though the atoms have no extension, their heterogeneous nature is the cause of the extension and visibility of the combinations of atoms. Though Kanada is not clear about where the visibility of the combinations begins, his later followers suggest that an aggregate of three atoms (*tryanuka*), others of three double atoms, produces extension, and it is visible in the shape of the dust mote (*trasarenu*) dancing in the sunlight. Answering to the four kinds of material objects—earth, water, light and air, we have four kinds of atoms producing the four senses of touch, taste, sight and smell. This is why each special sense reveals a single quality, however excited. Though the qualities of earthly things, as colour, taste, smell and tangibility, vanish on the destruction of the thing itself, they are always found in their respective atoms, though in earth and atoms of earth new qualities are produced by heat (*pakaja*). Water, light and air do not suffer a similar change. There can never come a time when there will be an utter annihilation of things. The atoms will abide forever.

Sankhya

The Sankhya is a reaction against the idealistic monism of the Upanishads. It believes in a real matter and an infinite plurality of individual souls which are not emanations of a single world soul.

The Sankhya adopts the view that the cause and the effect are the undeveloped and the developed states of one and the same substance. Development is the coming to light of what is latent or hidden even as destruction is disappearance into the original cause. There is no such thing as utter annihilation. Applying this principle, the ultimate basis of the empirical universe is said to be *prakriti* (nature). The world is the transformation of *prakriti*, which cannot be equated with any one of the stages of its evolution.

Prakriti is a string of three strands or *gunas*, *sattva* or potential consciousness, *rajas* or activity and *tamas* or restraint. They are called *gunas* (qualities), as they are factors in the substance of *prakriti*. They represent different stages in the evolution of any particular phenomenon. *Sattva* signifies the essence or the form which is to be realized, *tamas* the obstacles to its realization, and *rajas* the force by which the obstacles are overcome. The *gunas* are always changing, but when they are held together in a state of equilibrium (*samyavastha*) there is no action. The tendencies to manifestation and activity are held in check by that of nonmanifestation and nonactivity. When the tension is relieved development results. *Prakriti* evolves under the influence of *purusha* (subject) into the apparatus of thought as well as the objects of thought.

Theory of Evolution.—The first product of the evolution of *prakriti* (nature) is *mahat*, "the great" or *buddhi* (intelligence). Self-sense (*ahankara*), or the principle of individuation, arises next. From this, in its *sattva* aspect, arise the *manas* (internal organ), the five organs of perception and the five of action; from the same in the *tamas* aspect the five fine elements (*tanmatras*) arise. The *rajas* element helps both. From the five fine elements, by a preponderance of *tamas*, the five gross elements are produced. The account is probably suggested by the subject's experience and transferred to a cosmic plane. In the state of dreamless sleep the self is present, though it does not apprehend the world. So, in the case of world dissolution, the selves are not distinguished and *prakriti* is unperceived. When one wakes from sleep there is, first, the rise of consciousness, followed immediately by the sense of selfhood and the restlessness of desire. The senses begin to function until the world is perceived. This order is followed in the Sankhya theory of evolution.

Plurality of Souls.—*Purusha* is the intelligent self, for whose experience *prakriti* evolves. It is a mere witness, a solitary indifferent spectator. It is pure consciousness while *prakriti* is unconscious. It is inactive, unalterably constant, and devoid of the *gunas* while *prakriti* is active, alterably constant and consists of them. *Prakriti* and its products depend for their manifestation on the light of *purusha*, which does not depend on anything else for illuminating objects. The Sankhya believes in a plurality of selves. If the self were one all should become free when one attained freedom, which is not the case. Freedom is not coalescence with the absolute spirit but isolation from *prakriti*.

The empirical individual is not the pure self but the self distinguished by the conjunction of the senses, etc., and limited by the body. While the pure self remains beyond the intellect the reflection of the self in it appears as the ego. Activity belongs to the intellect, and on account of its union with *purusha* the indifferent self appears as an actor. Though not an agent, the self appears as an agent through confusion with the agency of nature, even as the latter through proximity to the self appears to be conscious. Every ego possesses within the gross material body, which suffers dissolution, a subtle body formed of the psychical apparatus including the senses. This subtle body is the basis of rebirth as well as the principle of identity in the various existences.

The evolution of nature is adapted to the ends of the self. The spiritual centres are, however, incapable of exerting any direct influence on nature, though they are said to excite it to activity. The union of self and nature is compared to a lame man of good vision mounted on the shoulders of a blind man of sure foot.

The real self has relations with a real world on account of a fancied relation between the two. When the self recognizes its distinction from the ever evolving and dissolving world of nature the latter ceases to operate towards it. The efficient cause of the development of nature is not the mere presence of the selves but their nondiscrimination. Freedom is the result of discrimination. No cause is assigned for the original entanglement of the free spirits in the bonds of ignorance.

Yoga

The Yoga differs from the Sankhya in its insistence on mental discipline and acceptance of theism, though its connection with belief in God is somewhat loose. God does not create, reward or punish. Union with God is not the goal of Yoga endeavour. God is only a particular soul not essentially different from other souls co-eternal with him. He stands in an eternal connection with the most refined constituent of matter and is endowed with supreme power, wisdom and goodness.

Our bondage is due to nondiscrimination. The true light of the spirit will shine if the obscuring mental activities are suppressed. The method of Yoga consists in the suppression of all mental activities, conscious as well as unconscious. The eightfold path is a means of it. The first two, *yama* (abstention) and *niyama* (observance), refer to the ethical preparation. The next two, *asana* (posture), *pranayama* (regulation of breath), insist on the discipline of the body so as to make it flexible. We can control involuntary muscles as well by the breathing exercises. The

next step of *pratyahara* or the withdrawal of the senses from their natural outward functioning answers to what modern psychology calls introversion. While these five are only accessories, *dhyana* (fixed attention), *dharana* (contemplation), and *samadhi* (concentration) are integral elements of Yoga. Through concentration we get into direct touch with the reality of the things and obtain intuitional knowledge. The process of concentration is to be continued until the mind is dissolved and self-illumination results. *Samadhi* is the perfect life of spirit.

Purva Mimamsa

The Purva Mimamsa has for its special object the ascertainment of duty (*dharma*). It is not a philosophical system, though it refers to philosophical topics incidentally. It believes in the reality of the world and the individual souls. As it deals with ritual specially, it points out how every act produces its effect sometime or other through the principle of *apurva* or the link between the act and the result. While the earlier writings do not admit the existence of God, the later ones do.

A chief writer of this school, Kumarila, argues for the theory of self-evidence (*svatah pramana*). Truth is its own guarantee. Cognitions are by themselves valid and their validity can be set aside only by the contrary nature of their objects or by the recognition of discrepancies in their causes. When we are in doubt about the true nature of a thing perceived at a distance or in faint light, we can resolve the doubt by a second cognition obtained under improved conditions. Even in the most difficult cases we can obtain an absolutely true cognition after a series of three or four. Correspondence and coherence theories do not produce validity but only test it.

Vedanta

The Vedanta Sutra attempts to set forth the teachings of the Upanishads in a consistent way. Its short aphorisms are unintelligible by themselves. Many different systems ranging from pure nondualism to explicit dualism attempt to interpret the Vedanta Sutra. The chief of them are those of Shankara, Ramanuja and Madhva.

Shankara's Non-Dualism (Advaita).—Shankara (*q.v.*) in his system asks whether there is anything in experience which may be regarded as foundational and discusses the claims of the different factors of experience to that title. Our senses may deceive us and our memory may be an illusion. The waking tracts may not be different from dream worlds, where also we visit places, handle shadows and battle with ghosts. Though all objects of experience may be open to doubt, there is something which is beyond all doubt. Everyone is conscious of the existence of one's own self and no one thinks "I am not." The self cannot be doubted or denied for "it is the essential nature of him who denies it." Though we cannot know it by thought, it does not entirely escape us. It is the object of the notion of self (*asmat-pratyayavishaya*) and is known to exist on account of its immediate presentation (*aparokshatvat*). This self is distinct from the body, the senses and the understanding. It is the principle of consciousness which is unaffected when the body is reduced to ashes and the mind perishes. It is one, universal and infinite.

Logical knowledge based on the distinction of subject and object is not final. The real excludes all relations, but logical knowledge is relational in character. The real simply *is*, but we attempt to characterize it in knowledge and no predicate is found adequate to it. In judgment, we equate the real with the unreal, the subject with the object. We attribute to the Atman activity, agency and enjoyment. All our knowledge is strictly speaking nonknowledge (*avidya*). The ascertainment of the ultimate reality by the exclusion of all that is imposed (*adhyasta*) on it is wisdom (*vidya*). *Avidya* is another name for our finitude. When its roots are cut our bondage is broken. Shankara admits the reality of intuitional consciousness where the distinctions of subject and object are superseded.

Shankara adopts the distinction between truth (*paravidya*) and empirical truth (*aparavidya*). The latter is not illusory or deceptive but only imperfect or relative. The empirical world is not self-existent or real. Yet there must be a reality on which it rests. Even if we regard the whole universe as merely imaginary there must be something which is the basis of all imagination. That reality is Brahman. As it is opposed to all empirical existence, it is given to us as the negative of everything that is positively known. We cannot even call it one (*ekam*). It is to be called nondual (*advaitam*). It is the wholly "other" but not nonbeing. When we are not content with such negative accounts we describe it as the personal God (Ishvara). God is the absolute cast through the molds of logic.

Doctrine of Maya.—Every object in the world tends to pass away from itself to something else. The categories of time, space and cause which bind experience are self-contradictory. Our knowledge of the world is inconsistent. When intuitional experience arises the pluralistic universe is sublated. The term *maya* (appearance) registers the imperfection and relativity of the world. It does not mean that the world is a mere illusion. Shankara's refutation of Buddhistic subjectivism is decisive on this question. While he traces the world to *avidya* (ignorance) he takes care to point out that this ignorance is cosmic in character. The phenomenal self and the phenomenal world are mutually implicated facts. The mind with its categories on the one side and the world which it construes through them on the other hang together.

We cannot conceive the relation between the world and the absolute. The question of relation has meaning only if we have two "distincts," but the world is not distinct from Brahman. The finite is the infinite hidden from our view through certain barriers. When we intuitively recognize the absolute the relative disappears; when we discuss about the relative there is no absolute to which it has to be attached. The problem arises on account of a confusion of standpoints. If Brahman is to be viewed as the cause of the world it is only in the sense that the world cannot be explained apart from Brahman, though the latter is in no way touched by the world of appearance. Brahman is the basis of the apparent existence of the world (*vivartopadana*).

The individual soul is different from the Atman. Its divine nature is concealed by the external adjuncts (*upadhis*) of the sense organs and vital airs which form the subtle body. These, together with *karma*, accompany the soul in its migrations. *Moksha* or salvation is the lifting of the veil of ignorance which conceals from the soul the truth that it is and always has been one with Brahman. The road to realization lies not through something done or accomplished but through knowledge or the sweeping aside of the delusive veil of ignorance. Shankara is clear that this insight cannot be attained without the discipline of moral life. Insight is not so much an answer to a riddle as a victory in a battle.

Ramanuja's Theism.—Ramanuja endeavours to show that the God of religious faith is not the unconditioned abstraction of Shankara but a personal being whose reality need not be doubted simply because our knowledge of him is imperfect. The sense of personal communion with God involves a real fellowship with another. The supreme Brahman has internal differences (*svagata-bheda*). Souls and matter are comprehended within the unity of the supreme as attributes to the substance or parts to a whole or body to the soul which animates it. Though attributes of God, souls and matter are in themselves substances possessing qualities with their own distinct modes, energies and activities. Souls, matter and God are different on account of their natural differences (*svarupabheda*) but one on account of their identity (*aikyam*) of the modes and substance. Identity means only inseparable existence (*aprthaksiddhi*).

For Ramanuja, causation is only an alteration of state. The creation of the universe from Brahman is not a production of something new but only a change of condition. It is a modification of that which is subtle into that which is gross. In the causal condition Brahman has for his body or mode the conscious (*cit*) and unconscious (*acit*) entities in their subtle form, while in the effect condition they are in a gross form.

Ramanuja does not accept the explanation of the world and of the individual souls as mere productions of ignorance enveloping the nature of Brahman. If the multiplicity is due to human ignorance, then there should be no such world for God. But Scrip-

ture tells us of God's creation, etc., which means that God reckons with the world of multiplicity. We cannot regard the world as unreal, like the mirage, for while the activity prompted by the latter is unsuccessful, that based on the knowledge of the objects is successful. The reality of the world established by perception cannot be sublated by Scripture as the spheres of perception and Scripture are different. Simply because objects do not persist we cannot conclude that they are unreal.

While for Shankara, freedom consists in the removal of a barrier and the entering into the secure realization of a permanent and inalienable truth, for Ramanuja, it is communion with God to be reached by devotion and faith. The individual is not effaced when the goal is reached but maintains his self-identity and enjoys the fruit of his faith in unending felicity.

Madhva's Dualism.—Madhva (*q.v.*) stands out for unqualified dualism and insists on the five great distinctions of God and soul, God and matter, soul and matter, one soul and another and one part of matter and another. Reality is of two kinds, independent (*svatantra*) and dependent (*paratantra*). God is the only independent reality; matter and souls are dependent. God controls souls and matter though he does not create or destroy. He is the efficient but not the material cause of the universe. Though absolutely dependent on Brahman, the individual souls are essentially active agents and have responsibilities to bear. While God is all-pervading, the souls are said to be of atomic size. They yet pervade the body because of the quality of intelligence. No two souls are alike in character.

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INDIAN PIPE (*Monotropa uniflora*), a chlorophyll-less saprophytic herb, called also corpse plant and ghostflower, found in moist, rich woods throughout most of temperate and warm North America and also in the Himalaya mountains and Japan. It is considered by some as belonging to the family Pyrolaceae (often united with Ericaceae) and by others as of the family Monotropaceae. It is a smooth waxy-white plant, of unusual appearance, which grows on decaying vegetable matter and is somewhat parasitic on roots. The erect, usually clustered stems, four to ten inches high, bear small scales representing leaves and terminate in a single nodding flower, about one inch long, blossoming from June to August, followed by a many-seeded capsule, which becomes erect in ripening. Occasionally the flower, or more rarely the whole plant, has a pinkish or reddish tinge. All parts of the plant turn blackish in drying. There are two other species of the genus, both north temperate, one of which, *M. hypopitys*, the yellow bird's-nest or pinesap, with flowers in a drooping cluster, widely distributed in Europe, Asia and North America, occurs in the British Isles.

GRANT HAIST

INDIAN PIPE (MONOTROPA UNIFLORA)

INDIANS, NORTHWEST COAST. In their classification of American Indian cultures anthropologists put into one northwest coast category all of those that were to be found along the shores of the Pacific ocean from southern Alaska to northwestern California. Although there were local differences among the many small groups inhabiting this narrow coastal strip, and although there was a decided scaling-down in the complexity of their institutions from north to south, all shared basic cultural traits that set them apart from their neighbours to the north, east and south, and gave a distinctive quality to their way of life.

Most of these groups have come to be known by the names of languages rather than tribes. The coast Salish surrounded Puget sound and extended down the coasts of Washington and Oregon to include the Tillamook just south of the Columbia river. The Chinook (*q.v.*) lived on the Columbia river itself from The Dalles, Ore., to the sea. Many small groups occupied favourable beach sites in Oregon, among them the Alsea, Siuslaw, Coos, Umpqua, Tututni and Tolowa. The Yurok (*q.v.*), living at the mouth of the Klamath river, were the southernmost representatives of this culture area. (For a more complete list of tribes and languages, *see* INDIAN, NORTH AMERICAN.)

None of these people farmed, made pottery or domesticated any animals except the dog. In spite of these handicaps they lived in permanent villages, accumulated substantial stocks of material goods, spent the winter in leisure activities, and attained one of the highest population densities in aboriginal North America. All this was made possible by a skilful exploitation of the abundant natural resources of the area. Although hunting on land and wild vegetable foods were important, the sea was the primary source of food. The staple was salmon, caught in the summer and preserved for use the rest of the year along with great quantities of herring, clams, cod and halibut. Marine game included seals, sea lions and whales, the latter being captured on the high seas by the Nootka (*q.v.*). Villages dotted the great length of jagged shore line, one or more of them occupying sites at the mouth and on the lower course of almost every stream. Some of the beach sites were the summer resorts of individual families which owned fishing rights there. Others were villages of well-constructed plank houses, some of which could seat over 200.

Woodworking was a highly valued skill throughout the area. It was most fully exercised among the Kwakiutl, Haida and Tsimshian (*qq.v.*). To give visible expression to social position, carvers and painters emblazoned house posts and walls, feasting dishes, ceremonial rattles, wooden chests and totem poles with the family crests of their owners. The heraldic devices were highly stylized animal forms; the Tlingit (*q.v.*) also wove them into blankets of mountain goat wool and cedar bark.

Chiefs were the heads of wealthy groups of kinsmen who were matrilineally related among the Tlingit, Tsimshian and Haida; to the south the chiefs traced their connections bilaterally. In some cases a single kin group made up a village; in others, two or more united for common benefits without relinquishing their fundamental independence. Power depended on the traditional rating of families, determined by wealth.

Food was the ultimate measure of wealth and social position. Other valued items included fishing sites, houses, canoes, elaborately carved dishes and, in the north, locally made blankets and copper plates traded in from Alaska. In Oregon and California the possession of dentalium shells from Vancouver Island and large obsidian blades from the interior made a man rich. North of Puget sound, intangible property in the form of personal names, ceremonial privileges and family emblems were even more highly treasured. In this northern sector every birth, marriage, death or initiation into a secret society had to be announced and celebrated at a potlatch (*q.v.*), when great quantities of food and other prop-

erty were given away to guests in accordance with their rank. Each person's social position depended on the number and magnitude of potlatches given in his name. There were gradations in rank with relatively few people at the top and a few others at the very bottom who were the slaves of other men. Slavery and rank based on wealth characterized the entire area, but in Oregon and California men displayed their treasures on formal occasions instead of giving them away in potlatches.

With the discovery of the area by Europeans and the opening of the fur trade the Indians experienced a 50-year period of unprecedented prosperity. They traded pelts for quantities of exotic luxury goods as well as a few that were useful. The increased wealth primarily was fed into the old prestige system. The carver's art reached its peak, potlatching boomed and the newly rich struggled to elevate their social position in the face of traditional opposition. With the decline of the fur trade distinctive features of northwest coast culture gradually faded until few remnants remain. These Indians now earn their livings as loggers, miners, trappers, fishermen or workmen with little to distinguish them from other Canadians or Americans in craft, belief or appearance. Significantly, however, they have not been removed from their ancestral sites in Canada and Alaska; in conterminous U.S. they have been relegated to reservations near or far from their original locations. In Washington they still form communities of predominantly Indian extraction. In Oregon, coastal Indians no longer form communities but have spread and mixed, retaining only a memory of their distinctive past.

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(H. G. BT.)

INDIAN SUMMER, a spell of warm, clear weather often persisting for a week or more, characteristic of middle and late autumn in central and eastern United States. It occurs in a large, stagnating, anticyclonic area; the first day or so may be cold, but under the clear skies with light winds the daytime hours of each succeeding day become warmer and warmer, while frost, dew, hoar or valley fog may occur during each chilly night. The haziness of the air, the musty odour and glorious mordant colouring of the leaves, the smell of smoke from rampant fires in the dry woods and the relaxing physiological effect of the warmth following the previous cold snap all contribute to the distinctive and romantic stereotype of Indian summer that has been cherished by generations of Americans. In some years Indian summer spells may be brief or lacking; in others they are prolonged or recurrent. The weather-map situation for Indian summer is not so definite or clear-cut a type as the weather itself: it may be described in general as caused by conversion of a moving, cool, shallow, polar air mass into a deep, warm and stagnant anticyclone. The strong temperature inversions that develop at low levels in the free air in such an anticyclone (*q.v.*) have the effect of concentrating the smoke and dust in the air near the ground and causing a large range of temperature between day and night. (R. G. SE.)

INDIAN TOBACCO: *see* LOBELIA.

INDIAN TURNIP: *see* JACK-IN-THE-PULPIT.

INDIA-PAKISTAN, SUBCONTINENT OF, includes not only the Republic of India, Pakistan, Jammu and Kashmir but also independent Nepal, Sikkim and Bhutan. It excludes Burma, once a province of the British Indian empire, and the island of Ceylon, which is virtually connected to its southeastern mainland by a chain of sandbanks known as Adam's Bridge.

So defined the subcontinent has an area of 1,704,299 sq.mi. and a population (1961) of 543,133,616. In area and population it is thus of the same order of magnitude as the whole of Europe excluding the U.S.S.R. and is inhabited by peoples as diverse in origin and language.

The territory now included within India and Pakistan (including Kashmir) was for many years under British rule (*see* below, *History*) and it was hoped that, with the grant of independence in 1947, there would arise a united independent India. However, the age-old antagonism between Hindu and Muslim proved too strong. The transfer of power on Aug. 15, 1947, was to two new dominions of the British Commonwealth. The larger retained the name India with its capital at New Delhi (capital of undivided India since 1912), the smaller, in two separated sections in east and west, becoming Pakistan (capital Karachi). Bharat was taken as the official Hindi name of India. (*See* the separate articles on INDIA, PAKISTAN, NEPAL and BHUTAN.)

The Indians and Pakistanis can scarcely be said to have a word of their own by which to express their common subcontinent. In Sanskrit it would be called Bharata-varsha, from Bharata, a legendary monarch of the Lunar line; but Sanskrit is no more the vernacular of India-Pakistan than Latin is that of Europe. The name Hindustan, which was at one time adopted by European geographers, applies properly only to that portion of the peninsula lying north of the Vindhya mountains, or yet more strictly to the upper basin of the Ganges where Hindi is the spoken language.

India, a word derived through the Greeks from the Persicized form of the Sanskrit *sindhu,* "river," pre-eminently the Indus, became familiar only after the British connection. To the establishment by the British of a single administration and to the adoption of English as the only common language of educated Indians was due the emergence of the conception of India as a political unit, not, like Europe, a mere geographic term.

The term "Further India" was formerly applied to the Indochinese peninsula. Burma (*q.v.*), which by British conquest formed part of India after 1885, was in 1937 separated from India. The island of Ceylon (*q.v.*), lying at the foot of India, came under British rule in 1795. Thenceforward it was first administered by the government of Madras until 1798, when its control was transferred to the governor general of India, but in 1802 it became a crown colony under the sole authority of the British colonial office. On Feb. 4, 1948, it attained to full self-government as a member of the Commonwealth of Nations. Aden (*q.v.*), at the mouth of the Red sea, with Perim and protectorates over the adjacent mainland and the island of Sokotra, was included within the British Indian empire until April 1, 1937, when it became a crown colony.

The Andaman and Nicobar Islands (*q.v.*) in the Bay of Bengal and the Laccadive Islands (*q.v.*) in the Arabian sea are administered from India.

On the coast of the peninsula itself, small former Portuguese settlements of Goa, Damão and Diu (*qq.v.*) until 1961 broke the continuous line of Indian territory. Similar French territories (*see* PONDICHERRY) were ceded to India in 1954. The subcontinent is shut off from the rest of Asia on the north by a vast mountainous region, known in the aggregate as the Himalayas, amid which lie the kingdom of Nepal and the Indian-protected principalities of Sikkim and Bhutan (*qq.v.*), with the great tableland of Tibet behind. From the rest of the world it is severed by tropical oceans.

This article is arranged in the following sections and subsections:

I. Physical Geography
  A. Geology
  B. Physiography
  C. Climate
  D. Vegetation
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II. Natural Resources
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  A. Ancient History
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  C. European Settlements
  D. British Ascendancy
  E. British Imperial Administration
  F. Indian Independence

I. PHYSICAL GEOGRAPHY

A. Geology

Geologically the Indian subcontinent consists of three elements —the Himalayas, the Indo-Gangetic plain and the Deccan plateau. The relations of the Himalayas to the peninsula and the essential differences between them are dealt with in the articles Asia and Himalayas, and a more detailed description of the geology of the Himalayas is given there. The following account deals only with the Indo-Gangetic plain and the peninsula.

Indo-Gangetic Plain.—The Indo-Gangetic depression is the foredeep of the Himalayas, lying between the folded belt which forms the mountain range and the rigid foreland constituted by the peninsula. It bears the same relation to the Himalayas as the Pacific deeps bear to the island arcs near which they lie, but in those the level is lower and both foreland and foredeep lie beneath the sea. There can be no doubt, however, that the solid rocks of the Himalayan foredeep extend far below sea level. The present rivers, large though they are, can scarcely have brought the vast quantity of material which fills the foredeep, and geologists have postulated a great westward-flowing river, the Indo-Brahm, from central Asia. The infilling material is mainly alluvium: the older alluvium with kankar (nodular concretions of limestone) and the newer alluvium still being deposited. In the west wind-blown material plays a part. Everywhere, except in the neighbourhood of the hills, the deposit is fine-grained, consisting of sands and muds, though kankar concretions may sometimes give a pebbly appearance.

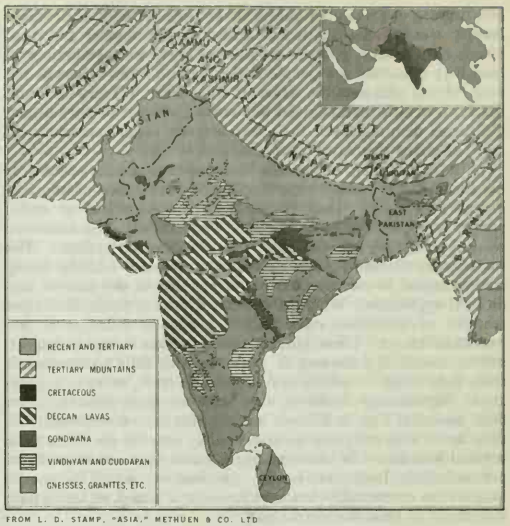
At Delhi a spur of old rocks appears from under the alluvium but over vast areas no boring has ever reached the base of the alluvium or has even shown any downward increase in the coarseness of the material. In a boring at Calcutta a bed of peat with wood, about 360 ft. below sea level, clearly points to subsidence. A boring at Lucknow reached nearly 1,000 ft. below sea level without any indication of an approach to the bottom of the deposit. Sir Sydney Burrard found that the deflections of the plumb line and anomalies of gravity suggest that the loose material filling the Indo-Gangetic depression extends to a depth of 40,000 ft. He thought so great a depth scarcely probable. But the foredeeps of much less massive mountain arcs reach 20,000 ft. and more, and in comparison with these Sir Sidney's estimate seems not improbable for the Himalayan foredeep. Later work by E. A. Glennie has made considerable additions to the knowledge of the depth and relief of the rocky floor of the trough but allows a maximum thickness of only 6,500 ft.

Peninsular India.—The geological history of the Indian peninsula has been so different from that of Europe that the classification of the strata which is natural in Europe cannot be used in India, and an almost entirely different terminology becomes necessary. The grouping, originally proposed by Sir Thomas Holland and later commonly adopted, is as follows:

Aryan group	Tertiary and Recent Cretaceous and Deccan lavas Gondwana system
Dravidian group	(absent in the peninsula)
Purana group	Vindhyan system Cuddapah system
Vedic, or Archean, group	Dharwar system Gneisses and granites

The term Archean is here used in the restricted sense in which it is often employed, denoting only the crystalline and schistose rocks of Pre-Cambrian age. The Vindhyan rocks consist of normal sedimentary deposits which rest unconformably upon the Archean but which, from the total absence of fossils, are believed to be Pre-Cambrian also, like the Algonkian of North America or the Torridonian of Scotland. The Dravidian group, which is absent in the peninsula but present in the Himalayas, corresponds approximately with the Paleozoic up to the Upper Carboniferous. The Gondwana system includes the oldest fossiliferous beds of the peninsula and ranges from the Upper Carboniferous to Lower Cretaceous.

The pre-Gondwana rocks (Archean and Purana groups) form the foundation of the whole peninsula. Southeast of a line drawn from Goa to Allahabad they occupy most of the surface, the areas covered by later beds being relatively small. Northwest of this line they are concealed over a wide space by the great outflows of the Deccan basalts, but they reappear at the surface in Bundelkhand and Gujarat. In southern India appearances suggest that there was an ancient gneissic series, including granitic and other intrusive masses, into which has been infolded a later series of sedimentary and volcanic beds, now for the most part converted into schists. The schistose series is the Dharwar system, which runs in long narrow bands through the gneiss from south-southeast to north-northwest. There has certainly been strong folding in this direction, but some geologists consider that the Dharwar system is the older and that the gneissic rocks have been intruded into it. Farther north, however, where the Dharwar rocks have been less altered and retain their original bedding, they seem to be later than the main body of the gneiss though intrusions of later date penetrate both. The gneissic series is in fact a complex of various ages and it has not yet been possible to separate it completely into its several parts.



FROM L. D. STAMP, "ASIA," METHUEN & CO. LTD

GEOLOGIC FORMATIONS OF THE INDIA-PAKISTAN SUBCONTINENT

Rocks of Dharwar type and probably of Dharwar age occur also in the Aravalli range, in Madhya Pradesh and in western Bengal. The famous "marble rocks" of Jabalpur, for example, are referred to this system. It is interesting to note that while in southern India the trend of the Dharwar folds is from south-southeast to north-northwest, in the Aravalli range it is from southwest to northeast. The Dharwar rocks form the most highly metalliferous system in India. In southern India all the most productive gold-bearing quartz veins, including those of the Kolar gold fields, lie within it; while in Madhya Pradesh and Bengal it includes valuable manganiferous deposits. Iron ore of high quality also occurs and has given rise to the great iron and steel industry of Bihar-Bengal.

The rocks of the Purana group have not been subjected to the intense folding which has affected the Dharwar system, and have suffered little from metamorphism. They are mostly sedimentary deposits, such as sandstones, shales and limestones, and rest quite unconformably and often horizontally upon the older rocks. But in spite of their unaltered condition no fossils have been found in them and for this reason they are supposed to be Pre-Cambrian in age. In southern India the group occurs in the Cuddapah basin and between Belgaum and Kaladgi. It covers a wide area in Madhya Pradesh and it forms most of the northern border of the peninsular massif overlooking the Indo-Gangetic plain. Some

failure to conform has been recognized in the group and various local subdivisions have been made, but in the absence of fossils the correlation of rocks in widely separated areas is necessarily open to doubt. Two points of general interest may be noted. In the first place, although both the Cuddapah and the Vindhyan systems are often undisturbed, in places the former has been strongly folded: along the eastern margin of the Cuddapah basin, for example, the Cuddapah beds show strong overfolding and overthrusting toward the east, the trend of the folds being from north to south. If these beds are correctly referred to the Pre-Cambrian there were certainly two great periods of mountain building in Pre-Cambrian times, separated by a long interval, the first one being post-Dharwar and pre-Cuddapah and the second post-Cuddapah and pre-Vindhyan.

The second point of general interest is that all the most famous diamond deposits, such as those of Kurnool in southern India and of Panna in Bundelkhand, belong to the upper Vindhyan system. The diamonds usually occur in sandstone or conglomerate and have evidently been carried by water in the same way as other pebbles. No diamond-bearing igneous rock like that of Kimberley, S.Af., has been found, and the original source from which the diamonds have been derived is unknown, though certain igneous rocks have been suspected.

The Gondwana System.—The Gondwana system is the most important and interesting set of beds in India. Outside the peninsula, for example in Assam, some poor coals are found in the Eocene, but in the peninsula all the principal coal seams lie in the Lower Gondwana series. The Gondwana beds occur in strips which are let into the foundation of older rock by faults. These strips, which may be continuous or broken, show a close connection with the lines of existing rivers and probably by their comparative softness determined the courses which the rivers took. There is, for example, a series of Gondwana patches along the Damodar and a more continuous strip roughly parallel to the Mahanadi. These two strips unite into a broad triangular area traversed by the Son. Another strip is associated with the Godavari.

The Gondwana system consists chiefly of sandstones, shales and clays, with seams of coal in the lower division. For the most part the deposits are entirely of terrestrial origin, but in Cutch (Kutch) and at several places along the Coromandel coast marine beds are interstratified toward the top. The fossils found in these marine bands are of Upper Jurassic age. In general, however, plants are the predominant fossils, with reptiles, crustacea and fresh-water fish locally. The Lower Gondwana is characterized by ferns of the *Glossopteris* type and by Equisetaceae, the Upper Gondwana by the prevalence of Cycadaceae. The lowest subdivision of the Gondwana system is known as the Talcher series and near its base is a remarkable clay with striated boulders, now universally admitted to be of glacial origin. In its lithology, animal life and vegetation the Gondwana system of India is remarkably like the Karroo system of South Africa, and it was this resemblance that led Eduard Suess and Georg von Neumayer to the conception of Gondwanaland (*q.v.*). It should, however, be pointed out in passing that the *Glossopteris* vegetation has a much wider distribution than was originally supposed and extends into northern Asia and the U.S.S.R.

A major interest of the Indian Cretaceous lies in the evidence that it affords for a former connection between India and South Africa. The marine Cretaceous of the Indian peninsula belongs entirely to the Upper division of the system. A number of detached outcrops occur along the valley of the Narmada from the town of Bagh in Madhya Pradesh, past Baroda, to Wadhwan in Gujarat. In the south of India there is a Cretaceous area of 200 or 300 sq.mi. in Tiruchirapalli district and smaller patches near Pondicherry and Viruddhachalam. By far the greater number of species which have been obtained from the Narmada (Narbada) Cretaceous occur also in Europe but only about a third of them have been found in southern India. On the other hand only about a sixth of the numerous species which have been found in the south Indian Cretaceous occur in Europe. Moreover, there are Cretaceous beds in Assam and nearly all the species found there are southern Indian forms. Finally, many of the Assam and south Indian species occur also in South Africa. Hence it has been concluded that in Upper Cretaceous times the Narmada area lay in a northern sea which stretched into Europe, while Assam and the southeast border of India lay in a southern sea which extended to South Africa. Between these seas a land mass stretched from Africa to India.

The Deccan Lavas.—The Deccan trap, to use the old name, is an extensive series of basaltic lava flows with a total thickness of several thousand feet, which covers an area of about 200,000 sq.mi. in the northwestern quadrant of the peninsula. Along the west coast it reaches the sea without any diminution in thickness from about 21° N. to 16° N., and since the lavas are certainly subaerial it is clear that at the time of their eruption the land must have extended much farther to the west than it does now. The flat-topped hills and deep-cut valleys characteristic of the Deccan lavas area are well shown on the route to Bombay from either Calcutta or Madras. In spite of the great extent of these lavas there is very little indication of volcanoes and it is believed that the eruptions took place from fissures, with little explosive action. The duration of the eruptions cannot be determined with certainty. Probably they began during the later part of the Cretaceous period but may have continued into the Eocene.

The Tertiary beds of the peninsula are insignificant. Near the west coast there are a few small outcrops in Travancore, Gujarat and the Kathiawar peninsula (Saurashtra) and a more complete sequence in Cutch. On the east coast the Cuddalore series, ranging in age from Eocene to Pliocene, occurs in patches from Orissa to the southern extremity of the peninsula.

The most interesting of the Recent deposits in India is laterite which caps many of the hills and plateaus of the Deccan lavas area and is also found extensively at a lower level upon both the western and the eastern borders of the peninsula. It is a surface formation caused by the weathering characteristic of regions where temperature and humidity are high enough.

Laterite owes its prominence to the fact that, though comparatively soft when first quarried, it hardens on exposure and after hardening often resists erosion more strongly than the rocks on which it rests.

B. Physiography

The Indian subcontinent is the middle of the three irregularly shaped peninsulas which jut out southward from the mainland of Asia. Its form is that of a great triangle with its base resting upon the Himalayan range and its apex running far into the Indian ocean between the Bay of Bengal (east) and the Arabian sea (west). It extends from latitude 8° to 37° N. that is to say, from the hottest tropical regions to far within the temperate zone. The length of India from north to south and its greatest breadth from east to west are both about 2,000 mi., but the triangle tapers with a pear-shaped curve to a point at Cape Comorin, its southern extremity.

The territory is rich in varieties of scenery and climate, from the highest mountains in the world to the extensive sandy wastes of the Thar (*q.v.;* Indian) desert and vast river deltas raised only a few inches above the level of the sea. The Indian subcontinent is divided into three well-defined tracts.

The Mountain Wall.—The first of the three regions is the Himalayas and their offshoots to the southward, comprising a system of stupendous ranges, the loftiest in the world. They extend in the shape of a scimitar, with its edge facing southward, for a distance of 1,500 mi. along the northern frontiers of West Pakistan and India. At the northeastern angle the Dihang river, the connecting link between the Tsangpo of Tibet and the Brahmaputra of Assam, bursts through the main range. At the opposite or northwestern angle the Indus in like manner pierces the Himalayas and turns southward through West Pakistan. Ancient trade routes exist, by means of which merchandise from the plains finds its way over heights of 18,000 ft. into Sinkiang and Tibet. The Muztagh (Snowy mountain), the Karakoram (Black mountain) and the Chang Chenmo are the most famous of these passes.

The Himalayas not only form a double or treble wall north of the subcontinent but at their eastern and western extremities

send out ranges to the south, which protect its northeastern and northwestern frontiers. On the northeast those offshoots form a barrier between Assam and the tribal areas of upper Burma. On the opposite or northwestern frontier the mountains run down the entire length of the Afghan border from the Himalayas and are then continued to the sea so that the plateau of Baluchistan, though forming part of Pakistan, actually lies beyond the wall. As they proceed southward, their best-marked ranges are in turn known as the Safed Koh, the Sulaiman and the Kirthar mountains. These massive barriers have peaks of great height, culminating in the Takht-i-Sulaiman (Throne of Solomon) 11,100 ft. above the level of the sea, but the mountain wall is pierced at the corner where it strikes southward from the Himalayas by an opening through which the Kabul river flows. An adjacent opening, the Khyber pass, the Paiwar (Kurram) pass to the south of it, the Gumal pass near Dera Ismail Khan, the Tochi pass between the two last named and the Bolan pass via Quetta still farther south furnish the gateways from Afghanistan. The Kirthar, Brahui and Pab mountains, forming the southern offshoots in western Baluchistan, have a much smaller elevation.

River Plains.—The wide plains watered by the Himalayan rivers form the second of the three regions. They extend from the Bay of Bengal on the east to the Afghan frontier and the Arabian sea on the west, and they contain the subcontinent's richest and most densely populated areas. The vast level tract which thus covers the northern part of the subcontinent is watered and drained by three distinct river systems. One of these systems takes its rise in the hollow trough beyond the Himalayas and issues through their western ranges upon the Punjab as the Sutlej and Indus (*qq.v.*). The second of the three river systems also takes its rise beyond the double wall of the Himalayas, not very far from the sources of the Indus and the Sutlej. It turns, however, almost due east instead of west, enters India at the eastern extremity of the Himalayas and becomes the Brahmaputra (*q.v.*). These rivers collect the drainage of the northern slopes of the Himalayas and convey it, by long and tortuous although opposite routes, into India-Pakistan. The third river system of northern India receives the drainage of their southern slopes and eventually unites into the mighty stream of the Ganges (*q.v.*; Ganga).

Southern Plateau or Tableland.—The third division of India comprises the Deccan (*q.v.*), the three-sided tableland which covers the southern or more strictly peninsular portion of India.

Vindhya-Satpura Mountains.—Standing between the plateau and the great plains of the north is a succession of ranges with a general direction of east to west and known in the aggregate as the Vindhya mountains (*q.v.*). Guarding the flanks of this tumbled mass stand two peaks sacred to the mysteries of the Jain religion, Mt. Abu on the extreme west and Mt. Parasnath on the extreme east, with a succession of ranges stretching 800 mi. between. The various ranges of the Vindhyas, from 1,500 to more than 4,000 ft. high, form, as it were, the northern wall and buttresses which support the central tableland. Though pierced by road and railway, they stood in former times as a barrier of mountain and jungle between northern and southern India and formed one of the main obstructions to welding the whole into an empire. This barrier is reinforced to the south by other east-west ranges, notably the Satpura range (*q.v.*).

Ghats.—The other two sides of the elevated southern triangle are known as the Eastern and Western Ghats. These start southward from the extremities of the Vindhya system and run along the eastern and western coasts of India. The Eastern Ghats stretch in fragmentary spurs and ranges down the Andhra and Madras coasts, here and there receding inland and leaving broad level tracts between their base and the coast. The Western Ghats form the great sea wall of Maharashtra, with only a narrow strip between them and the shore. The Eastern Ghats have an average elevation of 1,500 ft. The Western Ghats ascend more abruptly from the sea to an average height of about 3,000 ft. with peaks up to 4,700 along the Bombay coast, rising to 7,000 and even 8,760 (Dodabetta peak) in the upheaved angle which they unite with the Eastern Ghats to form toward their southern extremity. The inner triangular plateau thus enclosed lies from 1,000 to 3,000 ft. above the level of the sea, in general higher in the west than in the east, but the surface is broken by isolated hills and ranges exceeding 4,000 ft. in height. Its best-known hills are the Nilgiris (*q.v.*), with the summer resort of Ootacamund, 7,000 ft. above the sea. (*See* also GHATS.)

On the eastern side of India, the Ghats are traversed by a number of broad and easy passages from the Madras and Andhra coasts. Through these openings the rainfall of the southern half of the inner plateau reaches the sea. The drainage from the northern, or Vindhyan, edge of the three-sided tableland falls into the Ganges. The Narmada and Tapti carry the rainfall of the southern slopes of the Vindhyas and of the Satpura hills, in almost parallel lines, into the Gulf of Cambay, but from Surat to the extreme south the Western Ghats form a lofty unbroken barrier between the waters of the central plateau and the Indian ocean. The drainage has therefore to make its way across India to the eastward by turning sharply round projecting ranges and by tumbling down ravines or rushing along the valleys, until it finally falls into the Bay of Bengal. In this way the three great rivers of the main plateau (viz., the Godavari, the Krishna or Kistna and the Cauvery; *qq.v.*) rise in the mountains overhanging the western coast and traverse the whole breadth of the central tableland before they reach the sea on the eastern shores of India. A fourth great river, the Mahanadi (*q.v.*), drains the northeastern sector of the plateau also to the Bay of Bengal.

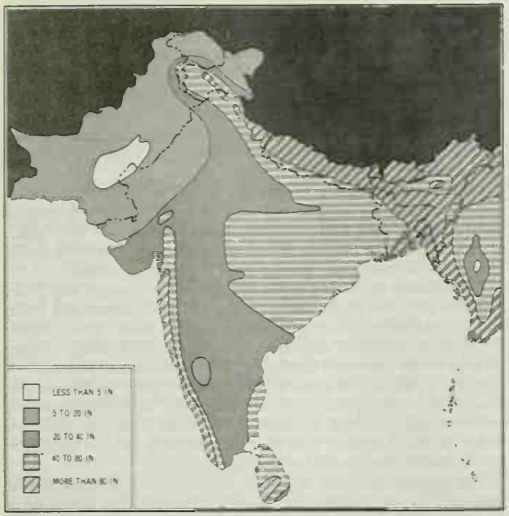
Of the three regions thus briefly surveyed, the first, or the Himalayas, lies in part beyond the political frontier, but a knowledge of it supplies the key to the ethnology and history of India. The second region, or the great river plains in the north, formed the theatre of the ancient race movements which shaped the civilization and the political destinies of the whole Indian peninsula. The third region, or the triangular tableland in the south, differs markedly in its population, languages and traditions from either of the other two divisions.

C. CLIMATE

Regional Climate.—The subcontinent of India, with its lofty mountain ranges behind and its extensive seaboard exposed to the violence of the winds of two oceans, forms an exceptionally valuable field for the study of meteorological phenomena.

From the gorge of the Indus to that of the Brahmaputra, a distance of 1,400 mi., the Himalayas form an unbroken watershed. The average elevation of the Himalayas crest may be taken at not less than 19,000 ft. and therefore equal to the height of the lower half of the atmosphere, and indeed few of the passes are below 16,000 or 17,000 ft. Although there are local air currents common to all mountain regions, the Himalayas isolate the Indian subcontinent climatically from the rest of Asia.

The general circulation of air within the mountain wall is determined in part by prevailing planetary winds, in part by the special relief of the region. In winter northern India-Pakistan lies in the extra-tropical high-pressure belt which encircles the northern hemisphere. A mass of cold heavy air accumulates, from which cool light air streams move down the Ganges valley as northwest or west-northwest winds, though the normal direction of these cool dry winter winds is northeast. They are in fact comparable to the northeast trade winds. At this season some of the cyclonic disturbances of the Mediterranean continue their passage eastward till they reach the plains of northern Pakistan and the Punjab plains of India to bring an appreciable winter rainfall. Elsewhere in the subcontinent the cool season is also the dry season except along the coastlands south of Madras where again disturbances bring a marked October–December rainfall. The subcontinent begins to heat up in March, April and May; the outward-flowing winds cease and there is little air movement. Finally the heated air over the subcontinent rises and with the consequent upset of relative pressures there is a sudden inrush of moisture-laden air from the ocean. This is the "bursting of the monsoon" or the coming of the rains. Again the actual direction of the air currents is dependent to a large extent upon relief; they tend to blow up the major valleys and, notably in northern India, up the Ganges valley parallel to the Himalayas. As they



RAINFALL MAP OF INDIA-PAKISTAN, SIMPLIFIED

pass inland the air streams deposit their moisture, and rainfall decreases in amount, as well as becoming more irregular, with increasing distance from the coast. There is also a startling contrast between the windward and leeward slopes of hill ranges which lie in the path of the monsoon.

On the basis of total rainfall four zones may be distinguished. The wet zone has over 80 in. of rain a year and drainage becomes a major problem. Where the natural evergreen forests have been removed, rice is the main crop. However even the wettest parts of India may suffer from droughts harmful to crops in the dry months. The intermediate zone has a rainfall of between 40 and 80 in. and supports a deciduous forest, which loses its leaves in the dry season, and a mixture of crops. The dry zones have a rainfall of between 20 and 40 in., which tends to be irregular from year to year and in its incidence through the season. Although dry zone crops—millets for food, and cotton—grow well in average seasons, this is the old famine zone of India where irrigation is highly desirable. Below 20 in. of rainfall are the semidesert and desert zones where little can be grown without irrigation.

The Seasons.—The Indian year may be divided into four seasons: (1) the cold season, including the months of January and February; (2) the hot season, comprising the months of March, April and May; (3) the southwest monsoon period, including the months of June, July, August, September and October; and (4) the retreating monsoon period, including the months of November and December. The temperature is nearly constant in southern India (Trivandrum 26°–28° C. [79°–82° F.] in monthly average) the whole year round, but in northern India the variation is very large. In the cold season the mean temperature averages about 17° C. (30° F.) lower (Lahore 12° C. [54° F.] average in January) in the Punjab than in southern India. In the Punjab, Uttar Pradesh and northern India generally, the climate from November to February resembles that of the Mediterranean Riviera, with a brilliant cloudless sky and cool dry weather. The hot season begins about the middle of March, when there is a steady rise in temperature, continuing until the break of the rains in June. In May the highest temperatures are found in the East Punjab, Delhi and Rajasthan.

The southwest monsoon currents usually set in during the first fortnight of June on the Bombay and Bengal coasts (though they linger on their way upcountry) and give more or less general rain in every part of India during the next three months, but the distribution of the rainfall is very uneven. Overlooking the Bay of Bengal, where the mountains catch the masses of vapour as it rises off the sea, the rainfall is enormous. At Cherrapunji (*q.v.*) in the Khasi hills the rainfall averages 428 in. a year. Similarly, where the southwest monsoon blows against the coast south of Bombay the rainfall is very heavy, but when the air currents have passed over the crest of the Western Ghats they have little moisture left. There is very little rain over a strip 100 to 200 mi. in width in the western Deccan parallel with the Ghats, and it is this part of the Deccan, together with the Mysore tableland and the Carnatic, that is most subject to drought. The Bengal monsoon passes by the Coromandel coast and the Carnatic with an occasional shower, taking a larger volume inland and abundant rain to Assam. The same current also supplies with rain the broad band across India which includes the Vindhyas, Chota Nagpur, the greater part of Madhya Pradesh and central India, Orissa and Bengal. Rainfall rapidly diminishes to the northwest from that area. A branch of the Bombay current blows pretty steadily through Rajasthan to the Punjab, carrying some rain to that area divided between Pakistan and India. But the greater part of the northwest (which lies in Pakistan) is served as a rule by cyclonic storms between the two currents. In September the force of the monsoon begins rapidly to decline, and in its rear springs up the gentle steady northeast monsoon, which gradually extends over the Bay of Bengal. A wind similar in character, but rather more easterly in direction, simultaneously takes possession of the Arabian sea. The most unhealthful season immediately follows the rains, when malaria is prevalent, especially in the north. Later the sharp contrast between day and night temperatures at the outset and end of the cold weather in the north encourages pulmonary diseases. (L. D. S.)

D. Vegetation

In India-Pakistan the combination and permutation of geological history, topography, climate, soil, as well as the effect of edaphic and biotic factors produce a bewildering series of plant habitats which in their diversity are probably unequaled in any area of comparable size on the earth's surface. From the arctic snows of the highest Himalayas to the torrid plains of India, from areas with probably the greatest rainfall in the world to huge tracts in which the precipitation is only a few inches in the year, from shales, alluvium and limestones through to the salt-laden deltaic muds, from almost untouched forest to the densely populated areas, are extremes between which every gradation and variety can be demonstrated.

The most ancient parts of the Indian subcontinent are the Khasi hills and Deccan plateau. The Himalayas began to rise much later. Between these three elevated areas are the vast stretches of comparatively recent alluvium laid down by the Indus and its tributaries to the northwest and that by the Ganges and Brahmaputra to the northeast. The rising Himalayas were therefore open to invasion of plants from east, west and north. The Khasi hills would be likely to show affinities with Malaya and also with the east while the Deccan could be expected to show the influence of the Malayan region and of East Africa. This has been shown to be true from an analysis of the vegetation which has also shown a surprising degree of endemism, about 61% according to D. Chatterjee.

The subdivision of the subcontinent into six phytogeographical regions follows that of Sir Joseph Hooker with slight modifications.

Eastern Himalayan Region (and Southern Extension).—The region consists of a series of parallel ranges increasing in height to the Sela and Everest massifs. The dominant families are Gramineae (grasses) and Orchidaceae (orchids). Members of the Lauraceae are conspicuous in the foothills together with the hill areas south of the Brahmaputra valley, while in the temperate zone huge oaks, *Magnolia*, *Castanopsis*, *Bucklandia* and other genera appear. On the outer ridges conifers such as *Abies delavayi*, *A. densa*, *Larix griffithii*, *Taxus baccata*, *Tsuga dumosa*, *Picea spinulosa*, *Pinus wallichiana* and *P. roxburghii* are to be found. Rhododendrons, primulas and the genus *Meconopsis* (blue poppy) are extremely well represented as are numerous other plants grown in English and American gardens. There are tea gardens and Cinchona plantations in the Darjeeling district.

In the Khasi hills area the extremely common Malaysian genus

Nepenthes (pitcher plants) is represented by a solitary species confined to a restricted area on the Khasi tableland. *Pinus insularis* (*P. khasya;* Luzon pine) occupies large areas in the Khasi and Naga hills. Apart from some endemic genera (*Tupidanthus* and a few others) the Khasi vegetation resembles that of the eastern Himalayas. The South American weed, *Eupatorium odoratum*, has occupied large tracts in the Assam valley.

Western Himalayan Region.—There the area consists of parallel ranges gradually merging into the Tibetan plateau. Most of the rain of the southwest monsoon falls on the southern face of the outer ranges so that the hinterland becomes more and more arid toward the north. There the precipitation takes the form of snow that falls in the winter and the melting of which enables a rich alpine vegetation, *Ranunculus, Aconitum, Pedicularis, Aquilegia, Androsace*, etc., to survive. Gramineae and Leguminosae are the predominant families. To the northwest and central portion pure forests of pines are found, *Pinus gerardiana, P. wallichiana, P. roxburghii*, and firs *Abies densa, A. pindrow, A. spectabilis* and somewhat to the east *Picea smithiana* (Himalayan spruce) and *Tsuga dumosa* (Himalayan hemlock). *Cedrus deodara*, the deodar, is one of the very important timber trees of the region and grows in pure stands. Junipers and *Ephedra* (joint fir) occur in the extreme northwest. On the outer foothills *Boswellia* (frankincense), *Holoptelea, Engelhardtia*, cherries and maples are found. Oaks, rhododendrons and primulas are few in number. Many European and middle east genera flourish at high altitudes.

Indus Plain Region.—A large part of this area is almost desert where the rainfall scarcely reaches eight inches per year. In the driest parts stretches of sand and dunes are common and the vegetation is reduced to spaced bushes of *Lycium, Leptadenia, Haloxylon, Capparis* and occasionally *Euphorbia neriifolia*. *Calotropis procera* is a common shrub. Farther east thorn forest develops and there *Acacia arabica, A. leucophloea* and *A. modesta* with *Prosopis spicigera* and *Salvadora oleoides* are common. Grasses are rare. Many of the ruderals (plants of waste places) are common to this area and Egypt.

Gangetic Plain Region.—The most important type of vegetation found in this region, which extends from Uttar Pradesh in the west to Assam in the east, is undoubtedly the sal (*Shorea robusta*) forest. These forests, in which the sal (a valuable timber tree) grows in remarkably pure stands, extend all along the northern part of the region to find their eastern limit in Nowgong, Assam, with a southern diversion into the states of Bihar, Orissa and Madhya Pradesh. Where the rainfall is heavy the associated trees and undergrowth often consist of evergreen species. In central India, however, the predominant associates are of a very much drier type.

In the Assam valley, bordering the outer northern slopes of the Naga hills, a type of evergreen forest is developed. This contains Dipterocarpaceae, one of which, *Shorea assamica*, is found in this one place only, and many other species of evergreen trees belonging to the genera *Mesua, Cinnamomum, Pachylarnax, Mansonia* (with relatives in east Africa and Malaya), *Dysoxylum* and others.

Malabar Region.—This region occupies a narrow zone on the west coast in which a coastal strip is followed inland by mountainous country rising to a height of 9,000 ft. The rainfall is very heavy and the vegetation developed is a tall evergreen forest in which species of *Cullenia, Calophyllum, Garcinia, Mesua, Holigarna* and *Artocarpus* are found with an undergrowth of small lauraceous trees, and bushes of the genus *Impatiens* (snapweed) and the family Zingiberaceae. An evergreen forest of different composition is found at the higher levels and occupies the valleys and depressions of the hills above, where it is protected by its moist habitat from the fires that sweep over the grassy downs. These shola forests, as they are called, are composed of stunted thick-boled trees of the genera *Ternstroemia, Syzygium, Michelia, Gordonia, Ilex*, etc., with shrubs of Oleaceae, Rubiaceae, Berberidaceae and others.

Deccan Region.—This occupies the remainder of Madras state east of the Malabar region. The rainfall over much of this region is less than 40 in. per year and certain parts receive no more than 10 in. Broadly speaking the vegetation is mainly deciduous, a good deal of it consisting of umbrella thorn forest of various species of *Acacia* and *Dichrostachys*, which in the still drier and poorer sites are interspersed with species of fleshy *Euphorbia*. The typical deciduous forest consists of teak (*Tectona grandis*), species of *Terminalia, Dillenia pentagyna, Ougeinia dalbergioides, Anogeissus latifolia, Lagerstroemia parviflora* and many others. Bamboos (*Dendrocalamus strictus* and *Bambusa arundinacea*) form the sole undergrowth. One grass, *Eulaliopsis binata*, of value for paper, is very common.

Special areas.—Beach forests are found in coastal areas consisting of loose sea sand mixed with shell fragments. A characteristic tree in such habitats is *Casuarina equisetifolia* with which are found *Hibiscus tiliaceus, Pongamia glabra* and *Erythrina indica* (Indian coral tree). A common grass is *Spinifex littoreus*.

Tidal forests are found at the mouths of the Ganges and Brahmaputra and, to a lesser extent, those of the Godaveri and Indus and to some extent along the coast in suitable areas. Near the sea in definitely salt-water areas the vegetation consists almost entirely of trees of the mangrove family, *i.e.*, Rhizophoraceae (*Rhizophora, Ceriops, Kandelia, Bruguiera*), with shrubs such as *Excoecaria, Sonneratia, Carapa, Avicennia* and *Aegiceras*. *Nipa fruticans* is a common palm. Behind the above type, in the big deltas, *Heritiera minor* is the dominant tree but the majority of the mangrove species mentioned above are also present.

The grasslands which are such a conspicuous feature of the landscape in the Nilgiris, the Khasi hills and in the plains areas of Bengal and Assam are considered to be the result of human interference and the grazing of domestic animals. In the tall grassland the grasses are of the genera *Saccharum, Erianthus, Imperata* and *Arundinella*. Heavily grazed, the grassland degenerates into a short turf composed of *Chrysopogon* and depauperate (stunted) *Imperata*. In the hills the grassland consists of species of *Apocopis, Eulalia, Ischaemum, Dimeria* and many others. Alpine meadow consists mainly of *Poa* (bluegrass) and *Festuca* (fescue). Much of the hill grassland which has followed shifting cultivation has been invaded by the South American weed *Eupatorium odoratum*.

(N. L. Bo.)

E. Animal Life

Mammals.—The Asiatic or Indian lion used to exist in most of the west, north and central parts of the subcontinent but its last refuge is now the Gir forest in Gujarat. Lions have only survived there because of strict protection by the former rulers of Junagadh, and in the early 1960s they were believed to number less than 300. No lions from Africa were ever introduced: a few were once brought to Gwalior but these were quickly killed.

The tiger is found in most parts of the subcontinent except in the extreme northwest and higher Himalayan ranges. Because of its greater cunning and wariness it has managed to survive, whereas the bolder lion was shot almost to extinction by sportsmen. The spread of settlement and cultivation and the increase in human population with firearms and motor vehicles have everywhere reduced the tiger population and the numbers of all wild animals. Lack of natural food such as deer and pig often drives the tiger to become a cattle lifter, and very occasionally a man-killer or even a man-eater, though man-eaters are rare and are usually aged or disabled animals. No black variety of tiger has been proved to exist, but varying stages of albinism have been recorded, the most notable being the white tigers of Rewa in Madhya Pradesh, India.

The leopard or panther still exists in fair numbers throughout the subcontinent. As in the case of the tiger, there are some leopards that live in thick forest and prey on wild deer, etc., but many of them are found close to human habitation where they prey on smaller cattle, goats and poultry. A black variety is sometimes found in the regions of heavy rainfall in south and northeast India. The cheetah or hunting leopard is now almost certainly extinct in the subcontinent, the last recorded instance of its existence being the two shot in 1947 by the ruler of the former Korea princely state (now part of Madhya Pradesh). Any cheetahs in captivity in India and Pakistan are of African origin. Other cats include the handsome tiger or clouded leopard (*Neofelis nebulosa*), the most beautiful golden cat (*Felis temmincki*), the rare marbled

cat (*Felis marmorata*), the leopard cat (*Felis bengalensis*), the fishing cat (*Felis viverrina*) and the common jungle cat (*Felis chaus*). There are many species of civets, mongooses and martens. The striped hyena is found in many parts but has become extinct in northeast India.

Wolves are found in the uplands of Kashmir and in the arid and scrub areas to the northwest of the subcontinent. The fox, with several species and subspecies, is found in much the same type of country as the wolf. Jackals abound everywhere. Dhole or wild dogs (*Cuon* species) are also almost universally found, especially in forested areas, and hunt in packs.

In addition to the brown bears of the Himalayan region, there are the Asiatic or Himalayan black bear (*Selenarctos tibetanus*) and the sloth bear (*Melursus ursinus*) in the forested regions of the subcontinent. The Malayan sun bear (*Helarctos malayanus*) is found in the extreme east. The red panda or cat-bear (*Ailurus fulgens*) lives in the mountainous areas in the extreme north.

The Asiatic or Indian elephant (*Elephas maximus*) is not found in West Pakistan or in the extreme northwest and north of India, but it is fairly common in East Pakistan and in northeast and south India. Elephants are protected by law and can only be hunted by special control licence or when specially proclaimed by the district magistrate. They are frequently tamed and used for purposes of state. The Asiatic elephant is smaller than the African elephant and bulls rarely exceed 10 ft. in shoulder height. It is also distinguished by its convex back, smaller ears, etc. Asiatic cow elephants, moreover, never have tusks and bulls in some cases are tuskless and are known as makhnas. A peculiar marine and estuarine mammal, related to the elephant, is found off the coast of south India—the dugong (*q.v.*). It is less rare off the coast of Ceylon.

Of the three species of Asiatic rhinoceros, two (*Dicerorhinus sumatrensis* and *Rhinoceros sondaicus*) have become extinct in northeast India and East Pakistan. The largest of the three species (*R. unicornis*) survives in fair numbers in Nepal and the Indian states of West Bengal and Assam, where it is strictly protected. Poachers persist in hunting the animal because of its horn, highly valued as an aphrodisiac.

The wild boar (*Sus cristatus*) is common in many parts of the subcontinent and is one of the most persistent raiders of food crops. The once very rare pygmy hog (*Sus salvanius*) may exist in areas below the foothills of the eastern Himalayas, but there has been no authentic record of this diminutive species for some years. The Indian wild ass (*Equus hemionus khur*) frequents the sandy flats of the Rann of Cutch.

Only a very few species of antelope are found in the subcontinent. The blackbuck (*Antilope cervicapra*) exists precariously in the open cultivated areas in the west, north and centre, is rare in the south and is not found in the northeast. The nilgai or blue bull (*Boselaphus tragocamelus*) survives in small numbers except in the northeast and south. The four-horned antelope (*Tetracerus quadricornis*) is rare, while the Indian gazelle or chinkara survives here and there in the drier regions.

Of the deer tribe, the beautiful chital or spotted deer (*Axis axis*), the barking deer or muntjac (*Muntiacus muntjak*) and the hog deer (*Axis porcinus*) survive in decreasing numbers. The sambar (*Cervus unicolor*) is becoming rare in its forested habitat. The swamp deer (*Cervus duvaucelli*) are fewer since the spread of cultivation. The two species most in need of protection from threatened extinction are the Kashmir stag (*C. elaphus hanglu*) and the brow-antlered deer (*Cervus eldi*) of Manipur in northeast India. Of the latter there were believed to be only about 100 in existence in the early 1960s but the other subspecies found in Burma is commoner. The musk deer (*Moscus moschiferus*) is found all along the Himalayas but is threatened because of the commercialization of its musk pod. The tiny mouse deer or chevrotain (*Tragulus meminna*) is found only in the south of the subcontinent.

The magnificent gaur, the so-called "bison" of sportsmen, abounds in the forested hills of northeast, central and south India, though in fewer numbers than before. It is the largest of the world's wild oxen, bigger than the true American and European bison. Another type, domesticated and known as the gayal, is found in the mountainous areas of northeast India and East Pakistan. The wild buffalo (*Bubalus bubalis*) has become very rare in Nepal and in Madhya Pradesh and West Bengal but survives in fair numbers in Assam. The horns of the bull are thicker, but those of the cow usually have a much larger spread.

The only ape found in the subcontinent is the hoolock or white-browed gibbon (*Hylobates hoolock*). There are a number of macaque monkeys and langurs. A notable addition to the latter genus is the golden langur (*Presbytis geei*) of northwest Assam. Both the slow and slender loris are found.

In some populated districts large numbers of dogs and monkeys roam as wild or semi-wild scavengers.

Rodents are well represented throughout the subcontinent, squirrels, marmots (in the higher regions), rats, mice, porcupines and hares living in almost all areas. The hispid hare (*Caprolagus hispidus*) is believed to be very rare.

Birds.—The subcontinent of India-Pakistan, with its great diversity of climate and physical features, contains one of the richest and most varied avifaunas of the world. There are at least 2,061 species and subspecies of which about 350 are winter visitors. The largest birds are probably the sarus crane (the height of a man) and the lammergeier or bearded vulture (with a wing span of over eight feet), and one of the smallest is Tickell's flowerpecker. Most remarkable for their beauty are the Himalayan pheasants, of which the cocks of most species possess brilliantly coloured plumage. For song the most notable are the graywinged blackbird (*Turdus boulboul*) of the Himalayas, the whistling thrushes (*Myiophoneus sp.*), the shama (*Copsychus malabaricus*) and the magpie robin (*Copsychus saularis*). The parakeets do not make good talkers, but the hill myna (*Gracula religiosa*) is well known for its clear rendering of the human voice. For mimicry, not speech, the racket-tailed drongo (*Dicrurus paradiseus*) and the rufus-backed shrike (*Lanius schach*) are outstanding, and the former species becomes remarkably tame when kept in captivity.

Three species are believed to be extinct: the mountain quail (*Ophrysia superciliosa*) has not been observed since 1876, nor Jerdon's courser (*Cursorius bitorquatus*) since 1900, and the last pinkheaded duck (*Rhodonessa caryophyllacea*) was shot in 1935 and none has been authentically seen since then. A species which has become very rare and which occupies the attention of conservationists is the great Indian bustard (*Choriotis nigripes*), threatened both because of its large size and its value in terms of meat and because its habitat is more and more encroached on by human settlement and cultivation.

Geese and snipe are not being reduced in numbers, though both indigenous and migratory ducks are becoming scarcer. Pheasants, partridges, jungle fowl and quail also are probably less numerous than at the beginning of the 20th century. Vultures, kites and crows play an important part as scavengers. Crows are harmful when they multiply in the big towns and in the neighbourhood of colonies of breeding birds, as they tend to destroy eggs and young birds.

Reptiles.—The reptiles of the subcontinent are more numerous than the mammals and comprise more than 150 genera with over 550 species. Three kinds of crocodile inhabit the region, two with broad snouts (*Crocodylus porosus* and *C. palustris*) and one with an elongate snout (*Gavialis gangeticus*) which is purely fish-eating. Land and fresh-water tortoises are numerous, as are turtles. Lizards and snakes are remarkably numerous, the latter constituting more than half the total number of reptiles. Pythons are useful in that they eat rodents which are destructive to forest plantations and other crops, and are therefore protected in some parts. The cobra (*Naja tripudians*) is one of the commonest and yet one of the most deadly of snakes, but the larger king cobra or hamadryad (*N. bungarus* or *N. hannah*), which ranges up to 12 or 13 ft. in length, is comparatively rare. The krait, especially the banded krait, is also dangerous and poisonous, as is the Russell's viper (*Vipera russelli*). Batrachians are plentiful and consist of 22 genera and over 130 species.

Fishes.—Including marine and even deep-sea forms, 437 genera and more than 1,600 species of fishes have been enumerated in and around the subcontinent. The carps are well represented, all are

edible and of them the rohu (*Labeo rohita*) and catla (*Catla buchanani*) are common in the north. Large, sporting mahseer are found in all swiftly flowing rivers. No Salmonidae (salmon, trout, char) which are indigenous are found, for the trout of Kashmir, Kulu valley, Nilgiris and other places have all been introduced. The hilsa (*Clupea ilisha*) is a popular food and is found in the sea round all the shores.

Insects.—Locusts frequently appear, especially in the northwest of the subcontinent. They can do enormous damage to crops if precautions are not taken to destroy the eggs and hoppers. Termites (incorrectly known as white ants) are found everywhere and do great damage to woodwork of every kind except the very hardest (such as teak). Mosquitoes are prevalent where the temperature is above 15° C. (60° F.) and the malarial species is a serious threat to health, transmitting malaria and elephantiasis.

The subcontinent of India-Pakistan, together with Ceylon and Burma, possesses 1,443 species of butterflies. Among the most beautiful in India-Pakistan are the blue peacocks and the banded peacocks (*Papilio sp.*), the kaiserihind (*Teinopalpus imperialis*), the orange oakleaf (*Kallima inachus*) and the birdwings (*Troides*). The largest is the common birdwing (*T. helena minos*) with a wing span of up to 190 mm.; the smallest is the grass jewel (*Zizeeria trochilus*) of only 15 mm. (E. P. G.)

II. NATURAL RESOURCES

Water.—As about 70% of the population of India and Pakistan is directly dependent upon agriculture for its existence, the supply and control of water are of overwhelming importance in the subcontinent. As stated in *Climate* above, two rainfall zones have excessive or adequate rainfall and two dry zones (desert and semi-desert) require irrigation. Thus, of the total area under cultivation, almost 16% is irrigated. Approximately 41% of the irrigated area is watered by canals, 20% by tanks, 29% by wells and 10% by other methods. A few of the older canals are inundation canals, often dating from Mogul times, which fill with the rising river and from which offtakes lead the water to the land. The Indus and its tributaries bring water from the melting snow of the Himalayas, and from these rivers water is led off into perennial canals vital to the agriculture of the Indus region. The waters were the cause of much dispute until their use was finally agreed upon by the Indus Waters treaty of 1960. This gave the unrestricted use of the Ravi, Beas and Sutlej waters to India, and the Indus, Jhelum and Chenab waters to Pakistan. Tank irrigation occurs more in the south and east. Tanks are sited where there is a considerable catchment area, usually wasteland, or are strung out along the stream beds. High evaporation and seepage lose much water so that few tanks hold water all the year and are thus a less efficient form of irrigation. Wells, though each irrigates only a small area, are important in aggregate, and especially because the supply of water from them can be carefully adjusted.

Hydroelectric potential is greatest along the Himalayas from Assam to Malakand, in the Western Ghats and in the southern hills. However, the great seasonal variation in the river flow and the consequent need for large reservoirs limit development.

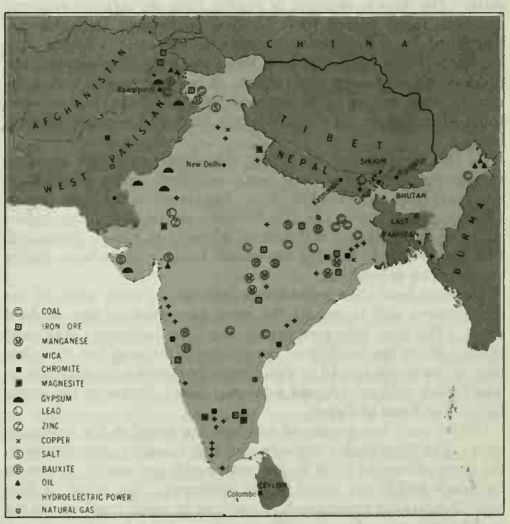
Soils.—While in the 1960s there remained a great deal of work to be done on the soils of the subcontinent, four major groups are generally recognized.

Alluvial soils, chiefly in the Indo-Gangetic plain, are agriculturally of greatest importance as they support almost half the total population. They vary from the coarse sediments of the bhabar to fine silts in the Ganges delta. Variations in fertility are caused by fresh deposits of silt, by drainage and by the absence of alkali pans. Black earths or regur form the second group of soils and are mostly found on the Deccan lavas. Their colour is probably caused by the presence of iron particles and they are much associated with cotton growing. They have high moisture-retaining properties and when wet become difficult to work.

On the Archean crystalline rocks a third group of soils, the red soils, develops (though some in colour are gray, brown or black). On the uplands they are very poor, but there are loams in some lowlands which are fertile when irrigated. Finally there is the lateritic group of soils, somewhat infertile, with a hard pan of aluminom and ferric oxides below a leached top soil. All Indian soils are generally deficient in nitrogenous and organic matter, and the black earths and red soils are also deficient in phosphoric acid.

Minerals.—India is much better endowed with mineral resources than Pakistan. The coal fields of the subcontinent lie almost entirely in the down-faulted Gondwana beds and especially in Bihar-West Bengal. Almost all the coking coal lies in the Damodar fields and reserves of this type of coal are not large, though there are adequate reserves of other coals. Oil reserves are generally small and are associated with the foothills of the Himalayas and are chiefly in Pakistan, where there is also an extensive natural gas field at Sui. Smaller deposits of natural gas occur in the Punjab in India, and there is a little oil produced in Assam and in the Gulf of Cambay. Prospecting for further deposits has been carried out almost continuously since World War II.

The subcontinent is well endowed with iron ore reserves, containing some of the world's largest, though these are almost exclusively confined to India. They are mainly hematites and magnetites of high iron content. The main deposits lie on the northern flanks of the Orissa hills, in Madhya Pradesh, the Damodar valley, in Mysore, around Salem. There are also many lesser deposits. Ferroalloys, manganese, chromite and vanadium are all present, with important deposits of chromite in West Pakistan.



MAJOR MINERAL AND POWER RESOURCES OF INDIA AND PAKISTAN

Nonferrous metal reserves are small, though there is some lead, gold (from the Kolar fields in Mysore, India) and copper. More considerable deposits of aluminum are present both in the bauxite deposits of Madhya Pradesh and in the laterites of the peninsula. Mica is mined principally in Bihar and accounts for three-quarters of the world's supplies. Salt is chiefly mined in West Pakistan, and there are adequate supplies of building stone, limestone and gypsum. Ilmenite is recovered from beach sands in Kerala, India, and in northeastern India there are large deposits of thorium.

Land Use.—*Agriculture.*—Shifting agriculture is practised in Assam and in the more remote parts of central India. Clearings are burned in the forest and, after two or three years when the fertility of the cleared land has declined, fresh ones are made. The abandoned clearings grow over in a tangled mass of scrub, unlike the tall forest that was there previously. Millets, dry rice, maize (corn) and buckwheat are the principal crops grown in the clearings. This form of agriculture only supports a very small population and is full of inherent dangers, both to the forest, which does not regain its former value, and to the soil, giving rise to soil erosion.

Peasant agriculture, which is the predominant type found all over the subcontinent, consists of irrigated or dry farming of food and cash crops, together with trees and gardens. Finally, there is a limited number of plantations: rubber in Kerala, tea on the Himalayan slopes and in Assam and coffee in Mysore.

The crops in India and Pakistan are divided according to the monsoon into those harvested in spring (rabi) and autumn (kharif). Kharif is sown when the rains begin and harvested in October–November. The chief kharif crops are rice, millets, cotton and jute. Rabi is sown when the rains have ended and harvested in February–March. Rabi crops include wheat, barley, linseed, rape and mustard. The rabi and kharif crops are often sown on the same ground, sometimes with catch crops between, thus giving rise to complicated patterns of two or three crops a year.

Forestry.—For botanical aspects of forestry see *Vegetation* above. Forest covers 15.2% of India, but only 3.7% of Pakistan. Timber is a considerable resource in those parts of India which are too hilly to be used for agriculture and which enjoy a moderate rainfall, and in the mountains where access may be difficult. Pakistan has some poor forest land in the west as well as the tidal forests of the Ganges delta in the east, which yield firewood and charcoal.

Fisheries.—Fisheries have long been neglected in the subcontinent partly because of the climate, which is not favourable to the marketing of fresh fish, and partly because of the low caste of the fisherman. The continental shelf extends for some distance round the subcontinent but most fishing has in the past taken place within six miles of the shore. Modern developments are the introduction of new apparatus for deep-sea fishing and the cultivation in ponds and irrigation tanks of such fish as the vegetable feeder *Catala catala.*

See also *The Economy* sections of INDIA and PAKISTAN.

(L. D. S.)

III. ANTHROPOLOGY

Races.—In the Indian subcontinent elements of four major racial groups, the Europoid, the Mongoloid, the Veddoid and the Negroid, have met and merged in various combinations. Because of its geographical situation the subcontinent has played the role of an enormous cul-de-sac which brought to a standstill successive waves of migration entering from the northwest and northeast. With the Indian ocean barring any further southward expansion, populations of different origin dovetailed and mingled, though many retained a considerable measure of racial and cultural distinctiveness. Indeed, environmental as well as historical factors favoured the spatial coexistence of populations distinct in race, language and cultural level, and the result is an ethnic and linguistic pattern of unparalleled complexity.

Archaeological evidence is silent on the racial characteristics of the men who produced the various Paleolithic industries, which date from glacial and interglacial periods, but the persistence into historical times of Paleolithic and particularly Microlithic cultures in certain areas, and the continuous occupation of the same sites for several millenniums, suggest that at least some of the ethnic groups responsible for the manufacture of stone implements of Paleolithic type have contributed to the composition of the present population of the subcontinent. Skeletal remains found in the towns of the Indus civilization (*c.* 2500 B.C.) show that a mixture of races comparable to that of modern days already existed in that early period, and skulls found in burials of the Early Iron Age in the Deccan are not significantly different from the racial type now prevailing in the same area.

While the onetime existence of a Negroid racial element has been deduced from the present occurrence of very dark-skinned populations whose heavy pigmentation is otherwise not easily explained, there is on the mainland at present no ethnic group generally evincing Negroid characteristics, and the only true Negritos on Indian territory are the pygmies of the Andaman Islands. Tightly curled hair suggestive of Negroid affinities is found in isolated members of certain aboriginal tribes or very low castes, but nowhere does this trait extend to a whole population.

The most primitive and presumably the oldest racial type is the Veddoid, so-called after the Veddas, a tribe of forest nomads in Ceylon. As this type shares with the aboriginals of Australia such characteristics as the broad nose, slight prognathism and prominent superorbital ridges, it has sometimes been referred to as Proto-Australoid. This type is represented principally by such forest tribes as the Kadar (*q.v.*; Kadir) and Malapantaram of Kerala, the Kurumba of Kerala and Mysore and the Chenchu (*q.v.*) of Andhra Pradesh. A lighter-skinned variant of the Veddoid type is widespread among the tribal populations of middle India; Bhil, Khond, Oraon, Munda (*qq.v.*), Gond (*see* GONDWANA), Gadaba, and Saora are some of the tribes which conform in their general racial make-up to this variant of the Veddoid type. A round or heart-shaped face, broad nose, slightly wavy hair and slender build are characteristic of this type, which in Paleolithic times may well have dominated the scene in the whole of peninsular India.

Already in the cities of the Indus civilization there were, besides individuals roughly resembling Veddoids, large numbers of people representing a long-headed type similar to that of the Mediterranean races. Such long-headed populations of basically Europoid type seem to have spread over much of India even before the Aryan invasions (*c.* 1500–1200 B.C.). This type is now predominant in most of northern India, while in south India people of Europoid features though of dark pigmentation form the majority of the population in many regions of more advanced civilization.

The speakers of Aryan languages, who between 1200 and 1500 B.C. crossed the subcontinent's northwestern mountain barriers and soon occupied much of the Indus basin and the Gangetic plains, undoubtedly belonged to a similar and basically Europoid racial group. Mediterranean types with finely chiseled narrow faces, prominent noses, light-coloured skin and eyes are frequent in northern India and West Pakistan.

Besides this long-headed type there is another and broad-headed Europoid type which is concentrated mainly in Baluchistan, Gujarat and parts of Maharashtra and is characterized by a somewhat stocky build reminiscent of the Alpine type of Europe.

Whereas Europoid types reached the subcontinent from the west, Mongoloids with eastern associations have long been dominant in the Himalayan regions and the highlands of Assam and Chittagong. A Paleo-Mongoloid type is found among such tribes as Naga, Abor, Khasi and Garo, whereas a more highly specialized Mongoloid type closely related to that of Tibet occurs among the Bhotia populations of Bhutan, Sikkim and Nepal. Mongoloid types seem to have had an influence also on the racial pattern of some of the tribal areas of Bihar and Orissa, but no pure Mongoloids are found in peninsular India.

Correlations between racial types and linguistic groups can be established only to a very limited extent. Speakers of Tibeto-Burman languages, for instance, are almost invariably of Mongoloid race, but a good many Mongoloids do not speak Tibeto-Burman but Mon-Khmer languages (*e.g.*, the Khasi of Assam). Aryan languages are spoken by all the light-skinned populations of Europoid type of northern India and also by numerous aboriginal tribes of Veddoid type such as Bhil, Baiga and certain groups of Gond, though it is most probable that these tribes originally spoke different tongues. All the populations of southern India, irrespective of racial type, speak Dravidian languages and it is hence meaningless to use the term "Dravidian" to designate a racial element in the Indian population.

It is possible, on the other hand, to correlate certain racial traits with distinct levels of culture. The Veddoid type, for instance, occurs mainly among primitive tribal populations and is not to be found among any of the higher Hindu castes. Comparative studies based on anthropometric data from a large number of castes and tribal communities have also led to the recognition of significant correlations between such individual features as cephalic index, nasal index and the absolute circumference of the head. It has been found that many culturally primitive tribal groups differ in respect of measurable physical characteristics from the more advanced Hindu populations, and that within the aboriginal groups there is a significant difference between the small-headed tribes

of such western states as Maharashtra, Mysore and Kerala and the larger-headed tribes of Orissa and Bihar. In some regions of India there are measurable physical differences also between the various social strata of Hindu society. Thus most of the dominant groups in Maharashtra, including the majority of the Brahman castes, all the higher agriculturists and higher artisan castes, form on the basis of anthropometric data a cluster of mesocephalics clearly distinguishable from the dolichocephalic (long-headed) lower agricultural and lower artisan castes.

The caste system with its insistence on the endogamy of comparatively small populations works in a manner unparalleled in other countries for a persistence of regional racial types and against their amalgamation even under conditions of close spatial contact. Racial distinctions, moreover, are not only indicative of different origins but are operative in determining present-day social relations. People of Mediterranean type with light skin and long prominent noses feel superior to the dark-skinned, curly-haired, broad-faced Veddoid aboriginals, consciously or unconsciously equating these primitive features with cultural backwardness. While in some ancient centres of civilization, such as the Gangetic plains, the population is comparatively homogeneous, there are many regions where ethnic groups of widely differing racial type live in close proximity. In the Malabar district of Kerala, for instance, physical types include the dark-skinned, curly-haired, broad-faced Panyer agricultural labourer and one-time serf, the small wiry Veddoid Kurumba of the jungles, the long-faced Nayar (*q.v.*) landowner of medium pigmentation and tall stature, and the light-skinned Nambudiri Brahman of Mediterranean type. The physical features of the lower castes and jungle tribes distinguish them so unmistakably from the higher Hindu castes, that even in the absence of present-day caste barriers mobility from group to group would be impeded by obvious differences in appearance. In their effect on the interrelations of different ethnic groups racial distinctions are thus no less important a factor than linguistic differences, and unlike the latter they cannot be removed by a conscious conformity to the standard set by a socially or politically dominant group.

In Pakistan barriers between different ethnic groups are not as rigid as in India, but social divisions comparable to the Hindu castes occur also among Muslims and inhibit intermarriage and the easy fusion of racial types. In West Pakistan a Europoid strain with coarser features and a heavier build than those of the Mediterranean type of the Gangetic plains predominates, and there are also elements resembling the Armenoid type of western Asia and the Balkans. The population of East Pakistan, on the other hand, consists partly of people similar in physical make-up to the Bengalis of India and partly of Mongoloid tribes akin to the hill tribes of Assam and Burma.

Languages.—The languages of the subcontinent are summarized in INDIAN LANGUAGES, INDO-ARYAN LANGUAGES, DRAVIDIAN LANGUAGES, MUNDA LANGUAGES and TIBETO-BURMAN LANGUAGES. Hindi is the official language of India; other important languages are Assamese, Bengali, Gujarati, Kanarese, Kashmiri, Malayalam, Marathi, Oriya, Panjabi, Sanskrit, Tamil, Telugu and Urdu. Bengali and Urdu are the official languages of Pakistan and Pashto (Pushtu; *q.v.*), Sindhi and Panjabi are important regional languages in West Pakistan. All these languages are discussed in separate articles. *See* also HINDUSTANI LANGUAGE; SANSKRIT LANGUAGE; PRAKRIT LANGUAGES.

Types of Culture.—The racial and linguistic diversity of the subcontinent is matched by an equally complex pattern of cultural types. There is no other part of the world where primitive and highly advanced civilizations have coexisted in such proximity over so long a period. Even now there are jungle tribes which, situated within a radius of less than 100 mi. from ancient centres of urban civilization, persist in an economy of hunters and food gatherers fundamentally similar to that of Paleolithic man. Many of the settled aboriginal tribes have not advanced far beyond the material standard of Neolithic civilizations. The majority of the peasant populations, though now accustomed to the use of certain machine-made goods, still conform in their methods of agricultural production to a pattern several thousand years old. It is only in the major towns and industrial centres that the 20th century has brought about a radical change in the style of living and therefore a readjustment of social institutions.

Much of the anthropological research carried on in the subcontinent has been concerned with the tribal populations, though since about 1945 anthropological methods have been applied also to the study of advanced Hindu and Muslim societies. Many aspects of these societies and their civilizations, customs and cultures are dealt with at length in the articles CASTE (INDIAN), HINDU; HINDUISM; INDIAN ARCHITECTURE; INDIAN ART; INDIAN LAW; INDIAN LITERATURE; INDIAN MUSIC; INDIAN PHILOSOPHY; ISLAM. This discussion is largely focused on the more primitive populations, the only record of which is found in the writings of anthropologists. In India these populations, representative though they are of great variety of archaic culture patterns, number only about 25,000,000 in a total population of well over 400,000,000. No sharp distinction can be drawn between tribal and nontribal populations, but for practical purposes all those Indian communities which do not form an integral part of the Hindu caste system are regarded as tribal. In Pakistan the term "tribal" is mainly applied to compact populations which have retained a measure of political cohesion and autonomy coupled with a traditional association with a specific territory.

A classification of the various cultural patterns found within the subcontinent follows most conveniently the criterion of economic level. On the lowest level stand the seminomadic jungle tribes which subsist mainly on wild forest produce such as roots, tubers, berries and honey, and the flesh of wild animals. Conical or rectangular bamboo or leaf huts are their dwellings, digging stick, bow and arrow their most important implements. They live in small groups, consisting of a few families, the members of which have a joint right in a tract of territory. There is no tribal authority beyond the old men of the individual groups, and disputes are usually settled by informal arbitration. Deities controlling the wild game and the growth of wild fruit are worshiped by prayer and first fruit offerings, but there is little complex ritual and no priesthood.

Representative of this cultural level are, among others, the Malapantaram and Kadar of Kerala, and the Chenchu of Andhra Pradesh, but there are also some as yet little known food gatherers in the lower ranges of the Himalayas, such as the Chepang of Nepal. The numbers of all these tribes are very small and their assimilation to the style of living of more advanced populations is likely to occur within one or two generations.

More numerous are the tribes of shifting cultivators representative of the next highest economic level. Many of these tribes inhabiting hills and forest areas combine the chase and the gathering of wild produce with a primitive form of agriculture known as slash-and-burn cultivation. It involves the periodic felling and burning of forest, and the planting of millets, maize (corn), rice and other crops in the soil fertilized by the ashes. Digging sticks or hoes serve to loosen the soil, but neither plow nor animal traction is used. Dwellings are built solidly enough to last for some years, but there is a tendency to shift settlements whenever new land is taken under cultivation. Pigs, fowls and dogs are the main domestic animals, and cattle, if kept at all, are used only for dairy purposes and slaughter. Mannan and Muthuvan in Kerala, Hill Reddi and Kolam in Andhra Pradesh, Baiga and Kamar in Madhya Pradesh and Juang in Orissa are examples of such shifting cultivators. Small local groups are the main social and political units; the authority of village headmen is very limited, but priests, seers and magicians function as intermediaries between man and supernatural powers. With agriculture develops the cult of the earth goddess, often propitiated with animal sacrifices.

Shifting cultivators using more advanced farming methods are found in the hills of Assam, where such tribes as Naga, Abor and Garo build large permanent villages, even though fields are periodically shifted. Ax and hoe remain the main agricultural implements, but the areas cultivated are large enough to support substantial settlements and the development of a fairly complex material culture. The cohesion of the large, often fortified, villages is great where head-hunting or frequent feuds used to compel

communities to maintain solidarity in the face of external dangers (*e.g.*, among the Naga). There is no uniformity in the organization of such communities; some are run by village councils recruited on the principle of seniority, while other tribes have powerful village chiefs, forming an aristocratic class distinct from the commoners. Class distinctions are thus already found on the level of shifting cultivators, and slavery was practised until 1947 in some of the remoter hills of the Assam-Tibet borderlands.

Some of the hill tribes of Assam (*e.g.*, Angami Naga, Apa Tani) have developed rice cultivation on irrigated and elaborately constructed terrace fields. All such fields are privately owned, and associated with landownership is hereditary wealth emphasizing class distinctions.

The economic basis of the greater part of the tribal population of peninsular India is plow cultivation of a type practised also by many Hindu castes. While the use of the plow allows permanent cultivation even on nonirrigable land, the efficiency of cultivation with the help of plow and animal traction is not necessarily greater than that of the hoe cultivation of the Assam hill tribes, and the average standard of material culture of the aboriginal of middle India, who works his land with plow and bullocks, does not surpass that attained by some of the Assam hill tribes. But whereas in Assam cattle is considered only a source of meat and is neither milked nor yoked to the plow, cattle breeding is an important part of the farming economy of such middle Indian tribesmen as Gond, Santal or Munda.

A mainly pastoral economy, on the other hand, is confined to an isolated tribe, the Toda (*q.v.*), in the Nilgiri hills of southern India, and to certain tribes of Baluchistan and Kafiristan in West Pakistan. In some parts of Baluchistan nearly half of the population is nomadic: some groups always live in tents and habitually wander over the country throughout the year, others move in a much more restricted circle, grazing their camels and flocks of sheep in the hills during spring and summer and in winter returning to the neighbourhood of permanent villages.

The Kohistanis of the Swat area of West Pakistan practise an extreme form of transhumance, oscillating between altitudes of 2,000 and 14,000 ft. Most families possess houses in four to five different settlements, and at any one time of the year nearly the whole population is concentrated in the altitude belt appropriate to the season. Their economy is based on a combination of the cultivation of grain crops on terraced fields, mostly irrigated and plowed with bullocks, and on the breeding of oxen, buffaloes, sheep, goats and donkeys. The Ahir, a herdsmen caste of northern India, have a tradition of pure pastoralism, and now live in symbiosis with cultivators of other castes. Among some of the Bhotia tribes of the Himalayas, both in India and Nepal, the breeding of yak, sheep and goat is the mainstay of the economy, though agriculture is seldom entirely neglected.

Social Structure.—Environment and economic possibilities impose on the populations of each region of the subcontinent a certain uniformity in material matters. The pattern of settlements, house form, dress and diet are usually similar, irrespective of differences in caste, religion and ethnic groupings among the rural population. Insofar as the structure of society is concerned, tribal populations differ, however, from the Hindu and Muslim peasantry as well as one from the other. Under the guise of outward similarities there are fundamental distinctions in the systems of descent and kinship, the regulation of marriage and the laws of inheritance. Most tribal societies are egalitarian and the tribe, which may comprise 10,000 members and be dispersed over a large territory, is an endogamous unit all members of which are basically equal and can hence intermarry. This feature, more than others, distinguishes tribal societies from Hindu caste society. A tribe, such as for instance one of the Gond tribes, may be subdivided into a number of exogamous sections, each comprising several named clans, and united in the cult of the same deities associated with the section's mythical history. Descent within tribal section and clan may be reckoned in either the male or the female line, but the number of tribes organized on matrilineal principles is small: such tribes are found mainly in Assam (Khasi, Garo) and in Kerala (Padhya, Muthuvan, Paliyan).

There are numerous variations in the form of marriage. In all except such matrilineal societies as that of the Khasi and Garo the wife moves to her husband's house and village, and the married couple with their unmarried children constitute the basic economic unit. The bridegroom usually has to pay a bride price, and the bride receives in turn a dowry of movable articles but seldom of land. The stability of marriage varies from tribe to tribe, but divorce is everywhere permissible and the marriages of many tribal populations are very unstable. Nearly all tribes, including the Muslim tribal populations of West Pakistan, practise polygyny, though multiple marriages never amount to more than a small percentage of marital unions. Much less prevalent is polyandry, found in the form of fraternal polyandry (the marriage of two brothers with one woman) among the Bhotia tribes of the Himalayas and the Todas of the Nilgiris, and combined with matrilineal descent and inheritance among the Nayar and other castes of Kerala, where women used to enter unions with a number of unrelated men but did not establish a common household with any. This type of polyandry, however, belongs mainly to the past, and now all types of polygamy are illegal for members of communities classified as Hindus.

In regard to the choice of marriage partners a major dividing line separates the societies of northern and southern India. In northern India marriages within both the paternal and the maternal descent group are forbidden, and the prohibition of marrying into either of the two groups is often extended to marriages within the same locality. Consequently brides have to be brought from other often distant villages, and the web of marriage relations extends, in time, over a wide area. In sharp contrast to this system of local exogamy is the south Indian practice of cross-cousin marriage. There a man's marriage with the daughter of his mother's brother or father's sister is the preferred type of union, and the repeated establishment of marital alliances between two groups of kin leads to the formation of compact social clusters and the concentration of marriage ties within a very limited area. On the whole cross-cousin marriage prevails mainly among the populations speaking Dravidian languages, while the speakers of Aryan languages in northern India do not countenance alliances of this type. Muslims in Pakistan and India, on the other hand, follow the Islamic practice of permitting the marriage of the children of brothers as well as of brother and sister. There are among Muslims altogether few restrictions on the choice of a spouse. Polygamy is permitted and so is divorce, but some kinds of divorce create a barrier to remarriage with the same woman without her having first consummated a marriage with another man. While among some Muslim communities large dowries are customary, there are others (*e.g.*, the Swat Pathans) among whom substantial bride prices are paid for women, although the payment of bride price is contrary to Islamic law.

While among tribal societies marriage has usually no, or only limited, religious implications and the bond between spouses can be easily dissolved, Hindu marriage has a sacramental character, and the higher Hindu castes traditionally do not permit divorce or even the remarriage of widows. The wife owes her husband complete subservience, and the self-immolation of widows, called *sati* (suttee; *q.v.*), forbidden by law in 1829, was considered an act of the highest piety.

The Hindu family is ideally completely patriarchal and even married sons remain under the authority of the father. The traditional pattern is the joint family consisting of a man and his wife (or wives), their married sons and the latter's wives and children. The members of such a joint family enjoy their property and all their earnings in common, and they usually live under one roof. The joint management of property may continue after the father's death, but individual members are entitled to demand partition. The joint family, though unfavourable to the development of initiative on the part of junior members, serves the purpose of providing mutual assistance in adversity. While it persists in rural conditions, modern urban life and individual cash earnings tend to weaken the structure of joint families.

The social unit next in importance to the family in Hindu society is caste (*see* CASTE [INDIAN]; RAJPUT; UNTOUCHABLES)

and the principle of endogamous groups arranged in a hierarchic order has also influenced Muslim society of Pakistan and India.

The Indian and, to a somewhat lesser extent, the Pakistani village community is as a rule not a homogeneous accumulation of families but consists of several caste groups, each of which has links with members of the same caste in other villages. The traditional picture of an Indian village as a self-contained small "republic" is somewhat idealized, because real power usually rests with the members of the locally dominant caste, who are also the principal landowners. Apart from a small number of Brahman families (*see* BRAHMAN), whose supreme caste status is independent of their economic position, there are one or more castes of cultivators. These castes of medium status usually account for the bulk of the populations, and are engaged mainly in agriculture. Below them stand the castes of such artisans as carpenter, blacksmith, potter, weaver, barber, washerman and the traditionally untouchable castes of tanner, cobbler, butcher and sweeper. According to an arrangement known as the *jajmani* system, the members of these lower castes perform certain services for the landowners and cultivators and receive in return a share in the harvest in the form of fixed quantities of grain. The blacksmith, for instance, repairs agricultural implements or replaces them with iron provided by his client but is not paid in cash by those to whom he stands in a *jajmani* relationship. Each of these artisans and village servants has a circle of clients, and the relationship continues ideally from generation to generation, though personal friction may lead to its suspension or termination.

Disputes between members of the same village are usually adjudicated by a village council, known as panchayat (literally "council of five"), which is an informal body including most of the householders of the village. Traditionally the panchayat can impose fines and even sentences of excommunication, which involve a social boycott of the offender. Apart from the village panchayats on which members of several castes are represented, there are in many areas caste panchayats composed of the senior members of castes from several villages. These caste panchayats act as courts sitting in judgment on offenders against caste rules. All these bodies do not administer a rigid legal code but aim at compromise and solutions acceptable to both parties. Since 1947 the governments of several Indian states have tried to extend the powers of village panchayats and to establish regional panchayats based on similar principles.

In traditional Indian society groups of villages stood under the loose authority of feudal chiefs, who collected the land revenue, and owed allegiance to a superior princely ruler. This part of the old social structure is no longer in existence and a uniform administrative system has led to a gradual elimination of specific local arrangements.

Religion.—Orthodox Hinduism and Islam are treated in the respective articles HINDUISM and ISLAM. The Jains, adherents of Jainism (*q.v.;* a heterodox Hindu religion) and the Sikhs (*q.v.*), dissenters from Brahmanical Hinduism, are important minority sects. The Parsees (*q.v.*) are followers of Zoroaster. Only a summary of religious phenomena outside the scriptural tradition is given below.

Most of the food gatherers and some of the more primitive shifting cultivators lack the idea of a division of the world into different spheres. Men, gods and spirits are thought to move within the same orbit, even though the realm of certain deities lies beyond the reach of men. The majority of the more advanced tribal populations, on the other hand, have a clear idea of a land of the dead, where the departed dwell in the company of certain gods and divine ancestors. It may be thought of as an underworld or as a place in the extreme east or west. Few of the Indian tribes have any idea of a creation of the world, but various myths deal with the origin of the human race, which according to some has emerged from the earth, while others trace its descent to some divine ancestors.

All the primitive religions of the subcontinent concern the establishment and manipulation of contacts with supernatural forces. These forces are invariably imagined as personal and anthropomorphic. The idea that the deities are different from humans and in possession of powers exceeding those of men does not necessarily imply a belief in their insubstantiality, though the substantiality attributed to the gods is different from that of man. Most tribes believe that gods and spirits may at times be seen and heard. The relationship between man and gods is usually considered reciprocal, but this reciprocity may lie on different levels. On the lowest level, men and gods are equally in need of material goods, and their relationship is little more than a mutually advantageous traffic, the gods rendering men assistance in exchange for offerings and animal sacrifices. On a different level are the deities who are considered basically benevolent and appreciative of an attitude of reverent worship rather than in need of material offerings. The benign earth mother of many agricultural tribes as well as the clan deities of the Gond tribes fall into this category. Between clan deities and clan members there is a close emotional tie, and the gods often manifest themselves by possessing the priest or other members of the clan susceptible to trance experiences.

In a category by itself is the figure of a supreme deity that occurs in the beliefs of many, though by no means all, primitive tribes. This deity, usually associated with the sky, is to some tribes a more or less otiose figure, whereas other tribes attribute to him the power and also the will to intervene decidedly in the affairs of men. Among the Munda tribes this high god is identified with the sun; the Ho of Bihar worship him as Sing-bonga ("sun-spirit") and the Bondo of Orissa as Singi-Arke ("sun-moon"), whereas many tribes speaking Aryan and Dravidian languages, *e.g.,* Bhil and Gond, refer to the supreme deity by the Sanskrit name Bhagavan. The idea that this deity is the source of the life principle animating human beings has wide prevalence, and so has the belief that the supreme god recalls the life-giving force and thereby causes men's death. There is no sharp dividing line between the human and the divine, however, and many tribes worship clan ancestors as figures of supernatural powers. Even the recently deceased are sometimes likened to gods and believed to exert their beneficial influence on the living.

Many tribal populations consider the relationship between men and gods as so intimate that a mediation of priests or seers can be reserved for special occasions. Food gatherers, such as Chenchu and Kadar, have no priests, and every individual can approach the gods directly. But where a settled style of life has led to the establishment of more permanent groups, priestly functions are performed by religiously gifted persons and those with a hereditary responsibility to represent the group in all dealings with the deities of the locality or clan. At this stage psychic gifts, and particularly the ability to bring about conditions of trance and spirit possession, predestine persons for the task of seers and shamans. Seers acting as shamans are also considered capable of entry into the land of the spirits and of exerting their influence on such spirits as may have caused disease or other misfortune. There is widespread belief that a vocation to the role of shaman is due to an initiative on the part of supernatural powers that impose on a person the task of acting as a mediator between the world of humans and that of the spirits. Yet, nowhere among tribal populations exists an organized priesthood. Village and clan priests, seers and shamans all till the land like any other tribesman and perform their ritual practices in addition to their normal economic pursuits. There is no tribal society where priests are supposed to concern themselves with the moral conduct of their fellow tribesmen. They are mediators between men and supernatural beings but are neither the guardians nor the interpreters of a moral code. In pursuance of their task of discovery into the causes of misfortune and illness they may indicate how to placate an offended deity or to drive off a demon of disease, but they do not occupy themselves with the philosophical problem of good and evil.

All tribes of the subcontinent have some ideas regarding the survival of one or several elements of the human personality after death. There is a widespread belief that life in the land of the dead is a reflection and repetition of life on this earth, and though the manner of death may influence a person's fate in the next world, there is little trace of the Hindu idea that merit or demerit acquired in this life determines the manner of existence after death. Whereas Hinduism has favoured the survival of archaic tribal

beliefs, Islam has overlaid and displaced most of the earlier practices and ideas. Only in areas, such as Kafiristan, where Islam, although now the official religion, is of comparatively recent introduction, do some of the indigenous religious ideas survive; *e.g.*, traces of a cult of mountain gods and a female deity of the chase. To the pre-Islamic period belong also such elements as the wooden grave effigies still found in some areas of Kafiristan.

With the improvement of communications and the spread of a centrally organized education, many of the features of tribal cultures are declining in both states of the subcontinent, but there is, on the other hand, a new consciousness of the value of local cultural traditions and achievements, and where tribes form compact blocks of population tendencies to conform with the customs of the politically and economically dominant populations are counteracted by the tendency to play on tribal sentiment in order to obtain support for the pursuance of political aims. The cultural diversity of the subcontinent thus persists in the face of the general modern trend to uniformity in material goods and ways of living. *See* also *The People* and *Population* sections of INDIA and PAKISTAN. (C. v. F.-H.)

IV. ARCHAEOLOGY

A. STONE AGE

The Indian subcontinent falls into a number of clearly marked geographical regions, many of which correspond to modern cultural or linguistic entities with their own well-established historical traditions. Such differences extend back in time and they are more marked and have changed less than in many other parts of the world, perhaps because the geographical regions are so well differentiated. Two such regions are the great river basins of the Indus and the Ganges, the former with the ancient cities of Mohenjo-Daro and Harappa dating from the 3rd millennium B.C., and the latter with such cities as Varanasi (Benares) and Patna which go back into the 1st millennium B.C. Both these river plains contrast strongly with the hill and forest region of central India, an area of isolation and cultural stagnation where tribal groups who practise shifting cultivation and augment their economy by hunting and collecting wild vegetable foods have persisted into the 20th century. Further major cultural regions are formed by the eastern and western coastal plains of peninsular India, and by the Deccan plateau, all of which may be further subdivided.

Discoveries relating to India's prehistoric past occurred sporadically from the early 19th century, but it was only after 1863 that Robert Bruce Foote began any sort of systematic research. The Government Archaeological survey, which came into being in 1862 as the result of continued efforts by Gen. Alexander Cunningham, was from the start primarily concerned with the monuments and inscriptions of the historical period, and it was only after 1922, with its excavations at Mohenjo-Daro and Harappa, that it made any major contributions to prehistoric research, which until 1945 remained mainly the province of amateurs and foreign university expeditions.

Bruce Foote termed the major cultural periods Paleolithic, Neolithic and Iron Age, in line with European terminology. During the first half of the 20th century attempts were made to find cultural subdivisions of the Paleolithic corresponding to the Lower, Middle and Upper Paleolithic and Mesolithic of Europe and the Mediterranean world. Since Indian independence a great deal of work has been done in the field of prehistory (relatively less in Pakistan) by both the archaeological department and by the universities, and this fourfold division of pre-Neolithic cultures has proved somewhat misleading. Three major cultural periods prior to the Neolithic revolution are now generally recognized and these are known either as Early, Middle and Late Stone Age, or Early, Middle and Late Paleolithic. For the purpose of this article the terms Early, Middle and Late Stone Age will be used.

It is remarkable that no human or hominid remains have yet been found in association with either Early or Middle Stone Age industries in India. They have however been found at Late Stone Age occupation sites in western India and in Ceylon (*see* CEYLON: *Archaeology*) and in numerous Neolithic and post-Neolithic sites.

The Early Stone Age.—This is represented in India by a hand-ax industry which closely parallels those of Europe, western Asia and Africa, and clearly forms part of the same major cultural tradition. The industry has been found in the earlier of two major Pleistocene aggradation deposits on many of the large rivers of western and central India and the northern Deccan. It has also been found widespread in southern India, both in river gravels and on the surface. The tools are commonly made of quartzite and the main types are the hand-ax (fig. 1 [A]), the cleaver (fig. 1 [B]) and the discoid or ovoid (fig. 1 [C]), all of which may be made on either large flakes or natural nodules of stone such as river pebbles. The proportion of cleavers is higher than it is in European hand-ax industries but similar to those of Africa, with which the Indian industry has close affinities on technological grounds (*see* AFRICA: *Archaeology*). The proportion of discoids and ovoids is probably higher than elsewhere and these form one of the peculiarly Indian features of the industry. It has not yet been possible to work out a chronological series of developments within the hand-ax tradition as it has in Europe and parts of Africa.

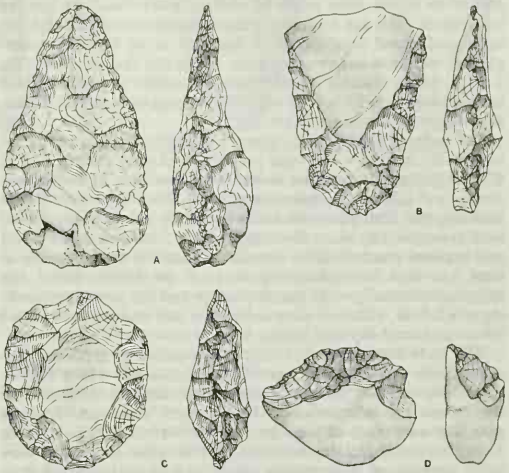


FIG. 1.—INDIAN EARLY STONE AGE TOOLS: (A) HAND-AX; (B) CLEAVER; (C) DISCOID; (D) CHOPPING TOOL

Throughout India tools known as "choppers" and "chopping-tools" have been found alongside those of the hand-ax industry. These are unifacial or bifacial (fig. 1 [D]) and are generally made of river pebbles, such as have been found to accompany and to precede hand-ax industries in many parts of the world. In the northwest of India and Pakistan, along the Himalayan foothills, these tools appear to be relatively more numerous than elsewhere, and they have been described as a separate industry, known from the river terraces where first they were discovered as Soan. Whether they do in fact represent a separate industrial tradition or simply a different aspect of the same tradition, related perhaps to a different series of human activities, was not clear by the early 1960s, nor had their exact time relationship to the hand-ax industries been established.

The Middle Stone Age.—Traditions of stoneworking during this period are clearly a development of those present in the Early Stone Age. As in the European Mousterian and the African Middle Stone Age, the emphasis is more and more upon making tools from flakes struck from carefully prepared cores by the Levalloisian technique, and there is a general reduction in the size of tools. Middle Stone Age industries are found in the second of two Pleistocene aggradation deposits on many of the rivers in northern Deccan and in central and western India which also contain Early Stone Age tools in the first aggradation phase. They are notably absent from the rivers of northern Gujarat, where these flow in fairly close proximity to the Sind desert.

The Middle Stone Age industries show a considerable range of

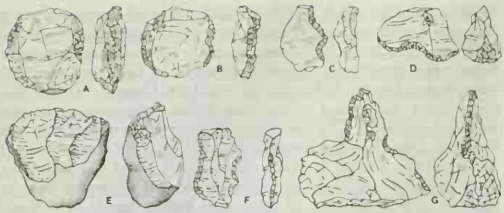


FIG. 2.—INDIAN MIDDLE STONE AGE TOOLS: (A) UTILIZED TORTOISE CORE; (B, C, D) FLAKE SCRAPERS; (E) BLADE-FLAKE CORE; (F) UTILIZED BLADE-FLAKE; (G) BEAKED TOOL

variation both in space and time, and a considerably wider range of raw material than the Early Stone Age. In general they consist of flake tools made from flakes struck from cores (fig. 2 [A, E]), prepared in such a way as to yield either round or elongated flakes, and often struck from prepared striking platforms. By far the commonest tools are scrapers; points are extremely rare and undeveloped; hand axes appear to drop out in all but the earliest phases; awls and borers made from flakes are characteristic (fig. 2 [G]), as are discoids which frequently consist of round utilized cores and seem to have been used as chopping tools or adz blades, as do some of the larger flakes.

The reduced size of tools strongly suggests that they were intended for hafting. The high proportion of scrapers (fig. 2 [B, C, D, F]) suggests a culture in which woodworking figured prominently, and taken in conjunction with the absence of stone points indicates that their place was taken by missile points of hard wood such as are used by many hunting people in southeast Asia. Local and regional characteristics became emphasized in the course of time. In their later phases the tools of the Middle Stone Age industries became greatly reduced in size and the secondary working much finer, although basic techniques and tool types remained unchanged until the Late Stone Age.

The Late Stone Age.—This is characterized by small parallel-sided blades and geometric microliths. Industries which contain both these elements in varying proportions are widely distributed throughout the subcontinent. In the north and west the tools generally were made of some kind of chalcedonic silica, which has a regular conchoidal fracture like flint or glass and which may be in the form of semiprecious stones such as agate, carnelian or bloodstone. In the extreme south and east and in Ceylon, quartz was often employed.

Although the new techniques made their appearance all over India, the Middle Stone Age traditions were not entirely swept away and a proportion of miniature discoidal cores (fig. 3, [F]) and flakes is found alongside the newer forms. A Late Stone Age assemblage almost always includes a proportion of lunates, sometimes with other geometric forms such as triangles and trapezes (fig. 3 [B, C, D, J]); scrapers of several kinds including hollow scrapers with small concavities (fig. 3 [E]); utilized flakes and blades; backed blades; awls or borers (fig. 3 [I]) which sometimes resemble those of the Middle Stone Age in miniature form; characteristic blade cores (fig. 3, Nos. [A, G]); and core-trimming flakes. Burins of any kind are extremely rare (fig. 3 [H]).

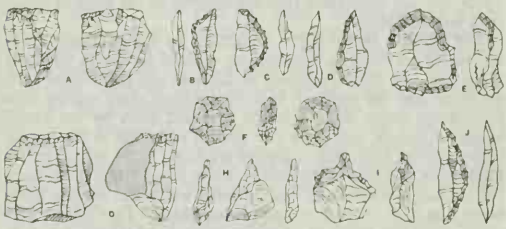


FIG. 3.—INDIAN LATE STONE AGE TOOLS: (A, G) BLADE CORES; (B, C, D, J) GEOMETRIC MICROLITHS; (E) SCRAPER; (F) DISCOID; (H) GRAVER; (I) BEAKED TOOL

The impression of continuity is increased by the fact that in the south the same factory sites were used by both Middle and Late Stone Age craftsmen. The change was a far-reaching one, however, for the advent of microliths clearly indicates a revolution in hunting methods and probably the introduction of the bow and arrow. For the first time in India man lived in caves where they were available. Each cultural region had its characteristic Late Stone Age industry and its own blend of old and new techniques, with a general tendency for Middle Stone Age traditions to linger rather more in the south than in the north.

Rock Art.—Rock paintings and bruisings are associated with the Late Stone Age, Neolithic and later cultures in many parts of India. In central India, where many of the numerous caves and rock shelters were inhabited by Late Stone Age man, paintings predominate. They were executed in various shades of orange, red or purple on the walls and ceilings of rock shelters, often in great profusion. They depict hunting scenes in which men with bows and arrows, and sometimes spears, pursue or surround large herds of antelope; long lines of male and female dancing figures with linked hands; animal-headed human figures; erotic scenes; and in one case horse-drawn chariots being ambushed by men with spears and bows and arrows like those of the hunters. Paintings of a similar nature have been recorded in other parts of India. The rock paintings and bruisings of Neolithic and later age in south India are also noteworthy, and the dominant subject is the humped bull. Less common are scenes depicting animals of the chase, antelope and deer, human figures (sometimes dancing) including a man (or perhaps a god) with a long staff; and in a later series spear fighters, horsemen armed with axes, and even elephant riders also occur.

B. Neolithic-Chalcolithic Cultures

Pre-Harappan Cycle.—There appears to be an interval of several millenniums between the first food-producing settlements at Jericho or Jarmo and those of India. Geographical factors may be invoked to suggest the main lines of contact across the Iranian plateau. One such line followed the Makran coast and the eastward-trending valleys of southern Persian and Pakistan Baluchistan; another line ran north of the great Iranian desert and via the southern foothills of Afghanistan toward Kandahar and Quetta. In discussing the Neolithic-Chalcolithic cultures of the subcontinent the Indus civilization provides at once a climax and a central point. The remaining cultures are dealt with in two parts: first, Pre-Harappan for those which appear before the Indus civilization and which therefore provide the cultural background for it; and second, Post-Harappan for those cultures which arose during or after the Indus civilization and which may be said, however indirectly, to have arisen from it.

As is to be expected, the Pre-Harappan cycle has so far only been found in those parts of the subcontinent that adjoin the Iranian plateau. It must be emphasized that comparatively little work has been done in any of this area and further excavations may well push back the date of the earliest settlements. In the Quetta valley of north Baluchistan, which has long acted as a focal point on the routes between the Indian subcontinent and Iran, the earliest settlements, dated by radiocarbon, appear during the 4th millennium B.C. To the north and east, in the Zhob and Loralai valleys, analagous sites have been reported, and south of Quetta in Kalat there is evidence of a similar sequence. In the south of Baluchistan there is as yet no firm evidence of the beginning of settlement. Two groups of painted pottery have been isolated there, largely overlapping at the sites where they have been collected, but no satisfactory excavation had been done in this area by the early 1960s. Probably the earlier is that named after type sites at Nal and Nundara, and the later after sites at Kulli and Mehi. Farther east, on the foothills of the Kirthar range and the edge of the Indus plains, a third important group of sites known as Amri is found. This perhaps derives ultimately from the north (Quetta region), but it also has affinities with the pottery of Nundara. The importance of the Amri sites is emphasized by their discovery in the Indus valley itself and the stratified occurrence of Amri-type sherds (pottery fragments) under Harap-

pan at several sites. Thus, whatever may be the origin of the Indus civilization, the Amri culture is in places replaced by it.

So little is known of the cultural equipment of all these early settlements that great caution must be exercised in describing them. As well as pottery they were probably equipped with a typical Neolithic blade industry and with tools of copper and perhaps of bronze. Certainly during this period humped cattle and sheep were kept and some sort of agriculture practised, possibly linked to irrigation from surface drainage tanks.

At about the middle of the 3rd millennium the sites are overlain by Harappan settlement. The Indus civilization is fully dealt with in a separate article.

Post-Harappan Cycle.—While the Indus civilization was flourishing, a Neolithic-Chalcolithic way of life spread far beyond the areas in which the Pre-Harappan cultures are found. It may well be that this spread was linked in some way with increasing economic stimuli from the Indus. It is only since about 1940 that knowledge of these cultures has come to light and the information available is often rather uneven. It is necessary to consider the sequence in different regions separately. The earliest culture so far dated is that of north Mysore. There a series of Neolithic settlements appeared before the close of the 3rd millennium B.C.

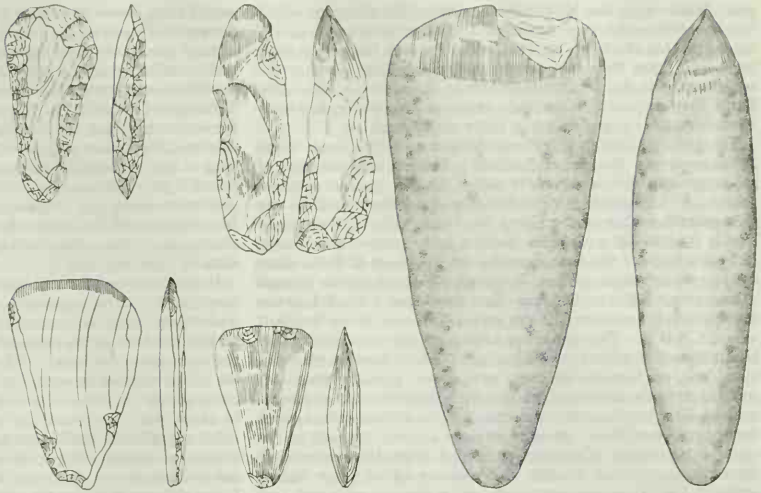


FIG. 4.—REPRESENTATIVE AX TYPES AND RELATED FORMS FROM INDIAN NEOLITHIC STONE TOOLS

The culture was apparently largely pastoral and bones of humped cattle, sheep and goats are found in the settlements. The "ash" or "cinder" mounds of Bellary were in 1957 shown to be burned out cattle pens of the Neolithic period. The potter's craft was well developed but the wheel was not used. The predominant pottery was plain gray or buff ware, with smaller quantities of burnished red and black ware, sometimes painted in purple. Surviving tools are almost entirely of stone: a typical Neolithic blade industry occurs with many small blades and a small proportion of lunates and geometric forms, and a ground stone ax industry producing tools with predominantly oval sections (fig. 4). Finds of pottery and tools indicate an extension into south Mysore and eastward to the coast. Sometime after the middle of the 2nd millennium B.C. this culture was augmented with new traits from farther north. In Maharashtra and the north Deccan there is another series of sites which may rather be called Chalcolithic. They occur on the upper reaches of the Godavari river and its tributaries. The earliest pottery has strong resemblance to that of Mysore, but it is soon replaced by a distinctive ware heavily painted in purple on a light slip (*c.* 1800 B.C.). About 1500 B.C. a new wave brought further distinctive pottery, often wheel-made, with many spouted pots and channel spouts. In this area there was a similar Neolithic blade industry, but copper flat axes, reminiscent of the Indus valley types, are found alongside rare stone axes. A similar sequence is found on the Narmada river where extensive excavations have been made at the ancient site of Maheshwar. There a blend of Maharashtran and more northerly influences is seen, and radiocarbon dates of between 1500 and 1300 B.C. have been revealed. There too a heavily painted white slipped ware appears in the lowest levels. Other sites appear in the Malwa plateau where a comparable Chalcolithic sequence is beginning to emerge. In the Kathiawar peninsula there is evidence of local Chalcolithic culture in contact with the Harappan stations which were established there and a slightly different sequence has been discovered. It thus appears as if in the regions mentioned above these Neolithic-Chalcolithic cultures were flourishing during the period of the Indus civilization. Whether any are actually Pre-Harappan has still to be investigated.

It is probable that further work in Rajasthan will reveal a comparable sequence of Post-Harappan sites. In the Ganges-Jumna (Yamuna) doab evidence is still very slight but a number of copper hoards containing flat axes and distinctive harpoons have been discovered which may be assigned to the Post-Harappan period. Eastward, in the hills and forests of central India, there is evidence of an extension of some sort of Neolithic groups. In the 1960s they were known only from finds of stone axes in Banda and Mirzapur districts, and in Chota Nagpur where they appear to have come in contact with a separate eastern Neolithic influence which is found also in Assam and Bengal and has its origins apparently in the Neolithic of south China and southeast Asia. This chapter of India's prehistory is still obscure, but ground stone axes are found even in Early Historic sites in the Ganges valley and must have persisted long in areas of isolation.

C. Later Prehistory

The Indo-Aryans.—Although occasional objects of bronze are reported in many sites of the Post-Harappan cycle, the introduction of anything comparable to the Bronze Age of Iran and the middle east into India has always been associated with the arrival of Indo-European speaking tribes, often referred to as Aryans. In the Punjab the first signs of an intrusion are in the Cemetery H at Harappa where urn burials of a new kind accompany pottery suggesting Iranian parallels of *c.* 1700 B.C. In Sind at Chanhu-Daro and Jhukar a different pottery associated with distinctive stone and copper "button seals" and spiral-headed pins, also with Iranian affinities, must indicate another movement of about the same date. A number of stray finds of bronze weapons, notably a bronze sword or dirk from Fort Munro in the Baluch foothills, also indicate intrusions from the west and the Caucasus. The centuries following 1700 B.C. must have witnessed several such movements, for this was a time of great upheavals in Iran. Which of these various intrusions may be associated with the tribes of the Rigveda is a problem that in the early 1960s had still to be solved. There have been several suggestions that the Vedic Aryans may have entered India in the 14th–12th centuries B.C. By the end of the millennium another intrusion is attested in Sind where coarse gray pottery from Jhangar indicates a break with earlier potting traditions. In the north a line of sites can be followed down the now dry Ghaggar valley into Rajasthan and thence to the Ganges-Jumna doab. The Painted Gray pottery which makes its appearance at these sites is found at places associated with the

great Indian epic, the Mahabharata, which tells of a war which has been estimated from historical traditions to date to *c.* 850 B.C. Probably the tribes who made the Painted Gray ware were using iron from their first arrival in India. Their pottery and settlements are the direct forerunners of those of the succeeding Early Historic period, when Indo-Aryan settlements spread eastward down the Ganges valley to Bihar and Bengal.

The Painted Gray ware settlements have so far not been found in the northwest frontier of Pakistan. There a different type of predominantly red pottery with many Iranian features was revealed in 1958 which is probably related to the period of the Achaemenidae when under Cyrus the Great (559–529 B.C.) and Darius I (522–486 B.C.) these districts came under Iranian rule. Although coins of the Achaemenidae are very rare in India there are many other signs of their influence. Throughout the Ganges valley, about 500 B.C., the gray ware developed a black lustrous surface which has earned it the name Northern Black Polished ware or N.B.P. This fine ware continued in vogue during the Mauryan period when the archaeological record from north India is suddenly augmented with many new items. Coinage, which occurred first in the northwest under Achaemenid stimulus as punch-marked silver bars became commoner, both in a silver and a copper currency. Inscriptions appeared in three scripts: Aramaic in the extreme northwest, Kharosthi developed from the Aramaic in the same region and Brahmi, the ancestor of all later Indian scripts. The first stone monuments and sculptures appeared, and many fine craft traditions in working gem stones, making terracotta figurines, etc., have been found (*see* also INDIAN ARCHITECTURE; INDIAN ART).

South Indian Iron Age.—The date when ironworking reached south India is unknown, and although some scholars have proposed dates as late as the 3rd century B.C., it is probable that it took place during the second quarter of the 1st millennium B.C. Widespread remains of this Iron Age culture are found throughout the peninsula, particularly in the form of megalithic graves. These include several types of stone cist, sometimes with oriented "port holes"; burials in small pits and caves; and burials in large urns and sarcophagi of pottery, sometimes with animal legs and heads. Nearly all the graves contain grave goods including distinctive black and red pottery, sometimes with scratched owners' marks, and a range of iron tools; sometimes also objects of copper or bronze and items of jewelry are found. The iron tools belong to a regularly recurring range of types. Flat iron axes with iron cross band hafting, iron swords and knives, sickles, tridents, tripods, and lamp brackets and lamps are particularly common.

Comparatively little is known of the settlements of the period, as research had till the 1960s been mainly directed to the graves. The culture continued to flourish until the opening of the Christian era, when already the names of the main Tamil kingdoms of the south are known and when the Sangam age witnessed the flowering of a remarkable civilization with a highly developed literature. At this time also trade contacts with the Roman and Mediterranean world, which had been developing under the Ptolemies, reached its climax, and quantities of Roman coins have been found in south India. (B. AL.; F. R. A.)

V. HISTORY

A. ANCIENT HISTORY

The invasion of India by Aryan tribes from the northwest inaugurates the historical period proper. The oldest literary document of India was composed in the period immediately following this event, when the invading tribes were still battling in the Punjab and the adjacent regions for possession of the land. The date of these events can be reached only by approximate calculations. The close linguistic connection between Vedic Sanskrit and the ancient Iranian language of the Avesta argues against too long a period of separation, and the literary and linguistic evolution of Sanskrit between the earliest hymns of the Rigveda and the period of Buddha and Mahavira (which can be dated *c.* 500 B.C.) indicates a considerable period, but definitely not the millenniums in which the age of the Vedas is sometimes reckoned. A period of 600 years or at most 700 years from the earliest compositions of the Veda to the end of the Vedic period, about 500 B.C., is most commonly assumed. Behind this and at least some centuries earlier, since the early documents do not speak of it, lies the invasion, or rather the series of invasions, *c.* 1500 B.C. onward. The original home of the Aryans appears to have been southern Russia, from which they spread out in several directions. At a date roughly contemporary with that postulated for the beginning of the invasion of India, another group of Aryans is to be found in the near east ruling in the country of the Mitanni, where they were eventually absorbed into the native population. The Indo-Aryans and Iranians on the other hand moved eastward across the steppes, whence they proceeded to found their two great nations in India and Iran.

It has been pointed out that when the Aryans entered India they found it in the possession of peoples whose material civilization was in many respects superior to their own. The superiority of the invaders lay in political and military organization and in the technique of warfare. The Rigveda abounds in allusions to the bitter warfare between the invaders and the previous occupants of the country. Particularly numerous are the references to cities (*pur*) destroyed, the significance of which term was not fully appreciated until excavations unearthed the great Indus cities (*see* INDUS CIVILIZATION). At the same time, it is still not possible to say whether it was the Aryans who destroyed the Indus cities or whether the cities destroyed had succeeded those of the Indus. The Aryans themselves were a pastoral and agricultural people living mainly in villages and made no attempt to occupy the cities that they overcame; it was only centuries later, with the advance of civilization and prosperity, that the great historical cities of northern India began to arise.

The geographical horizon of the early Vedic period as depicted in the hymns of the Rigveda is fairly narrowly delimited. The centre was the Punjab, the land of the five rivers. To the west the frontier rivers (Gomal, Kurram, etc.) were known, and to the east Aryan tribes had settled on the Saraswati, a region which later counted as the most sacred land of Brahmanism. Mention of a battle fought on the banks of the Jumna against non-Aryan tribes indicates the easternmost point of Aryan expansion at that period. Over that country the consolidation of Aryan power was first completed, and it served as a base for the rapid occupation of the greater part of northern India in the succeeding centuries.

The later Vedic period, during which this process was achieved, may be placed between the 10th and 6th centuries B.C. The latest hymns of the Rigveda and also its final redaction date from the beginning of this epoch. The three other Vedas (sacred literatures of the Hindus), Sama-, Yajur- and Atharva-, follow closely in time (*see* VEDIC RELIGION). After them there arose a large body of explanatory and commentatorial literature, the Brahmanas (*q.v.*), devoted to the explanation of the sacred literature. Toward the close of the period the Aranyakas and, in particular, the Upanishads indicate a new philosophical approach and herald the beginnings of the intellectual revolution to come. None of this literature is devoted to history, and, though many rulers and their kingdoms are mentioned casually, it is rarely possible to fix their place in time. More information can be gathered from them about social and material conditions that prevailed in pre-Buddhist India. The famous *Purusasukta*, one of the latest hymns of the Rigveda, proclaims for the first time the basic principles of the caste system—the division of society into the four "colours" (*Varna*), Brahmana, Kshatriya, Vaisya and Sudra. The growth and increasing complication of this system is already apparent in the later Vedic texts and is progressively accentuated as the centuries go by.

Apart from the contemporary literature some information may be gathered from the great epic Mahabharata and the Puranas. The tradition of the former was founded in Vedic times, but since it was not established in its present form till 1,000 years later, it is not reliable as a detailed chronicle of events. The Puranas contain dynastic lists dealing with the major early kingdoms, which on the whole appear to be founded on sound tradition.

Moreover, the early Buddhist literature—particularly the Jatakas—contains many references to kings of the late Vedic period whose historicity seems to be established.

The general picture that emerges from all this material is that of the continued expansion of Aryan power; of the establishment of a series of permanent kingdoms or states which retained their identity throughout the period and later; and of a gradual shift of the centre of gravity toward the east. After the Rigveda the region of the Punjab faded into the background. The centre of Aryan power became the land of the Kurus with their capital (Hastināpura) near Delhi, with whom were closely associated the neighbouring Panchalas. It was there that the Brahman religion was finally consolidated, and it was there also that classical Sanskrit, which was to become the national language of India for 2,000 years, was evolved. It was the centre of an empire of the Kurus that was the chief political power in the early part of the period, its greatness being reflected after many centuries in the Mahabharata. Some of its rulers are mentioned in contemporary literature, and a list is provided by the Puranas. Like its successors, the empire crumbled and vanished, so that a proverb current in the later Vedic period asked "What became of the descendants of Pariksit?"

Aryan expansion from that centre proceeded in two main directions and is reflected in the much wider geographical nomenclature of the later Vedic texts. The advance was steadily continued down the Ganges valley, and stable kingdoms arose in Kosala, Videha, Kasi and other centres. Magadha remained longer outside the Aryan pale, but a powerful dynasty was installed there by the end of the period. This expansion was associated with a shift of power to the east, and the later Vedic texts indicate that kingdoms of Kosala and Videha had replaced the Kurus and Panchalas as the most important centres of political power. Another road of expansion led southwest to Avanti (capital Ujjayini, modern Ujjain) and thence to the ports of the west coast, where trade with the near east was early established. It is probable that writing was first introduced into India by this route toward the close of the Vedic period. To the south the Asmakas, Vidarbhas and allied tribes crossed the Vindhya mountains and established Aryan rule in Maharashtra at an early date.

Kosala and Magadha.—Toward the close of the 6th century B.C. the Vedic period reaches its close in the face of the rise of new religions and ideologies which transformed the intellectual climate of the country. Gautama Buddha (*q.v.*) and Vardhamana Mahavira (*see* MAHAVIRA, VARDHAMANA JNATIPUTRA) stand out among many teachers and reformers as the founders of religions that have survived to this day (*see* BUDDHISM; JAINISM). Because of the interest that believers took in the lives of these two leaders, the history of India is for a short time illuminated by more than usual information.

The various states (*mahajanapadas*) which had been established in late Vedic times are enumerated in the Buddhist literature, and at that period there appears a tendency for the smaller to be incorporated in the greater. The most important states of the time were the eastern monarchies of Kosala and Magadha, which were not only the political centres of India at the time but also the homes of the new religious and intellectual ferment which was affecting the country. To the southwest lay the kingdom of the Vatsas ruled by Udayana, later to become famous in Indian legend, and to the southwest again Avanti (*q.v.*) was ruled by Pradyota the Fierce, a powerful and ruthless king. To the northwest the Kuru and Panchala countries maintained their identity, and on the extreme northwest of the Indo-Aryan territory lay the kingdom of Gandhara, soon to be incorporated, together with Sind, into the Persian empire. To the north of the Magadhan and Kosalan kingdoms lay a series of aristocratic republics (Licchavis, Sakyas, etc.), from among which the founders of the new religions sprang.

The kingdom of Kosala (capital Sravasti), at that time ruled by Prasenajit, roughly a contemporary of Buddha, had already incorporated the older kingdom of Kasi, which in Vedic times had existed as an independent and powerful kingdom. To the north the expansive tendencies of the Kosalan kings tended to reduce the neighbouring republican tribes to the state of vassals. More important in the long run was the neighbouring kingdom of Magadha, whose expansion, already evident at that period, was destined to create the most extensive empire that ever held sway in ancient India. About 600 B.C. a new dynasty in that kingdom had been founded by Sisunaga, and a successor of his, Bimbisara (*c.* 550–490), held sway in the time of Buddha. He is represented as busily engaged in extending the frontiers of his kingdom, his most important acquisition being the annexation of the kingdom of Anga to the east. Bimbisara was followed by his son Ajatasatru, who attained the throne by murdering him. Ajatasatru pursued his father's policy of expansion with the conquest of Videha and adjoining territories to the north. On the other hand, a war against Kosala seems to have been indecisive. Ajatasatru also founded a royal residence at Pataliputra (modern Patna), which was to become the premier city of northern India for centuries afterward. For the next century information from Buddhist and Jaina sources is almost completely lacking. From the *Puranas* it appears that the dynasty founded by Sisunaga continued to rule in Magadha, and it is clear that this was a period of imperialist expansion, since when light again appears in the middle of the 4th century Magadha has outclassed all its rivals and emerges as the premier power of northern India. At that time the old dynasty was overthrown, and a usurper, Nanda, occupied the throne. At the time of Alexander III's invasion of India (327–325) the major portion of the Ganges valley was under Nanda's dominion, and the occupation of considerable territories in the south appears attested by native tradition. The Magadhan army consisted of 200,000 soldiers and a corresponding number of elephants, horses and chariots.

The Mauryas.—The dynasty of Nanda was short-lived. Chandragupta Maurya (*q.v.*), assisted by the Brahman Vishnugupta, or Chanakya, and by allies from the northwest of India, overthrew the sons of Nanda and established himself in Pataliputra (*c.* 321 B.C.). Once established, Chandragupta proceeded to expand the empire in every direction. The territories of the northwest conquered by Alexander were occupied by him, and in 305 Seleucus Nicator found it advisable to cede to him all the Indian territories up to Afghanistan in return for a treaty and a gift of 500 elephants. Chandragupta died *c.* 296 and was succeeded by his son Bindusara, about whom little is known though it is clear from the result that he was successful in the expansion and consolidation of the empire.

Bindusara's son Asoka (*q.v.*) (274–237 or perhaps 232) was the greatest and most celebrated of all Indian rulers. Of Asoka's reign we are well informed in his own edicts, which are engraved in stone in various parts of his vast empire, particularly in the frontier regions, so that an accurate idea of its boundaries can be gained. It is clear that the whole of India except the Tamil south was under the direct control of the Mauryan empire. Asoka himself undertook only one campaign of conquest, that of Kalinga (Orissa and the region to the south); afterward, distressed by the slaughter and misery involved, he renounced further ideas of conquest and devoted himself to the promotion of righteousness. He became an earnest adherent of Buddhism, and in his reign, if not at his instigation, a great council was held in Pataliputra to establish the tenets of the Buddhist religion and the organization of its members. Buddhist missionary activity dates from that period, and Asoka's own son Mahendra (Mahinda) is credited with the conversion of Ceylon.

The Mauryan empire did not long survive Asoka. A number of his successors are mentioned in the Puranas and Buddhist literature, but it is not clear whether they reigned successively over the whole empire or over parts of it as it began to disintegrate. Finally, *c.* 185, Pushyamitra, commander in chief of the last Maurya, assassinated his master and founded the Sunga dynasty (185–72 B.C.). Pushyamitra was an opponent of the Buddhists, and a growing Brahmanical reaction dates from that time. His empire seems to have been considerable, though not on the Mauryan scale, but it was progressively weakened under his successors. The last Sunga met the same fate as the last Maurya, and after him a short-lived Kanva dynasty held sway in the

north until about 28 B.C. From then till the rise of the Guptas no power of importance arose among the native kingdoms of northern India.

Foreign Invasions, 180 B.C.—A.D. 200.—The fall of the Mauryan empire was followed by two major developments in the political history of India. On the one hand, there arose in the Deccan a new imperial power, the Andhras, known also by their family name of Satakarni, or Satavahana. Northern India, on the other hand, was subjected to a series of invasions from the west—by Greeks, Sakas, Parthians and Kushans—which constituted the major political pattern for the next three centuries.

The empire of the Andhras arose on the ruins of the Maurya empire and provided a unitary rule for the greater part of the Deccan for nearly three centuries. The earlier rulers were engaged in conflict with the Sungas and Kanvas, and the destruction of the latter dynasty is attributed to them. The period of their greatest power and influence came later, in the 2nd century A.D., when under the rulers Gautamiputra Satakarni (*c.* A.D. 100–130) and Vasishthiputra Pulamayi (*c.* 130–155) they were successful in guarding the Deccan against foreign invasion. The last great Andhra ruler was Yajnasri (*c.* 166–195). By the 3rd century the Andhra empire was replaced in the Deccan by a series of minor kingdoms, Ikshvakus, Salankayanas, etc.

The Andhras were noted as patrons of Prakrit literature, and it was under them that the Maharashtri Prakrit was elevated to the status of a literary language. An anthology attributed to the Andhra king Hala is all that now remains of this literature. The *Brhatkatha* of Gunadhya, written in a different Prakrit (Paisaci), was also a production of the Andhra period. In the religious field Buddhism prospered under the Andhras, and Nagarjuna, the great propagator of Mahayana Buddhism, flourished under their patronage.

Contemporary with the early Andhras, the kingdom of Kalinga came into prominence for a short time during the reign of Kharavela, who in a famous inscription left a detailed account of his reign. The kingdom, at that time a home of Jainism, was clearly powerful enough to compete with the Andhras and to overrun the weakened states of northern India, but after Kharavela complete darkness descended upon it, and it must be assumed that the growing power of the Andhras led to its eclipse.

The fall of the Maurya empire was followed immediately by the first of a series of foreign invasions from the northwest. Such invasions were not new. The empire of the Achaemenids had embraced the provinces of Gandhara and Sind, and, after destroying the Persian empire, Alexander had invaded India to subdue those provinces which owed allegiance to the Persian kings. But these invasions had not penetrated farther than the northwestern corner of India; the greater part of the country had been left untouched, whereas the invasions that followed penetrated deeply into northern India and prevented the emergence of any formidable indigenous power in the region as long as they lasted.

The first of the new invaders were Greeks from the kingdom of Bactria, which had established itself in the eastern part of Alexander's empire. Early in the 2nd century Demetrius II, the Greek king of Bactria, crossed into India and carried all before him. He occupied the country as far as Pataliputra, which he besieged, and had he not been recalled by treachery at home he might have achieved what Alexander failed to accomplish. As it was, Pushyamitra gradually asserted himself against the Greeks in northern and central India, and Greek rule was confined to the region of the Punjab where their most famous ruler was Menander (*q.v.*), whose name is perpetuated in a Buddhist work (*Milindapanha*) in which a teacher expounds the doctrines of his faith to the Greek king. After Menander's death the Greek kingdom lasted into the early part of the 1st century B.C. but was gradually weakened by the onslaughts of the Sakas, or Scythians. The Greek invasions were not without effect in the cultural field. In sculpture there arose in Gandhara a school operating almost entirely under Hellenistic inspiration. In science Indian astronomy is notably indebted to the Greeks, from whom it has borrowed some of its technical terms. But on the whole the influence was short-lived, and in the long run little remained.

The Sakas, moving from their central Asian home, brought about the downfall of the Greek kingdom of Bactria and followed the Greeks in the invasion of India. About 80 B.C., under their ruler Maues, or Moga, they appeared in control of the Punjab, and under his successor they were firmly established in Muttra. Closely associated with the Sakas were the Parthians (in Sanskrit, Pahlava), who eventually established some kind of suzerainty over them. Their most powerful ruler in India, Gondophares (*q.v.*), achieved fame in Christian legend, since it was under his rule that the apostle Thomas is said to have gone to convert India.

A later group of Sakas established itself in Ujjayini, and it is possible that the Saka era (A.D. 78 *ff.*; *see* CHRONOLOGY) was founded on that event. Inscriptions record Ysamotika and Cashtana as early rulers of this dynasty, and they still bear Iranian names; later they were progressively Indianized, and by A.D. 150 Rudradaman, in a famous inscription, speaks as a purely Hindu monarch. The dynasty lasted till the close of the 4th century, when it was destroyed by the Guptas.

The most powerful of all the invaders of the period were the Kushans, a people known to the Indian tradition as Tukhara (Tokharians) (*see* YUE-CHI). Their early wanderings in central Asia are recorded by the Chinese historians; they appear on the Indian scene when the first Kushan dynasty under Kujula Kadphises (Kozulokadphises) and Vima Kadphises (Ooemokadphises) established itself on the borders of India in the 1st century A.D. Their greatest figure is Kanishka (*q.v.*), founder of the second Kushan dynasty. Inscriptions show that the whole of northern India, at least as far as Benares (Varanasi), was subject to Kanishka, and in addition to this his empire included considerable stretches of central Asia. He was a great patron of Buddhism, and the fact that his empire combined the central Asian area with India contributed as much as any other single factor to the spread of that religion throughout Asia. Kanishka's recorded successors are Huvishka and Vasudeva, after whom, early in the 3rd century, the Kushans recede into obscurity.

The Guptas and Classical India.—The 3rd century may be taken as the beginning of the classical age of Indian civilization. The series of foreign invasions in the preceding period had in no way interfered with the cultural life of the country. On the contrary it had been one of the most creative periods in Indian history, and during that time literature, art, science and philosophy had gradually evolved the form that they were to retain, in the main, through the succeeding centuries. The foreign rulers were on the whole eager to adopt and patronize the native culture and by doing so contributed materially to its advancement.

After a period in which no major power appeared on the scene and of which the political history remains comparatively obscure, a new and successful attempt at empire-building was begun in the 4th century by the Guptas, a dynasty originating in the same part of India as the imperial Mauryas. The accession of Chandra Gupta I (*q.v.*) (320) marked the beginning of their greatness, and from that date the Gupta era was founded. The great conqueror of that dynasty was Chandra Gupta's son Samudra Gupta (*q.v.*). The details of his career were engraved by his minister Harishena on an Asokan pillar at Allahabad, from which he is seen as the main founder of the Gupta empire.

The campaigns of Samudra Gupta soon resulted in the incorporation of the major part of northern India in the Gupta empire. In the east the kingdoms of Nepal and Assam and in the northwest the tribes of the Punjab paid him tribute. To the south Samudra Gupta undertook an ambitious campaign down the east coast, advancing as far as Kanchi to defeat the early Pallava king Vishnugopa. The son and successor of Samudra Gupta, Chandra Gupta II Vikramaditya (*q.v.*), further expanded the empire by the conquest of the Saka kingdom of Ujjayini and the surrounding territories (Malava, Aparanta). Under him the Gupta empire reached the zenith of its power and splendour. His reign coincides also with the golden age of Sanskrit literature. Indian tradition relates that nine literary notables, including the poet Kalidasa, resided at the court of Vikramaditya.

The Guptas, unlike the Mauryas, did not seriously attempt to incorporate southern India in their dominions. The successful

campaign of Samudra Gupta was more in the nature of a raid than an organized plan of conquest. The chief power in the Deccan at the time was the Vakataka kingdom, with whom the Gupta kings found it politic to maintain friendly relations. These relations were strengthened by matrimonial alliances, and the agreement between the two powers seems to have continued throughout the period.

At the very end of the long reign of Kumara Gupta I (*c.* 414–455) mention is made of serious trouble in the northwest, and for the first time the Hephthalites (*q.v.*), or White Huns, appear on the Indian scene. Under Skanda Gupta (455–470) the empire was successfully defended against the impending dangers and the Hephthalite invasions were postponed for nearly 50 years.

After Skanda Gupta the imperial period of the Guptas came to an end, though the family continued to rule with lessened authority for some centuries. At first the empire was split up, with a western centre at Ujjayini and an eastern at Pataliputra. At the same time new dynasties began to arise. In the west a general of the Guptas established at Valabhi the Maitraka dynasty, which was to reign with distinction for several centuries; in the north, at Kannauj, the Maukhari dynasty grew into a formidable power.

In these circumstances the Hephthalites finally succeeded in making a successful invasion and conquering a considerable part of northern India. In 510 Toramana overcame all opposition and penetrated deeply into India. His son Mihiragula maintained this supremacy, until toward the end of his reign a successful campaign by the Gupta Baladitya drove the Hephthalites from eastern India. In 533 in western India Yasodharman, a prince of obscure origin, was successful in re-establishing Hindu supremacy.

In the following century a successful though short-lived attempt at empire-building was undertaken by Harsha (Harshavardhana) of Thanesar (606–647). In a series of campaigns he established himself as the dominant ruler of northern India, but against the powerful Chalukya kingdom of the south he was unable to make any impression. Harsha was a great patron of letters and himself an author of Sanskrit dramas. At his court lived Bana, one of the most famous of Sanskrit authors, and it is to his pen that we owe an account of the youth and early career of Harsha. Harsha was also favourably inclined toward Buddhism, and it was during his reign that the Chinese pilgrim Hsüan Tsang (*q.v.*) visited India. The account that Hsüan Tsang left of his travels is one of the most valuable documents for the history and civilization of the time.

Dynastic Rivalries, 650–1200.—After the death of Harsha northern India was again divided into a large number of separate states. An attempt by Yasovarman of Kannauj, early in the 8th century, to build a northern Indian empire was shattered on his defeat (736) by Lalitaditya of Kashmir. Gradually two main powers arose in the north. In Bengal the Pala dynasty established itself in the middle of the 8th century and reigned till the 12th. The Palas were noted as supporters and protectors of Buddhism at a time when in the rest of India it was giving way to Hinduism. They were followed by the Senas, who after a short but culturally brilliant period of rule were uprooted by the Muslims. In the western portion of northern India a new series of rulers—the Rajputs—came into prominence then. Their origin remains somewhat obscure, as does that of the Gurjara tribe, which appeared then for the first time in Indian history and provided in the Gurjara-Pratihara dynasty the leading power of the period. Tradition relates that the four leading Rajput families, Paramara, Chahamana, Pratihara and Chaulukya, originated in a sacrificial fire at Mount Abu; modern historians, with little direct evidence, have seen in them the descendants of the various foreign invaders of India.

By the 8th century the power of the Gurjara-Pratiharas was consolidated under Nagabhata I, and he was successful in repelling (740) the further advance of the Muslim invaders, who in 712 had occupied Sind. The supremacy of the Gurjara-Pratiharas in northern India continued for two centuries, and during that period they maintained a successful front against further Muslim encroachment. They were also in recurring conflict with their main Indian rivals, the Palas of Bengal and the Rashtrakutas of the Deccan. In the latter part of the 10th century the Gurjara supremacy was destroyed, and northern India was again split up into a multitude of small and warring principalities. Among these dynasties mention may be made of the Chaulukyas of Gujarat (*c.* 950–1300), the Paramaras of Malava (Bhoja, 1010–55), the Chandellas and Kalachuris of central India and the Chahamanas of Rajputana. In those circumstances the task of the Muslim invaders was made easier especially because the native powers, who had little inkling of what was in store for them, were more interested in pursuing their own private quarrels than in combining against the invader. In 1001 Mahmud of Ghazni (*see* below) made himself master of the Punjab and from that centre carried on a series of devastating raids against northern and western India. The final debacle did not come until nearly two centuries later. In 1192 Prithwiraj, the Chahamana ruler of Delhi, was defeated and slain in a decisive battle, and in a few years from that date the whole of northern India was engulfed by the Muslim flood.

In the south the period saw the consolidation of two main centres of political power, one centred in the Deccan and covering the Maratha (Mahratta) and Kanarese areas, the other in the south centred in the Tamil country. After the end of the rule of the Vakatakas the Deccan came again under unitary rule by the rise of the early Chalukyas (*q.v.*; 543–757). Pulakesin I established his capital at Vatapi (Badami), where it remained, and under him the Chalukyas acquired the status of a great power. The most powerful ruler of this dynasty, Pulakesin II (608–642), extended his territory in all directions and in doing so came into conflict with both Harsha in the north and with the Pallavas in the south. From the latter he acquired territory on the east coast around the mouth of the Krishna and Godavari, where a junior branch of the family continued to rule for several centuries (Chalukyas of Vengi). Successful during most of his reign, he was finally defeated and slain in conflict with the Pallavas. In spite of this the Chalukya kingdom continued to flourish under his descendants, until power was wrested from them by the Rashtrakuta (*q.v.*) family (757–*c.* 975). The Rashtrakutas organized their state on strongly militaristic lines, and their history consists mainly of aggressive campaigns against their northern and southern neighbours. In these they were predominantly successful, and in northern India in particular their attacks contributed not a little toward the weakening of those states in face of the coming Muslim invasion. Toward the end of the 10th century the Chalukya family again won mastery of the Deccan, and its second phase of rule, centred this time at Kalyani (Hyderabad state), continued for about 200 years (*c.* 975–1189). After the fall of this dynasty a series of smaller kingdoms—the chief of whom were the Yadavas of Deogir (1187–1312) (*see* DAULATABAD), the Hoysalas (*see* HOYSALA) of Dorasamudra (Dvarasamudra) and the Kakatiyas of Warangal (till 1425)—partitioned their territories. As in the north, no great imperial power remained in the Deccan to meet the Muslim attack.

In the extreme south the three Tamil kingdoms—Chola, Pandya and Chera—which had for long maintained an independent existence together with an indigenous Dravidian culture, were overshadowed by the Pallavas, a dynasty of northern origin. The Pallavas are first noticed in the 3rd or 4th century in Prakrit inscriptions in Kanchi, where they were established as successors of the Satavahanas, but it was not until the latter part of the 6th century, under Simhavishnu, that they acquired the status of a great power. Under Mahendravarman I (600–630) and Narasimhavarman I (630–660) the Pallavas reached the height of their power and prosperity. In the south they were without rivals, and to the north they maintained a successful front against the contemporary Chalukya power. Under their rule northern culture penetrated in a greater degree to the south, and in particular the Shiva and Vaishnava religions attained in that period the predominant position in the Tamil country which they still held at mid-20th century.

The Pallava power continued till toward the close of the 9th century, when it was replaced by a new empire, that of the Cholas (*q.v.*). One of the three ancient Tamil dynasties, the Cholas had

long subsisted as vassals of the Pallavas, but during that period they were able not only to assert their independence of the Pallavas but also to replace them as the new imperial power of the south, with such success that they achieved for a time a dominion wider than anything seen under the Pallavas. Under the kings Rajaraja I (985–1014) and his son Rajendra (1014–44) the Cholas reached the height of their power. They not only controlled the whole of southern India and Ceylon but also were able to send a military expedition as far as the Ganges and to defeat the Pala king of Bengal. They were, moreover, the greatest naval power of the time, and under Rajendra a successful naval expedition was dispatched to Malaya and Indonesia.

Toward the close of the 12th century the Chola supremacy became seriously weakened and under Kulottunga III (*c.* 1180–1216) the rival Pandya dynasty asserted its independence. With the accession of Sundara Pandya (1251) the Pandyas replaced the Cholas as the premier dynasty of the south, but their triumph was short-lived because early in the next century (1310) the Muslim invader appeared in southern India and inaugurated a new epoch. (T. Bw.)

B. The Muslim Period

The Arab conquest of Sind in A.D. 712 was merely an episode in the history of Arab expansion, for although Hajaj, the viceroy of the eastern provinces of the caliphate, was an imperialist, Sind was not rich enough nor sufficiently well placed strategically to serve as a base from which the Arabs could extend their rule over the rest of India. Moreover, the difficult nature of their line of communications through Baluchistan and the decline of the central government prevented the dispatch of adequate reinforcements. In India, as in Europe, the 8th century witnessed the end of the wave of Arab expansion, and it was not until Islam had been firmly established in the area corresponding to modern Afghanistan that the Muslim conquest of India became possible.

Mahmud of Ghazni.—With the decline of the effective power of the Abbasid caliphate independent Muslim dynasties had arisen in Persia, Afghanistan and Turkistan. So far as India was concerned the most important of these was the Yamini, or Ghaznevid, dynasty founded by Turkish slaves in the mountainous regions surrounding Ghazni. It was under their ruler Subuktigin (977–997) that they first began to raid into northern India. At that time large tracts of the Punjab and the Kabul valley between the Chenab river and Lamaghan acknowledged the rule of the Hindushahiyyas under Raja Jaipal, but he proved no match for Subuktigin, who wrested from him the country between Lamaghan and Peshawar. The most famous of the Ghaznevids was Mahmud (*q.v.*; 971–1030), whose empire at its greatest extent stretched from the frontiers of Mesopotamia to the Ganges river and from Transoxiana to the deserts of Rajputana. Authorities differ as to the extent of his expeditions into India and also as to their number, which is varied between 12 and 17. As a result of these expeditions he destroyed the power of the Hindushahiyyas, annexing all their territories between Lamaghan and the Chenab; captured the famous fort of Nagarkot in the Kangra valley and the stronghold of the heretical Karmatians of Multan; and seized Bhatinda, which guarded the route to the Ganges valley. Mahmud was therefore an Indian ruler only in a very limited sense, for his Indian conquests were confined to the Punjab, which became a frontier province of his extensive empire. But his plundering incursions carried him as far afield as the Jumna-Ganges doab and the coast of Kathiawar. The most famous of his expeditions was that across the desert from Multan to the temple of Somnath, which housed a huge Hindu idol in the form of a lingam, or phallus, that was washed daily in water brought by runners from the Ganges. It was served by 1,000 Brahmans and 600 musicians, dancers and attendants, who were supported by the offerings of innumerable pilgrims and by the revenues of 10,000 villages owned by the temple. Mahmud with iconoclastic fury razed the place to the ground, and no fewer than 50,000 Hindu devotees are said to have laid down their lives in defense of their deity. Mahmud was a zealous upholder of Islam, an ardent warrior against idolaters and a stern persecutor of heretics, particularly those who were politically as well as doctrinally dangerous. So far as India is concerned the importance of his career is that by his systematic policy of plunder and massacre he shattered the economic strength of northern India and paved the way for its final subjugation by later Muslim invaders.

Delhi and the Sultanates.—Mahmud's descendants were driven from Ghazni by a rival Muslim power, the Shansabanis of Ghor, and forced to take refuge in the Punjab. Mohammed of Ghor (*q.v.*), the ablest of the Shansabani sultans, departed from the policy of predatory incursions and resolved to conquer northern India. The expulsion of the Ghaznevids from Lahore in 1186 was followed by several years of warfare, culminating in the defeat of the Hindu forces of Rai Prithwiraj of Delhi at the final battle of Taraori (Tara'in) in 1192, after which northern India almost as far as the gates of Delhi was annexed. The work of conquest was completed by Mohammed's generals, who subjugated the Gangetic doab and overran Bihar and Bengal. After Mohammed's assassination by Muslim heretics in 1206, his general, Qutb-ud-Din Aibak, founded the dynasty known as the Slave kings of Delhi (*q.v.*). Thus was established the sultanate of Delhi, which lasted until Babur laid the foundations of the Mogul empire in 1526. During that period Hindustan was ruled by five successive dynasties: (1) the Slave dynasty (1206–90); (2) the Khaljis (1290–1320); (3) the Tughluqs (1320–1413); (4) the so-called Sayyids (1414–51); and (5) the Lodis (1451–1526).

Of the 33 sultans of Delhi, few deserve to be remembered. The work of Aibak was completed by Iltutmish (1211–36), who ruthlessly crushed internal revolts, reannexed Bengal, conquered Sind and, toward the end of his reign, advanced through Malwa to the Narmada river. His death was the signal for dissensions which, together with Mongol raids across the northwest frontier, prevented the consolidation of Muslim power, and it was not until the reign of Balban (1266–87) that the sultanate became powerful again. Balban's time was fully occupied with the suppression of rebellion, which gave him little opportunity for entertaining ideas of fresh conquests. It must be remembered that throughout the 13th century the Muslim hold on Hindustan was extremely precarious. In fact, it was a military occupation effective only in the neighbourhood of Muslim garrisons and military forces. Because of the numerical inferiority of the invaders and the vastness of the country large areas had necessarily to be left in the hands of Hindu chiefs, who probably were the dominant factor in the situation.

Balban's successors were worthless, and power passed to the Khaljis, the ablest of whom was 'Ala ud-Din (1296–1316). His short reign was characterized by oppressive regulations designed to crush the Hindu chiefs and prevent rebellion. His demand for one-half of the gross produce of the land as revenue impoverished the peasantry and he has therefore been condemned as a ruthless tyrant, but the necessity for consolidation called for stern measures. He not only restored order but conquered the Hindu kingdom of Gujarat and stormed the Rajput fortresses of Ranthambhor and Chitor. It is recorded that before the sack of Chitor (Chittorgarh) its defenders performed the horrible rite of *jauhar* and immolated their wives and daughters to save them from dishonour. The Khalji period is important because it marks the beginning of Muslim penetration across the Narmada into the Deccan and southern India. At that time the chief Hindu powers to the south of the Narmada were the Yadavas of Deogir, the Kakatiyas of Warangal, the Hoysalas between the Krishna and the Cauvery and the Pandyas of Madura and the far south (*see* above). No united front was presented to the invader and 'Ala ud-Din's general, the eunuch Malik Kafur, easily penetrated to the extreme south of the peninsula, plundering the principal cities and temples. There was a fundamental difference between the Deccan policy of the Khaljis and that of their successors, the Tughluqs: Khalji policy was not one of occupation, whereas the Tughluqs aimed at permanent conquest.

Under Mohammed ibn Tughluq (1325–51) the sultanate attained its greatest extent and in the year 1330 stretched from Madura to the borders of Kashmir. Mohammed's removal of the capital from Delhi to Deogir and his attempt to rule over the

whole of India from the Deccan was doomed to failure, for no strongly centralized government was possible until the development of communications in the second half of the 19th century. Mohammed has been eulogized as a cultured dreamer and denounced as a bloodthirsty tyrant. An attempt to whitewash his character has been made by those who refuse to accept the contemporary evidence of travelers like Ibn Batutah and historians like Zia ud-Din Barni, but he appears to have been guilty of revolting cruelties which would be unpardonable in any age. Toward the end of his reign the sultanate began to decline. Madura broke away as early as 1334. By 1341 Bengal had been lost. In 1347 the whole of the Deccan, except Khandesh in the Tapti valley, was formed into an independent Muslim kingdom under the Bahmanis. His successor, Firuz Shah (1351–88), made little attempt to recover these possessions, and after his death Malwa, Jaunpur and Gujarat refused to acknowledge the suzerainty of Delhi, and the whole of northern India relapsed into anarchy. This was the state of affairs when Timur (Tamerlane) crossed the Indus toward the end of 1398. His invasion, which lasted until March 1399, was merely a large-scale raid, and his depredations and ruthless massacres were confined to the vicinity of his line of march through the Punjab to Delhi. Its chief result was to intensify the existing anarchy. From Timur's visitation to the establishment of the Lodi dynasty in 1451 no regular government existed, since the authority of the so-called Sayyids was confined to a small area around Delhi.

The Lodis were Afghans, or Pathans, with a tribal conception of sovereignty, the sultan being merely the most powerful of the tribal leaders. Bahlul, their first ruler, fully realized his position, but the attempt of his successors, Sikandar and Ibrahim, to revert to the autocratic methods of Balban and 'Ala ud-Din Khalji estranged their followers and produced rebellions which weakened the sultanate and paved the way for the Mogul conquest of Hindustan. Moreover, northern India was hopelessly divided, since independent Muslim states had arisen in Sind, Multan, Gujarat, Malwa, Khandesh and Bengal. Another outstanding feature of the 15th century was the growing strength of the Rajputs in the deserts of Rajputana, where they had taken refuge after their defeat in the days of Mohammed of Ghor. In the Deccan the Bahmani (*q.v.*) kingdom had resolved itself into five independent Muslim sultanates: (1) the Nizam Shahis of Ahmednagar; (2) the Adil Shahis of Bijapur; (3) the Kutb Shahis of Golconda; (4) the Barid Shahis of Bidar; and (5) the Imad Shahis of Berar. To the south of the Krishna and Tungabhadra rivers stretched the mighty Hindu empire of Vijayanagar (*q.v.*). Founded on the ruins of Chola power, it reached its greatest extent under Krishna Deva Raya (1509–29), and it was not until 1565 that the Muslim kingdoms of the Deccan combined to overthrow this last stronghold of Hinduism.

The Mogul Empire.—Babur (*q.v.*), the founder of the Mogul, or Mughal, dynasty, was descended from Timur and Genghis Khan, the two great scourges of Asia. He records in his famous *Memoirs* that his chief ambition was to recover the vast territories which had once formed part of Timur's mighty empire. In this he was thwarted by Shaibani Khan, ruler of the Uzbek tribes of Turkistan. Ousted from his ancestral dominions in central Asia, he was eventually forced to take refuge in the mountain fastnesses of Kabul, which served as a convenient base for his attacks upon India. In April 1526, after a series of preliminary raids, he routed the forces of Ibrahim Lodi on the historic field of Panipat, where the fate of India has so often been decided. This victory has long been regarded as resulting from the extensive employment of artillery, but there is neither textual nor circumstantial evidence to support this contention. In the following year at Khanua he overwhelmed the Rajput confederacy under Rana Sanga of Mewar, and by 1529 he had overrun Bihar. At his death in 1530 he controlled the greater part of northern India. His son Humayun succeeded to a troublesome charge, for the Afghan chiefs had been only temporarily crushed and it cannot be said that Babur had consolidated his power in Hindustan. Moreover, Humayun, an opium addict, lacked the energy necessary for the completion of Babur's task. After years of desultory warfare he was defeated by an extremely able Afghan rebel named Sher Shah and was forced to seek asylum in Persia in 1544. Sher Shah proved himself a capable general and an able administrator during his short reign of five years, but under his successors anarchy supervened and gave Humayun the opportunity to attempt the reconquest of his lost dominions. Humayun succeeded in recapturing Delhi and Agra in 1555 but died in the following year. His importance lies in the fact that he was the father of Akbar, who, at the second battle of Panipat, in 1556, defeated the forces of a Hindu usurper called Hemu and re-established his dynasty in Hindustan. Panipat may therefore be termed a decisive battle, for there had been no Mogul empire before Akbar, only the attempt to create one.

Akbar (*q.v.*) (reigned 1556–1605) was undoubtedly the greatest of the Mogul emperors. For the first five years of his reign his kingdom was restricted to the Punjab, Ajmer, Gwalior, the basin of the Ganges and Jumna and the country between the Gumti and the foothills of the Himalaya. A further 15 years of incessant warfare resulted in the annexation of the whole of northern India with the exception of lower Sind. Between 1586 and 1601 he extended his rule over Kashmir, Baluchistan, Kandahar, Khandesh, Berar and parts of Ahmednagar and Orissa. At his death in 1605 his empire comprised 15 provinces, or *subas*, and stretched from Ahmednagar in the Deccan to Kabul and Kashmir in the north.

As far as his Hindu subjects were concerned, Akbar's policy was one of conciliation, for he realized that it was impossible for him to rule as a strictly orthodox Muslim sovereign whose duty it was to spread the Islamic faith. He therefore abolished the *jizya* (the hated poll tax on non-Muslims) and the taxes which had previously been levied on Hindu pilgrims. For the same reason he sought to obtain the active support of the Rajput chiefs and enlisted Hindus in his armies and in the imperial service. At the same time his conception of sovereignty was autocratic, and this led him to crush the ulema, a religious body of Muslim doctors and scholars which constituted a check upon his powers. Although genuinely interested in the study of comparative religion and inclined to toleration, his religious policy appears to have been to a very great extent secondary to dynastic and political considerations. A further basic principle of his administration was to demand no more than one-third of the gross produce from the peasant, for he was convinced that the stability of his empire depended upon an equitable system of assessing and collecting the land revenue. The structure of the central government which he evolved, the elaborate checks upon the powers of the provincial governors, and his military organization testify to his administrative ability. It was only when his successors departed from the main principles of his rule that the empire began to decline.

His son Jahangir (*q.v.*; 1605–27) neglected the administration and was subservient to a selfish junta controlled by his favourite wife, Nur Jahan. The extravagant expenditure of the court was a serious drain on the financial resources of the country, and Jahangir was forced to make use of the accumulated cash reserves of his father. It was during his reign that the Persians recovered Kandahar. Important European evidence on the prevailing conditions is contained in the *Remonstrantie* of the Dutch factor Francisco Pelsaert and in the *Journal* of Sir Thomas Roe, the first English ambassador to the court of the Great Mogul. Jahangir is chiefly remembered for his self-revealing *Memoirs*, from which it appears that he was a drunken despot subject to outbursts of fiendish cruelty.

He was succeeded by his son, Shah Jahan (*q.v.*), who had an almost insatiable passion for building. Not content with erecting a new capital city at Shahjahanabad he enriched the world's store of beauty by many other buildings, outstanding among which are the Moti Masjid and the Taj Mahal, both at Agra. His reign was also a period of great literary activity while the arts of painting and calligraphy were not neglected. That the splendour of the Mogul court reached its zenith under Shah Jahan must not blind one to the fact that he set in motion influences which finally led to the decline of the empire. His expeditions against Balkh and Badakhshan and his attempts to recover Kandahar brought the

empire to the verge of bankruptcy. Moreover, unlike Akbar, he displayed a religious bigotry surpassed only by his more orthodox successor, Aurangzeb. In 1657 Shah Jahan fell ill, and in the civil war that ensued between his sons Aurangzeb defeated Dara Shikuh at the battle of Samugarh in 1658, after which he assumed the imperial title and imprisoned his father in the fort at Agra until his death in 1666.

The political and religious intolerance of Aurangzeb (*q.v.*; 1658–1707) was the chief cause of the decline of the empire. Puritanically orthodox and extremely bigoted, he departed from Akbar's conciliatory policy toward the subject Hindu population. It is significant that during the war of succession he claimed the throne as the champion of orthodox Islam against the heretical principles and practices of his brother Dara Shikuh. As soon as he assumed power, the *kalima*, or Muslim confession of faith, was removed from all gold and silver coins lest it should be trampled underfoot or otherwise defiled by unbelievers. Censors of morals were appointed to suppress unorthodox practices. Courtiers were forbidden to salute in the Hindu fashion. Hindus were excluded from public office, their schools and temples were destroyed and the detested poll tax was reimposed. Aurangzeb subjected the Sikhs of the Punjab to persecution and put their religious leader, or guru, to death because he refused to embrace Islam. This transformed the Sikhs from a sect of quietists into a brotherhood of fanatical soldiers opposed to Muslim rule. The result was that the Rajputs, Jats and Sikhs of the north and the Marathas of the Deccan under their famous leader Sivaji raised the standard of revolt.

Under Aurangzeb's revenue policy pressure on the peasant was increased by raising the revenue demand to one-half of the gross produce. The writings of contemporary European travelers contain frequent references to absconding peasants and untilled soil which lead one to infer that the mass of the population must have lived dangerously near the subsistence level. The uncontrolled oppression of a selfish bureaucracy, for Mogul administration was bureaucratic not feudal, had led to a steady impoverishment of the agricultural classes, the most important revenue-producing part of the population. The general result of all this was a decay in all branches of the administration accompanied by a corresponding economic decline.

It is true that during Aurangzeb's reign the empire attained its greatest extent and, after the annexation of Bijapur and Golconda, stretched from the Hindu Kush to the Coromandel coast. But his policy of expansion in the Deccan and his attempt to rivet his authority on the whole of India was a military and political miscalculation. Apart from the fact that disturbances created by the Rajputs and Jats in the north prevented him from concentrating all his forces in the south, Aurangzeb found it impossible to enforce an unpopular despotism over distant southern provinces where the physical features of the country favoured guerrilla warfare at which the Marathas were peculiarly adept. Not only did the expansion of his empire during the second half of his reign produce financial exhaustion but it also proved fatal to its solidarity. Consolidation had not kept pace with conquest. Nothing is more noticeable than the corrupting effect of the possession of India upon its conquerors. From the middle of the 17th century there had been a marked deterioration in the character of the Mogul aristocracy. The younger sons of the nobility had grown effeminate in the harem where, surrounded by eunuchs and low-born favourites who pandered to their desires, they became familiar with degrading forms of vice from an early age. All authorities agree as to the decay of the army as a fighting machine. It must also be remembered that the Mogul empire was an alien government. Drawing no strength from ancient tradition or popular support, it depended upon the efficiency of its military forces and the ability of the emperor and his chief advisers. When Aurangzeb died in 1707, he had failed to crush the Marathas of the Deccan and his authority was disputed throughout the length and breadth of his dominions.

One of the fundamental weaknesses of Muslim rule was the absence of any definite rule of succession. This resulted in fratricidal conflicts. The death of Aurangzeb was no exception to the general rule. An internecine struggle ensued between his three surviving sons, the eldest of whom was eventually successful and proclaimed himself emperor with the title of Bahadur Shah. A man of 64 when he began to reign, he possessed neither the ability nor the energy to restore the declining fortunes of the empire. The successors of Bahadur Shah were wretched puppets controlled by favourites and court factions. Between the death of Bahadur Shah in 1712 and the accession of Mohammed Shah in 1719, five puppets were successively installed on the throne of Delhi. To understand the reason for this rapid succession of feeble rulers some knowledge of the prevailing factions is essential. The two chief parties struggling for power were the Turanis, who were immigrants from the country to the north of the Oxus (Amu-Darya), and the Iranis from Persia who, though less numerous, were noted for their administrative ability. Opposing these two foreign factions were the Hindustanis or Indian Muslims, either converts or descendants of former immigrants. These rivalries had been kept in check before 1707 but in the early years of the 18th century they grew in intensity and must be reckoned as one of the causes of the downfall of the empire. During the reign of Mohammed Shah (1719–48) able adventurers rose to power and provincial governors laid the foundations of independent dynasties. Nizam ul-Mulk, the Mogul viceroy in the Deccan, founded the state of Hyderabad. From a Muslim adventurer, Ali Vardi Khan, descended the nawabs of Bengal, while the kings of Oudh sprang from Saadat Ali Khan, the Mogul governor of that province. It was during this reign that the Marathas of the Deccan overran Malwa, Gujarat, Bundelkhand and parts of Rajputana and made repeated incursions into Bihar and Bengal. Maratha historians have contended that this expansion was prompted entirely by religious motives, the chief of which was the desire to protect their co-religionists in northern India from Muslim persecution. This ignores the economic factor, for the Marathas were aggressive and predatory and their peshwas realized that the Deccan was too poor to form the centre of an empire. In 1737 they even defeated an imperial army outside the walls of Delhi. Eventually the emperor was forced to come to terms. To make matters worse, northern India was invaded by Nadir Shah of Persia, who in 1739 defeated the emperor's forces at Karnal, about 20 mi. N. of the historic field of Panipat. A popular uprising in Delhi in which several hundred Persian soldiers lost their lives was the signal for an indiscriminate massacre of the inhabitants of that city, after which, in the words of the contemporary chronicler, "the streets remained strewn with corpses, as the walks of a garden with dead flowers and leaves." Nadir Shah made no attempt to annex northern India to his empire and was satisfied with the acquisition of vast booty, which included the famous Peacock throne of Shah Jahan and the Koh-i-Nor diamond. Apart from this, the chief result of Nadir's expedition was to intensify the existing anarchy and accelerate the decline of the empire. Foreign invasion was not so much a cause of the downfall of the Mogul empire as symptomatic of a decline that had already taken place.

After the death of Mohammed Shah the Marathas overran almost the whole of northern India from the Narmada river to Peshawar in the vicinity of the Khyber pass. They were gradually driven southward from the Punjab by Ahmad Shah Durrani, who had risen to power as ruler of the turbulent Afghan tribes of Kabul and Kandahar. Between 1747 and 1769 he led no less than ten invasions into Hindustan. The Marathas had to face a formidable coalition of the northern Muslim chiefs, who joined forces with the Afghan invader. They also had to fight without the assistance of the Rajputs and other Hindu powers, whom their revolting cruelties and extortionate demands had estranged. Eventually they were crushingly defeated by Ahmad Shah Durrani at the third battle of Panipat in 1761. This victory had far-reaching consequences. It enabled the nizam to recover his power in the Deccan and probably saved the state of Hyderabad from extinction. It proved to the Indian world that neither the Marathas nor the Mogul emperor could protect them from foreign aggression. Internal dissensions then seriously impaired the strength of the Marathas and power passed from the peshwa, or titular head of the confederacy, to the generals—Sindhia of Gwalior,

Holkar of Indore, the gaikwar of Baroda and the raja of Berar, or Nagpur. But the real importance of the Maratha defeat was that it granted the British the respite needed for the consolidation of their power in Bengal.

C. European Settlements

Portuguese Enterprise.—The quest for India by sea was begun by Portugal, the smallest nation on the Atlantic seaboard and the first of the European states to become consolidated. After more than 50 years of preliminary exploration by intrepid Portuguese mariners, Vasco da Gama rounded the Cape of Good Hope and anchored off Calicut (Kozhikode, *q.v.*) on May 20, 1498, the voyage from Lisbon having taken 10 months and 12 days. Friendly relations were established with the zamorin, or Hindu raja, of Calicut, but Pedro Álvares Cabral, the leader of the second expedition which reached India in 1500, quarreled with the zamorin and sought trading concessions from his rival, the raja of Cochin, with the result that Cochin, with its excellent harbour, became the first trading headquarters of the Portuguese in India. The first Portuguese viceroy was Francisco de Almeida (1505–09), a firm believer in the importance of sea power, who gained command of the sea in Indian waters by the destruction of the Arab-Egyptian fleet in 1509. It is important to note that the absence of timber on the shores of the Red sea, which prevented this fleet from being rebuilt, was one of the principal causes of the growth of Portuguese power in the east. Almeida's successor, Affonso d'Albuquerque (*q.v.*) (1509–15), believed that it was also essential to build fortresses on land and aimed at establishing a coastal empire based on the retention of important strategical positions. Since the carrying trade of the Indian ocean was in the hands of Arab merchants, he attempted to intercept this trade at its base. With this object he seized the island of Socotra and built a fortress at Hormuz which enabled him to control the mouth of the Red sea and the entrance to the Persian gulf. Realizing that a fortified base was essential for supremacy at sea, he captured Goa and thus obtained command of the trade with the Malabar ports. Because of its central position Goa became the capital of the Portuguese possessions in India. The conquest of Malacca in 1511 enabled him to control the valuable spice trade of the Malay archipelago. It was fortunate for the Portuguese that, during the critical years when they were establishing their power on the Malabar coast, the rivalry between the Muslim kingdoms of the Deccan and the Hindu empire of Vijayanagar prevented any effective resistance to their schemes. A policy of proselytization was also carried on successfully.

The Portuguese empire reached its greatest extent in the middle of the 16th century. Its existence depended upon the command of the sea in Indian waters. With the arrival of more powerful Dutch and English fleets in the first half of the 17th century, Portuguese power rapidly declined and Portugal lost its monopoly of eastern trade.

Dutch Enterprise.—The closing of Lisbon to Dutch vessels toward the end of the 16th century adversely affected their carrying trade, especially the pepper trade, and prompted them to trade directly with the spice islands of the archipelago. Their first expedition under Cornelis de Houtman reached Bantam in Java in 1595, one year and three months after leaving the Netherlands. A realization of the weakness of a system of separate voyages led to the formation in March 1602 of the United East India Company of the Netherlands. This powerful concern, with inscribed funds totaling £540,000, was granted a monopoly of trade and was empowered to maintain fleets and armed forces. The Dutch concentrated on establishing themselves in the archipelago, and their first governor general, Pieter Both (1609–14), established factories or trading posts at Bantam and Jacatra (*i.e.*, Jakarta, or Batavia). The most important of their governors general was Jan Pieterszoon Coen (1617–22), who was to the Dutch in the 17th century what Albuquerque had been to the Portuguese in the 16th. Intensely prejudiced against the English, Coen protested to the home authorities when his hands were tied by the Anglo-Dutch treaty of 1619 that amalgamated the two companies for a period of 20 years. In 1623 Herman van Speult, the Dutch governor of Amboina, executed 12 Englishmen whom he considered guilty of conspiracy. This lamentable occurrence, known as the massacre of Amboina, had important results, for from that date the English confined their activities to the mainland of India. After this the Dutch were not seriously challenged in the archipelago until Lord Minto's occupation of Java in 1811. Even in India the Dutch were the real successors of the Portuguese and established factories on the Coromandel coast, in Gujarat and in Bengal. The death blow to Dutch interests in India proper was Robert Clive's capture of Chinsura in Bengal in 1759. (*See* also Dutch East India Company.)

The English East India Company.—On Dec. 31, 1600, Queen Elizabeth granted a charter to the "Governor and Company of Merchants of London trading with the East Indies." Compared with the Dutch company already in the field this company was an insignificant body of private traders with inscribed funds amounting to only £30,133. For the first 12 years of its existence it was run as a regulated company, gradually developing after 1612 into a joint-stock concern.

The first two voyages, following the Dutch example, proceeded to the archipelago for pepper and spices. It was during the third voyage that the "Hector," commanded by William Hawkins, reached Surat on the Gujarat coast. Thence Hawkins traveled to the Mogul court at Agra, where for a time he became the boon companion of Jahangir but failed to obtain trading concessions. In 1611 the ships of Sir Henry Middleton reached Surat but met with a hostile reception, the result of Portuguese intrigues. In the following year Thomas Best anchored off the mouth of the Tapti, where he defeated a much superior Portuguese fleet, thereby increasing the prestige of his compatriots. Eventually, in 1613, an imperial firman granted permission for the establishment of a permanent English factory at Surat. The Portuguese persisted in their hostile attitude but in 1614 were again defeated, by four English vessels under Nicholas Dowton. One of Dowton's ships, the "Hope," which left India in March 1615, was the first English vessel to return to England with a cargo from India. In September of the same year Sir Thomas Roe arrived in India as the first English ambassador to the court of the Mogul emperor, where he created a good impression and obtained important privileges for his countrymen. By 1619 English trading posts had been established at Surat, Agra, Ahmedabad and Broach. Surat became the company's headquarters, with a president and council who controlled the other factories.

The island of Bombay formed part of the dowry of Catherine of Braganza when she married Charles II of England in 1661. Seven years later Charles handed it over to the company, reserving an annual quitrent of £10 as a mark of sovereignty. This payment appears to have lapsed in 1730. It was Gerald Aungier, governor there from 1670 to 1677, who first realized that Bombay was a more suitable base for English enterprise on the west coast than Surat, which suffered from the lack of a good harbour and was exposed to Maratha raids. Despite its foul climate, to Aungier it was "a city which by God's assistance is intended to be built." He laid the foundations of English justice, fixed the land revenue and established the first English mint in India. For its defense was raised the first European regiment in India, the Bombay Fusiliers. It was not, however, until 1687 that Bombay replaced Surat as the company's headquarters on that coast.

The first English settlement on the Coromandel coast was at Masulipatam (Masulipatnam) in 1611. In 1626 a subsidiary settlement was formed at Armagaon. In return for a substantial annual payment, permission was obtained in 1639 from the local Hindu ruler to build a fortified factory at Madraspatam. There in the following year Francis Day built Fort St. George, which developed into the company's headquarters on that coast. When the Moguls overran the area, the company's status remained unchanged except that Mogul sovereignty was acknowledged on its coins. Settlements were formed at Porto Novo and Cuddalore in 1681.

Because of the unhealthful climate of Cuttack in Orissa, where they had settled in 1633, the English moved to Hooghly in Bengal and obtained permission to build a factory there in 1651. To

protect themselves from the exactions of local rulers it was decided in 1681 to fortify the settlement. After an attack by the local Mogul governor, Job Charnock (who was in charge of the settlement) deemed it advisable to abandon the place for Sutanati lower down the river. Sutanati was temporarily abandoned in 1689 in favour of Chittagong, but in 1690 Charnock returned to Sutanati, where he laid the foundations of modern Calcutta (*q.v.*). The settlement was fortified in 1696 and renamed Fort William in honour of William III. In 1700 all the Bengal factories were placed under the control of a president, Sir Charles Eyre becoming the first president and governor of Fort William in Bengal.

Between 1600 and 1750 the company had to contend with serious difficulties both at home and abroad. Not only had it to withstand the attacks of rival European nations but, in England, its monopoly of eastern trade was the subject of much hostile criticism, which led to the formation of rival trading associations and to attacks by pirates or interlopers, for whose depredations the Indian coastal powers held the company responsible. Moreover, the anarchy which accompanied the decline of the Mogul empire placed the company's settlements at the mercy of semi-independent provincial governors and encouraged the Marathas to attack Surat. In 1698 the enemies of the company in England, with the consent of parliament, formed themselves into a rival company known as the "English Company trading to the East Indies." After much bickering the two companies came to an agreement in 1702 by which they were amalgamated into the "United Company of Merchants of England trading to the East Indies." This was the company which obtained territorial sovereignty in India and retained its possessions until the crown assumed control in 1858. Despite all these difficulties, in the first half of the 18th century the volume of India's overseas trade, which was chiefly an export trade, increased enormously. The most important exports were cotton and silk piece goods, cotton yarn and raw silk. An important change in its export trade was the decline of the spice trade, occasioned by the European demand for sweet in preference to spiced dishes and by the use of winter fodder for cattle to ensure a supply of fresh meat throughout the year. Bullion, particularly silver, was the principal import into India; next in importance came broadcloth, lead, copper, tin and quicksilver. (*See* also EAST INDIA COMPANY.)

The French Company.—It was not until 1664, in the reign of Louis XIV, that the Compagnie des Indes Orientales was formed. Between 1666 and 1690 French settlements were established at Surat, Pondicherry, Masulipatam, Chandernagore, Balasore and Kasimbazar (Cossimbazar); to these were added Calicut in 1701 and Mahé in 1721. Unfortunately the company became entangled in the financial schemes of John Law (*q.v.*) and suffered severely when the crash came in 1720. After this it was reorganized as the Perpetual Company of the Indies. By 1744 the chief European rivals for the trade of India were the English, Dutch and French. There were other European companies in the field, such as the Ostend company formally chartered in 1722, the Danish company re-established in 1729 and the Swedish company of 1731, but they cannot be regarded as serious competitors.

When news reached India in 1744 that England and France had become involved in the War of the Austrian Succession, an unsuccessful attempt was made by Joseph François Dupleix, the French governor of Pondicherry, to secure French interests in the east by a treaty of neutrality between the two companies. The arrival of an English squadron under Commodore Curtis Barnett, which swept French shipping from the seas and captured their China fleet, forced Dupleix to summon the comte Mahé de la Bourdonnais from Mauritius to his assistance. The death of Barnett and the timorous tactics of his successor gave the French command of the sea long enough to enable them to capture Madras. It was not until the arrival of Adm. Edward Boscawen with reinforcements, in April 1748, that the English recovered their power at sea. By the treaty of Aix-la-Chapelle (1748) Madras was restored to the English in exchange for Louisbourg, the capital of Cape Breton Island.

After 1748 an unofficial war gradually developed in southern India between the English and French companies. The death of Nizam ul-Mulk in 1748 was the signal for a struggle between his descendants for the viceroyalty of the Deccan, and the death of Anwar ud-Din produced a similar struggle for the nawabship of the Carnatic. While the French supported Muzaffar Jang for the viceroyalty of the Deccan and Chanda Sahib for the nawabship of the Carnatic, the English espoused the causes of Nasir Jang and Mohammed Ali. To relieve the pressure on Mohammed Ali, who was beleaguered in Trichinopoly (Tiruchirapalli), the English sent Robert Clive (*see* CLIVE, ROBERT CLIVE, Baron), one of their servants, to attack Arcot. Clive's capture of Arcot in 1751 and his successful defense of it against the forces of Chanda Sahib and his French allies proved the turning point in the struggle. Stringer Lawrence's defeat of the French before Trichinopoly and the capitulation of the French forces, together with Dupleix's failure to reverse this decision, meant the ruin of French schemes for controlling the Carnatic.

Muzaffar Jang, the French candidate for the viceroyalty of the Deccan, had been escorted to Hyderabad and Aurangabad by a French army under Charles de Bussy, the ablest officer in the service of the French. On the assassination of Muzaffar Jang, Bussy championed the cause of another claimant, Salabat Jang, who in Oct. 1751 granted to Dupleix and after him to the French nation, free of all tribute, the southern provinces of Arcot, Trichinopoly and Madura. This grant was rendered worthless by the English victories in the Carnatic. Bussy's expedition into the Deccan proved a fatal division of forces and a dissipation of military strength. The failure of Dupleix's ambitious plans for a French empire in India led to his recall in Aug. 1754, and, with the arrival of his successor, Charles Robert Godeheu, a provisional treaty was arranged which terminated the unofficial war between the two companies. The final struggle between the French and English was postponed until the outbreak of the Seven Years' War, in the course of which Eyre Coote defeated the French general Thomas de Lally at Wandiwash on Jan. 22, 1760. Pondicherry surrendered to a combined land and sea force in Jan. 1761.

D. British Ascendancy

Clive and Bengal.—The privileges enjoyed by English merchants in Bengal were based on an imperial firman of 1717, but this often proved valueless against the extortionate demands of semi-independent provincial governors and local officials. With the decline of Mogul power the nawabs of Bengal became practically independent of the central government. In 1756 the nawab Siraj-ud-Daula attacked and captured the English settlement at Calcutta. He incarcerated the prisoners in the notorious Black Hole, a military prison 18 ft. by 14 ft. 10 in. in size. Estimates of the number imprisoned vary from the 146 of the contemporary evidence to as low as 64. In the morning only 23, or perhaps 21, persons emerged alive. The chief reason for Siraj-ud-Daula's attack was the fear of foreign aggression. There was also much truth in his contention that the English had fortified their settlements in Bengal without his permission and had abused the trading privileges granted by the imperial firman of 1717.

To avenge this outrage Robert Clive and Adm. Charles Watson sailed to the Hooghly with a force from Madras. Clive easily recaptured Calcutta and forced Siraj-ud-Daula to sign a treaty confirming all the privileges which the English had formerly enjoyed. But it soon became obvious that the nawab had no intention of keeping his word and that he was intriguing with the French. Clive therefore decided to replace him with Mir Jafar, a person more favourably inclined to the English company. In this he was supported by the famous Hindu bankers the Seths, whom Siraj-ud-Daula had threatened with circumcision. On June 23, 1757, Siraj-ud-Daula's forces were easily defeated at the battle of Plassey. This victory was of supreme importance in the growth of British power in India, for, by making the British the *de facto* rulers of Bengal, it placed at their disposal one of the wealthiest parts of India, the resources of which were used to destroy the French power in the Carnatic. All European opposition in Bengal ceased with the repulse of a Dutch naval

expedition to the Hooghly and the capture of the Dutch settlement of Chinsura in 1759. In the following year Clive returned to England. His policy had been to strengthen the British position in Bengal and rule through a puppet nawab. His successor, Henry Vansittart, replaced Mir Jafar with Mir Kasim but made the mistake of strengthening the new nawab, who, from the beginning, asserted his authority and quarreled with the company over the question of the abuses connected with the internal trading of its servants. It cannot be denied that the company's servants and their native agents had been guilty of gross abuses and oppression. Mir Kasim has therefore been depicted by Indian writers as a great patriot solicitous for the welfare of his subjects. The important point to remember is that he was aiming at complete independence of foreign control and at reversing the decision of Plassey. Vansittart failed to realize this and adopted a conciliatory policy which encouraged the nawab in his designs. Exasperated by the attitude of Vansittart's colleagues who were opposed to the governor's policy, Mir Kasim perpetrated the horrible massacre of Patna in 1763, when 150 Englishmen were put to death in cold blood, a far more deliberate crime than the Black Hole of Calcutta. The defeat and flight of Mir Kasim was followed by the restoration of the more pliant Mir Jafar. A final attempt to oust the British from Bengal was made by Shah Alam, the titular Mogul emperor, and his nawab-wazir, Shuja ud-Daula, the ruler of Oudh, but they were crushingly defeated by Maj. Hector Munro at the battle of Buxar in 1764. This victory completed the work of Plassey. Henceforward the British were the unchallenged rulers of Bengal. This was the position when, in 1765, Clive returned to India as governor of Bengal for the second time. By the treaty of Allahabad (1765) he restored Oudh to Shuja ud-Daula, with the exception of the two districts of Kora and Allahabad, which were handed over to the emperor for his support. By a special agreement with the emperor the company was granted the diwani, or right to collect and administer the revenues of Bengal, Bihar and Orissa, in return for a promise to pay the emperor an annual tribute of 26 lakhs of rupees. Clive's foreign policy thus aimed at converting Oudh into a buffer state to protect the company's possessions from Maratha attacks. Clive left India in 1767 and for the next five years Bengal was governed by mediocrities.

Warren Hastings.—When Warren Hastings (*q.v.*) became governor of Bengal in 1772, the Mogul empire had resolved itself into conflicting factions. In the struggles of the nizam of Hyderabad, of Haidar Ali of Mysore and of the Maratha confederacy there was no idea of a balance of power in the European sense. Territorial aggrandizement and paramountcy in the Indian peninsula were the declared aims of the Marathas. Thus, the foreign policy of Hastings was to maintain intact the British possessions in India, threatened as they were during his term of office (1772–85) by the Marathas, by a formidable coalition of the country powers round the nizam of Hyderabad and by the arrival of a French armament in Indian waters.

By the treaty of Benares (1773) Hastings reversed Clive's policy. Because the emperor by this time had deserted the British for the Marathas, in whose hands he had become a puppet, Hastings refused to continue the payment of the tribute since this would have been tantamount to furnishing the Marathas with financial aid to facilitate their attacks on Bengal. For the same reason he reclaimed the districts of Kora and Allahabad, which were sold to the ruler of Oudh. In order to strengthen the northwestern frontiers of Oudh he assisted Shuja ud-Daula to conquer the Rohilla country. Because Clive's alliance with Oudh had been a financial drain, Hastings entered into a subsidiary alliance with that state whereby its ruler subsidized a British force for its protection. His relations with Oudh and his Rohilla policy aimed at strengthening an important buffer state upon whose security the safety of Bengal depended. Similar motives influenced him in an unsuccessful attempt to form a subsidiary alliance with the Maratha state of Berar, or Nagpur, which commanded the land route between Bengal and Madras. Had he been given a free hand he would have protected the British possessions by a chain of allies stretching from the Jumna to Gujarat. He would also have allowed the Indian states to ally themselves with the crown of Great Britain but was overruled. The remarkable thing is that he was able to accomplish so much during his 13 years of office for he was severely handicapped by the Regulating act of 1773, which, although making him the first governor general of Bengal, placed him at the mercy of a bare majority on his council. The Regulating act also allowed the subordinate presidencies of Bombay and Madras to act on their own initiative in cases of imminent necessity or where they had received direct orders from the home authorities. Bombay's interference in Maratha affairs, which had been encouraged by the court of directors in England, led to war with the Marathas; and the situation was retrieved only by the prompt action of Hastings, who dispatched Gen. Thomas Goddard against them. After the defeat of the Marathas by Goddard and the storming of Mahadaji Sindhia's rock-fortress of Gwalior by Capt. William Popham peace was concluded by the treaty of Salbai in 1782.

While the Maratha war was taking place, Haidar Ali of Mysore, who had been estranged by the policy of the Madras council, invaded the Carnatic in 1781 and threatened Madras. Once more Hastings rose to the occasion and sent Eyre Coote by sea to Madras. After much bitter fighting the war was brought to an end by the treaty of Mangalore (1784), which stipulated a mutual restoration of conquests. During this war the situation had been further complicated by the arrival of a French naval force under the famous admiral Pierre André de Suffren (*q.v.*), who, between Feb. 1782 and June 1783, fought five more or less indecisive conflicts with the English squadron under Adm. Sir Edward Hughes. Although he was unable to destroy the French squadron Hughes was able to thwart their efforts to obtain command of the sea. Peace between England and France in Europe led to a cessation of these naval encounters. While his masters in England had lost the American colonies, Hastings had preserved their Indian empire intact.

Cornwallis, Shore and Wellesley.—The most important problem of internal administration, apart from the preservation of law and order, was the assessment and collection of the land revenue. The efforts of Warren Hastings had been merely experimental. To estimate the fertility of the soil required a detailed survey, for which the company's servants were unfitted. Moreover, the local Indian revenue officials conspired together to keep the British in ignorance of the real assets of Bengal. In 1793 Lord Cornwallis, against the advice of his ablest revenue officer, Sir John Shore, and without a survey, ordered a permanent settlement of the land revenues of Bengal. The demand from the zamindars, or landholders, was fixed in perpetuity, and they were declared to be the hereditary proprietors of their holdings. This was a grave error since the same advantages could have been secured by a temporary settlement for a long term of years without the disadvantage of unalterably fixing the revenue demand. Fortunately this system was not extended to the rest of India.

Cornwallis also attempted to reform the administration of justice. Although Hastings had made serious efforts to grapple with this problem, the administration of criminal justice was notoriously defective. Cornwallis, who distrusted Indians, placed it entirely under British supervision. The civil courts were also reorganized. In the districts of Bengal he vested the collection of the revenues and the administration of justice in separate officers, thus making the collectors purely fiscal agents. Cornwallis' reforms were defective in many respects: no means existed whereby the new laws could be brought to the notice of an illiterate peasantry; the courts were not numerous enough to cope with the cases brought before them, and accused persons were confined in prison for long periods pending trial; in the long run his mistrust of Indians in the administration of justice proved to be a fundamental error; and his separation of the revenue and judicial functions proved unworkable and too expensive.

His principal achievement was the reorganization of the Indian civil service on a footing worthy of its task. This was accomplished by prohibiting the collectors from engaging in private trade and by paying them adequate salaries, thus placing them above corruption.

From the earliest days of the British connection with India there were two opposing forces at work, a forward tendency and a policy which sought to restrict or prevent expansion. In accordance with Pitt's India act of 1784, both Lord Cornwallis and his successor, Sir John Shore, pursued a policy of nonintervention in the affairs of the native states. To this there were two exceptions. Cornwallis found it impossible to avoid a conflict with Tipu Sahib of Mysore, who in 1790 made an unprovoked attack upon a British ally, the ruler of Travancore. After initial reverses, Cornwallis in 1792 advanced to the walls of Seringapatam and dictated terms by which Tipu was deprived of one-half of his territories and compelled to pay a huge indemnity. Neither can it be contended that the policy of Cornwallis and Shore toward Oudh was one of nonintervention, for they recognized that some control of this buffer state was essential. Shore even found it necessary to depose its ruler, Wazir Ali, because he was hostile to British interests. Elsewhere Shore's policy was one of unenterprising neutrality, and his refusal to protect Hyderabad from Maratha incursions resulted in the defeat of the nizam at Kharda in 1795. The system of neutrality prescribed by the home authorities lowered British prestige and increased the influence of French adventurers at the Indian courts. Lord Wellesley therefore found the British without allies when he arrived as governor general in May 1798; both Daulat Rao Sindhia and the nizam had entrusted their best battalions to French officers; Tipu Sahib was intriguing on all sides against the British; Oudh was in no condition to serve as a buffer state; and the Carnatic and Tanjore (Thanjavur) had lapsed into anarchy. He also found the army badly organized and the financial condition of the company distressing.

As a result of Tipu's intrigues a small French force from Mauritius reached Mysore in 1799. A Jacobin club was formed, a tree of liberty planted and Tipu was hailed as "Citoyen Tipou." Eventually Wellesley declared war, and after a short campaign of three months Tipu was defeated and slain in May 1799. Wellesley decided to form a small central kingdom of Mysore and to restore the ancient Hindu dynasty. What was left was divided between the British and their allies. From that time Mysore was really under British control. Between 1799 and 1801 Tanjore, Surat and the Carnatic were placed under British administration. Because of the weakness of Oudh as a buffer state its ruler was compelled, in 1801, to surrender Rohilkhand, Farrukhabad, Mainpuri, Etawah, Cawnpore (Kanpur), Fategarh, Allahabad, Azamgarh, Basti and Gorakhpur. Thenceforward it was entirely surrounded by British territory except on the Nepalese frontier and ceased to be a buffer state.

Wellesley was the first governor general to realize that the time had come for the British to stand forth as the paramount power. To accomplish this it was essential to control or crush the Marathas. His efforts at forming separate subsidiary alliances with each member of the Maratha confederacy ended in failure. Dissensions among the Marathas and the flight of the peshwa to British territory gave him the opportunity he sought. By the treaty of Bassein (1802) the peshwa entered into a subsidiary alliance and accepted British arbitration in his disputes with the other country powers. This naturally proved unacceptable to the other members of the confederacy and made war inevitable. In southern India the forces of Sindhia and Berar were crushed by Lord Wellesley's brother, Gen. Arthur Wellesley (later duke of Wellington), at Assaye and Argaon in 1803. In the same year Gen. Gerard Lake defeated Sindhia's forces in northern India at Aligarh and Laswari. As a result of these victories the British annexed Cuttack and all of Sindhia's territories in the Upper Doab. Wellesley was recalled before he was able to crush the forces of Jaswant Rao Holkar, who had become active in 1804.

Minto and the Marquess of Hastings.—For a few years after Wellesley's departure British prestige was once more lowered by the resumption of a policy of nonintervention, but French intrigues in Persia forced Lord Minto (governor general, 1807–13) to adopt a more active foreign policy. After the treaty of Finkenstein (1807) by which Napoleon promised to force Russia to restore Georgia to Persia, French influence became paramount at the Persian court. This prompted Minto to send John Malcolm on a mission to Persia, Mountstuart Elphinstone to the Afghan Shah Shuja at Peshawar and Charles Metcalfe to Ranjit Singh, the Sikh ruler of Lahore. It was Napoleon's sacrifice of Persian interests at the peace of Tilsit in 1807, not Minto's diplomatic measures, that brought about the decline of French influence at Teheran. Elsewhere more concrete results were obtained. An expedition to the French islands in 1810 led to the capture of Bourbon and Mauritius, and in the following year Java was taken from the Dutch.

Establishment of British Paramountcy.—From 1813 to 1823 the company's territories were governed by the marquess of Hastings. Like Wellesley before him, he found that the policy of nonintervention prescribed by the authorities in England had broken down and that the country was being plundered by well-organized bands of brigands. He was first called upon to deal with the Gurkhas of the Himalayan state of Nepal, whose continual raids across an ill-defined frontier into British territory compelled him to declare war. The incompetence of the British officers chosen and the stubborn resistance of the Gurkhas prolonged the campaign from Nov. 1814 to March 1816. The situation was retrieved in the final stages by Sir David Ochterlony, and the Nepal durbar, after the capture of Fort Malaun, came to terms. By the treaty of Segauli (1816) the Gurkhas were forced to cede Garhwal and Kumaon (Kumaun) together with most of the Tarai (Terai). They also agreed to withdraw from Sikkim and to accept a British resident at Katmandu.

This accomplished, the governor general turned his attention to the extirpation of the Pindari robber bands, who, urged on by the Marathas, had begun to plunder the company's territories. Eventually the home authorities gave a reluctant consent to military operations, and in 1818 the Pindaris were destroyed by a force of 120,000 men and 300 guns, the largest force that the British had been able to command in India up to that date. The Pindari war developed into a struggle with the Marathas. For this Hastings was fully prepared and, in the final Maratha war (1817–19), British arms were everywhere successful. As a result of this war the military power of the Maratha states was completely shattered and the territories of Holkar and the raja of Berar greatly reduced in size. Holkar was forced to cede Ajmer, the strategical key to Rajputana. The peshwa was deposed and forced to reside as a pensioner at Bithur near Cawnpore. Thus, by the suppression of the Pindaris, the defeat of the Marathas and the inclusion of the Rajput and other states within the pale of British protection, the British became the paramount power in the Indian peninsula. Except on the northwest frontier all the Indian states accepted the British ascendancy and from that time began to look to the British for rights and privileges.

Burmese aggressions on the northeast frontier led to war with Burma from 1824 to 1826. After a badly managed campaign the British dictated terms in the treaty of Yandabu, by which the Burmese agreed to accept a British resident, pay an indemnity of £1,000,000, surrender Assam, Arakan and the coastal strip of Tenasserim and abstain from all interference in Cachar, Jaintia and Manipur.

British Social Policy.—Amid the wars attending the establishment of British power in India there had been little time for social reform, although such practices as slavery, infanticide and suttee were extremely prevalent. Even though it was decided in 1833 to emancipate all slaves in British territory, it was not until 1843 that slavery lost its legal status in British India. As early as 1795, as a result of the efforts of Jonathan Duncan, the company's resident at Benares, female infanticide was declared to be murder, but it was a difficult order to enforce and as late as 1870 it was necessary to verify the existence of female children some years after birth. Suttee, or the burning of Hindu widows on the funeral pyres of their husbands, was sanctioned by the Hindu religion. This horrible rite was also tolerated by the British because it was feared that its suppression would provoke widespread disturbances. Despite the protests of Christian missionaries, of isolated British officials and of the Indian reformer Ram Mohan Roy, nothing effective had been done before the

administration of Lord William Bentinck, by which time a strong demand for its abolition had arisen in England. Bentinck, therefore, arrived in India in 1828 armed with instructions from the court of directors to consider measures for its abolition. In 1829 it was declared illegal in the Bengal presidency, and persons assisting a voluntary sacrifice were guilty of culpable homicide. To Lord Dalhousie must be given the credit for its abolition in the Indian states. The honour of suppressing thuggee (*thagi*), a semireligious cult and an organized system of murder, must be shared between Bentinck and Capt. William Sleeman. It was not until an approver, named Feringhia, saved his life by betraying its secrets to Sleeman that the various gangs were hunted down. Between 1831 and 1837, 3,266 thugs were disposed of in one way or another (*see* THUGS).

Until the third decade of the 19th century no attempt was made to impose a European culture on India. The British conception of empire was confined to the establishment of law and order, the foundation of an administrative system, the dispensing of justice and the collection of revenue. There gradually developed a deeper sense of responsibility for the welfare of the inhabitants of India. As early as 1792 Charles Grant, supported by William Wilberforce and Zachary Macaulay, fellow members of the Clapham sect, had advocated the regeneration of India by the introduction of a knowledge of the Christian religion, the English language and western science. For many years they were voices crying in the wilderness, for the company's policy was one of strict neutrality as far as Hindu and Muslim religious observances were concerned. As late as 1833 the government of Madras was responsible for the administration of 7,500 Hindu shrines. This was denounced by public opinion in England as tantamount to the encouragement of idolatry. With the growth of the humanitarian and evangelical movements the support of missionary enterprise increased, and one of the main achievements of the Whigs in 1833 was that missionaries were allowed to proceed to India without a licence. From 1813 to 1835 there was a period of controversy between the Orientalists and the Anglicists. Thomas Babington Macaulay, who became in 1833 the first legal member of the governor general's council, supported the Anglicists in a famous minute which was largely responsible for the fact that English became the principal medium of instruction and western literature and science the chief subjects of study. In 1837 great encouragement was given to western learning by the supersession of Persian as the language of the law courts. The administration of Bentinck (1828–35) therefore stands out as a great landmark, for the study of the English language unlocked the door to a study of modern scientific knowledge and brought Indians into closer contact with the liberal and democratic ideas of the west.

Frontier Wars and Annexations.—Soon after the arrival of Lord Auckland as governor general in 1836 the British became alarmed at the growth of Russian influence in Persia. At that time the British sphere of influence in northern India extended to the Sutlej river. Between British India and Afghanistan lay the independent states of the Punjab under its Sikh ruler, Ranjit Singh, and Sind under the Talpur amirs. Shah Shuja, the Sadozai ruler of Afghanistan with whom Minto had concluded a treaty, had been ousted from his dominions and forced to take refuge in British territory. Auckland found Afghanistan divided into three states: Dost Mohammed Barakzai had extended his rule over Kabul, Ghazni and Jalalabad; Kandahar was independent under Dost Mohammed's brothers; and Herat was governed by Kamran Mirza, a Sadozai.

In the 1830s Russophobia was at its height. Urged on by Count Simonich, the Russian envoy at Teheran, the shah had laid siege to Herat, which in those days was regarded as the gate to India. In June 1836 Auckland was warned by the foreign office in London of these intrigues and that Dost Mohammed was in active correspondence with Persia. To ascertain the exact state of affairs Auckland dispatched Alexander Burnes ostensibly on a commercial mission to Kabul. Friendly relations could have been established had Auckland been prepared to help Dost Mohammed recover Peshawar, which had been lost to the Sikhs. This Auckland could not promise since he was anxious to conciliate Ranjit Singh. Burnes, who was tied by his instructions, was therefore outmaneuvered by the Russian agent P. Vitkevich and recalled. Auckland, influenced by his private secretaries and other irresponsible advisers, decided to replace Dost Mohammed by the more pliant Shah Shuja. To this the British government agreed. One of the chief reasons for Auckland's decision to invade Afghanistan was to relieve Herat, yet, when news arrived that the shah had abandoned the siege, he persisted in his efforts to oust Dost Mohammed from Kabul. At first the British were successful. Shah Shuja was restored and Dost Mohammed took his place in India. Eventually there was a general rising of the Afghan tribes against the British. The principal reasons for this were the unpopularity of Shah Shuja, hatred of foreign domination and the licentious conduct of British troops at Kabul. Both Burnes and Sir William Macnaughten, the British envoy, were assassinated and the troops besieged in Kabul. Gen. William Elphinstone and his military advisers eventually decided to retreat to India, but the force was practically annihilated before reaching Jalalabad. Out of 4,000 troops and 12,000 camp followers only W. Brydon, Maj. Lisant of the 37th native infantry, a merchant named Barnes and a few Indians reached Jalalabad. The restoration of the British position in Afghanistan was the work of Lord Ellenborough, who succeeded Auckland in Feb. 1842. After British honour had been satisfied by the avenging armies of Generals George Pollock and William Nott, Dost Mohammed was allowed to return to Kabul as ruler. The first war with the Afghans was a melancholy piece of folly which left a legacy of hatred and poisoned Anglo-Afghan relations for many years.

The reverses sustained by the company's troops in Afghanistan were not calculated to raise British prestige on the northwest frontier. Moreover, Auckland's treatment of the amirs of Sind had made them distrustful of British motives. In 1832 the British had pledged themselves to protect the territories of the Hyderabad and Khairpur amirs. In contravention of these treaties Sind had been used as a base for the British advance into Afghanistan, and Auckland in 1839 had forced the amirs to subscribe to a subsidiary treaty which practically deprived them of their independence. The policy adopted by Ellenborough was not less highhanded and eventually provoked the amirs into attacking the British residency. In 1843 they were defeated by Sir Charles Napier at the battles of Miani and Dabo and their country annexed. The annexation of Sind may have been expedient politically and strategically; on moral grounds it was indefensible.

It was left to Ellenborough's successor, Sir Henry Hardinge (1844–48), to deal with the situation in the Punjab. After the death of Ranjit Singh in 1839, the Punjab had become the scene of widespread lawlessness and domestic contentions. The only effective power was the Sikh army, which in 1845 comprised 88,662 men supported by a powerful artillery. Suspecting the British of contemplating the annexation of its country and eager for war, the Sikh army in Dec. 1845 crossed the Sutlej and invaded British territory, whereupon Hardinge declared war. The Sikhs were defeated in desperate struggles at Mudki, Ferozeshah, Aliwal and Sobraon, after which they were forced to surrender all territory on the British side of the Sutlej together with the Jullundur Doab, to pay an indemnity and to limit the strength of their armed forces. In 1846 Gulab Singh, a Dogra raja, was placed in possession of all the hill country between the Indus and the Ravi, including Kashmir, Ladakh, Gilgit and Chamba. The administration of the Punjab was entrusted to a council of regency presided over by Sir Henry Lawrence with a team of brilliant colleagues, the chief of whom were John Lawrence, Herbert Edwardes and John Nicholson. These arrangements did not prove acceptable to the Sikhs, and Lord Dalhousie, who succeeded Hardinge in 1848, was faced with a second war six months after his arrival in the country. The indecisive battle of Chillianwalla was followed by the destruction of the Sikh army at Gujarat, whereupon Dalhousie annexed the Punjab to British India. After nearly a century of incessant warfare the British political and geographical frontiers had become conterminous. (*See* also SIKH WARS.)

Dalhousie's period of office was marked by extensive annexations, and as a stage in the growth of British power in India it is comparable only with those of Wellesley and the marquess of Hastings. Soon after the defeat of the Sikhs his attention was directed to the northeast frontier, where Anglo-Burmese relations had steadily deteriorated since the conclusion of the treaty of Yandabu in 1826 that ended the First Burmese War (*see* BURMA: *History*). Dalhousie's failure to obtain satisfaction for Burmese acts of extortion on British merchants was sufficient cause for a declaration of war in 1852. After a short well-organized campaign, Dalhousie, contrary to the instructions of the court of directors, contented himself with the annexation of Pegu or Lower Burma, which gave the British complete control of the Burmese coast line and enabled them to develop the port of Rangoon.

In India itself he complied with the directors' instructions and, in accordance with what has been aptly termed the doctrine of lapse, annexed any tributary or dependent Hindu state whose ruler had died without a natural successor or without having previously adopted an heir with the sanction of the paramount power. In pursuance of this policy the following Hindu states became British territory: Satara (1848); Jaitpur, to the north of Jhansi (1849); Sambalpur (1849); Jhansi (1853); and Nagpur (1854). Years of chronic misgovernment under a succession of dissolute rulers prompted Dalhousie to annex Oudh in 1856. This was the only case of annexation not in accordance with the doctrine of lapse or the result of conquest.

The Indian Mutiny.—Dalhousie's successor, Lord Charles Canning, reached India in 1856. A year later the sepoys of the Bengal army mutinied. An analysis of the factors underlying this revolt brings to light social, religious, economic, political and military causes. To regard it merely as a sepoy mutiny is to underestimate the increasing pace of westernization after the establishment of British paramountcy in 1818. Despite numerous invasions the structure of Hindu society had persisted, and it looked at first as if the British, like previous conquerors, had merely superimposed a political structure on the underlying Hindu social system. It soon became apparent, however, that Hindu society was being affected by the introduction of western ideas. Missionaries were challenging the religious beliefs of the Hindus. The humanitarian movement had led to reforms which went deeper than the political superstructure. Dalhousie had made efforts for the emancipation of women and had introduced a bill to remove all legal obstacles to the remarriage of Hindu widows. Converts to Christianity were to share with their Hindu brethren in the property of the family estate. There was a widespread belief that the British aimed at breaking down the caste system. The introduction of western methods of education was a direct challenge to orthodoxy, both Hindu and Muslim. The mutiny therefore was not so much a revolt against foreign political domination as a protest against westernization, the pace of which had been accelerated in the years immediately preceding its outbreak. These changes threatened the supremacy of the Brahmans, who were the upholders of orthodox Hinduism. Many of them had been dispossessed of their revenues or had lost lucrative positions. Everywhere the old Indian aristocracy was being replaced by British officials, and recent land-revenue settlements in Allahabad and Oudh had favoured the peasants at the aristocracy's expense. Dalhousie had instituted an inquiry into the titles of landholders and it had been discovered that many of their claims rested on patents of doubtful authenticity. More than 20,000 estates had been confiscated in the five years before the mutiny. The annexations of Dalhousie, especially the annexation of Oudh, had produced a discontented nobility and a disbanded soldiery.

The mutiny broke out in the Bengal army because it was only in the military sphere that Indians were organized. From 1764 onward there had been frequent sepoy mutinies. The conquest of Sind and the Punjab produced great discontent since the sepoy no longer received extra allowances for service in provinces which had become British territory. Four Bengal regiments alerted for service in Sind refused to march until these extra allowances were restored. There were also serious defects in the administration of the army. The growing centralization of military authority at headquarters and Bentinck's abolition of corporal punishment in the native army had deprived commanding officers of adequate powers of punishment, for it was not until after the suppression of the mutiny that summary courts martial were instituted. There had been recruited high-caste sepoys, whose caste prejudices interfered with their military duties. Until the General Enlistment act of 1856 sepoys could refuse to proceed on foreign service. At the close of Dalhousie's administration the distribution of European troops was unstrategic. Only three regiments garrisoned the 900 mi. between Calcutta and Meerut. To make matters worse European troops were hopelessly outnumbered. In fairness to Dalhousie it must be stated that his appeals to rectify this grave error had been pigeonholed in London. The pretext for revolt was the introduction of the new Enfield rifle; to load it the lubricated cartridges had to have their ends bitten off by the sepoys. There appears to be some foundation for the popular belief that the grease used for this purpose was a mixture of pigs' and cows' lard, an insult to both Muslims and Hindus.

Geographically the mutiny was practically confined to Upper and Central India and did not spread to Bombay and Madras. Thanks to the efforts of Herbert Edwardes, John Nicholson and John Lawrence the Punjab remained loyal. With the exception of the Mogul emperor and his sons and Nana Sahib, the adopted son of the deposed peshwa, none of the important Indian princes joined the mutineers. The extension of the revolt was gradual and resulted from gross British incompetence in the early stages when sterner and prompter action might have prevented it. But Canning was incapable of rapid decisions, and mediocrity was the prevailing note on his council. (For the military history of the mutiny *see* INDIAN MUTINY.)

E. British Imperial Administration

After the fall of Delhi, Bahadur Shah, the last puppet Mogul emperor, was tried for complicity in the revolt and condemned to exile. The crown took over the government of India from the East India company and a secretary of state, assisted by a council of experts, took the place of the board of control dating from William Pitt's India act of 1784. Lord Canning became the first viceroy and governor general. The assumption of direct government by the crown was the occasion for a royal proclamation. To the peoples of India the queen proclaimed her deep personal concern for their welfare. The hour of victory was not to be an opportunity for repressive legislation. An assurance was given that neither race nor religion should debar Indians from employment in the government of the country. Henceforth fitness was to be the criterion of eligibility. To the princes the crown relinquished the right, recently enforced by Dalhousie, of resuming their territories on the failure of natural heirs. One of the most important questions after the mutiny was the reorganization of the military forces in India. It was eventually decided to amalgamate the British forces with the British army under the nominal control of the crown, thus ensuring that the Indian army should be an imperial force and not a local militia.

The second half of the 19th century was a period of consolidation and conciliation. It was an age of moral and material progress, of commercial development and constitutional experiments, of administrative and legal reforms. It witnessed a centralization under the crown made possible by the rapid development of communications, with the result that the secretary of state's powers increased at the expense of those of the governor general. It also witnessed the fixed resolve of educated Indians to secure a larger share in the government of their country. Of outstanding importance were the legal codes. The Indian penal code, first drafted by Macaulay as early as 1834, became law in 1860. Codes of criminal and civil procedure were enacted in 1861. The same year saw the unification of the judicial system by the amalgamation of the supreme court and the *adalats* ("courts") of the company into high courts. In 1861 provision was made for the nomination of unofficial members to the governor general's legislative council. The working of the executive council was also remodeled by the introduction of the portfolio system of business.

The mutiny left the government of India saddled with an enormous debt. By 1864 the efforts of James Wilson and his successor, Samuel Laing, had converted the debt into a surplus by means of large economies in military and civil expenditure and by introducing an income tax and other imposts. The year 1871 saw the beginnings of financial decentralization, which made the provincial governments more responsible for their own finances. This was gradually extended until, in 1882, the provinces received a share of the revenues instead of a fixed grant from the central treasury. During the viceroyalty of Lord Lytton (1876–80), Sir John Strachey, his finance minister, abolished the internal customs line, a huge cactus hedge interspersed with stone walls and ditches extending from Attock to Berar. This had been erected to prevent the untaxed salt of Rajputana and the lightly taxed salt of southern and western India from entering British territory. By granting compensation to the Indian states the British were able to control the sources of supply and remove this fiscal anachronism. In accordance with the doctrines of free trade, Strachey remitted the import duties on many articles. In 1882 the general customs tariff, with the exception of salt, liquor, tobacco and kerosene oil, was abolished. This lasted until 1894 when the progressive decline in the exchange value of the rupee made additional taxation imperative. A general duty of 5% was therefore imposed on imports. In the interests of the Lancashire manufacturers a countervailing excise duty was placed on Indian manufactured cotton cloth—a measure which rankled with growing bitterness in the Indian mind until abolished in 1926.

Before 1858 no attempt had been made to grapple with the problem of recurrent famines by introducing a system of famine relief and there had been little expenditure of public funds. The modern idea that famine relief is the responsibility of the state was not recognized until India passed under the crown. The Famine commission of 1867 under Sir George Campbell laid the foundations of a more humane policy and enunciated the principle of preventing deaths from starvation. In the Bihar famine of 1873–74 village inspection, the basis of modern organization against famine, was carried out for the first time. The idea of insurance against famine originated with Sir John Strachey, who in 1874 contended that famines were normal periodic calamities against which it was necessary to make financial provision. During the southern Indian famine of 1876–78 the Temple, or reduced, ration, named after Sir Richard Temple, was adopted in Madras and Bombay but was abandoned after three months as insufficient. The Famine commission of 1878–80, presided over by Sir Richard Strachey, Sir John's elder brother, recommended that a definite system of procedure should be embodied in a famine code to be put into operation by the local governments subject to the financial control of the central government. A commission in 1898 under Sir James Lyall confirmed these principles but advocated in addition a more liberal famine wage and an extension of gratuitous relief. Unfortunately before these proposals had been incorporated in the provincial codes the great famine of 1899–1900 occurred. The Famine commission of 1901 recommended an efficient system of intelligence in order to obtain earlier estimates of anticipated crop failure and placed special emphasis on the importance of moral strategy since moral depression led to physical deterioration.

Of all the viceroys between 1858 and the end of the century Lord Ripon (1880–84) did most to make the British connection acceptable to educated Indian opinion. Appointed by a Liberal ministry in England, he sponsored a factory act, the first of its kind in India, and repealed the Vernacular Press act of 1878, which had muzzled the Indian press. In 1882 he decided to foster local self-government as a measure of political education even at the cost of administrative efficiency. But his rule is chiefly remembered for the famous Ilbert bill of 1883 by which he sought, as a minor administrative reform, to permit senior Indian judges to try criminal cases in which Englishmen were involved. Furious opposition from the unofficial English element in Bengal and Bihar resulted in the measure's being considerably modified. The importance of the controversy is that it intensified racial antagonism.

Foreign Policy.—The death of Dost Mohammed in 1863 was the signal for fratricidal conflicts in Afghanistan, and it was not until 1868 that his son Sher Ali succeeded in crushing all rival claimants. The policy of the government of India under Sir John Lawrence (1864–69) was one of abstention from interference in Afghan affairs and no attempt was made to recognize Sher Ali until his power had been firmly established. The desire for a closer alliance prompted Sher Ali in 1869 to meet Lawrence's successor, Lord Mayo (1869–72), at the conference of Ambala, the results of which have been much overrated by historians. The advance of Russia in central Asia led to a further conference at Simla in 1873, but Sher Ali failed to obtain dynastic pledges and had to content himself with vague promises of support. From this date Russian influence gained ground at Kabul. Sher Ali was further estranged by the Seistan arbitral award of 1872, which in his opinion favoured Persia, and by the British occupation of Quetta in 1876, which he regarded as a knife pointed at him. Caution therefore marked the policy of the government of India toward Afghanistan until the arrival of Lord Lytton in 1876. The Peshawar conference of 1877 was a final attempt to reconcile Sher Ali, but it was wrecked by the efforts of Lytton and his advisers in England to force British residents on the amir. Russia's reply was the mission of General Stolyetov to Kabul. The refusal of Sher Ali to allow a British mission under Sir Neville Chamberlain to cross the frontier at Ali Masjid furnished Lytton with his famous *casus belli* for the Second Afghan War (1878–80). On two occasions, in 1839 and in 1878, Russian intrigues had led to a British invasion of Afghanistan. The proper solution would have been to bring pressure to bear on Russia in Europe, for strained relations between India and Afghanistan were obviously to the advantage of Russia. British military operations were successful and Sher Ali fled the country. By the treaty of Gandamak (1879) his son Yakub Khan was recognized as amir and the British position around Quetta in Baluchistan was acknowledged. The assassination of Sir Louis Cavagnari, the British resident, in Sept. 1879, was followed by the reoccupation of Kabul by a force under Gen. Sir Frederick (later Field Marshal Earl) Roberts. In July 1880 Abdurrahman Khan, the nephew of Sher Ali, was recognized as amir of Kabul in return for his acknowledgment of the British right to control his foreign relations. Three years later this promise was renewed by Lord Ripon, who also bestowed on Abdurrahman an annual subsidy of 12 lakhs of rupees to be spent on the defense of his northern frontiers. In promising to protect Afghanistan against unprovoked aggression the British pledged themselves to defend a country of unknown limits. The Russian occupation of Merv in 1884 gave the necessary impetus to negotiations which ended in the appointment of an Anglo-Russian commission for the delimitation and demarcation of the northern boundary of Afghanistan. Although the Panjdeh incident of 1885, when an Afghan force suffered heavy losses in an engagement with Russian troops, brought Britain and Russia to the verge of war, the process of demarcation was completed by the year 1888. The last frontier dispute in which Russia was concerned was settled by the Pamir agreement of 1895. Thus, in the closing years of the 19th century, the recognition of a definite frontier between Russia and Afghanistan led to a decided improvement in Anglo-Russian relations. The boundary between India and Afghanistan was delimited by the Durand agreement of 1893. British penetration into the tribal areas of the northwest frontier of India provoked the Pathan tribesmen to revolt in 1897. The Tirah expedition of 1898 was followed by a temporary cessation of hostilities. On the northeast frontier strained relations with Burma led to the Third Burmese War of 1885, which ended with the acquisition of Upper Burma. By the convention of Peking in 1886, China recognized British rule in Burma and arrangements were made for the delimitation of the frontier between Burma and China.

Lord Curzon as Viceroy (1899–1905).—Lord Curzon's attention was first directed to the problem presented by the tribes of the northwest frontier, largely an aftermath of the forward policy adopted by his predecessors. His policy has been aptly summarized as one of withdrawal and concentration. Regular troops were recalled from isolated garrisons in tribal territory and the defense of these forward areas entrusted to a tribal militia

supported by British movable columns. In 1901, to increase the control of the government of India over frontier administration, he created the North-West Frontier Province, which he placed under a chief commissioner assisted by officers of the political department and other specially recruited officials. Curzon's foreign policy aimed at the exclusion of Russian influence from areas of vital importance to the protection of India. Convinced of the necessity of maintaining British political and commercial supremacy in the Persian gulf, he frustrated Russian schemes for a coaling station at Bandar Abbas and for a railway terminus at Kuwait and also the French attempt to obtain a naval base on the coast of Oman. Similar motives influenced him in sending an expedition into Tibet in 1904 under Col. Francis Younghusband. Since the dalai lama had come under the influence of a Russian Buddhist named Dordzhiyev, Curzon considered it essential that British influence should be recognized in such a manner at Lhasa as to make it impossible for any other power to exercise pressure on the Tibetan government inconsistent with the interests of British India. It appears that his fears of Russian penetration into Tibet were not well founded. The Younghusband expedition, which slaughtered about 700 badly armed Tibetans, was an inglorious episode in British history and served no useful purpose.

His internal administration was characterized by far-reaching reforms. The Punjab Land Alienation act protected the peasant against moneylenders. Co-operative credit societies and agricultural banks were instituted. An agricultural department was formed to improve farming and cattle breeding, and a department of commerce and industry was founded to encourage trade. The administration of the Indian police was reformed and a criminal investigation department created. In addition, commissions were appointed to inquire into education, irrigation and famine administration. His interest in Indian culture resulted in the Ancient Monuments Preservation act of 1904 and the appointment of Sir John Marshall as director-general of archaeology. Unfortunately Curzon lacked tact, and his unguarded utterances, especially his Calcutta convocation speech, and his attitude to the Indian princes were, to say the least, regrettable. His attitude of mental superiority combined with unpopular proposals for the partition of Bengal were largely responsible for the unrest and the outbreak of grave political crime with which his successors were confronted. As in the days of Dalhousie, the pace of reform had been too rapid. His viceroyalty may be said to mark the end of benevolent autocracy. (*See* also CURZON OF KEDLESTON, GEORGE NATHANIEL, 1st Marquess.)

The Indian Nationalist Movement.—In its early stages this movement took the form of constitutional agitation which aimed at securing for Indians a greater share in the administration of the country. At first there was no desire to dispense with the British connection, but the reluctance of the government of India to grant reforms produced a distrust of British motives which led in the 20th century to a revolutionary movement demanding self-government and freedom from foreign control. A Hindu religious renaissance in the second half of the 19th century, by focusing attention on India's great cultural heritage, fostered national consciousness and racial pride. Prominent among the religious reformers were Keshub Chunder Sen (1833–84), who broadened the basis of the Brahmo Samaj; Dayanand Saraswati (1824–83), founder of the Arya Samaj; and Ramakrishna (1834–88), whose work was continued by his more famous disciple Swami Vivekananda. But the most important factor underlying the growth of the nationalist movement was the influence of British rule. The establishment of British paramountcy and the development of communications facilitated centralization and tended to greater unification. English became the lingua franca of educated Indians and brought them into contact with European liberalism and political philosophy and with the ideas of nationalism and patriotism prevalent in the west. It enabled them to study the works of Edmund Burke, John Stuart Mill and other political philosophers and to read the lives of Giuseppe Garibaldi, Giuseppe Mazzini and Lajos Kossuth. They saw the part played by nationalism in the Italian *risorgimento* and how it had helped to unify Germany. The awakening of Japan and the defeat of Russia by an oriental power was looked upon as symptomatic of general occidental decadence. Beneath the constitutional agitation lay a stratum of bitter economic discontent, and unemployment among educated Indians produced a vehement demand for a more rapid indianization of the administration. Racial discrimination against Indians, especially in South Africa, the controversy about the Ilbert bill of 1883 and the partition of Bengal in 1905 all played their part and led to the Swadeshi movement, which advocated the use of Indian-made goods. This developed into an agitation for the boycott of British goods resembling the boycott of U.S. goods in China.

In imitation of western methods Indians formed societies for the discussion of political affairs. This was the purpose of the Indian association formed by Surendranath Banerjea in 1876. It was not until 1885, however, that the first Indian national congress met at Bombay. Its founder was Allan Octavian Hume, an Englishman who had consistently advocated the introduction of a more representative form of government, and it was hoped that it would develop into a sort of Indian parliament for the discussion of grievances. The first congress was attended by 72 delegates, chiefly lawyers, schoolmasters and newspaper editors. Of these only two were Muslims. The second congress in 1886 was composed of 440 delegates, but because of the influence of Sir Sayyid Ahmad only 33 Muslims attended. In reply to Lord Dufferin's description of the congress as a microscopic minority, 1,248 delegates attended the annual meeting in 1888. The last decade of the 19th century witnessed a change in the character of Indian nationalism, and by 1907 the moderate party led by Banerjea and Krishna Gokhale had given way to a virulently anti-British party under a Maratha Brahman journalist Balgangadhar Tilak and a Bengali named Aurabindo Ghose, who had taken a first class in the Classical tripos at Cambridge. The anarchist movement was first organized by the Brahmans of Poona and owed much to inflammatory articles advocating the assassination of British officials which appeared in Tilak's paper, the *Kesari*. Centres of conspiracy were also formed in London, Paris and San Francisco, Calif. From Bombay the movement spread to Bengal, where, under Barindra Ghose and his brother Aurabindo, recruits were trained both mentally and physically for revolution. The English secondary schools and colleges of Bengal were the most fruitful recruiting centres. Eventually, in 1908, as a result of the discovery of bombs, dynamite and correspondence, 35 conspirators were arrested, of whom 15 were found guilty. An approver was shot dead in jail, the public prosecutor was assassinated in Calcutta and a deputy superintendent of police was murdered while leaving the high court. From this it is clear that the most important problem of Lord Minto's viceroyalty (1905–10) was the suppression of political conspiracy.

The Morley-Minto Reforms.—In an attempt to meet Indian political aspirations, important constitutional reforms were carried out in concert between Lord Minto and Lord Morley, the secretary of state for India. In 1907 Morley appointed two Indians, Sayyid Husain Bilgrami and Krishna Gupta (afterward Sir), as members of his council in London. By the Indian Councils act of 1909 the governor general's legislative council and the provincial legislative councils were considerably enlarged and their powers increased to enable them to adopt resolutions on matters of administrative and financial policy. In the provinces the official members were outnumbered, but an official majority was still retained at the centre. Because of Muslim agitation the principle of communal representation was formally incorporated in the constitution. For the first time an Indian was appointed to the governor general's executive council. Unfortunately these reforms did not go far enough. Because of the restricted franchise, the reformed councils were not based on any system of direct popular representation. The percentage of lawyers among the nonofficial elected members was too great, and the official bloc was always strong enough to dominate the voting power in all councils. In fact, they were merely advisory bodies and lacked ministerial responsibility, the essence of the parliamentary system. Neither did these reforms, as Morley had expected, check the rising tide of unrest in India.

From 1909 to 1914.—Between 1909 and 1914 the terrorist movement spread from Bombay and Bengal to Bihar, the United Provinces, Madras and the Punjab. In July 1909 Sir Curzon Wyllie, political aide-de-camp at the India office, was assassinated by an Indian at the Imperial institute in London. Five months later an unsuccessful attempt was made to assassinate Lord and Lady Minto at Ahmedabad. In December of the same year Arthur Jackson, the district magistrate of Nasik, was shot dead at a farewell party given in his honour. In 1910 a secret society was unmasked at Satara. Robert Ashe, the district magistrate of Tinnevelly in Madras, was killed in June 1911. In Dec. 1911 occurred the Delhi bomb outrage, in which Lord Hardinge of Penhurst, who had succeeded Minto in Nov. 1910, was seriously wounded. The archconspirator behind the Ghadr (mutiny) movement in the Punjab was one Hardayal, who had proceeded to Oxford university with a state scholarship which he surrendered in order to return to India to preach sedition. Hardayal was later arrested in the U.S. but, escaping from custody, fled first to Switzerland and then to Berlin, Ger., leaving his unfortunate dupes in India to pay the penalty for their crimes.

It must not be imagined that these acts of violence were typical of the Indian attitude toward British rule. Among the moderates, at least, there was for some time after the Morley-Minto reforms a better feeling, and at the 1910 congress, for the first time, an address of welcome was presented to the new viceroy. The visit of the king-emperor to India in 1911 and the revocation of the partition of Bengal temporarily checked the growing unrest. For a time the new system of communal electorates strengthened Muslim loyalty, but this attitude gradually changed as a result of the apparent indifference of the British government to Muslim interests, which were endangered by the Italo-Turkish and Balkan wars. A motion proposed in the imperial legislative council on Jan. 24, 1911, demanding the discontinuance of separate representation for Muslims, served only to exacerbate Hindu-Muslim relations. By 1913 the attitude of the Muslim league, which had been formed in 1906 as a counterpoise to congress, became so hostile that the Aga Khan resigned the presidency. The treatment of Indian immigrants in the self-governing dominions and colonies intensified the growing resentment against western supremacy. The leader of the Indian movement of passive resistance in South Africa was Mohandas Karamchand Gandhi (*q.v.*), soon to become famous for the adoption of a similar plan of campaign in India itself.

Despite all this unrest the opening years of the 20th century witnessed a great increase and a striking change in the trend of India's foreign trade. On the eve of World War I, although Great Britain still had the bulk of this trade, the U.S. and Japan had become more serious rivals.

World War I.—Although the government of India was automatically involved in World War I by the royal declaration, Indians of all classes and shades of political opinion, with the exception of a minority of extremists, gave positive proof of their support of the Allied cause. The martial classes flocked to the recruiting centres; the Indian princes offered their imperial service troops; Nepal placed its Gurkhas at the disposal of the empire; and even Tibet offered to provide a contingent of 1,000 soldiers. Amir Habibullah of Afghanistan remained loyal to his engagements, despite the fact that his country was much disturbed by the presence of German and Turkish emissaries. Notwithstanding the fact that the military forces in India had been raised purely for local defense, the loyal response of the country made possible the dispatch of troops to all theatres of war with the result that for some time India was so denuded of troops that only 15,000 were available for its immediate defense. These were later reinforced by contingents from the territorial regiments of Great Britain. About 80,000 British and 230,000 Indian troops were sent overseas from India in the first few months of the war. Indian sepoys were called upon to endure the European winter campaign of 1914–15 and distinguished themselves at the battles of Neuve Chapelle and Loos. In Nov. 1915 it was decided to withdraw the bulk of Indian troops from France for service in the middle east and other theatres of war. They fought throughout the badly managed Mesopotamian campaign; served with Viscount Allenby in Palestine and with Jan Christian Smuts in east Africa; bore their full share of the fighting in Gallipoli and Salonika, Egypt and the Cameroons; were used to protect Aden and the Abadan pipeline in the Persian gulf; and saw service in Kurdistan, Trans-Caspia, North China and on the northwest and northeast frontiers of India. India's total contribution to the war effort was 1,302,000 men; casualties amounted to 106,594, including 36,696 deaths from all causes. Out of the total number of combatants Bengal, with a population of 45,000,000 provided only 7,000. The much less densely populated Punjab was the chief recruiting centre and provided roughly 300,000 fighting men, Muslims, Sikhs, Dogras and Jats, of whom more than one-half were Muslims. Of the total number of combatants recruited throughout British India, three-quarters came from the Punjab and the United Provinces. India's financial contribution was no less remarkable. At its own request it bore the expense of its overseas forces and, in addition, made a free gift of £100,000,000 to the imperial exchequer. By means of war loans in 1917 and 1918 a sum of £73,000,000 was raised. India's immense wealth of raw material was placed at the service of the empire, and by 1918 it had supplied stores and equipment to the value of £80,000,000.

It would be a mistake, however, to infer that the internal situation was free from anxiety since the government of India had to contend with the Ghadr conspiracy in the Punjab and with the terrorist movement in Bengal. Every effort was made by Germany to take advantage of this. On the outbreak of war an Indian Tamil, Chempakaraman Pillai, who had formed the International Pro-Indian committee at Zurich, Switz., left Switzerland for Berlin, Ger., where he and Hardayal were employed by the German foreign office to disseminate anti-British propaganda. The chief centres of German propaganda were Bangkok in Siam and Batavia in the Dutch East Indies, which were under the direction of the consul general for Germany at Shanghai, China, himself acting under instructions from the German embassy in Washington, D.C. The refusal of the Canadian authorities to allow Sikhs, who failed to comply with the immigration regulations, to land in Vancouver, B.C., was skilfully exploited by the Ghadr party in the United States and Canada. The return of these discontented Sikhs to India led to serious unrest in the Punjab, and in Feb. 1915 an abortive attempt was made, in conjunction with the Bengal revolutionaries, to overthrow British rule. Efforts by the Germans to co-operate with these conspirators and to land arms and ammunition met with no success since they had overestimated the organizing ability of their Indian confederates and underrated the vigilance of the British authorities.

The entrance of Turkey into the war was followed by efforts to undermine the loyalty of Indian Muslims. Discontent expressed itself in the Khilafat movement, the members of which regarded the sultan of Turkey as the legal caliph. The arrival of a Turco-German mission in Kabul gave rise to exaggerated rumours which prompted some of the younger members of the Khilafat party to cross the frontier and join forces with certain discontented mullahs in Afghanistan and the tribal tracts of the northwest frontier. Although a small punitive expedition had to be undertaken against the Mohmand tribes to the northeast of Peshawar, the danger of a rising of the powerful Afridis was averted when the British, in Feb. 1915, decided to double their allowances. In Aug. 1916 Turkish emissaries visited the frontier with money for the notoriously anti-British Haji Sahib of Turangzai, one of whose counselors was the infamous Mohammed Ali, a graduate of Cambridge and a lecturer in the amir's college at Kabul. Great pressure was also brought to bear on the amir Habibullah to declare war, but he refused to break his engagements with the government of India.

During World War I the conception of India as a self-governing dominion within the empire took a firmer hold than ever before on the politically minded classes. In his presidential address to the national congress of 1915 Sir Satyendra P. Sinha (*see* SINHA, SATYENDRA PRASSANA SINHA, 1st Baron) spoke with pride of the fact that India's contribution to the war effort had not fallen be-

hind that of other parts of the empire: although, in his opinion, India was not ripe for self-government, he was convinced that this should be the final aim of British rule. Events proved that this pronouncement did not go far enough to meet the aspirations of educated Indians, and Lord Chelmsford, who succeeded Lord Hardinge as governor general in 1916, was confronted with a widespread agitation for home rule sponsored by Mrs. Annie Besant and Balgangadhar Tilak, who had been released from detention. A home rule league was established in Sept. 1916, and Mrs. Besant's paper, *New India*, became the medium for an intensive campaign. In October, 19 members of the governor general's legislative council published a memorandum in which they complained of the inadequacy of the Morley-Minto reforms and claimed that India's loyalty during the war had earned for it the right to parliamentary institutions. In November proposals for extensive constitutional reform were made by joint representatives of the congress and the Muslim league. This Hindu-Muslim *rapprochement*, known as the Lucknow pact, recognized the principle of communal electorates as far as Muslims were concerned and was hailed somewhat prematurely by M. A. Jinnah (*q.v.*), a prominent Muslim leader, as the birth of a united Indian nation. The policy of the national congress for 1916 was a triumph for the principles of the Home Rule party, and political independence was advocated by both moderates and extremists. A resolution was passed that a proclamation conferring self-government on India should be immediately issued by the British government. Widespread agitation continued throughout 1917 and forced the British government to turn its attention to Indian affairs. Eventually on Aug. 20, 1917, E. S. Montagu, the secretary of state for India, declared in the house of commons that "the policy of His Majesty's Government, with which the Government of India are in complete accord, is that of the increasing association of Indians in every branch of the administration and the gradual development of self-governing institutions with a view to the progressive realisation of responsible government in India as an integral part of the British Empire." The announcement went on to emphasize that the stages in this development had to be gradual and that the pace would be determined by the British government. Indians naturally interpreted this as a promise of equality with the self-governing dominions. Muslims, however, regarded it as a victory for the Hindu majority and saw in it a threat to communal representation. From this time onward Hindu-Muslim rivalry developed apace and expressed itself in violent communal outbreaks. The visit of the secretary of state to India to hold consultations with the viceroy resulted in the publication of the famous Montagu-Chelmsford report of 1918 (*see* MONTAGU, EDWIN SAMUEL).

The Punjab Rebellion, 1919.—In order to cope with revolutionary conspiracy, the ramifications of which had been disclosed by the publication of the report of the Sedition committee presided over by Sir Sidney Rowlatt, it was proposed to endow the government of India with emergency powers. The draft bills, published in Jan. 1919, provided for the internment of persons suspected of subversive activities and for the trial of political offenders by judges unassisted by juries since it was feared that juries would be intimidated by deliberate terrorism. The agitation which ensued saw the emergence of Gandhi as a factor in Indian politics and the organizing of a movement of passive resistance, known as *Satyagraha*, the use of which in South Africa had first brought him into prominence. Now too for the first time the masses began to be affected. When the Rowlatt act was passed in March 1919 Gandhi announced that as a protest March 30 should be observed as a hartal, or day of abstention from business. Events soon proved that his doctrine of ahimsa, or nonviolence, was not appreciated by the Indian mob, and his preaching of passive resistance led to violent outrages in Delhi, Gujarat and the Punjab. The railway station at Delhi, focus of all the railway traffic of northern India, was stormed by the mob, and British troops and police officers were assaulted. In the firing which followed eight persons were killed. Because of the subversive activities of Kichlu, a Kashmiri Muslim who had taken a degree at a German university, and a Hindu assistant surgeon named Satya Pal, the Punjab had been seriously disturbed since the middle of 1918. Not dissuaded by what had happened in Delhi, Gandhi ordered another hartal for April 6. Posters appeared in Lahore and Amritsar announcing this date as the day of *ghadr*, or mutiny, and urging the populace to "kill and die." Proclamations by the Punjab authorities forbidding public meetings were openly defied, and riots took place throughout the province. Emissaries were sent to the border tribes and Afghanistan, but fortunately war with Afghanistan did not coincide with the Punjab disturbances. Chaos reigned in Amritsar between April 10 and April 12. The mob murdered five Europeans and attempted to murder two Englishwomen (a missionary and a doctor). It set fire to the Anglican church and to the mission school while the teachers and pupils were at work; looted two English banks and put to death three British managers; set fire to the railway goods station and murdered a British official on duty (an attack on the passenger station was repulsed); stormed and gutted the central telegraph office; set fire to the town hall; and finally attacked the Calcutta mail train. Similar outbreaks occurred at the same time in Lahore. At Kasur, 25 mi. from Lahore, the mob, on April 12, held up the trains and murdered two British warrant officers. Turning their attention to government buildings, the rioters attacked the treasury and burned the civil courts. The whole outbreak appears to have been a well-organized attack on communications, with the result that Sir Michael O'Dwyer, the lieutenant governor, was forced to rely on radio. At Amritsar, on April 13, took place what has been termed the Amritsar massacre, when Brig. Gen. Reginald Dyer's troops fired on a mob which had collected in the Jallianwalla Bagh in defiance of the prohibition, killing 379 and wounding 1,208. His action was approved by the Punjab government but condemned by the secretary of state for India, the army council and the Hunter commission. The house of lords, however, justified his conduct on the ground that he had saved British rule in the Punjab. As a result of this unfortunate affair racial feeling in India became more bitter than at any other time since the mutiny, and many moderate "home rule" enthusiasts changed over to a more extreme nationalism.

The Third Afghan War.—On Feb. 20, 1919, Habibullah Khan was assassinated in his camp near Jalalabad and his brother Nasrullah Khan was proclaimed as amir in his stead. A few days later Amanullah Khan (*q.v.*), a son of the late amir, who controlled the arsenal and treasury at Kabul, was accepted as ruler by the army and the Young Afghan party, and Nasrullah was imprisoned because of his guilt in instigating the murder of his brother. The assassination of Habibullah had not been entirely unexpected in Afghanistan since his policy of neutrality from 1914 to 1918 had incensed the mullahs and other powerful sections of the population who blamed him for not having gone to the assistance of Turkey. Anxious to placate the mullahs and allay this discontent, Amanullah, at a durbar in Kabul on April 13, declared Afghanistan to be free from foreign control. On May 4, unable to resist the popular demand for war against Britain as the chief enemy of Turkey, he proclaimed a jihad, or holy war, and pamphlets calling upon the tribesmen to rise were distributed by the Afghan postmaster at Peshawar. An attempted rising in Peshawar, in co-operation with the Indian revolutionary party, was foiled by the vigilance of the local frontier officials. On May 3 Afghan troops crossed the frontier near Landi Khana and occupied the village of Bagh, whereupon British reinforcements were rushed through the Khyber pass to Landi Kotal. The Afghans were driven from Bagh on May 11, and within eight days of mobilization British troops had advanced through the Khyber into Afghanistan and occupied Dakka. The only Afghan success during the campaign was the penetration of Nadir Khan to Thal in the Kurram valley. After Jalalabad and Kabul had been bombed the amir on May 31 asked for an armistice. A preliminary treaty was signed at Rawalpindi on Aug. 8, 1919, and ratified by a formal treaty on Nov. 22, 1921. In the future Afghanistan was to be free to control its own foreign affairs, but the government of India withdrew the privilege enjoyed by Afghanistan of importing arms and ammunition through India and discontinued

the subsidy which had been paid since the viceroyalty of Lord Ripon. Amanullah persisted in regarding his defeat as a victory and erected a monument at Kabul depicting the British Lion with one leg chained. The cessation of hostilities with Afghanistan did not bring peace to the northwest frontier, and from 1919 to 1920 punitive operations had to be undertaken against the fierce Mahsud tribes inhabiting the heart of Waziristan.

The Act of 1919.—The main trend in Indian history after the conclusion of World War I was the development of self-governing institutions and the rapid growth of the nationalist movement under the leadership of Gandhi. The Government of India act of 1919 was based in the main on the principles adumbrated in the Montagu-Chelmsford report. Before 1919 the chief characteristics of British rule in India, from the administrative, financial and legislative points of view, had been the concentration of authority at the centre, the control of the executive over legislative functions and the responsibility of the British parliament for the whole of Indian government. Under the reformed constitution, authority, instead of being concentrated at the centre, was to be in large measure devolved on the provinces; the opportunities of the central legislature for influencing the government of India were to be increased; and the control formerly exercised by parliament was to be modified by handing over certain subjects of provincial administration to Indian ministers responsible to the provincial legislatures.

At the centre the first reform was to increase the number of Indian members on the governor general's executive council from one to three. The central legislature was entirely remodeled and made bicameral by the creation of a new body called the council of state composed of 60 members, not more than 20 of whom were to be officials (that is, persons in the full-time civil or military service of the crown). There was to be a majority of elected members, but the franchise was extremely limited in order to give this new body the character of an upper chamber. The legislative assembly (that is, the old imperial legislative council) consisted of 145 members, 104 of whom were elected. Of the elected members 52 were returned for general constituencies, 30 for Muslims, 9 for Europeans, 7 for landowners, 4 for commerce and 2 for Sikhs. The franchise was on the same lines as for the provincial councils with a somewhat higher electoral qualification. The duration of the council of state was to be five years; that of the legislative assembly, three. It is important to note that this was the first time that the official majority was withdrawn from the central legislature. A bill rejected by the assembly could be certified by the governor general as essential to the peace or good government of the country. The same applied to the grant of supplies or new taxation proposals.

At first there were eight major provinces under governors, viz., Madras, Bombay, Bengal, the Punjab, the United Provinces, the Central Provinces, Bihar and Orissa, and Assam. The North-West Frontier Province, Baluchistan, Delhi, Coorg, Ajmer-Merwara and the Andaman and Nicobar Islands were left in charge of chief commissioners or agents of the central government. Burma became a governor's province in 1923, as did the North-West Frontier Province in 1932. Reserved for the administration of the central government were military matters and foreign affairs, tariffs and customs, railways, posts and telegraphs, income tax, currency and coinage, the public debt, commerce and shipping and civil and criminal law. The subjects allocated to the provincial governments included local self-government, medical administration and public health, education, public works, irrigation, land revenue, famine relief, agriculture, forests and police.

By an ingenious device unofficially known as dyarchy, or double government, the provincial executive was divided into two parts: a governor and executive council responsible for what were termed "reserved subjects"; and ministers chosen by the governor from the elected members of the provincial legislature to whom were entrusted the "transferred subjects." Reserved subjects included irrigation, land revenue, famine relief, administration of justice, development of mineral resources, police, control of newspapers and printing presses, criminal tribes and prisons. The transferred subjects under the control of Indian ministers included local self-government, medical administration and vital statistics, public works, education, agriculture, the civil veterinary department, fisheries, co-operative societies, forests, excise and industries. In this way Indians were to take charge of great departments of provincial administration as leaders of elected majorities in the legislatures.

The provincial legislatures were unicameral, the legislative councils varying in size from province to province. In all cases they were considerably enlarged and were nearly twice the size of the 1909 councils. The franchise was extended mainly by lowering the property qualification, which resulted in an electorate of about 5,500,000. Since a large proportion of the voters were illiterate use was made of ballot boxes of different colours; or pictorial symbols, such as tigers and umbrellas, were used on ballot papers. Communal electorates were maintained for Muslims, Sikhs, Anglo-Indians and Europeans. In Madras seats were reserved for non-Brahmans and Christians. It will be noted that the system of dyarchy was confined to the provinces and was intended to train Indians for responsible government. There was no dyarchy at the centre, where the governor general continued to be directly responsible to the secretary of state for India and the British parliament. Provincial legislatures were thus set the difficult task of discharging two different functions at the same time: in one sphere (the transferred subjects) they were to exercise control over policy; in the other (the reserved subjects), while free to criticize, they were to have no responsibility. There was therefore a tendency in the years that followed for these councils to regard the government as a whole and to think of the ministers as if they were executive councilors. There was also a tendency to magnify the functions of the reserved field.

The Government of India act of 1919 received the royal assent on Dec. 23, 1919. Elections were held in Nov. 1920, and in the first week of Jan. 1921 the new provincial executives came into office. The central legislature at Delhi was opened in state by the duke of Connaught on Feb. 9, 1921. On the previous day he had opened the new chamber of princes, thus placing on a permanent footing the previous system of informal conferences. Provision was made in the act for the appointment of a parliamentary commission after a period of ten years to inquire into the working of the new constitution and into the possibilities of further constitutional advance.

Khilafat and Swarajists.—The idea behind the Montagu-Chelmsford reforms had been to allay political agitation and to inspire Indians with a spirit of co-operation and a sense of responsibility. Many factors combined to defeat this object. The new constitution did not prove acceptable to the Congress party, which boycotted the first elections in 1920; thus only about one-third of the total electorate went to the polls, and the abstention of the extremists left the moderates in a majority on the new councils. India was also seething with racial and religious discontent. The memory of Amritsar still rankled in the minds of both Hindus and Muslims. India's position as a member of the League of Nations and the presence of its representatives at the imperial conferences led to an increasing demand for dominion status since Indians resented their position of inferiority and their failure to obtain redress for the disabilities suffered by their compatriots in South Africa. Resentment was also caused by the attitude adopted by European colonists in east Africa, who were advocating the restriction of Indian immigration on the ground that it was antagonistic to the best interests of the African people. All this was accentuated by the treatment of Indian indentured labourers in Fiji. Considerable unrest was also caused by the publication in Oct. 1920 of the Esher committee's report, the recommendations of which were tactlessly aimed at subordinating the Indian army to the needs of imperial strategy. Indians naturally regarded this as an attempt to deprive India of the control of its military forces, which were to be used for what was termed imperial aggression in the middle east.

The Khilafat movement, which aimed at the preservation of the Turkish empire and restoration of the caliphial powers to a supreme Muslim authority in Mecca, was another source of anx-

iety to the government of India. The demand by influential sections of British and U.S. opinion that the Turks should be expelled from Constantinople and the failure of the Khilafat deputation to obtain satisfaction from David Lloyd George produced great discontent among Indian Muslims and prompted two agitators, the brothers Mohammed and Shaukat Ali, to proclaim that it was the duty of all true Muslims to leave India for countries where Islam was respected. In obedience to this call many thousands of Muslims sold their goods and joined the *hijrat* ("flight") movement from India to Afghanistan. It was calculated that in the month of Aug. 1920 more than 18,000 persons, the *muhajrin*, as they were called, moved in the direction of Afghanistan. The limited resources of Afghanistan compelled the Afghan government to forbid their entry into the country, with the result that the road from Peshawar through the Khyber pass was strewn with the graves of old men, women and children who had succumbed to the hardships of the journey. The failure of this movement was a severe setback to Khilafatist agitation.

The death of Tilak in Aug. 1920 left Gandhi undisputed leader of the nationalist party. In a letter to Lord Chelmsford he announced his adoption of a policy of non-co-operation as a remedy against a government for which he retained "neither respect nor affection." This was the situation facing Lord Reading when he succeeded Lord Chelmsford as viceroy in April 1921. Gandhi had no sooner taken charge of the nationalist party than he formed an entente with the leaders of the Khilafat movement. Hindu and Muslim grievances were then combined in subversive agitation, which produced the Moplah rebellion of 1921–22 and caused bloodshed and disorder for more than two years in every province in India.

The Moplahs of Malabar, fanatical Muslims of Arab descent, broke out into rebellion in Aug. 1921. The aim of these people was to establish an independent Khilafat kingdom in Malabar. A reign of terror ensued in which thousands of innocent Hindus were either massacred or forcibly converted to Islam. Since the topography of the country favoured guerrilla warfare the rebellion was not suppressed until Feb. 1922. The chief result of this abortive insurrection was to shatter the Hindu-Muslim entente and to exacerbate communal relations. It is recorded that 450 lives were lost and 5,000 persons injured in communal disturbances between 1922 and 1927. The Khilafat agitation gradually petered out after the failure of the *hijrat* movement, but the chief reason for its decline was the establishment of a strong secular Turkish republic and the abolition of the caliphate in 1924.

Serious rioting resulting from Gandhi's policy of non-co-operation marred the occasion of the landing of the prince of Wales at Bombay in Nov. 1921. On Feb. 4, 1922, mob violence was responsible for the murder of 21 police officers at the village of Chauri Chaura in the United Provinces. Eight days after this tragedy Gandhi, realizing his responsibility for the massacre, suspended his campaign of civil disobedience. In March he was arrested, tried for sedition and sentenced to six years' imprisonment. In 1922 the peace of the Punjab was seriously disturbed as a result of the efforts of the Akalis, a reforming sect of Sikhs, to redeem certain shrines and temples from the maladministration of their mahants, or hereditary incumbents, in order to apply the revenues for the spiritual benefit of the Sikh community. Unfortunately the movement, laudable enough in itself, was exploited for political purposes by extremists, and troops had to be employed to suppress disturbances. It was not until the passing of the Sikh Shrines' act of 1925 that more sober views were asserted.

At the end of 1923 the Swarajists, a Congress home-rule party under the leadership of Pandit Motilal Nehru and Chitta Ranjan Das, contested the elections to the legislatures, their aim being to wreck the constitution from within by consistent obstruction. Although large numbers of Swarajists were returned to the legislative assembly and to all provincial councils, it was only in the Central Provinces that they obtained an absolute majority which made the working of dyarchy impossible. In Bengal the support of certain independent members, chiefly Muslims, gave them a majority, and their refusal to vote ministerial salaries led to the suspension of the transferred subjects. Elsewhere dyarchy continued to function, especially in Madras where the opposition to Brahman supremacy united to form the Justice party.

Indianization of the Services.—The growth of the nationalist movement naturally led to the demand for a more rapid indianization of the civil and military services. Although the principle of indianization had been adopted as early as 1833 and had been incorporated in the royal proclamation of 1858, the British showed a reluctance to admit Indians into the higher ranks of the civil service. As late as Aug. 1922 Lloyd George, in his "steel-frame" speech, declared that he could see no period when India would be able to dispense with the guidance and assistance of a British element in its civil service. This was followed in June 1923 by the appointment of a royal commission under the chairmanship of Viscount Lee of Fareham to examine the position of the superior civil service in India. The report of this commission, published in May 1924, contained proposals for a large increase in the recruitment of Indians, but, although it recommended that the Indian civil service should be half Indian after 15 years and the Indian police likewise after 25 years, the proposed pace of indianization did not prove acceptable to Indian opinion. Whereas Indians had been slowly and reluctantly admitted into the higher ranks of the civil service, they had been rigidly excluded from the commissioned ranks of the army, and it was not until 1918 that they became eligible for the king's commission. In the same year ten places were reserved for Indians in the Royal Military college at Sandhurst, Eng. The year 1923 saw the introduction of a cautious experiment known as the "eight units scheme" which aimed at building up a small force (five infantry battalions, two cavalry regiments and one pioneer unit) entirely officered by Indians. In 1927 the number of reservations at Sandhurst was raised to 20 and Indians also became eligible for admission to Woolwich and Cranwell, both in England. It was not until 1934, however, that an Indian Sandhurst was opened at Dehra Dun.

Political Assassination, 1923–32.—The year 1923 witnessed a recrudescence of terrorist activity with a new and bolder technique. Terrorists entered the Congress party, were elected to its committees and forced their resolutions upon its conferences. Bombs of a more powerful type were manufactured and leaflets were issued proclaiming that the Bengal Revolutionary council had decided to assassinate police officers and any persons assisting them. The old method of obtaining funds by the robbery of wealthy Indians was discarded in favour of skilfully planned attacks on post offices and railway cash offices by gangs of armed dacoits. In 1924 an Englishman was murdered in Calcutta by mistake for Sir Charles Tegart, the commissioner of police. To combat this type of crime, special measures were introduced by the Bengal Criminal Law Amendment act of 1925, which led to the internment of 150 ringleaders and to a temporary cessation of outrages. It was calculated that in Bengal, out of a total population of 50,000,000, not more than 2,000 men and women were in the inner circle of the anarchist movement. Checked in Bengal, the terrorists transferred their activities to the United Provinces and the Punjab. In Dec. 1928 two police officers were murdered in Lahore. In April 1929 bombs were thrown into the legislative assembly at Delhi, and in December of the same year an unsuccessful attempt was made to wreck the viceroy's train. Because of the improved situation in Bengal all interned terrorists were released in Jan. 1929, and in the following year the Bengal Criminal Law Amendment act was allowed to lapse. This was the signal for a revival of terrorism in the province. In April 1930 there occurred the most daring raid that had yet been attempted; a gang of about 100 Bengali youths dressed in uniform attacked the police armoury, the European club and the telegraph office at Chittagong. There were 30 outrages besides this in 1930, including the assassination of the inspector general of police and of the inspector general of prisons and an unsuccessful attempt to assassinate the governor of the Punjab. Attempts were also made in July 1931 and in Feb. 1932 on the lives of the acting governor of Bombay and the governor of Bengal. Between 1931 and 1932 in Bengal three district magistrates and one district judge were assassinated and several senior officials of the civil service

wounded. The Congress party contended that these murders were the outcome of repressive legislation, but others pointed out that an amnesty had always been the signal for further outrages. The formation on the northwest frontier of a revolutionary party known as the Red Shirts under the leadership of Abdul-Ghaffar Khan, a Pathan of Utmanzai, was followed by grave disturbances in Peshawar, Bannu, Mardan and Kohat in April 1930. In the same month Abdul-Ghaffar was arrested, but as a result of Gandhi's intercession with the viceroy he was released in March 1931. In August of the same year the Red Shirt movement was officially affiliated to the Congress party; but because of his subversive activities Abdul-Ghaffar was once more arrested in Dec. 1931.

In addition to the recrudescence of anarchical crime, the government of India under Lord Irwin, who had succeeded Lord Reading in April 1926, was confronted with the rapid growth of communal antagonism and with a civil disobedience movement under the leadership of Gandhi, who had been released from prison because of ill health. Although Lord Irwin showed a marked sympathy with the cause of Indian self-determination and attempted by means of conferences to bring the leaders of the two religions into agreement, his efforts proved unavailing and communal bitterness remained an outstanding feature of the Indian situation from this time onward. When the third elections were held in Nov. 1926, appeals were made to electors in many cases on communal lines. Relations between Hindus and Muslims were exacerbated by the anti-Muslim attitude of the Mahasabha, an extremely orthodox Hindu organization, and by the rejection of communal electorates in the Nehru constitution drawn up by an entirely Indian body under the chairmanship of Pandit Motilal Nehru in 1928.

The Simon Commission.—The act of 1919 provided for an inquiry into the working of the new constitution after a period of ten years. In response to Indian wishes this inquiry was expedited by two years, and the appointment of a statutory commission was announced on Nov. 8, 1927. Appointed by a Conservative government in England, it consisted of seven persons, all members of the British parliament, under the chairmanship of Sir John Simon. Two visits were paid to India: Feb. 3–March 31, 1928, and Oct. 11, 1928–April 13, 1929. The noninclusion of Indians offended the strong sentiment of national self-respect that prevailed in India, and at first the commission was boycotted even by moderate nationalists like Sir Tej Bahadur Sapru. When the members of the commission landed at Bombay on Feb. 3, 1928, they were greeted with hostile demonstrations which included a hartal, or suspension of business. During their second visit, however, they found committees from both the central and provincial legislatures prepared to co-operate in the examination of witnesses. In the same year the Nehru report was published advocating the immediate grant of "full responsible government on the model of the constitutions of the self-governing dominions," but extremists under the influence of Motilal's son, Jawaharlal Nehru (*q.v.*), declared that they would be satisfied with nothing short of *purna swaraj;* that is, complete national independence. At the Calcutta congress of Dec. 1928 a resolution was passed giving the British until the end of 1929 to accept the Nehru constitution, their refusal to be followed by a civil disobedience campaign. The disturbed condition of India prompted Lord Irwin to proceed to London for consultation with the Labour government, which had come into office. On Oct. 31, 1929, after his return to India, he was authorized to make two important announcements:

1. "In view of the doubts which have been expressed both in Great Britain and India regarding the interpretation to be placed on the intentions of the British Government in enacting the statute of 1919, I am authorized on behalf of His Majesty's Government to state clearly that, in their judgment, it is implicit in the Declaration of 1917 that the natural issue of India's constitutional progress as there contemplated is the attainment of Dominion status."

2. To disperse the distrust concerning British intentions, which had been aggravated by the exclusion of Indians from the statutory commission, he also declared that, after the report of the Simon commission, there should be a round-table conference in London to which Indians would be invited in order to express their views before proposals for the future government of India were laid before the British parliament.

These pronouncements were accepted by the moderates, but the Lahore congress of Dec. 1929 passed resolutions in favour of complete independence and authorized immediate preparations for a campaign of civil disobedience. The signal for this campaign was given by Gandhi when he set out on his ceremonial march from Ahmedabad to the sea coast and on April 6, 1930, broke the law by manufacturing salt on the beach at Dandi. Widespread disturbances followed, from which Muslims as a body held aloof. One feature of the movement was the unexpected assistance of women, some of whom emerged from purdah to join the Congress demonstrations and assist in the picketing of liquor shops. Both Gandhi and Jawaharlal Nehru were arrested during the disturbances.

In June 1930 the Simon report was published. It main recommendations were that dyarchy should be replaced by full responsible government in the provinces, the governors still retaining special powers in an emergency; that the existence of racial and religious differences necessitated the retention of communal electorates; and that any constitutional reconstruction should take into consideration not only the provinces of British India but also the Indian states. Since the report contained no mention of dominion status and expressed doubts about the suitability of a parliamentary system of government in India it met with a hostile reception.

The Round-Table Conferences.—Between 1930 and 1932 three conferences were held in London to enable representatives of the various Indian communities and of the three British political parties to consider proposals for the future constitution of India. Because of the refusal of Congress to co-operate, the first conference (Nov. 1930–Jan. 1931) was representative only of a minority of politically minded Indians. Nevertheless, the success of this conference, at which the general principle of an all-India federation was accepted, was a severe blow to the influence of Congress and was an important factor underlying what is called the Irwin-Gandhi pact of March 1931, whereby the government of India agreed to release all political prisoners provided Congress would suspend the civil disobedience campaign. This was followed by a temporary improvement in the Indian situation, and Gandhi attended the second London conference (Sept. 7–Dec. 1, 1931) as the sole spokesman of Congress. For many reasons he was unable to make any constructive contribution to the deliberations of the conference and failed to bring about any solution of the communal problem. On his return to India early in 1932 he again fomented civil disobedience and was promptly arrested by Lord Willingdon, who had taken over the viceroyalty in April 1931. Because of the difficulties revealed at the second conference, a franchise committee under Lord Lothian, a federal finance committee under Lord Eustace Percy and an Indian states inquiry committee under J. C. C. Davidson proceeded to India for further investigation of these problems. For the same reason, in Aug. 1932, the British prime minister, Ramsay MacDonald, made his communal award by which the existing system of communal electorates was preserved and the depressed classes recognized as a minority community. This did not prove acceptable to Gandhi, who was in prison at Poona, and in deference to his wishes the caste Hindus and the depressed classes accepted a scheme known as the Poona pact, by which a larger number of seats was reserved for the depressed classes. After a third conference (Nov. 17–Dec. 24, 1932) which chiefly concerned itself with a consideration of the reports of the Lothian, Percy and Davidson committees, the British government elaborated its draft proposals, which were examined by a joint select committee of lords and commons assisted by specially selected Indians. From these discussions emerged the Government of India bill of 1935.

The Act of 1935.—The three main principles underlying the new constitution were an all-India federation, provincial autonomy and responsibility with safeguards. The federation was not to come into operation until the rulers of Indian states representing not less than half of the aggregate population of the states signified their desire to accede. Each state had to sign a separate instrument of accession, but for the provinces entry into the federation was compulsory. Power to amend the constitution

was vested in the British parliament, and a federal court was to be established to determine disputes between the constituent units of the federation. For the central government a system of dyarchy was devised whereby all departments, with the exception of foreign affairs and defense, were to be in charge of ministers responsible to the federal legislature consisting of a council of state and a house of assembly. The council of state was to be composed of 156 representatives of British India directly elected on a population basis, with the exception of six seats reserved for nomination by the governor general, and not more than 104 representatives of the Indian states appointed by the rulers of the states concerned. The house of assembly, which was to be re-elected every five years, was to consist of not more than 125 nominees of the states and 250 representatives of British India elected by the provincial legislatures. Communal representation was to be retained both at the centre and in the provinces. Because the federal legislature never came into operation, the central constitution continued to be that of the 1919 act.

British India was to be divided into 11 governor's provinces (Madras, Bombay, Bengal, United Provinces, Central Provinces and Berar, Punjab, Bihar, Assam, North-West Frontier Province, Orissa and Sind). Burma was separated from India, and Aden was placed under the colonial office. Responsibility of the executive to the legislature was to be the basic principle of government in the provinces; the governor's special powers were to be exercised only in an emergency. British Baluchistan, Delhi, Ajmer-Merwara, Coorg and the Andaman and Nicobar Islands were to be administered by chief commissioners responsible to the governor general. Except in the Central Provinces, Punjab, North-West Frontier Province, Orissa and Sind, the provincial legislature was to be bicameral. Provincial autonomy was established April 1, 1937.

The proposals for an all-India federation were bitterly assailed by Congress politicians on the ground that there was no true basis for a federation since the Indian states did not approximate to the provinces of British India in the establishment of responsible government, civil liberties and method of election to the federal legislature. Great exception was also taken to the reservation in the hands of the viceroy of powers over defense and foreign affairs. Muslims fought shy of the federation because it would strengthen the Hindu predominance in the central legislature. Although the states had at first supported the proposals for a federation their attitude gradually changed as they came to realize the sacrifice of sovereignty required of them.

At the first general elections in Jan. and Feb. 1937 the Congress party secured large majorities in all provinces except Bengal, the Punjab, Sind and Assam but refused to accept office unless provincial governors pledged themselves not to use their special powers of interference or to set aside the advice of their ministers. Since the governors declined to compromise their statutory powers it was not until June 1937, when Lord Linlithgow announced his intention of striving for "the full and final establishment in India of the principles of parliamentary government," that Congress ministries were formed and the minority cabinets, which had bridged the gap, disappeared. During their period of office from July 1937 to Sept. 1939 communal tension increased because of the grievances of Muslims under Congress rule in Bihar and the United Provinces. This was aggravated by the claim of Congress to represent Muslims as well as Hindus, a claim vigorously opposed by the Muslim league under Jinnah. As a result of Congress agitation for constitutional reforms in the Indian states serious disturbances broke out in Mysore, Hyderabad, Kashmir and Travancore. The new provincial governments were also confronted with agrarian unrest and with industrial disputes, the result of Communist propaganda. But useful social and agrarian legislation was introduced. Relief was given to certain classes of agricultural tenants, the burden of peasant indebtedness was reduced and an attempt was made to enforce prohibition.

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INDIA IN 1939

World War II.—When war broke out in Sept. 1939 India was declared a belligerent by the governor general without even the pretense of consultation with the central legislature or the provincial governments. The result was that Congress, although expressing its condemnation of Nazi aggression, refused to associate itself with the war effort unless India was declared an independent nation. The governor general therefore announced that dominion status was already envisaged by the British government as the goal of its policy and that at the end of the war it was prepared to modify the act of 1935 in consultation with the leaders of the various Indian communities and parties. At the same time he proposed to establish an advisory council representative of all major Indian interests in order to associate Indian public opinion with the prosecution of the war. This

assurance did not satisfy Congress, and in Nov. 1939 all Congress ministers resigned on the ground that the British government had failed to make an acceptable declaration of its war aims. The governors of the provinces concerned therefore assumed powers in accordance with section 93 of the act of 1935.

India's contribution to the war effort, though impeded by the refusal of Congress to co-operate, was magnificent. In 1939 the Indian army consisted of about 200,000 regular soldiers. By 1945 the government of India had recruited on a voluntary basis more than 2,000,000 Indians, the largest voluntary recruitment ever recorded in history. Indian troops served with distinction in all theatres. They played a major part in the first Allied victory of the war, the conquest of Italian East Africa. Out of the 1,000,000 troops engaged in the final Allied victory of the war, the defeat of the Japanese in Burma, 700,000 were provided by the Indian army. India's total casualties during the war were 179,935, of whom 24,338 were killed or died of wounds, 11,754 were reported missing, 64,354 were wounded and 79,489 were prisoners of war. But India's most important contribution was economic and the development of the industrial system enabled India not only to produce the bulk of military supplies needed at home but also to equip the imperial armies in Africa and the middle east. Many hitherto neglected resources were exploited, and the war saw a remarkable revival of the old Indian industry of shipbuilding. The net expenditure on defense rose from £34,500,000 in 1939 to £300,000,000 in 1945. One result of the Allied calls on its resources was to transform India from a debtor to a creditor nation with accumulated sterling balances at the end of 1945 amounting to about £1,250,000,000.

On several occasions during the war attempts were made to put an end to the political deadlock. On Jan. 10, 1940, Lord Linlithgow announced that the object of the government of India was the development of full dominion status in accordance with the Statute of Westminster. But in March of the same year the Muslim league under Jinnah's leadership condemned the act of 1935 as unacceptable to Muslims, whose aim was the establishment of an autonomous Muslim state embracing the areas where Muslims formed a majority of the population.

Once more in Aug. 1940 the viceroy repeated his statement that dominion status was the goal of British rule in India and announced that the British government wished India to enjoy that position under a constitution framed primarily by Indians as soon as possible after the end of hostilities. At the same time Indian political leaders were invited to serve as heads of departments on the viceroy's executive council. The reply of Congress to this proposal was that India should be granted immediate independence and that the task of drafting a constitution should be committed to an assembly elected by universal suffrage.

In Dec. 1941 Japan entered the war and in the opening months of 1942 occupied Singapore, Malaya and the Andaman Islands, overran Burma and threatened India with invasion. In spite of all this the political deadlock remained. On March 11, 1942, Winston Churchill, the British prime minister, announced that it had been decided to send Sir Stafford Cripps, a member of the war cabinet, to India with proposals for a settlement of the Indian constitutional problem. It was proposed to create a new Indian union as a fully independent dominion. As soon as the war ended, a new constitution was to be framed by a body consisting of elected representatives of British India and nominces of the Indian states. Membership in the proposed union was not to be compulsory, and dissenting provinces were to be free to form separate unions. Until the new constitution of the Indian union came into being the British government was to be responsible for the defense of India with the help of an Indian government composed of members of all parties and with the full co-operation of the Indian people. These proposals were rejected by Congress because they did not comply with its demands for the immediate establishment of a fully independent national government and by the Muslim league because they did not meet its wishes for an independent Muslim state. On Aug. 8, 1942, Congress passed a resolution calling upon the British to "quit India" immediately, failure to comply to be the signal for mass civil disobedience. This was followed by widespread disorders in the autumn of 1942, which were soon suppressed with the arrest of the Congress leaders. Meanwhile, in 1941, Subhas Chandra Bose, a left-wing nationalist extremist, had fled to Berlin, where he was made the focus of an Indian "freedom movement" that was anti-American as well as anti-British. In 1943–45, successively in Singapore, Rangoon and Bangkok, he headed a "provisional government of free India" which in July 1943 set up the "Indian National army," composed of Indian prisoners of war and deserters and Indian residents in overrun British territories, to fight with the Japanese on the Burma front. Bose died after an air crash in 1945.

In 1943–44 over 1,500,000 died in India as a result of famine and epidemics that followed. The Bengal famine of 1943 was caused by failure of the main rice crop harvested in the winter of 1942. This, unfortunately, was aggravated by the loss of Burma rice caused by the war with Japan and by a failure to ensure an equitable distribution of the available supplies. In Oct. 1943 Lord Linlithgow was succeeded as viceroy by Lord Wavell.

F. Indian Independence

With the end of World War II and the return of a Labour government to power in England it was announced that elections would take place to the central and provincial legislatures in India and that as soon as possible afterward a constitution-making body would be convened. In Feb. 1946 it was decided to send a British cabinet mission to India to discuss with the viceroy and Indian political leaders the constitutional future of the country.

When the mission reached India in March, responsible ministries were functioning in all provinces for the first time since 1939. Since the main political parties failed to reach an agreement, the mission was forced to produce its own plan. Until an elected constituent assembly had decided on India's future constitution, it was proposed to set up an interim government in which all portfolios would be held by Indians. The demand for a separate Muslim state of Pakistan was rejected as incompatible with the requirements of Indian defense. Eventually the Congress party agreed to form an interim government, which came into office on Sept. 2 with Nehru as vice-president to the viceroy.

This was followed by Hindu-Muslim clashes in which about 7,000 persons were killed. When the constituent assembly met on Dec. 9, 1946, it was boycotted by the Muslim league and the Indian states. On Feb. 20, 1947, the British government announced its intention of transferring power into Indian hands by a date not later than June 1948. At this juncture Lord Wavell resigned and was succeeded on March 23, 1947, by Viscount Mountbatten, who after a series of consultations with Indian political leaders announced that the only solution was the division of India into two separate states. An Indian independence bill became law on July 18, 1947. Its effect was to set up on Aug. 15, 1947, two completely independent states in India, the Dominion of Pakistan and the Dominion of India, their eventual boundaries in the Punjab and Bengal to be determined by a commission presided over by Sir Cyril Radcliffe. Partition and the division of Bengal and the Punjab were the signal for communal riots and mass migrations accompanied by hideous massacres, but by the end of Sept. 1947 the fury of the slaughter had died down. The early years of independence were dominated by armed clashes and friction over Kashmir (*see* Jammu and Kashmir).

India became a sovereign democratic republic in 1950 and Pakistan was proclaimed an Islamic republic in 1956. Both nations remained members of the Commonwealth. (For later history *see* articles India; Pakistan.) (C. C. D.)

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INDIA RUBBER: *see* RUBBER.

INDICATOR, CHEMICAL. An indicator is a substance that is capable of indicating the completion of a reaction. Methyl yellow, for example, imparts a yellow colour to an alkaline solution. If acid is slowly added, the solution remains yellow until all the alkali has been neutralized, whereupon the colour suddenly changes to red. Methyl yellow is therefore classified as an acid-base indicator.

Like most indicators, methyl yellow is visible even if its concentration is as low as a few parts per million parts of solution. Used at such low concentrations, indicators do not interfere with or have any influence on the reactions for which they are recommended. The common application of indicators is the detection of end points of titrations (*see* TITRATION).

The colour of an indicator alters when the acidity or the oxidizing strength of the solution, or the concentration of a certain chemical species, reaches a critical value or, more precisely, a critical range of values. Indicators are therefore classified as acid-base, oxidation-reduction or specific-substance indicators, every indicator in each class having a characteristic transition range. Methyl yellow is yellow if the hydrogen ion (acid) concentration of the solution is less than 0.0001 mole per litre and is red if the concentration exceeds 0.001. Ferrous 1,10-phenanthroline, an oxidation-reduction indicator, changes from red to pale blue when the oxidation potential of the solution is increased from 1.04 to 1.08 v.; and diphenylcarbazone, an indicator for mercuric ion, changes from yellow to violet when the mercuric ion concentration is increased from 0.000001 to 0.00001 mole per litre. Each of these indicators thus has a relatively narrow transition range, and each is capable of giving a sensitive, sharp indication of the completion of a reaction (the end point). In devising a new titration the chemist first calculates or empirically determines the changes in the properties of the solution that occur as the end point of the reaction is approached and passed. He then selects an appropriate indicator from tables of indicator transition ranges. Thousands of indicators have been studied, some of which have been individually synthesized to provide them with specified characteristics.

Commonly, indicators are complex organic compounds, similar in structure and optical properties to dyes. The chemical behaviour of indicators is, however, usually simple. The acid-base properties of methyl yellow (*p*-dimethylaminoazobenzene), for example, are entirely analogous to those of ammonia. Both compounds are weak bases which, when acid is added, combine reversibly with hydrogen ions. Moreover, the same simple mathematical equations describe the acid-base behaviour of both compounds; namely, the ratio of the concentration of the acidic form to the concentration of the basic form is proportional to the hydrogen ion concentration (*see* HYDROGEN IONS). The principal difference is that the basic form, NH_3, and the acidic form, NH_4^+, of ammonia are both colourless, whereas the corresponding forms of methyl yellow are yellow and red. The addition of a hydrogen ion to the methyl yellow molecule causes a redistribution of electrons and a consequent alteration in light absorption properties. This redistribution is in part made possible by the complexity of the indicator's molecular structure.

Although the visible change of the indicator is usually a colour change, it may instead be the formation or disappearance of a turbidity. If, for example, a soluble silver salt is added to a solution of cyanide that contains a trace of iodide, the solution remains clear until all the cyanide has reacted to form the soluble silver cyanide complex ion, $Ag(CN)_2^-$. Upon the addition of more silver a turbidity of silver iodide forms. Iodide is therefore an indicator for excess silver ion in this reaction.

A peculiar kind of indicator is the adsorption indicator, the best-known representative of which is the dye fluorescein. Fluorescein is used to detect the completion of the reaction of silver ion with chloride ion, the colour change occurring in the following manner. After a quantity of silver sufficient to precipitate all the chloride has been added, additional silver ion is partially adsorbed on the surface of the particles of silver chloride. Fluorescein also is adsorbed and, in combining with the adsorbed silver ion, changes from yellow-green to red.

Until about 1935 acid-base indicators were used extensively for the colorimetric determination of the pH of aqueous solutions. (The pH is a measure of acidity and alkalinity. The pH scale runs from approximately zero—very acidic solution—to approximately 14—very alkaline solution.) The procedure was (1) to select by trial and error an indicator with a suitable transition range; and (2) to compare the colour of the sample solution with the colours of standard solutions of known pH, all solutions containing the same amount of the same indicator. After the development of the glass electrode, which permits a precise and convenient electrochemical measurement of pH, the use of indicators for this purpose was abandoned, except as it survives in the employment of the so-called wide-range or universal indicator. The wide-range indicator is actually a mixture of indicators, the transition ranges of which slightly overlap one another and in combination extend from the very acid range to the very alkaline range. The indicators of the mixture are so chosen that the colour of the mixture indicates uniquely the pH; a colour chart gives the pH corresponding to a given colour. Thus, a mixture of methyl yellow (pH range 3 to 4), methyl red (4 to 6), bromthymol blue (6 to 8), thymol blue (8 to 9.5) and phenolphthalein (8.2 to 10) is coloured cherry red at pH 1, rose at pH 2, red-orange at pH 3, orange-red at pH 4, orange at pH 5, yellow at pH 6, yellowish-green at pH 7, green at pH 8, bluish green at pH 9 and blue at pH 10.

"Indicator paper" is dry, absorbent paper impregnated with one or more indicators. An estimation of pH can be made by putting a drop of test solution on wide range indicator paper and observing the colour. This technique avoids contamination of the solution.

(T. S. L.)

INDICATORIDAE, a family of small African and Asian birds called honey guides, which by their chattering lead animals, including man, to bees' nests. *See* HONEY GUIDE.

INDICTION. The word *indictio* under the Roman empire meant a governmental order for the requisition or compulsory pur-

chase of goods for the use of the court or army. In the 3rd century A.D., as the value of the regular tax revenue in money sank owing to the inflation of the currency, such indictions, at prices which became nominal and ultimately ceased to be paid, became increasingly common and came to supply the bulk of the government's needs. Being irregular (*indictiones extraordinariae*), they were grossly inequitable and oppressive. Diocletian (emperor 284–305) remedied this situation by systematizing them, levying them annually and uniformly throughout the empire on the basis of a census of land and population. Henceforth the praetorian prefects each year issued an edict fixing the amount of various goods—corn, wine, meat, clothes, etc.—to be levied from each fiscal unit of land (*iugum*) or of population (*caput*). These annual indictions were serially numbered, at first from 1 to 5, from A.D. 312 from 1 to 15, after which the cycle recommenced at 1. The indiction thus came to mean the annual budget or the financial year; this year did not coincide with the civil (consular) year, which began on Jan. 1, but ran from Sept. 1 to Aug. 31 (except in Egypt, where it began at a variable date in early summer). The indictional year was not used officially except for fiscal purposes, but private persons sometimes employed it for dating, usually in addition to the consular year; this practice was especially common in Egypt.

In the pontificate of Pelagius II (584) the Roman Church adopted the indiction for dating its documents, in conjunction with the consular year, later the regnal year of the emperor of Constantinople, and later still the regnal year of the Holy Roman emperor or the year of the pontificate of the pope. The popes (down to 1087) used the Roman (so-called Constantinopolitan) indictional year beginning on Sept. 1, but from the 7th century the indiction was often popularly reckoned in Italy from Jan. 1, thus coinciding with the civil year. The Anglo-Saxons also adopted the indiction but counted the year from Sept. 24, which they believed to be the autumnal equinox. This form of indiction was popularized by Bede and adopted by Charlemagne, from whom it passed to the medieval emperors and kings of France. In 1088 the papal curia abandoned the old Roman indiction and for the next century used indiscriminately the year beginning Jan. 1 and that beginning Sept. 24.

Under the Roman empire and in papal documents down to 1087 the first indiction thus means from Sept. 1 to Aug. 31, A.D. 312/313 or 327/328 or 342/343 and so forth, the second indiction 313/314 or 328/329 or 343/344 and so forth. The system, though convenient for its original fiscal purpose, was singularly ill adapted for dating documents of long-term interest and is, if the indiction is used alone without a regnal or other date, baffling to historians. It was in decreasing official use until the 16th century and can still be found in modern almanacs. *See* also CALENDAR; CHRONOLOGY. (A. H. M. J.; X.)

INDICTMENT, in the United States (and, until recently, in England), is a formal written accusation of crime affirmed by a grand jury and presented by it to the court for trial of the accused. English legislation enacted in 1933 and 1948 eliminated the grand jury system in that country. In the current English law a bill of indictment may be presented by any person to the appropriate officer of court when the person accused has been committed to trial by a magistrate and in certain other cases. When the bill is signed by the officer the document becomes an indictment.

An indictment must be stated with sufficient precision to fulfill four essential functions: to establish the jurisdiction of the court to try the case; to provide adequate notice to the defendant of the charges against him; to enable the court to pronounce judgment, upon conviction, according to the rights of the case; and to prevent a second prosecution for the same offense. Reforms of criminal pleading are limited to measures consistent with the attainment of these objectives. The indictment at common law was an instrument of remarkable prolixity. Formal requirements relating to such matters as the caption, commencement and conclusion of the document and the modes of alleging the elements of the offense were enforced with great rigour by the courts. Amendments were not permitted. The tendency of the modern law is strongly in the direction of simplifying the form and language of the indictment. Various statutes enacted in England in the 19th century were designed to lessen the rigours of the old rules of criminal pleading, but the basic reforms were accomplished by the Indictments act, 1915. The indictment in England now consists of three parts: (1) commencement, (2) statement of the offense and (3) particulars of the offense. Each charge must be in a separate count, but any number of felonies and misdemeanours may be joined in the same indictment. A defective indictment may be amended unless "the required amendments cannot be made without injustice."

Similar efforts to reform the indictment have occurred in the United States. Rule 7 of the Federal Rules of Criminal Procedure (1946), applicable to the federal district courts, provides that the indictment "shall be a plain, concise and definite written statement constituting the offense charged." No formal requirements as to commencement or conclusion are made. The federal procedure, as well as that of many of the states, authorizes the granting of "bills of particulars" to defendants when additional details about the matters alleged in the indictment are required in the interests of justice. The practices of the states vary considerably in the degree to which they diverge from the old law of indictments. State constitutional provisions sometimes impose requirements as to the form and language of the indictment. The law of some states authorizes the prosecutor or the court to amend a defective indictment when the changes relate to matters of form rather than of substance. In other jurisdictions only the grand jury may alter the indictment's language. In the United States, as in England, the indictment may contain several counts. Each count must adequately allege a single offense. Several counts may allege different versions of the same offense, but counts alleging different offenses may also be joined in the same indictment. If the offenses charged are alleged to have been committed by more than one person, all persons charged may be tried on the same indictment; but in such cases the court may in its discretion direct that the defendants be tried separately. A defective indictment may be attacked by a variety of pretrial motions, including the motion to quash. The Federal Rules of Criminal Procedure substitute for these numerous motions a single motion to dismiss or for other appropriate relief. Attacks on the indictment may include assertions that a count is duplicative (*i.e.*, charges more than one offense), that various formal errors were committed in drafting the instrument, that the language of the indictment does not sufficiently allege commission of an offense, and many others. In modern practice failure to raise objections to the indictment in the appropriate pretrial motion ordinarily results in waiver of the objections. This result does not follow, however, when the defects are fundamental; *e.g.*, when there is failure to show the jurisdiction of the court or to charge an offense. In most jurisdictions such objections may be noticed by the court at any stage of the proceedings.

In England crimes are classified as indictable offenses or petty offenses. Indictable offenses include treason, felonies and some misdemeanours. Under the modern English law crimes designated as petty offenses may be tried on indictment when the authorized penalties include imprisonment for a term exceeding three months. In the United States the indictment is only one of three principal methods of charging offenses. The offense may also be charged by information, which ordinarily consists of a written accusation resembling an indictment, prepared and presented to the court by a prosecuting official. Petty offenses may be tried on complaint of the aggrieved party or, in some cases, of a police officer.

The U.S. jurisdictions are not in accord as to when an accused may or must be tried by indictment. The fifth amendment to the U.S. constitution provides that trial of "capital or other infamous" crimes shall be on presentment or indictment of the grand jury. The term "infamous crime" has been defined as an offense punishable by death or by imprisonment in a penitentiary or at hard labour. The primary issue of constitutional interpretation is whether a defendant charged with an infamous crime may be permitted to waive the indictment and consent to prosecution by information. The Federal Rules of Criminal Procedure provide that one accused of a capital crime shall be prosecuted by indictment. Other cases in which the offense is punishable by a term exceeding one year in a penitentiary or at hard labour are tried on indictment unless the defendant waives indictment, in which case prosecution may

be by information. The waiver must be in open court after the defendant has been advised of the nature of the charge and of his rights. Petty offenses and misdemeanours for which no infamous punishment is authorized may be prosecuted by information. The fifth amendment applies only to the federal government and not to the states. Many state constitutions, however, contain similar provisions, and questions of waiver of indictment have arisen under state law. Some, but not all, of the states permit waiver of the indictment by the defendant. Beginning in the 19th century, many states of the U.S. eliminated grand juries from their procedures and authorized, with various regulations, the prosecution of all crimes by information. That such proceedings are valid and do not offend the due process clause of the 14th amendment was established in the leading case of *Hurtado* v. *California,* 110 U.S. 516 (1884).

See also CRIMINAL LAW: *Criminal Procedure: Indictment and Information.* (F. A. A.)

INDIES, LAWS OF THE, in general, the whole body of law promulgated by the crown of Spain for the government of the Spanish kingdoms outside Europe; and more particularly, a series of collections of decrees, compiled and published by royal authority, culminating in the *Recopilación de Leyes de los Reynos de las Indias* of 1680. From the beginnings of new world settlement, the law of Castile was also regarded as the basic law of the Indies. American conditions, however, presented many problems which had no exact parallel in Spain. An entire administrative and judicial hierarchy, civil and ecclesiastical, had to be created; and a vast native population europeanized and converted to Christian belief. Land had to be distributed and labour organized to work the land. From an early date, therefore, the crown found it necessary to legislate separately for the Indies and to adopt the principle —implicitly at first, but explicitly in the *Recopilación*—that new legislation promulgated for the Iberian kingdoms had no force in the Indies, unless given such force by explicit decree. Thus, while the subjects of the crown in the Indies continued to live, in general, according to the system of private law prevailing in Castile, they acquired a separate body of public law of their own, designed to carry over into America the spirit and intent of Spanish law, but also to adapt it to the vastly different conditions of American life.

Of the thousands of legislative enactments issued by the crown, many with the advice of the Council of the Indies founded in 1524, a small number took the form of codes of rules dealing with particular aspects of colonial life throughout the empire. The earliest of these codes, the "Laws of Burgos" promulgated on Dec. 27, 1512, by Ferdinand II of Aragon, was primarily an attempt to order the relations between Spaniards and Indians and to limit the demands made upon the conquered people. It was, in part at least, a response—a quite inadequate response—to complaints made by Dominican missionaries. The object of the code was to keep the remaining natives of the West Indies at work under seemingly humane conditions while fostering their conversion to Christianity. The Indians were assigned to Spaniards who were charged with protecting, Christianizing and civilizing them. The Indians were to be clothed, fed and settled in villages. By an amendment of July 28, 1513, the Indians were to work nine months for Europeans (one-third of the Indians to work in the gold mines) and three months on their own land raising food.

The "New Laws" of 1542, which also owed much to missionary agitation, dealt with the same subject in much more radical fashion, in particular by attempting to abolish the system of *encomiendas,* whereby leading Spanish settlers were empowered to levy tribute and services from specified Indian villages in return for military protection, the provision of churches and the payment of parish clergy. The New Laws provoked armed rebellion by the *encomenderos* in Peru and the threat of it in New Spain, and some of the clauses concerning *encomiendas* had to be repealed; though restrictions upon *encomenderos* were reintroduced, in a different form, in 1549. In 1552 a code of commercial regulations was published in Seville for the Casa de Contratación ("House of Trade"); in 1563 the constitution, procedure and powers of the colonial courts of appeal (*audiencias*) were defined; and in 1573 appeared the justly celebrated "Ordinances Concerning Discoveries," prohibiting unauthorized operations against independent native peoples and laying down rules for establishing good relations with the inhabitants of newly discovered lands. The vast majority of decrees (*cédulas*), however, were not arranged in code form but dealt empirically with matters of concrete detail, in response to specific complaints or reports. The bureaucratic paternalism of the Habsburg kings produced an extraordinary legislative profusion. Before the middle of the 16th century, the need for a general legal code was already apparent.

Attempts at codification made in the 16th century included the *Cedulario* of Vasco de Puga, published in 1563, which applied only to the viceroyalty of New Spain and contained many errors and omissions; the work of Juan de Ovando of 1570–71, never completed; and the four folio volumes of Diego de Encinas (1596), a roughly classified collection of decrees in chronological order, again with many mistakes—a valuable historical source but of little use to working lawyers. None of these met the need for an authoritative code. The collection which eventually appeared as the *Recopilación* was begun by Antonio de León Pinelo in 1624, under the supervision first of Rodrigo de Aguiar y Acuña and later of Juan Solórzano Pereira, both councilors of the Indies and both, particularly Solórzano, jurists of profound learning and great experience. The work, extracted from more than 400,000 *cédulas,* was completed in 1635 and approved by Solórzano the following year. It was not immediately published, largely because of lack of funds, and was further edited and abbreviated by Fernando Jiménez Paniagua before its eventual approval in 1680 and publication in 1681.

The *Recopilación de Leyes de los Reynos de las Indias* or *de Leyes de Indias* in its final form contains 6,377 laws, in nine books of very unequal length, subdivided into 218 *títulos* or chapters. Briefly stated, the contents of the books are: (1) ecclesiastical government and education; (2) the Council of the Indies and colonial *audiencias;* (3) political and military administration, viceroys and captains general; (4) discoveries, colonization and town governments; (5) provincial government and lower courts; (6) Indians; (7) penal law; (8) public finance; and (9) trade and navigation. Subsequent legislation, especially the far-reaching administrative and economic reforms introduced in the latter part of the 18th century, rendered much of the *Recopilación* obsolete; but proposals made under Charles III for bringing it up to date came to nothing. A recodification was begun in 1805, on the eve of independence, but never completed. The laws remained in force until the Spanish-American wars of independence and, in Cuba, in Puerto Rico and in the Philippines, until the end of the 19th century. The *Recopilación* was reprinted three times in the 18th century and twice in the 19th, the last two editions containing a supplement of later legislation; but the main body of the work was never revised.

The *Recopilación* is a notable monument of colonial legislation. It contains, no doubt, many inconsistencies; its phrasing is not always precise; and the marginal references to original *cédulas* are often inexact. It has none of the organic character of a modern (or of a Roman) code. Side by side with decrees enunciating vital principles of law, it gives rulings on trivial local matters; the installation of a clock in the courtroom at Seville; the gratuities of court ushers; and so on. Much space is devoted to details of ceremonial and precedence; much to restrictive commercial regulations which ultimately proved unenforceable. In accordance with the standards of the times, political power was kept in the hands of the peninsular Spaniards, cutting the colonials out of political life and depriving them of practice in reaching responsible decisions. These defects are more apparent, however, to the hindsight of the 20th century than they were from the normal standpoint of the 17th or 18th.

The *Recopilación* remains the most comprehensive code of law ever devised for a colonial empire and in many ways the most humane. It is permeated by lofty moral and religious principles. This characteristic is most apparent in the sections concerning Indians, which date, for the most part, from the 16th century. They reflect the public influence of such men as Francisco de Vitoria, one of the greatest theologians of his age and a founder of modern

international law; Bartolomé de las Casas, indefatigable missionary and polemicist and a passionate advocate of Indian rights; and García de Loaísa, the emperor Charles V's confessor, general of the Dominican Order and president of the Council of the Indies. Their arguments reinforced the royal determination to prevent the growth of a new colonial feudalism. The *Recopilación*, accordingly, retained the old ordinances which declared that the Indians were free men, the direct subjects of the crown, entitled to the protection of the law in their persons, lands and possessions; that they were rational beings, to be converted to the Christian faith by persuasion and not by force; that tribute and services might be demanded from them only by public authority; and that their laws and customs, where not repugnant to Christian morality or to the laws of Castile, were to be respected. The laws of the Indies were often evaded or disregarded, yet the records of the *audiencias* and of the *juzgado general de Indios* indicate that where they concerned Indians these laws were sometimes enforced. At the very least, they were an unequivocal declaration of policy, which anticipated many ideas associated with the doctrine of colonial trusteeship in the 20th century. (J. H. Py.; M. D. Be.)

INDIGESTION (Dyspepsia) is a subjective variable sensation of discomfort associated with food intake by the person experiencing the discomfort. It may be of nervous origin, the result of poor food habits, a reflex to pain or due to disease in the gastrointestinal tract. The sensation may be a bad taste in the mouth; a burning or tight feeling in the chest; belching or frequent vomiting; heaviness, gnawing, burning or fullness in the upper abdomen; a bloating or cramping sensation in any part of the abdomen; or irregular bowel habits. Nervous indigestion usually dates from youth and is associated with added stresses and strains of life as well as the intake of irritating foods. It responds well to mild sedation, antispasmodics and a bland diet. Indigestion caused by poor food habits usually can be corrected by eating in leisurely fashion, chewing the food well with the mouth closed and observing a bland diet. Indigestion may arise in reflex to pain in any part of the body, fatigue, anger or fear. This may be removed by elimination of the inciting cause. Similar sensations may be caused by spasms or tumours in the esophagus, inadequate valve action between the esophagus and stomach, ulcers or tumours of the stomach or duodenum, tumours or inflammation of the intestine. Therefore, such symptoms require thorough medical study in order to eliminate any such serious causes. (Je. A. S.)

INDIGETES DII (Indigites Dii), a category of Roman gods. The further terms *indigitamenta* (a list of such gods and their proper titles) and *indigitare* (to address a god by the correct name or invocation) constitute, with the first, a complex of words linked in form and meaning. Ancient sources do not explain the precise force of these technical terms, and modern scholars are not in agreement as to their etymology and original significance. The singular form *indiges* is well attested in connection both with the sun and with the Numicus river (Torto river, a very short stream south of the Tiber). *Sol indiges* had a festival on Dec. 11, perhaps celebrating the completion of the winter sowing; and the Numicus was *Pater indiges*, whose cult probably antedates that of *Iuppiter* (Jupiter) *indiges*, also associated with the river. The most plausible explanation of *indiges* would make it mean "inwardly active." This fits well with an invocation of sun and river to foster the growing crops of a primitive agricultural community. The phrase *indigetes dii* in Augustan literature seems to be a traditional formula used with conscious archaism by writers who had no clear concept of its etymological origins or semantic history. The theory that the Romans thought of their gods as falling into two complementary classes of original native deities (*dii indigetes*) and foreign newcomers (*dii novensides*) breaks down under analysis, based as it is on mistaken etymology and late antiquarian speculation.

See H. Wagenvoort, *Roman Dynamism*, pp. 83 ff. (1947); K. Latte, *Römische Religionsgeschichte*, pp. 43 ff. (1960). (D. E. W. W.)

INDIGIRKA, a river of the U.S.S.R., is located in northeast Siberia. It is 1,112 mi. long and drains a basin of 139,150 sq.mi. Its headstreams, the Khastakh and Taryn-Yuryakh, rise in the Verkhoyansk range in the northeastern part of the Yakut Autonomous Soviet Socialist Republic and flow in deep, narrow gorges. United as the Indigirka and receiving many short, rapid mountain tributaries, the river cuts north through the Cherskogo range into the broad Indigirka lowland, most of which is in tundra vegetation. This lower course, extremely winding, with low banks, enters the East Siberian sea by an extensive delta. The average annual discharge is 63,567 cu.ft. per second, with maximum flow (over half the annual total) in summer. In winter the flow is insignificant. The Indigirka begins to freeze up in late September in the lower course and early October in the upper, and remains frozen, in places to the river bed, until mid-June. These severe ice conditions greatly reduce the value of the river for transport, although it is navigable, with icebreakers when necessary, to the village of Khonu on the Arctic circle. Oimyakon, in a basin on the upper Indigirka, has recorded one of the lowest temperatures of the inhabited world, −70° C. (−94° F.). The only economic importance of the basin lies in the goldfield of its upper part, to which there is access by road from Magadan on the Sea of Okhotsk. On the lower course there is coal, as yet unexploited. (R. A. F.)

INDIGO, an important and valuable dyestuff, was obtained up until the last decade of the 19th century entirely from plants, mainly those of the genus *Indigofera*, of which the *I. sumatrana* and *I. arrecta* were the most important. The material was known to the ancients of Egypt, Greece and Rome, and according to Julius Caesar also to the Britons who obtained it from the woad plant, *Isatis tinctoria*.

In all the plants from which it was derived, indigo occurred in the form of a colourless glucoside, indican, $C_{14}H_{17}NO_6{\cdot}H_2O$, which was readily soluble in water. By a process closely akin to fermentation, the glucoside was split into glucose and indoxyl, C_8H_7NO, the latter also colourless. By mild oxidation, even by air, two molecules of indoxyl were converted by the loss of four hydrogen atoms into indigo, $C_{16}H_{10}O_2N_2$, a dark blue powder.

The cultivation of indigo plants and the extraction of the dyestuff was an important industry in India up to the beginning of the 20th century. In 1897, for example, no less than 1,750,000 ac. of land in this country were under cultivation for this purpose, and approximately 17,000,000 lb. of indigo were exported. The introduction of comparatively cheap synthetic indigo at about this time by the Germans therefore produced an economic upheaval in India.

In 1883, the German chemist A. von Baeyer announced the true chemical structure of indigo, and at once a race began between the leading German dyestuff companies to develop a commercial method for its manufacture. But it was not until approximately 15 years later that a process was developed that was economically sound. Although discovered elsewhere, it was developed in the plant of Meister, Lucius and Bruening at Hoechst and consisted in the fusion of phenylglycine sodium salt, $C_6H_5{\cdot}NH{\cdot}CH_2COONa$, in a mixture of caustic soda and sodium amide to indoxyl, the use of soda amide being the key to the success of the development.

Since World War II synthetic indigo has been made by this method in every country in the world possessing a first-rate dyestuff industry.

The cultivation of indigo-bearing plants in India has practically ceased.

See also references under "Indigo" in the Index. (J. H. Ss.)

INDIGO BUNTING (Indigo Bird) (*Passerina cyanea*), a North American bird of the finch family (Fringillidae), breeding chiefly in the northeastern United States and adjacent Canada, south to Georgia, west to Colorado and Texas. The adult male is of a deep blue nearly all over, changing to brownish in the autumn. The female is brown above and ochreous-white beneath. *See* Bunting.

INDIUM, a lustrous, silvery, metallic element softer than lead and both malleable and ductile, was discovered in 1863 by Ferdinand Reich and Theodor Richter by means of the spectrograph, and because of the prominent indigo-blue spectral lines they gave the name indium to the element. It is in group IIIb of the periodic table between gallium and thallium, which it resembles in many chemical properties.

For more than 50 years after its discovery little use was made of the substance, which has since found valuable applications in

the manufacture of transistors, in finishing engine bearings, as an ingredient in fusible alloys and solders and in other specialized uses, including the measurement of the thermal neutron flux of nuclear reactors (see *Uses*, below).

Occurrence and Recovery.—Indium is scattered widely throughout the world and is found in small amounts in many minerals, particularly those of zinc and lead. Numerous methods have been suggested or used for the extraction of indium from concentrates or residues. In one method, the zinc concentrates containing indium are roasted and leached with a solution maintained somewhat acid with sulfuric acid. The solution is treated with zinc and the indium is precipitated, together with copper, silver, etc. The precipitate is treated with sulfuric acid, and the silver is removed from the resulting solution by hydrogen sulfide. Indium is then recovered from solution by electrolysis. Aluminum can also be used, in place of zinc, for precipitating indium from acid solution.

Another process is based on the fact that indium can be precipitated selectively as a phosphate from a slightly acid solution. The method includes the precipitation of indium from the leach solution as indium phosphate, the conversion of indium phosphate to indium hydroxide by treating with strong caustic solution, filtering and heating to form the oxide, followed by the reduction of the oxide to metal. The resulting metallic indium can be further refined electrolytically if desired.

To recover indium from a zinc-lead metal, the molten bath is treated with a suitable chlorine-supplying agent or gaseous chlorine to remove selectively the zinc and indium as chlorides, using a low-melting cover slag and temperatures sufficiently low to avoid loss of indium by volatilization. The resulting chloride slag is then leached with dilute sulfuric acid and the indium is precipitated with zinc dust after removing lead sulfate by filtration. The zinc-indium sponge is then melted and the zinc is removed by means of chlorine.

Characteristics.—Indium metal is unaffected by air at ordinary temperatures, but at a red heat it burns with a blue flame to form the oxide, In_2O_3. The metal dissolves in mineral acids but is unaffected by potassium hydroxide or boiling water. When heated in the presence of the halogens, direct combination takes place; when heated with sulfur, the two elements combine with incandescence.

Uses.—Indium is used as a coating for aircraft sleeve bearings since it improves corrosion resistance and enables the surface to retain a more adherent oil film. For fire protection indium is an ingredient of low-melting alloys used in sprinkler heads, fire door links, fusible plugs, etc. Indium has the unique property, when molten, of wetting glass and other surfaces, which makes it valuable for producing hermetic seals between glass, metals, quartz, ceramics, marble, etc. It is also used extensively in the manufacture of P-N junctions in semiconductor devices and for soldering various parts of germanium transistors and rectifiers (*see* also TRANSISTOR: *Fabrication Techniques: P-N Junctions*).

Physical Properties of Indium

Atomic number	49
Atomic weight	114.82
Boiling point	2,046° C. (3,722° F.)
Crystal structure	Face-centred tetragonal
Density at 20° C. (68° F.), g./c.c.	7.31
Electrical resistivity, microhm-cm.	
(solid) 22° C.	8.8×10^{-6}
(at melting point) 156° C. (313° F.)	29
Electrochemical equivalent for In^{+++}, mg./coulomb	0.39641
Electrode reduction potential for In^{+++} ($H_2 = 0.0$ volt)	0.34
Latent heat of fusion, cal./g.	6.8
Latent heat of vaporization, cal./g.	484
Linear coefficient of thermal expansion, per 1° C.	24.8×10^{-6}
Mechanical properties:	
Tensile strength, p.s.i.	380
Elongation, % in 1 in.	22
Brinell hardness	0.9
Modulus of elasticity, p.s.i.	1,570,000
Melting point	156.17 ± .05° C. (313.1 ± .1° F.)
Nuclear data:	
Stable isotopes	In^{113}; In^{115}
Thermal neutron cross section, 2,200 m./sec.	
Absorption (barns)	190 ± 10
Scattering (barns)	2.2 ± 0.5
Specific heat cal./g./° C. (solid) 20° C.	0.058
Thermalconductivity per 1°C.,cal./sq.cm./cm./°C./sec.	0.06
Valence	Usually 3, but also 2 & 1

In the nuclear field indium is used to measure the thermal neutron flux of a reactor and to monitor neutrons for the protection of personnel and equipment. This ability of indium to measure neutrons depends on the activation of the indium by neutron capture. The main stable isotope (115), which is approximately 96% of natural indium, has a large capture cross section for thermal neutrons and the resulting isotope, In^{116}, is a radioactive beta ray and high-energy gamma ray emitter with a half life of 54 min. This activity, which is readily measured by conventional ionization instruments, gives a measure of the neutrons available for capture by indium. The characteristic of giving off intense gamma rays is the reason why serious consideration is being given to indium as a source of these rays for the preservation of food.

Organic indium compounds (particularly indium laurate) are used as additives to gasolines to give higher fuel efficiencies and to inhibit the deposition of carbon by the fuel during combustion. Another use of indium is as an anode in miniature alkaline batteries which are characterized by their long shelf life and freedom from gas evolution.

See also references under "Indium" in the Index.

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INDIVIDUALISM is a term somewhat similar in meaning to liberalism (*q.v.*). Both concepts place high value on the freedom of the individual. While liberalism, changing in connotation with the times, has come to include concepts of freedom that are compatible with either governmental control or conjoint activity, individualism stresses the self-directed, self-contained and comparatively unrestrained individual or ego. In present day usage, the term sometimes lacks liberalism's suggestion of approval and may even imply disapprobation. Alexis de Tocqueville (*q.v.*), who coined the word, described it in terms of a kind of moderate selfishness, disposing men to be concerned only with their own small circle of family and friends. A hermit is an individualist but not necessarily a liberal.

Conceptual Bases.—As a philosophy, individualism involves a value system, a theory of human nature, a general attitude or temper and belief in certain political, economic, social and religious arrangements. The value system may be described in terms of three propositions: all values are man-centred, that is they are experienced (but not necessarily created) by human beings; the individual is an end in himself and is of supreme value, society being only a means to individual ends (held by some to be divinely ordained); and all individuals are in some sense morally equal, this equality being best expressed by the proposition that no one should ever be treated solely as a means to the well-being of another person.

The individualistic theory of human nature holds that the interests of the normal adult are best served by allowing him maximum freedom and responsibility for choosing his objectives and the means for obtaining them, and acting accordingly. This belief follows from the conviction that each person is the best judge of his own interests and, granted educational opportunities, can discover how to advance them. It is also based upon the assumption that the act of making these choices contributes to the development of the individual and to the welfare of society—the latter because individualism is thought to provide the most effective incentive to productive endeavour and because it is also believed to lead to variety of individual development, which itself is judged valuable. These beliefs about human nature have tended, historically, to be based upon a mechanistic and atomistic theory of psychology—that is, the idea that behaviour is a matter of mechanical responses to sensations, directed toward maximizing pleasure and minimizing pain. Society, from this point of view, is seen as only a collection of individuals, each of which is a self-contained and ideally almost self-sufficient entity.

As a general attitude, then, individualism embraces a high valuation on self-reliance, on privacy and on respect for other individuals. Negatively, it embodies opposition to tradition, to

authority and to all manner of controls over the individual, especially when they are exercised by the state. It also looks with favour upon variety rather than uniformity, and change rather than fixity; it anticipates and values progress and, as a means to this end, subscribes to the right of the individual to be different from, to compete with and to get ahead of (or fall behind) others.

The institutional embodiment of individualism follows from these principles. Liberal democracy is the favoured form of government and *laissez faire* (*q.v.*) the approved policy. The role of the state is to maximize individual freedom and opportunity. Only the most extreme individualists believe in anarchy (*see* ANARCHISM), but all believe that government should keep its interference with men's lives (including their voluntary arrangements for social life) at a minimum and that it should confine itself largely to maintaining law and order, preventing individuals from interfering with others and enforcing agreements (contracts) voluntarily arrived at. The state tends to be viewed as a necessary evil and the slogan "That government that governs least governs best" is applauded. Moreover, each individual should have equal opportunity, through the ballot, to determine the form and activity of the state and, through freedom of expression and association, to influence the beliefs and behaviour of others.

Individualism also implies a property system according to which each person (or family) enjoys the maximum of opportunity to acquire property and to manage and dispose of it as he sees fit. Freedom of association extends to the right to join (or to refuse to join) any religious organization. For some, individualism implies the belief that individuals do not stand in need of priest or church to mediate between them and God and that church organization should not be authoritarian.

History.—Both a clearer understanding of its meaning, and a better perspective for judging its value and prospects, can be obtained by examining individualism (or tendencies toward the development of an individualistic approach) in terms of its history. Primitive societies seem frequently to be characterized by a group solidarity that leaves relatively little room for individual autonomy. Within the period of a few centuries ancient Greece, in Periclean Athens, saw the development from this kind of tribal society to a degree of democracy, equality and individual assertiveness that was a far cry from the degree of subordination of the individual to the authority of a graduated social structure found in Sparta. Athenian democracy was short-lived, but it was individualism rather than the Platonic notion of the state as analogous to an organism that came to prevail in Hellenistic Greece. Epicurus, following the atomism of Democritus, developed a more thoroughgoing individualism than the world had yet known. For him the individual was the unit, the basis of society, and the sensation was the foundation of individual psychology. Not only were society and the state secondary, but the individual was encouraged as far as possible to find his freedom and realization in withdrawal from politics and development of self-sufficiency. Justice, founded upon agreement or convention, was based upon the need of the individual for protection.

Although Epicureanism was widely adopted in the post-Aristotelian and Roman worlds, it was another and less individualistic school of thought, stoicism, that became dominant. Stoicism did develop a doctrine of moral equality. Its cosmopolitanism, however, and its insistence on an absolute standard of justice independent of the individual (and on the state as a natural institution having as its purpose the enforcement or approximation of this natural justice or natural law) constituted significant modifications of the stark individualism of the Epicureans.

Christianity, drawing upon ideas already developing in Judaism, introduced into the prevailing philosophy the emphasis on the supreme worth of the individual that had been lacking among the Greeks. Jesus' teaching also implied for many Christians the direct relation between man and God. This outlook provided a radically individualistic basis for religion that was not fully realized until the Reformation. For centuries, however, this individualistic element in Christianity was tempered by the concurrent belief that the individual most fully realizes himself by losing himself, by committing himself wholly to God and by emphasizing the importance of the life hereafter beyond that of earthly existence.

If individualism was highly qualified in the days of the Roman empire, the middle ages saw a far greater retreat into barbarian tribalism while the opening centuries of the modern period found a growing state centralism emerging from the weakness of feudal political society. Perhaps it was the very consolidation once more of political authority, freeing men from the insecurities of feudal society, that provided the condition for a rebirth of the spirit of individualism. Whatever the causes, and they were certainly complex, the Renaissance was characterized by a new spirit of inquiry, of discovery and of individual self-confidence and assertiveness. An exchange economy in which money replaced payments in kind, and in which free contract gave a new flexibility to arrangements hitherto fixed by immemorial custom, was representative of this development in the economic sphere. Similar movements toward freedom of the individual appeared throughout western culture. Science and the arts flourished. Soon the major over-all institutions found themselves under attack. The authority of the Roman Catholic Church was challenged by Luther, Calvin and their followers, and the new doctrine of the "priesthood of all believers" soon gained sway over large parts of Christendom. Partly as a result of religious strife, partly because in other ways the authoritarian secular states whose power had made possible the transition from feudalism to emerging capitalism were themselves unable or unwilling to adjust to the needs and demands of the rising commercial class, and partly because of the democratic demands inherent in the new individualism, some western European authoritarian political regimes were overthrown. Gradually the doctrine that government must be based upon popular consent implicitly or explicitly expressed in some form of a contract came to prevail.

Full-fledged individualism, as it is usually conceived to be, seems to have emerged first in England, perhaps because the English Catholicism was weaker and its ties to Rome more attenuated, and because England's insular position and consequent greater security following the Tudor era permitted a more relaxed society and a state in which it was easier for the individual to assert his demands successfully. Thomas Hobbes (*q.v.*), in the middle of the 17th century, building upon Epicurean ideas, presented a radically individualistic philosophy which was still politically authoritarian. His contemporary, John Lilburne (*q.v.*), less systematically but more effectively developed from a radically different viewpoint, that of economic "leveling," the democratic implications of the new philosophy, with emphasis on assertion of the universally accepted doctrine of natural rights (*q.v.*), including the natural right of political equality. The latter ideas were systematized and further developed later in the century by the Whig philosopher John Locke (*q.v.*), and gained support in British North America and France in the 18th century. The French Revolution, however, was characterized more by national sentiment than by individualism.

It was again in England, through the ideas of Adam Smith and Jeremy Bentham and their followers in economic and political theory, respectively, that the 19th century saw individualism advance to new heights. Smith's doctrine of *laissez faire*, based upon a profound belief (borrowed from French Physiocrats) in the natural harmony of individual wills and Bentham's hedonistic utilitarianism, with the basic rule of "each to count for one and none for more than one," set the stage for these developments. On the economic side, Smith's "obvious and simple system of natural liberty," pictured exchange of goods and services in free and competitive markets as the ideal system of co-operation for mutual advantage. Such an organization should maximize efficiency as well as freedom, secure for each participant the largest yield from his resources to be had without injury to others and achieve a just distribution, meaning a sharing of the social product in proportion to individual contributions.

Restrictions on Economic Individualism.—While economic individualism, and political individualism in the form of democracy, advanced together for a while, eventually they proved incompatible as newly enfranchised voters increasingly came to demand,

in the course of the 19th century, governmental intervention in the economic process. In point of fact the reasons for the growing demand for intervention were inherent in the attempt to adhere rigorously to an economic theory based almost solely on individualistic assumptions. In economics as in all other phases of life these assumptions are inadequate. Man is a social animal. His nature, his wants and his capacities are to a great extent the product of society and its institutions. His most effective behaviour is often through groups and organizations, running the gamut from the family through all manner of voluntary social and economically motivated associations to the state and international organizations. These units in varying ways interfere with the individualistic ideals of perfectly free association and of atomistic competition. Problems of monopoly and of technological, seasonal and cyclical unemployment, frequently associated in the public mind with individualistic economic theory, caused widespread dissatisfaction. Moreover, pure individualism, involving the institution of inheritance, tends to increase the tendency toward inequality inherent in the fact of unequal abilities. In this and other ways the individualistic society of the 19th century became more and more unsatisfactory to increasing numbers of people. Karl Marx demanded a radical departure from individualistic principles. Although his call for revolution and socialism did not succeed in the 19th century, gradually the collectivist principle gained headway, sometimes relying upon state ownership and management of business enterprises, but more frequently consisting of all sorts of state regulations limiting the freedom of the individual (and the corporation) in the management of property, for the welfare of society as a whole. The individualist state would intervene, if at all, only where it was clear that private activities, through the market or otherwise, were seriously damaging the public.

In the 20th century, even in nonsocialistic states, the presumption against state control became far weaker. If in any respect the nonpolitical institutions of society were apparently not working well, there was a strong demand that the state should intervene; and in the subsequently developed "welfare state," for instance, it was the government rather than the individual that took primary responsibility for insuring the great mass of the working population against the major hazards of life.

Organic View of Society.—Increased recognition of the need for a greatly enlarged role for the state went hand-in-hand with a modification all over the western world, of the individualistic theory of the nature of man and his relationship to the state. Contract theory tended to yield to theories that saw the state and the relationship between individual and state in less mechanical and more organic terms, while perceiving the individual himself less atomistically and more as an entity who was regarded as being as much effect as cause of society. Early examples of this emphasis were to be found in the works of Rousseau and Hegel. Even the mildly Hegelian British liberal T. H. Green, emphasized the organic relationship between individual and society. Among 20th-century American democratic theorists, John Dewey exemplified a similar trend (*e.g.*, in his *Individualism, Old and New*, 1930).

In the extreme form of romantic (Nazi and Fascist) totalitarianism all residue of individualism disappeared, the state or race became the final end of all, and the very notion of the individual as the basis of the western value system tended to fade away, along with its attendant belief in the moral equality of all men. Human reason is denigrated, and blind will or a mystical "spirit" of the group (political or racial) takes its place.

While the excesses of the 20th century totalitarianism had by mid-century produced a reaction against it in the free countries of the western world, particularly with respect to the supreme worth of the individual, there was also notable an attempt to capture certain values felt by some to have been embodied in totalitarian movements and to respond to forces that brought it about. More than this there were evidences of group-oriented thinking and values that seemed to be the unpremeditated product of innumerable conditions of modern life: large populations thrown together in tremendous metropolises, enabled by modern technology to share in each others' feelings and experiences to a greater degree than ever before; and a growing recognition of the fact that most human ends entailed group activity and group living. Psychologists discovered that men's minds seemed to perceive wholes before the parts of which they were composed. Similarly in many other fields the organic tended to displace the mechanistic approach and the whole tended to assume an importance that seemed to many men to be greater than that of the sum of its parts. In educational theory emphasis on "electives" had in some places given way to "core curricula," while much was heard of "adjustment to society" as a goal and less of the development of individuality; in criminology the idea that society was to blame for the criminal, or at least that he was not the master of his own soul, was bringing about sharp modifications in the theory of punishment; in economics "macro-economics," starting with measurement and analysis of the inputs and outputs of the economy as a whole, was supplementing if not displacing "micro-economic" analysis, which began with the individual firm; in political science the group had largely displaced the individual as the basic unit for analysis. Even physical science, with the development of the science of cybernetics, seemed to be moving from the mechanistic and atomistic approach to something more akin to the study of organisms.

The notions of the individual as the centre of value and of the moral equality of all individuals seemed to retain their fundamental position. In most other respects individualism and its corollaries appeared to be giving way to more social and organic modes of thought and endeavour although here and there, as in the field of education, there were indications of retreat from the most extreme applications of group theory. The possibilities for still further development seemed to be (1) an extension of these trends into totalitarianism; (2) a return to greater emphasis on the private; or (3) some degree of stabilization, philosophically and institutionally, at a point where the claims of the individual and the group, the private and the social, were in better balance than they had been in western civilization at least since the Renaissance. *See* also COLLECTIVISM; CORPORATE STATE; FASCISM; and references under "Individualism" in the Index.

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INDIVIDUALITY, BIOLOGICAL. Two different meanings are associated with "biological individuality." First, it is used synonymously with entity or unit. This connotation is derived from higher animals and plants that are encountered as individuals; that is, as clearly defined entities set apart from each other. They are characterized by a complex structure, but the diversity of their tissues and organs is integrated in a unit. When one speaks of an individual robin or beetle, fir tree or tomato plant, one has in mind the unity in form, structure and function that enables the robin, fir tree, etc., to behave and react as a whole, in its environment. The individual, in this sense, constitutes the basic biological unit, as a self-sustaining and self-reproducing entity. Higher categories, such as species, or plant and animal communities, are composed of large numbers of such units.

In modern biology, however, biological individuality frequently has another quite different meaning. It refers to the uniqueness of the individual, or individual specificity. In examining a population of robins or of fir trees, the student is initially impressed with the similarity of the individuals in all essential structural and behavioural features. It is this similarity on which the species concept is based. However, closer inspection brings to light another, equally significant, biological phenomenon, namely the remarkable variability among individuals within the general framework of the species characteristics. In fact, no two individuals are completely alike, if the details of structure and function are considered. In the final analysis, the uniqueness of the individual is due to its unique hereditary constitution.

Entity.—Returning to the first-mentioned definition of biological individuality as an integrated entity, it can be seen that this connotation is not so simple and unequivocal as it may seem. It loses its sharp focus when lower organisms, in both the animal and plant kingdoms, are considered. There exist forms of life to which the definition "integrated entity" is not applicable, and there are others that show transitions from unindividuated to individuated organization. The difficulty that may arise in applying the term "individual" to plants, even the more highly organized, is seen when these are multiplied by mere division. When cuttings are rooted they may for practical purposes be considered distinct individuals, but theoretically they are separated portions of one, since they have the same genetic constitution as the original plant. Again, a grafted apple tree is a composite unit built up of portions of two, sometimes more, individuals, termed stock and scion, mutually influencing one another. Furthermore, in the vegetable kingdom the change with lapse of time is well exemplified by the fact that in a tree new tissues are continually added at the periphery of the older, which gradually die; thus, though it is said that the age of a certain tree is to be measured in centuries, no living portion may, in fact, have survived for more than a few decades.

Cellular to Organismic Individuality.—The unicellular organisms (many bacteria, algae and slime molds, and the protozoa) represent clear individuality on the cellular level. Some bacteria, algae and higher fungi exist in the form of cell colonies—that is, filaments or sheets of cells—that may grow and branch indefinitely and fragment fortuitously. The mycelium of fungi is an irregular, dense feltwork of such filaments, with no definite shape or boundary and no inner organization, hence lacking the characteristics of individuality. However, the mycelium forms mushrooms (fruiting bodies) which represent the beginning of individuation.

The transition from unicellular to multicellular individuality is well represented by the small spherical green alga *Volvox*, which any observer would designate as an individual. Actually, it is a colony of hundreds of flagellate cells embedded in a gelatinous mass, that swims and behaves as a unit. The constituent cells resemble their free-living, single-cell relatives, but there are signs of beginning organization, or division of labour, in that some cells specialize in reproduction and others are particularly active in locomotion. The slime molds (*q.v.*) offer another striking example of a shift from cellular to supracellular individuality. These organisms spend the major part of their life cycle as single-celled, freely moving, amoebalike cells. Under appropriate conditions, hundreds of such individuals aggregate in a tightly packed cluster, which transforms itself into an erect fruiting body of definite shape and structure. The individual amoeboid cells, like those of *Volvox*, give up their independence and become building stones in a higher unit, whereby they undergo a certain degree of specialization. The term "individual" can be applied legitimately to both levels, the cellular and the supracellular.

The evolutionary trend from cellular to multicellular organization is observed in all higher organisms; it is undoubtedly related to the greater efficiency that can be achieved through division of labour among cell groups. *Volvox* and slime molds represent early steps in this direction. At the other extreme are the highest animals and plants, in which the specialization of the individual cells has been carried to the point where they are completely interdependent and subservient to the whole, and no longer capable of a free independent existence. Yet cellular individuality is not completely obliterated even in the highest forms. The individual cell remains the basic unit for all metabolic processes, such as energy transformation, respiration and growth. Furthermore, some cell types, such as white blood cells, are single cells, capable of amoeboid movement. Finally, living tissue cells (*e.g.*, nerve tissue or connective tissue) can be removed experimentally from an organism and grown in an artificial nutritive medium. In these so-called tissue cultures the cells not only survive for long periods but they may regain some characteristics of free-living cells, such as the capacity for active movement. Therefore, there is some justification in viewing the higher organism as a highly integrated cell colony. In a sense, higher organisms, plants and animals, are organized in a peculiar way; they represent both levels of individuation, cellular and supracellular, in one.

Supraorganisms: Animal Colonies and Societies.—In some animal groups (coelenterates, tunicates and others) a new type of individuality has been achieved on a still higher level, in the form of animal colonies, that is, groups of interconnected multicellular organisms. Successive steps in colony formation in the coelenterates may be observed. The well-known fresh-water polyp *Hydra* and its relatives, the sea anemones, are solitary beings. In the colonial corals, the polyps are linked together by a system of channels which enables them to share in a common food supply, but otherwise they retain their relative independence. In related forms, division of labour results in high specialization and modification of form of the individuals (polymorphism), which, in extreme cases, appear merely as special organs attached to a common stem. For instance, the colourful marine siphonophores (Portuguese man-of-war and others) have all but lost the appearance of a colony; individuation on a supraorganismic level comes into existence.

In the two parallel series—that is, the evolution from unicellular to multicellular organisms and from there to animal colonies of the siphonophore type—may be recognized a general rule: wherever the subordinate units are strongly individualized and only loosely connected with each other, the individuality of the higher unit is indistinct, and, conversely, the more the individuality of the lower units is obscured, the more definite and distinct is the individuality of the higher unit.

Animal societies have been viewed by some biologists as supraindividuals or supraorganisms, particularly with reference to the elaborate caste systems in termite, ant and honeybee societies, where, again, division of labour has resulted in a high degree of specialization and consequent interdependence of the different types. These societies may be compared with animal colonies in which the physical linkage is replaced by communication systems, such as the elaborate language of honeybees. (*See* also SOCIOLOGY, ANIMAL; SOCIAL INSECTS.)

Difficulties to the Individuality Concept.—The phenomenon of reproduction (*q.v.*) presents special difficulties to the individuality concept. The continuity of life is maintained by the faculty of all organisms to detach parts of their own living substance, thus giving rise to a new generation. This is done in a variety of ways: by the formation of gametes (egg and sperm) or of seeds or spores, or by budding, as in yeast or polyps, or fission, or by still other devices. Difficulties arise in determining exactly when and how the individuality of the offspring begins. Actually, one generation emerges from the other by a gradual process of individuation, and there are transitional stages during which no sharp line can be drawn between parent and offspring.

The phenomena of regeneration and regulation are closely akin to reproduction and present a similar dilemma. It is well known that a new plant can be grown from a cut-off shoot or even from a fragment of a leaf, as in *Begonia*. Likewise, fragments of flatworms (*Planaria*), earthworms or starfish can regenerate a new individual (*see* REGENERATION). The same capacity for regulation is manifest in the early developmental stages even of higher animals and man. If eggs or very early embryos of a sea urchin, salamander or frog are cut experimentally in half, each part will regulate to form a whole individual (*see* EMBRYOLOGY, EXPERI-

MENTAL). In the armadillo, fragmentation of the egg has become the established procedure; each litter of four to eight individuals derives from a single egg. Identical twins in man and in other forms arise in the same fashion from one egg (*see* MULTIPLE BIRTH). The difficulty of applying the individuality concept becomes insurmountable in the case of double monsters that derive from incompletely separated egg parts. There is a continuous series, from the Siamese-twin type, in which the individuality of the conjoined partners is undisputed, to those types in which only the heads or the posterior body parts are duplicated (*see* MONSTER).

Surveying the variety of design in the organization of living matter, it must be recognized that not all organisms are individualized, that individuality has become manifest at different levels of organization and in different degrees of distinctness, and that it is necessary to be cognizant of transitional states. No rigid definition of individuality can do justice to the diversity of the biological phenomena.

Individual Specificity.—As mentioned above, biological individuality has a second meaning, referring to the uniqueness of the individual with respect to the sum total of its structural, physiological, biochemical and behavioural traits. This is the result of the unique genetic constitution with which each organism is endowed, reflecting the enormous variety of recombinations and mutations of hereditary factors (genes) that occur in a cross-breeding population and are maintained by natural selection (*see* GENETICS; GENETICS OF POPULATIONS). As a result of the reshuffling of genes at fertilization and in the preceding processes of egg and sperm formation, each individual starts out with a unique constellation of hereditary factors that determine not only the structural and physiological adult characters but also the responses to its environment.

Everyday experience shows that no two human individuals are alike, but even in organisms in which the individual differences are not so obvious, they can be demonstrated by appropriate methods. The most sensitive indicator of biological individual specificity is the well-known intolerance of an individual for transplants of skin or other tissues from another individual (except from an identical twin, which shares its genetic make-up). (*See* PLASTIC SURGERY; TRANSPLANTS, TISSUE AND ORGAN.) This incompatibility, akin to immunological reactions, is based on biochemical agents, the "individuality differentials" (Loeb). Such differentials have been detected in all vertebrates, down to fishes, with the aid of the transplantation method. Of equal interest and significance are individual differences in blood groups; that is, immunological (antigenic) differences in red blood corpuscles (erythrocytes), which can be detected by their agglutination or lysis when combined with blood serum from other individuals. In man and several higher animals (monkey, cattle, sheep, chicken, dove) detailed studies have revealed numerous blood groups (the best known in man are the ABO groups, the MN group and the Rh factors) and subgroups (*see* BLOOD GROUPS). The possible recombinations of the blood group substances discovered so far go into the millions, and it can be assumed that each individual has its own peculiar blood type. Fortunately, many blood types are compatible with each other in transfusions, and only differences between major groups cause detrimental transfusion reactions. On the other hand, blood tests have been found to have practical applications in legal matters, and they may eventually supply a reliable index of individuality in animals, comparable to that of fingerprints in man, and assume great importance in animal breeding. It is of interest to note that many blood group factors in animals can be referred to particular genes, whereby the genetic basis of individuality is firmly established.

The clinician is well aware of individual differences in the response to many drugs, to anesthetics and to antibiotics. The wide range of variability in the drug reaction of human individuals is illustrated in a study of the minimum concentration of mercuric chloride that is required to produce skin irritation. The sensitivity varied over a hundredfold in a small sample of individuals. Remarkably great differences among individuals have also been found with respect to the chemical composition of blood and saliva, to enzyme and endocrine patterns, vitamin needs, amino acid excretion, taste sensitivity and many other physiological and biochemical characteristics. A striking example was found in connection with the study of taste sensitivity to phenyl thiocarbamide (PTC). This substance has a bitter taste for some individuals but is completely tasteless for others, and this trait is due to a single hereditary factor. It was found that PTC can be tasted by "tasters" only when it is dissolved in the individual's own saliva, but not when it is dissolved in that of another person. The anatomist is familiar with corresponding individual variations in structural details, such as the shape of skeletal elements, the patterns of nerves and blood vessels, and the weight of organs.

The uniqueness of fingerprints is so far the best criterion for identification of human individuals, and handwriting, when expertly analyzed, would be equally valid. The argument that in some of the instances cited above the differences may be due not to inborn diversity but exclusively to environmental factors can be met by studies of identical twins. They derive from a single egg and have therefore identical genetic constitution. In all traits that can be studied, identical twins show greater similarity than fraternal twins or other siblings, thus demonstrating the significant part that heredity plays as the foundation of biological individuality (*see* GENETICS, HUMAN). In man, the uniqueness of his biological heritage combines with the uniqueness of his stream of life experience to create "personality" (*see* PERSONALITY).

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INDO-ARYAN LANGUAGES are the satem languages of the Indo-European family that are still spoken in the northern and central parts of India and in Pakistan (*see* INDO-EUROPEAN) and include the Sinhalese language of Ceylon.

Classification.—Inscriptions of the Mitanni country (northeast Syria) of the 14th century B.C. contain proper names of Indo-Iranian type. Otherwise, the oldest specimens of Indo-Aryan speech very closely resemble the oldest Iranian. The development of the two old forms of speech went on independently and followed somewhat different lines. This is most marked in the treatment of a nexus of two consonants. While modern Iranian often retains the nexus with little or no alteration, modern Indo-Aryan prefers to simplify it.

The earliest extant literary record of Indo-Aryan languages is the collection of hymns known as the Rigveda. It may be taken as representing, on the whole, the particular vernacular dialect spoken in the east of the Punjab and in the upper portion of the Gangetic Doab. Later it extended between the Punjab and the modern Allahabad from the Himalayas to the Vindhya hills in the south, over the area known to Sanskrit geographers as the *Madhyadēśa* or Midland, also called *Āryāvarta* or the "home of the Aryans." There it received constant literary culture, and a refined form of its archaic dialect became fixed by the labours of grammarians during the 4th century B.C., receiving the name of *Saṁskṛta* (Sanskrit) or "polished," "refined" in contradistinction to the folk speech of the same tract and to the many Indo-Aryan dialects of other parts of India, all of which were grouped together under the title of *Prākṛta* (Prakrit; *q.v.*) or "natural," "unrefined." Sanskrit (*q.v.*) became the language of religion and polite literature, and thus the Midland, the native land of its mother dialect, became accepted as the true pure home of the Indo-Aryan speech.

Dialectal Variations.—In the time of Asoka (*c.* 269–232 B.C.), there were at least three dialects, an eastern, a western and another in the extreme northwest. The grammarian Patañjali (150 B.C.) mentions the existence of several dialects.

Round the Midland, on three sides—west, south and east—in Vedic times, Indo-Aryan dialects were spoken which all appear more closely related to each other than was any of them to the language of the Midlands. Thus, at an early period of the linguistic history of India there were two sets of Indo-Aryan dialects—one the language of the Midland and the other that of the dialects which form an Outer Band, according to the scheme suggested by Sir G. A. Grierson.

As time went on, the people of the Midland conquered the eastern Punjab, Rajputana with Gujarat (where they reached the sea) and Oudh. Hence in all these territories are found mixed forms of speech. The basis of each is that of the Outer Band, but the body is that of the Midland. From the Midland to the external borders of this tract, the influence of the Midland language grows weaker and weaker, and traces of the original Outer language become more and more prominent. In the same way the languages of the Outer Band were forced farther and farther afield over the Maratha country, into Orissa, into Bengal and, last of all, into Assam.

At the present day, a Midland Indo-Aryan language (western Hindī) occupies the Gangetic Doab and the country immediately to its north and south. Round it, on three sides, is a band of mixed languages, Panjabi (of the central Punjab), Gujarati, Rajasthani (of Rajputana and its neighbourhood), and eastern Hindī (of Oudh and the country to its south). Beyond these again, are the Outer Languages (Kashmiri, with its Dardic basis), Lahnda (of the western Punjab), Sindhi (here the band is broken by Gujarati), Marathi, Oriya (of Orissa), Bihari, Bengali and Assamese. The Pahari languages in the Himalaya, north of the Midland belong to the Intermediate Band, being recent importations from Rajputana, while Kohistani includes mixed dialects of the Sivat and Indus Kohistans. Thus, the Midland language is enclosed within a ring fence of intermediate forms of speech. *See* INDIAN LANGUAGES and also under various individual languages. *See* also references under "Indo-Aryan Languages" in the Index.

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INDOCHINA, the English equivalent of Indochine (*i.e.*, Indochine française or French Indochina), the former name of the region which comprises the eastern half of the Indochinese peninsula and which now includes the countries of Cambodia, Laos, North Vietnam and South Vietnam. The name acknowledged the early influence of Indian and Chinese cultures which produced distinctive customs, myths, religions and speech, but after 1954 it had no political or constitutional meaning.

Physical Geography.—Located either side of 19° N. and 107° E., Indochina's S-shape extends round a resistant crystalline massif —that part of the Annamite mountains (Chaîne Annamitique) south of the Song Boung. Differential movements between this massif and another in south China have produced compressional structures, gorges and plateau landforms in the north, basaltic extrusions to the south and a faulted rocky coast. To its extreme west are the Elephant range and Cardamom mountains bordering the Gulf of Siam. Between the Cardamom and the Annamite mountains spread the vast alluvial plains laid down by the Mekong. Northward the Annamites overlook the Red river delta, inland from which a complex of mountain and river gorges, arranged northwest-southeast, is transitional to the plateau of Yünnan and to the eroded sandstone and limestone highlands of Tongking, which come to the sea as the drowned karst landscape round the Along bay (Baie d'Along).

The low-lying delta of Tongking has many differences of level caused by uneven sedimentation, raised river beds and rapid changes of volume in the streams debouching from the surrounding highlands. Much of the outer delta is less than ten feet above sea level and is subject to tides along the distributaries

THE FOUR CONSTITUENT STATES OF INDOCHINA: LAOS, CAMBODIA, NORTH VIETNAM AND SOUTH VIETNAM

which have steep profiles, natural terraces and numerous embankments to control floods that endanger the dense population and the intense cultivation on the plain. While dominated by the Red river, the lowland is composite, the deltas of the Ma, Chu and Ca extending it southward and other streams from China extending it northeastward.

The lower Mekong ("great river") enters the tectonic depression south of the Annamite mountains roughly halfway along its northern side and flows southwestward across it for 150 mi. before turning east to discharge through several distributaries. The northwestern half of the depression, between the sandstone scarps of Korat and the Cardamom mountains, holds the great lake Tonle Sap, linked by the Stung Treng across a muddy plain (the Veal Phoc) to the Mekong. Most rivers feeding it are short and erratic so that the Tonle Sap varies considerably: at lowest (November–June) the water is 22 mi. broad and has an area of about 1,000 sq.mi., discharging to the Mekong through masses of tangled reed and vegetation which fringe the lake; at highest (June–October) the water may cover 4,000 sq.mi. with a width of 65 mi. because the Mekong discharges part of its enormous spate into the lake, which then acts as a regulating sump. The lower Mekong distributaries are without high levees and raised beds.

Much of the Mekong lowland is thickly wooded with swamp forest. The delta proper begins at the Stung Treng confluence (near Phnom Penh) where the Mekong divides into two branches, the western branch carrying the greater discharge while the other breaks down into minor distributaries through composite deltas laid down by the short Vaico and Saigon rivers. Lobate alluvial peninsulas between the distributaries form the eastern half of the delta, the western half being the Camau peninsula, a triangular

waterlogged area built of more recent silts modeled by the sea sweeping toward the southwest, which accounts also for the pattern of northeast-southwest sandspits on the delta and the cusp which is extending into the Gulf of Siam at about 200 ft. a year.

Outside the two major deltas, the east coast of Indochina consists of hills and cliffs separating numerous small drowned river mouths where short streams have built isolated deltaic fans with precarious raised river beds as in Tongking.

Climate.—Indochina, lying entirely south of the Tropic of Cancer, has a climate transitional between the equatorial of southeast Asia and the extremes of continental Asia. From mid-September to March, air streams from the north bring cool weather to Tongking, cool, gentle rains along the whole east coast and dry sunny weather to the southern plains. From June to September, winds from the south bring tropical warmth and high humidity to the whole region. The summer brings the highest rainfall to all regions. Damaging typhoons sweep across the Vietnam coast from seaward irregularly between July and November, when very heavy rains occur. Rainfall is of critical significance because wet farming is practised. Hanoi has an annual rainfall of 72 in. (high in August, low in January); Hue has 116 in. (high in October, low in April); Saigon averages 81 in. (high in September, low in February); Val d'Emeraude in the extreme southwest has 221 in. (high in July, low in January). (E. H. G. D.)

Vegetation.—In its primeval state the whole country was covered with dense forest, but now more than half is cultivated land or open savanna. Four types of forest can be recognized: (1) Rain forest in the areas of highest rainfall includes tall trees of the families Dipterocarpaceae and Leguminosae (*qq.v.*); *Hydnocarpus* (*q.v.*), which yields the chaulmoogra oil specific against certain forms of leprosy, grows in the swampy, flooded parts of the rain forest. (2) Monsoon forest covers areas having a dry season of several months; there also, dipterocarps are the dominant trees. (3) Pine forest occurs in the mountainous areas and (4) mangrove forest along the seashore and in estuaries. (M. W. F. T.)

Animal Life.—The fauna is very varied. The mammals include macaques, gibbons and the tiger and leopard, together with other smaller cats, otters, civets and wild dogs. Deer, gaur, banteng and water buffalo are found, as are the elephant and rhinoceros; by the 1960s the latter had been hunted nearly to extinction. The rodents include the porcupine and several species of rat, some economically destructive as pests. There are many bird species, including quail and francolins; reptiles of varied species are abundant. Fish, some of large size, are common, and there is an extensive variety of insect life. (Jo. E. H.)

The People.—The main peoples inhabiting the area are the Vietnamese (formerly known as Annamese or Annamites), a Southern Mongoloid group inhabiting the Tongking delta, the eastern coastal strip between the Annamite mountains and the sea, and the Mekong delta; the Khmer, a predominantly Proto-Malaysian (or Indonesian) group, who inhabit Cambodia; and the Thai (Tai or Laotian) of Laos, who are a mixed group of dominantly Southern Mongoloid affinities.

There are also numerous minorities who may be divided into the peoples of the northern and central mountains, and the peoples occupying the southern plains. The Southern Mongoloid groups include the Meo (Miao), Man, Thô and Lolo, and the Proto-Malaysian (or Indonesian) Moï and Kha groups who now occupy the central mountain region. The peoples of the plains comprise such groups as the Proto-Malaysian (or Indonesian) Chams, Kuys (Kouys), Muong, Pears, Cbongs and others, of Cambodia and South Vietnam.

The numbers of the various peoples of Indochina were estimated (1961) as follows—Vietnam (both republics): Vietnamese 28,000,000, Khmer (in South Vietnam) 500,000; Laos: Thais 2,000,000; Cambodia: Khmers 3,500,000, Vietnamese 350,000; minority groups in Indochina as a whole: Moï and Kha 1,000,000, Man and Meo 300,000, Muong 200,000 and Cham 100,000.

There are also over 600,000 nonassimilated Chinese, and, in Cambodia, Malayans and Indians numbering about 75,000. The number of Europeans declined considerably after the withdrawal of the French, before which there were about 40,000.

Languages.—The main language spoken is Vietnamese, which is a tonal language, much influenced by Chinese but also showing connections with the Mon-Khmer and Thai languages, spoken by the other two major groups of people in the area (*see* VIETNAMESE LANGUAGE). Many of the aboriginal groups speak languages allied to dialects of south China or belonging to the Malayo-Polynesian group.

Religion and Culture.—Buddhism is the predominant religion of the Indochinese peoples, a distinction being made between the Vietnamese type, which is of Chinese origin, and that of Cambodia and Laos, which is adapted from that of India. Many of the minorities are animists; some, like the Cham, are Brahmanists or Muslims. The activities of Christian missionaries have been widespread in Indochina, beginning in the 14th century, and there are several Catholic bishoprics. Hybrid sects, often of a highly organized character, such as those of Cao-Dai, Hoa-Hao and Bin-Xuyen, have also arisen, and claim large numbers of followers.

The culture of the Vietnamese is basically Chinese, and this has given them a cohesion that is lacking in the indianized cultures of the Khmers and Chams. The Laotian Thai groups also lack a well-established cultural unity, because their migrations occurred in small isolated units and they had little subsequent connection with each other.

The Vietnamese social system is based upon the clan, made up of a varying number of families. The family is patriarchal, and the families of a clan claim a common ancestor. There are thought to be about 300 of these Vietnamese clans, but three-quarters of the Vietnamese belong to one or another of about 12 main clans. Paternal authority is considered supreme, although in modern times the earlier rigidity of family discipline has been much relaxed. Marriages are mostly "arranged," their primary purpose being the rearing of children, especially male children, to perpetuate the family and the clan. Ancestors are revered and worshiped, the cult serving to unite the living and dead members of the family. The presence of the spirits of their ancestors is an unquestioned reality to the living members of the family, and they consider that to worship them upon the appropriate occasions, and to honour them at all times, is to increase their own spiritual wealth and to enhance their social standing in the community. (D. R. HU.)

History.—The conception of Indochina as a separate entity is of French origin and the following discussion deals only with the period of French penetration and rule. For the earlier and later history of the area *see* CAMBODIA; LAOS; VIETNAM.

French association with Indochina began in the 17th century through Catholic missionaries. French forces entered South Vietnam, then Cochin China, in 1799 when the local monarch (Nguyen) asked for help against a faction that had dethroned him. The French expedition reinstated Nguyen as emperor of Annam (1802) and his status was affirmed by the emperor of China. From the first, French interests were entangled with those of imperial China. Under Nguyen III, Hue, which was then the Annamese capital, was forcibly opened to French traders (1858). Cochin China was gradually annexed by 1867. The king of Cambodia accepted protection in 1863. The south thus consolidated, the French joined other European governments in pressing imperial China to open its doors to western trade, and to this end began penetration in Tongking where Chinese influence had been long-standing. The Chino-French treaty of 1885 ended Chinese suzerainty in Annam. Thereafter the landlocked chieftaincies and principalities of Laos, under loose Siamese tutelage, were brought under French protection by 1893. Later the French proclaimed the Indochinese union comprising Cochin China, Annam, Tongking and Laos, from which time Indochina was a single political entity. Except in Cochin China, the original royal houses continued under a federal-type central government which had exclusive authority in foreign affairs, finance, defense, customs and public works and was headed by a French governor general responsible to the French minister for trade. In Cochin China, the administration was prefectural and French in personnel. In Tongking a French resident replaced the traditional viceroy from the emperor of Annam and administration by the French was practically direct. Annam, Cambodia

and Laos had French residents under whom functioned loosely an indigenous aristocracy and a mandarinate administration of the imperial Chinese type.

From 1908, when a nationalist rising occurred in Tongking, nationalism continued to be active. In Annam, nationalism focused on the emperor and his aristocracy. In Cochin China it was more proletarian. Tongking's nationalism, interwoven with agitation for land reform, found expression in the Nationalist party of Vietnam. Ho Chi Minh (then called Nguyen Ai Quoc) founded in 1931 the Indochinese Communist party which stimulated nationalist as well as class struggles. The French acted vigorously, driving nationalist parties underground for the decade to 1941.

During World War II Indochina was confused by the ambivalent position of French personnel in Indochina and of the Vichy government in France. The Japanese entered Tongking in late 1940, occupying all Indochina by 1941. The Vichy government remained nominally in control until March 1945 when, after interning local French personnel, the Japanese proclaimed Tongking, Annam and Cochin China to be the autonomous state of Vietnam, under the emperor Bao Dai. The regime collapsed after the Japanese surrender in Aug. 1945, and in the north a party called the Vietminh under Ho Chi Minh at once proclaimed a "Democratic Republic of Vietnam" and assumed power.

After the war France was not immediately in a position to reoccupy Indochina and in accordance with an agreement reached at the Potsdam conference the country was temporarily occupied and administered by Chinese and British forces. The British forces withdrew early in 1946. Chiang Kai-shek's Chinese National army held the northern sector until the Chino-French treaty of Feb. 1946. The Vietminh league had remained quiet while Nationalist Chinese were in the north and it stressed the nationalist side of its policy. After the Chinese withdrawal the Vietminh negotiated directly with the French who in March 1946 recognized, subject to a referendum, the Democratic Republic of Vietnam as a free state within the Indochinese federation and the French Union. Negotiations were protracted, however, and led to a long period of fighting. At first neither party had sufficient strength to enforce its views. Indecisiveness ended when the Vietminh attacked Hanoi, initiating a seven years' war (1947–54). The Vietminh position became increasingly Communist and violent when a revolution within China provided a sympathetic Communist army immediately across the border. During a lull in 1949–50 the French ratified separate treaties recognizing Vietnam (under its emperor Bao Dai), Laos and Cambodia as independent self-governing states within the French Union, thus ending the conception that these states were united to form "French Indochina."

See also references under "Indochina" in the Index.

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(E. H. G. D.)

INDO-CHINESE LANGUAGES: *see* SOUTHEAST ASIAN LANGUAGES.

INDO-EUROPEAN. The term Indo-European refers properly to language and to language only, not to people or to civilization. It is applied to a number of languages found, in the old world, chiefly in India or Europe (hence the name). In Germany the corresponding term is "Indo-Germanic." German scholars have tended, unfortunately, to write as if only the Germans are the true "Indo-Germans," a view which was stoutly maintained as recently as 1945, though less has been heard of it since then. Some Indo-European languages existed in ancient times in Asia Minor; and not all languages of India or Europe at any time have merited the label in its strict meaning. In modern times Indo-European languages, especially of the Italic and Germanic subdivisions, have spread around the world.

Possible Origins.—The Indo-European languages possess in common certain phonematic, morphomatic, syntactic and verbal (*i.e.*, vocabular) features which, no matter how changed in the course of time, can be explained only on the assumption that they are descended from a common source, of which we have no direct record; *i.e.*, "by inheritance" and not by borrowing. Thus, in contrast with common words for tobacco, coffee or potato which are known from historical evidence to be common through borrowing, there is no means of accounting for the fact of Sanskrit *aśva-s*, Persian *aspa-*, Greek ἵππος, Illyrian *Ecco*, Tarentine ἴκκος (probably Messapic), Gaulish *Eppo*, Irish *ech*, Welsh *ebol*, Gothic *aihwa*, Latin *equus*, Umbrian *ekvine* (?) except by deriving them from a single source which is now written **ekṷo-* (adding *-s* if the actor, *i.e.*, if nominative case), the prefixed asterisk indicating that the word is known only by the comparison and history of the actually recorded words; and further that these recorded words all represent a common meaning, the hairy quadruped known in English as "horse." Nothing is said or implied about the zoological classification—whether the heavy draught horse, the shire horse, the Arab race horse or the horse of the steppes. It is likely, but not certain, that **ekṷo-s* was domesticated and used for riding (but not by a warrior with a panoply of armour) or for drawing chariots in war or in races.

There is a great mass of evidence such as this specimen indicates, not only in vocabulary but also in grammar, the interpretation of which is quite unequivocal; namely, that there existed in the 3rd millennium B.C. a language, or, according to some a group of related dialects, to which the name Indo-European is conventionally applied. Its much older source is conjectured to have been in the ancient Mediterranean basin (where it may have had links with Hamitic and Semitic and perhaps Caucasian languages), whence it (or rather speakers of it) had moved northward into Europe, following the last retreat of the ice, where they settled somewhere north of the Alps, and whence (perhaps during a spell of deteriorating climate) they migrated shortly before the dawn of written history roughly into the locations in which we find them at the beginning of the historic period; viz., Indic (Sanskrit), Persian, Armenian, Phrygian, Thracian, Illyrian, Greek, Albanian, Italic, Celtic, Germanic, Baltic and Slavonic.

Though it is not known precisely where Indo-European originated, some conjectures may be confidently ruled out as impossible: Indo-European did not evolve in the steppes, in the Baltic area, in southern Scandinavia, in Germany or in the Balkans. There is much to be said in favour of central Europe on the ground of the linguistic evidence, so far as it is trustworthy, that indicates the nature of the fauna and flora with which speakers of proto-Indo-European were familiar, and the climatic conditions in which they must have lived. But the elaborate attempts at a linguistic paleontology which sought to determine the original home of this language are no longer taken very seriously; even the effort to combine archaeological and linguistic evidence cannot be considered very successful. As for the physical features of those early speakers of Indo-European, until it can be shown that the skeletons of 3000–2500 B.C. are those of men who did talk Indo-European, nothing whatever can be asserted about "Indo-European" man (a misapplication of the term in any case). All that is known of the history of writing north of the Alps makes it altogether unlikely that a piece of Indo-European text will ever be found in a prehistoric European grave or cemetery. But unless and until one is, all is conjectural and hypothetical about such matters.

Discoveries and Problems of Interpretation.—The list of Indo-European languages enumerated above completed the canon at the beginning of the 20th century. It was not supposed that no then unknown ancient Indo-European languages would not be discovered, nor is it so supposed now. But in the first decade of the 20th century, consequent upon reports of vanished civilizations in Turkistan, expeditions were sent in 1904 from Berlin and Paris, which returned with masses of manuscript documents written in what turned out to be a hitherto unknown Indo-European language, commonly (but not accurately) called Tocharish, of which two chief varieties have been identified (*see* TOCHARIAN LANGUAGE). A decade later came a new surprise. In 1912 a Berlin Assyriologist, Hugo Winckler, had obtained thousands of cuneiform texts from the ancient capital and other sites of the ancient Hittite empire. After Winckler's death the texts were entrusted to an Austrian Assyriologist, F. Hrozný, by whom they

were quickly transcribed and who announced in 1917 that they contained evidence of one or more than one Indo-European language. Most of the work of interpretation was undertaken by other scholars: E. Forrer, J. Friedrich, F. Sommer, A. Goetze and E. H. Sturtevant. The language is again commonly and comprehensively (but not accurately) called Hittite. It was at first supposed that Hittite stood in a somewhat different relation to the Indo-European languages from that in which they stand to one another (as if it were a cousin, not a sister, language), and this view Sturtevant held to the end of his life, though no other Indo-Europeanist of repute now maintains it. Hence the term Indo-Hittite, introduced by Sturtevant, should be abandoned. (*See* also HITTITES: *Language.*)

There is yet another matter that has given rise to controversy. It is found that all Indo-European languages fall neatly into one of two distinct categories, those which labialize Indo-European *q*-consonants (Latin *quid*, Oscan *pid*, English *what*) and those which sibilize Indo-European *k*-consonants (Sanskrit *šatam* "hundred"). The two subdivisions are called respectively centum and satem languages (from the Latin and Persian forms of the word meaning "hundred"). It is the fashion to question whether this is a matter of independent development, as in the Romance languages, or whether it represents an ancient dialectal cleavage in predialectal Indo-European itself. The latter view seems to be preferable for the following reasons: (1) there is a complete coincidence between the two lines of separation: those languages which sibilize *k*-sounds do not labialize *q*-sounds, those which labialize *q*-sounds do not palatalize *k*-sounds; (2) this situation is not at all like that in the Romance languages, in which Rumanian has both labialization and sibilization; *e.g.*, *iapă* "mare" (Latin *equa*) and *cieru* "sky" (Latin *caelum*); (3) in Indo-European the satem languages sibilize *k*-sounds in all situations, not merely before front vowels; (4) the shift can be shown to be ancient, insomuch as it antedates the development of Indo-European *ə* (from $\underline{H}$) to *i* in Sanskrit (*tigita-s* "sharp"), a development which goes back to Indo-Iranian times.

But any exclusively or dogmatically stated assumption about the dialectal state of proto-Indo-European lacks validity. No specimen of proto-Indo-European is available much less specimens of its "dialects"; and it has been historical conditions and accidents, quite independent of particular dialectal features or isoglosses—even such accidents as conversion to a particular faith —that have determined when and where and how what varieties of Indo-European speech were to be recorded and preserved. But the possibility or fact of sudden emergence of a language from obscurity; the success or failure of "'external proletariats' of declining civilizations" in supplanting antecedent languages; the wide chronological gaps between the different dates at which the standard literary languages were developed; different degrees of simplification of linguistic technique and apparatus—all these and other factors make the actual written records of little direct value in themselves to reveal the dialectal situation of proto-Indo-European. It is necessary, therefore, to use analogies drawn from the historical period. Indo-European may be thought of as consisting of a number of dialects, a situation like that, for example, of the ancient Greek dialects (though it also reflects earlier historical conditions), followed, not as in Greece by the spread of a common standard but rather by the distribution far and wide of the existing dialects, the "conductivity" of nomadism (Toynbee) being known to be high in affecting the diffusion of languages; or it may be thought of as a more homogeneous speech which was next diffused in like manner, and then developed into separate dialects, as is known to have happened in the case of Latin and the Romance languages. Or the truth may lie somewhere between these assumptions; and the actual historical distribution of the recorded Indo-European languages, the well-known facts of certain more or less partial or complete isoglosses among them, and the highly probable correlation between expansion outward from the geographical centre of a linguistic unity beyond its periphery and retardation of development in the colonial languages, suggest that there were concentric circles of dispersion, the first almost entirely obliterated by the second and third waves, and the second everywhere (except for the Tocharish "breaker") obliterated in the east, and partly also in the west, by the third wave. These were, in chronological order: (1) the proto-Indo-European wave; (2) the wave of centum languages; (3) the wave of languages which show (in part by independent development) satem features.

The amazing thing about Hittite is the presence of laryngeal consonants (transcribed *h* and, medially, *h* and *hh*) which have eventually compelled the recognition of three such consonants (distinguished as $\underline{H}_1$, $\underline{H}_2$, $\underline{H}_3$) in proto-Indo-European itself, where in fact their existence had been postulated by the Swiss scholar Ferdinand de Saussure and the Dane H. Møller long before the discovery of enough Hittite texts to make decipherment or interpretation possible or any knowledge of Hittite obtainable. The result has been not only a greatly improved theory of the Indo-European vocalic system (especially the alternations *ē: ō: ə*, *ĕ: ŏ: nil*, and the presence and function of *ā, ā*) but also a valid explanation of the so-called "prothetic" vowels of Greek and Armenian (*e.g.*, Greek ἄελλα "windstorm" from **α$_F$εν(τ)-λα*, Gothic *winds*, Latin *uentus*, Hittite *ḫwantas;* Greek ὄνομα "name," but Latin *nōmen*), of puzzling alternations of aspirated and nonaspirated consonants (*e.g.*, Greek πλατύς but Sanskrit *pṛthivī*) or of voiced and unvoiced consonants (*e.g.*, Latin *uiuidus*, Sanskrit *jīvatha-s*).

An even more important result has been a total reconstruction of the Indo-European phonological system, which is now believed to have had a total number of phonemes that is also a power of 2, viz., 2^5; *i.e.*, *p b; t d; k g; qu gu;* $\underline{H}_1$ $\underline{H}_2$ $\underline{H}_3$; *s; r l; m n;* $\underline{i}$ $\underline{u}$; *ĕ; ĕ* combined with $\underline{H}_1$ $\underline{H}_2$ or $\underline{H}_3$ or with $\underline{i}$ $\underline{u}$ *r l m n;* $\underline{r}$ $\underline{l}$ $\underline{m}$ $\underline{n}$; *ĭ ŭ; ī ū.*

Common Characteristics.—Indo-European "roots" (these are grammatical abstractions) regularly have the pattern: consonant + vowel + consonant (*e.g.*, **$\underline{H}_1$es-* "to be") and are commonly extended by a suffix of the pattern vowel + consonant (*e.g.*, **$\underline{\text{ieu}}$-eg* as in Sanskrit *yuj-*, Greek ζυγ-, in which the vowel *ĕ* having been lost in both root and suffix, the consonant $\underline{u}$ has been vocalized). Indo-European languages use the inflectional method of word formation (*i.e.*, to build up stems); to indicate function and relation (*e.g.*, active and passive in the verb, or actor and patient in the noun) there are further forms such as Sanskrit *yugám*, Latin *iugum*, Old English *geoc*, all meaning "yoke"; or Greek ζεῦγος (neuter), Latin *iuxmentum* ("beast of burden"), Latin *iungere* ("to yoke," with a nasal infixed, indicating terminative action and thus becoming in Latin a present tense). In syntax there are notions of word order, and especially of the use of different forms (accidence) which constitute the system of nouns, pronouns, adjectives and verbs. For example, the genitive case indicates sphere of influence or action, so that when two concepts are represented as impinging upon one another the genitive case is used; *e.g.*, *patris liber* "father's book" (though the precise nature of the intersection—authorship, ownership or what not—must be clarified by the context), or *capitis damnare* "to condemn in the matter of a capital offense," *i.e.*, "condemn to death."

Edward Llwyd in his *Archaeologia Britannica* (1707) was perhaps the first to compare Germanic, Celtic, Greek and Latin words, but not very systematically; in 1786 Sir William Jones made his famous observation concerning the essential historical relationship between Sanskrit, Greek, Latin and Germanic; in 1816 Franz Bopp saw that the verbal system of Indo-European might be in part reconstructed from the evidence of the derivative languages in their oldest recorded forms; and items of vocabulary in Sanskrit, once this language had become known to the western world, such as *sarpa* "serpent," *pitar* "father," *asti* "he is," *dvā* "two," *trayas* "three" (*cf.* Latin *serpens, pater, est, duo, tres*), were rapidly collected, sorted and classified, so that a large number of regular correspondences was established, some of which have never been questioned.

In fact, there now exist a number of criteria which may be applied to any newly discovered and deciphered language to enable one to decide, if it appears a priori likely to be Indo-European, whether or not it actually is. These are: (1) the forms of the verb "to be" (since these are relatively stable); (2) terms of kinship; (3) numerals; (4) accidence, especially personal endings in the verb; *e.g.*, Sanskrit *bháranti*, Greek *φέροντι* (later *-ονσι*), Latin

ferunt, Gothic *bairand*, Old Church Slavonic *bératъ*, all meaning "they carry"; (5) forms of the pronoun; (6) syntactic functions; *e.g.*, of the optative mood (mild command or natural likelihood).

As an illustration it will be enough to take one word, the name of the "wolf" (perhaps not always clearly distinguished from "fox") that is widely enough distributed in regularly developed forms to suggest that the speakers of proto-Indo-European were familiar with the animal itself, and therefore must have lived in a region which is also its habitat. Thus there is Sanskrit *vṛka-*, Greek λύκος, Latin (Sabine?) *lupus*, Gothic *wulfs*, Old Church Slavonic *vlъkъ*, Lithuanian *vilkas*. Greek ἀλώπηξ "fox" is probably, Italic (Latin) *uulpes* "fox" certainly, related. But there are some curious divergences: Swedish and Norwegian use *vorg* "the villain," "criminal" for wolf, Irish has *fāel* and (modern Irish) *fael chū;* compare *cũ allaid* ("wild dog") in the sense of "wolf" (the etymology of *fāel* is unknown), and also modern Irish *mactire* (literally "son of the land").

It was common to use names of animals to designate human beings (much as in Uncle Remus): thus we have Sanskrit *Vṛka-karman* and *Vṛka-bandhu*, Greek Λυκοῦργος, Λυκόφρων, Λύκος, Serbian *Vuk* and *Vukovoj*, Old High German *Wolf-arn, Wolf-bado, Wolfo*, Gothic *Wulfila*, modern German *Wölfflin* and English *Wolf(e)* as a surname. This hardly looks as if the wolf were a beast of prey, but rather was thought of as a leader or totem. In the same way, the Italic tribe Hirpini derived their name from *hirpus* "wolf," which will recall the legend that Romulus and Remus were suckled by a she-wolf, a story to which modern India constantly furnishes parallels. The notion of the werewolf (Gothic *wáir* "man") is that of a being which has the capacity to convert itself from man to wolf and back again at will. Evidently it is a mistake to draw conclusions from a mere list of names of animals or of plants and trees; it is necessary also to know what these names connoted in a wider context than a merely zoological or agricultural catalogue.

See articles on the individual Indo-European languages; *see* also references under "Indo-European" in the Index.

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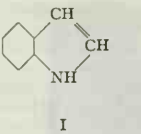
INDOLE (2,3-BENZOPYRROLE), a chemical agent present in extracts of jasmine, orange blossoms and lilac, was first prepared in 1866 by A. Baeyer, who regarded it as the parent substance of indigo. It crystallizes in colourless lustrous leaflets, melts at 52° C., boils at 253°–254° C., is readily volatile in steam and easily soluble in water, alcohol, ether or benzene. Its odour is generally fecal, but after careful purification and in sufficient dilution indole possesses a not unpleasant odour of flowers. Accordingly it finds a limited application in perfumery.

Indole occurs also in the coal-tar fraction, boiling at 220°–260° C.; after removal of phenols and strong bases the oil is treated with sodium or sodamide to form sodium indole, which is separated mechanically and decomposed by water.

It is synthesized by treatment of *o*-amino-ω-chlorostyrene, $H_2N{\cdot}C_6H_4CH{=}CHCl$, with sodium ethoxide, or by reduction of *o*-nitrocinnamic acid, $O_2N{\cdot}C_6H_4{\cdot}CH{=}CH{\cdot}CO_2H$. These reactions indicate its constitution (I).



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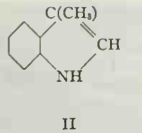

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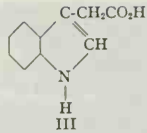

III

Skatole (3-methylindole: II) occurs in human feces, of which it is the chief volatile constituent; it melts at 95° C. and boils at 265°–266° C. Both indole and skatole are degradation products of tryptophan, an amino acid.

3-Indoleacetic acid (III), or heteroauxin, is one of the natural plant-growth hormones.

INDONESIA, REPUBLIC OF (REPUBLIK INDONESIA), a country of southeast Asia comprising a large island group extending east-west for more than 3,000 mi. (4,800 km.) across the Equator in the Indian and Pacific oceans between the Malay Peninsula and New Guinea. This territory, until Dec. 27, 1949, constituted the Netherlands East Indies. The component parts include Sumatra, Java, Bali, Borneo or Kalimantan (in part), Celebes (Sulawesi), Halmahera, Lombok, Sumbawa, Flores, Timor (in part), the Moluccas, and a multitude of smaller islands of the Malay Archipelago. From May 1963 Indonesia also assumed administrative responsibility for the former Netherlands (West) New Guinea, which was renamed Irian Barat (see *History*, below). The total land area is 735,268 sq.mi. (1,904,344 sq.km.) including West New Guinea. (For physical geography *see* MALAY ARCHIPELAGO; *see* also separate articles on the major islands for geographical, historical, and economic aspects.)

This article contains the following sections and subsections:

I. The People
  1. Languages and Ethnic Groups
  2. Religion
  3. Population
II. History
  1. Dutch Rule Until 1870
  2. The Modern Colonial Period
  3. The Nationalist Movement
  4. Independence
  5. Malaysia
  6. Internal Affairs
  7. Territorial Waters
III. Administration and Social Conditions
  1. Constitution and the Political Pattern
  2. Local Government
  3. Education
  4. Living Conditions, Health, and Welfare
  5. Justice
  6. Defense
IV. The Economy
  1. Production
  2. Trade and Finance
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I. THE PEOPLE

Remains of *Pithecanthropus* (*q.v.*) and *Homo soloensis*, found on Java, are evidence of the early presence of marginal branches of humanity in this area at a very ancient time. Later it became a zone of settlement and passage for various races moving eastward from the southern Asian mainland. The most recent migrations, starting perhaps 4,000 years ago, were those of the Malay peoples, belonging to the southern, or Oceanic, Mongoloid branch. In successive waves they occupied the archipelago, blotting out almost completely the earlier dark-skinned races in the western part and occupying less intensively the eastern islands, resulting there in a racial mixture of Malay, Melanesian, and Papuan. (*See* MALAY; MALAY ARCHIPELAGO: *Anthropology.*)

Modern Indonesians, although not a homogeneous racial group, can be characterized by their short stature, light- to dark-brown pigmentation, and mesocephalic heads with sleek black hair, wide noses, and thick lips. Negroid features are prominent in eastern Indonesia, the result of interbreeding with the Papuans. The population of modern Indonesia is composed of a large number of different peoples at varying levels of civilization, from the hunting tribes in the interior of Kalimantan to the highly skilled farmers of Java, Bali, and some sections of Sumatra. Although there is a

growing national unity, the manifold regional subcultures, divided by differences in language, customs, and historical tradition, are still much alive and manifest themselves in diverging attitudes toward national ideology and political structure of the new state.

1. Languages and Ethnic Groups.—Seventeen language groups are recognized in Indonesia; all belong to the Malayo-Polynesian family except that of North Halmahera, which is a member of the widely divergent Papuan group (*see* MALAYO-POLYNESIAN LANGUAGES; PAPUAN LANGUAGES).

The Sumatran peoples include the Achinese (or Atjehnese), Batak, and Gajo (*qq.v.*) in the north and Menangkabau (*q.v.*) in the centre, Lampung or Lampong (*q.v.*) in the south and the Malays along the east coast, all speaking distinct languages. The Malay language became the lingua franca all over the archipelago and now forms the basis for the national standard language (Bahasa Indonesia), which has also incorporated many words from other Indonesian dialects as well as from Dutch, Arabic, English, and Sanskrit. The Menangkabau, an enterprising people, are best known for their curious combination of a traditional matriliny with the Muslim religion. Their leaders were closely associated with the Javanese in the independence struggle.

On Java three distinct languages are spoken: Sundanese in the western uplands, Javanese (*q.v.*) in the middle and east, except for areas opposite the island of Madura, where Madurese (*q.v.*) prevails. In Kalimantan, Malay-speaking peoples live along the coast and Dayaks, speaking a variety of Borneo languages, live in the interior. Southwest Celebes is the homeland of the Mangkasaras (Makasars or Makassarese) and Bugi (*q.v.*), but these intrepid seafarers are also found in coastal settlements of east Borneo and many eastern islands. They differ in speech from the Toradja (*q.v.*) in the central highlands of the Celebes and from the Minahasa in the northern tip. The Balinese and their neighbours on Lombok and west Sumbawa constitute still another group, and several more are found in the eastern Lesser Sunda Islands (Flores, Timor, etc.) and in the Moluccas.

In addition to the indigenous population there are the Chinese, who belong to various south China dialect groups. The great influx from the China mainland was a response to the need for wage labour in western enterprises from 1870 to 1930. Many stayed, became business people and intermarried with Indonesians but retained their Chinese culture. In west Kalimantan the Chinese came in the 18th century to mine gold and remained as farmers and shopkeepers. In Bangka and Billiton a large number of Chinese work in the tin mines. Elimination of the perennial problem of dual citizenship of the overseas Chinese was attempted in a treaty with Communist China in 1955. This was ratified on Jan. 20, 1960, and provided for the choice of citizenship by alien Chinese by Jan. 20, 1962. The Chinese, who numbered 1,200,000 in 1930, were estimated at 2,200,000 in the early 1960s (70% born in Indonesia). The Indonesian government resents the dominant role of the Chinese in trade and industry and has attempted to curb it.

In 1930 there were about 233,000 Europeans and Eurasians in the Netherlands Indies, most of whom were Netherlands citizens, for the greater part native-born residents of mixed parentage. World War II, the revolution, and finally the mass expulsion in 1957, virtually eliminated all Dutch from Indonesia. The takeover of former Netherlands New Guinea in 1963 resulted in the inclusion of about 700,000 Papuans (*q.v.*) in Indonesian territory.

2. Religion.—Religious freedom is guaranteed under the constitution. The great majority of the Indonesians are Muslims, of the Shafi'ite sect of the Sunnis. (*See* ISLAM.) Intense devotion to Islam prevails among the Achinese, Menangkabau, Sundanese, and Banjarese (southeast Borneo); the Javanese have fused Islam with earlier Hindu and Buddhist beliefs, while elsewhere it is often only a thin veneer over animism. Balinese Hindus number about 2,000,000 and Christians 3,500,000, among them the majority of the Batak (north Sumatra), part of the Toradjas (central Celebes), all Minahasa (north Celebes) and Amboinese (Moluccas), some of the Dayaks (interior Borneo), and large groups in Flores, Timor, and nearby islands. Slightly more than half are Protestants and the rest Catholics. The Chinese in Indonesia may be characterized as being of Buddhist-Confucianist belief. In isolated areas tribal (animist) religions still prevail.

3. Population.—The census of 1930 gave a population of 60,413,000 (excluding West New Guinea). The 1961 census indicated the population to be 96,385,348, to which may be added 700,000 inhabitants of West New Guinea. Nearly two-thirds live on Java and the nearby island of Madura, together in size comparable to New York State or to England. The other island territories represent about 93% of Indonesia's land surface (including West New Guinea), and about one-third of its population. (*See* Table.)

Area and Population

Provinces by island groups (capitals in parentheses)	Area (sq. mi.)	1961 census*	Pop. density (per sq. mi.)
Celebes (Sulawesi)			
North Celebes (Manado)	34,200	2,003,211	58.6
South Celebes (Makasar)	38,786	5,076,138	130.9
Java and Madura			
Central Java (Semarang)	13,207	18,407,471	1,393.8
East Java (Surabaja)	18,503	21,823,020	1,179.4
Jogjakarta (Jogjakarta)	1,224	2,241,477	1,831.3
Greater Jakarta†	223	2,973,052	13,332.1
West Java (Bandung)	17,876	17,614,555	985.4
Kalimantan (Indonesian Borneo)			
Central Kalimantan (Palangga)	58,919	496,522	8.4
East Kalimantan (Samarinda)	78,162	550,764	7.0
South Kalimantan (Bandjermasin)	14,541	1,473,155	101.3
West Kalimantan (Pontianak)	56,664	1,581,034	27.9
Moluccas (Maluku) (Amboina)	28,766	789,534	27.4
Bali and Nusa Tenggara (Lesser Sunda Islands)			
Bali (Singaradja)	2,147	1,782,529	830.2
East Nusa Tenggara (Kupang)	18,485	1,967,297	106.4
West Nusa Tenggara (Mataram)	7,790	1,807,830	232.1
Sumatra			
Atjeh (Kutaradja)	21,387	1,628,983	76.2
Jambi or Djambi (Jambi)	17,345	744,381	42.9
North Sumatra (Medan)	27,331	4,964,734	181.7
Riouw (Riau) (Pakanbaru)	36,510	1,234,984	33.8
South Sumatra (Palembang)	61,067	4,847,224	79.4
West Sumatra (Bukittinggi)	19,219	2,319,057	120.7
West New Guinea (Irian Barat) (Sukarnapura)	162,915	758,396	4.7
Total	735,268	97,085,348	132.0

*Preliminary. †Coextensive with Jakarta city.

Political and social unrest and the creation of a large Indonesian bureaucracy caused a great migration to the cities. Jakarta (*q.v.*; Djakarta), the capital, has grown from 533,000 inhabitants in 1930 to 2,906,533 in 1961; Surabaja and Bandung each have approximately 1,000,000. More than 85% of the people, however, are still agrarian. The population pressure in Java is extreme and requires the outlet of colonization in sparsely populated islands.

II. HISTORY

For archaeology *see* INDONESIAN ARCHAEOLOGY AND ART. The historical record begins when relations with China and India developed about the beginning of the Christian era. Contacts with China were mainly commercial, but those with India led to the formation of states under strong Hindu and Buddhist cultural influence. Islam was brought to north Sumatra by Indian Muslim traders in the 13th century, and spread to the other islands in the next two centuries.

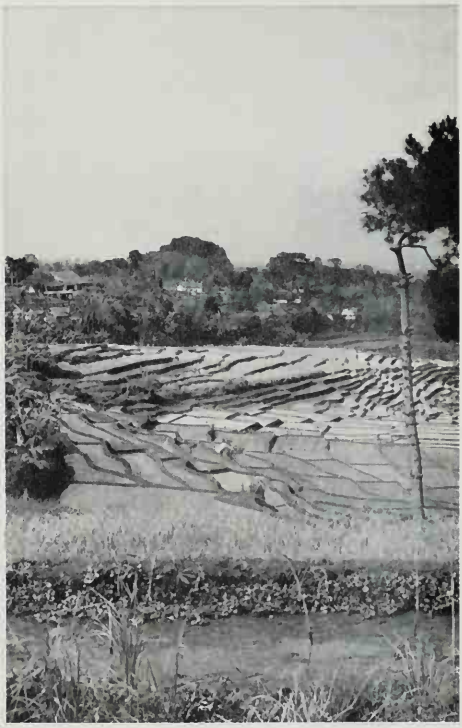
The Portuguese arrived in the Spice Islands (Moluccas) in 1510, followed by the Spaniards and, almost a century later, by the Dutch (1596) and British. The Europeans exploited local feuds to gain control of the spice trade, and in turn fought each other. The final outcome eliminated all but the Dutch from any significant role in the future of the archipelago.

1. Dutch Rule Until 1870.—The Dutch East India Company (*q.v.*), incorporated by the Netherlands States General in 1602, was intent on trade but eventually acquired territorial possessions in parts of Java and Sumatra in addition to the Moluccas. The company's holding became known as the Dutch East Indies or the Netherlands East Indies. Through maladministration and corruption the company became bankrupt and in 1798 the Netherlands state nullified its charter and took over its affairs and property. Before any reforms could be put into effect, the Netherlands was occupied by Napoleon and the British took over the Dutch East Indies (1811–16). The British lieutenant governor, Sir Thomas Stamford Raffles (*q.v.*), introduced some reforms, aiming

Berastagi, a small town on the north edge of the Karo-Batak plateau, a favourite hill resort for the plantation district of Medan, Sumatra. The volcano in the background is Mt. Sibayak

Young girls learning traditional dances in Ubud village on the island of Bali. Dancing is an integral part of Balinese life, serving magico-religious purposes or telling stories by pantomime

Workers at an oil refinery in Palembang, Sumatra. The petroleum industry plays an important part in Indonesian economy



Rice fields near Bandung on the island of Java. Rice is Indonesia's chief subsistence crop

SCENES IN INDONESIA

PHOTOGRAPHS, (TOP LEFT, TOP RIGHT, BOTTOM LEFT) WAAGENAAR—PIX FROM PUBLIX, (BOTTOM RIGHT) BOB LAUBACH FROM BLACK STAR

INDONESIA

Chinese women pounding rice in a village in Kalimantan (Indonesian Borneo). There are more than 2,000,000 Chinese traders, artisans, and labourers in Indonesia

Chital (axis deer) from India roam the grounds of the Bogor palace 30 mi. S. of Jakarta, Java. The palace, formerly the residence of the Netherlands Indies' governor general, is now the summer residence of the president of Indonesia

A Toradja village in the Celebes (Sulawesi). Family granaries (right) are built opposite houses; both structures are architecturally similar, being raised on stilts and covered with boat-shaped bamboo roofs

Twin volcanic peaks of Merapi and Merbabu in central Java

A young village boy astride the family water buffalo in the swampy delta area of southern Kalimantan (Indonesian Borneo)

SCENES IN INDONESIA

PHOTOGRAPHS, (TOP LEFT, BOTTOM RIGHT) HORACE BRISTOL—CAMERA PRESS—PIX FROM PUBLIX, (TOP RIGHT) LUC BOUCHAGE—RAPHO GUILLUMETTE, (CENTRE RIGHT) LINDEN—RAPHO GUILLUMETTE, (BOTTOM LEFT) CHRISTA ARMSTRONG—NANCY PALMER AGENCY

at free production for export by the Indonesians, a system continued by the Dutch until 1830.

By then it was clear that Indonesia, unlike India, did not respond to this policy and the "culture system" was introduced on Java, in an effort to graft forcefully an export economy onto the prevailing self-sufficient village structure. The cultivators had to devote part of their land and labour to the production of export commodities, such as coffee, sugar, and indigo, and deliver them to the government in lieu of money taxes. This policy led to exploitation of the peasants, but it was financially successful and opened the way for an exchange economy.

2. The Modern Colonial Period.—In 1870 the culture system was largely abolished in favour of private enterprise by European and to some extent Chinese capital. To protect native interests, the Agrarian Law of 1870 prohibited alienation of land to nonnatives; Dutch and other foreign entrepreneurs could obtain land by short-term rentals or, if it was not occupied, in long-term (75-year) leases. From that time export production expanded greatly, at first mainly on estates and after 1900 with increasing participation of native small holders. Initially Java was the chief area of production, but as effective government control was extended over other islands, they too began to take part in world commerce. In 1894 about 82% of all agricultural exports of the Dutch East Indies came from Java, in 1940 only 40%. There was a significant development of mineral production in the Outer Islands, mainly of tin and petroleum. This meant large investments of private capital, in 1939 estimated at 3,500,000,000 guilders, two-thirds of it Dutch, the remainder mostly Chinese, British, and American. Economic advance was checked by the depression of the 1930s, and the Dutch government turned to protectionist policies and the encouragement of manufacturing industries on Java.

Production for international trade was, however, of little direct benefit for the mass of the population. Their social order and traditional economy became seriously disrupted. From 1880 onward there were increasing demands in the Netherlands for a positive welfare policy in Indonesia, based on the moral responsibilities of guardianship.

The so-called "ethical policy," initiated about 1890, resulted in a number of improvements. Home and colonial finances were separated, measures were taken to revitalize the village community, provide rural credit, extend irrigation, prevent soil erosion, and improve public health. Although primary education was encouraged, little effort was made to provide more advanced training. However, the economic gains did little to raise the standard of living—and least so on Java—because they kept barely ahead of the rapidly increasing population, which more than doubled on the island between 1880 and 1940.

3. The Nationalist Movement.—The impact of modern economy and technology was accompanied by the spread of Western ideas of progress, democracy, and nationalism, which awakened Indonesian intellectuals. Stirring events in other parts of Asia as well as the spread of Marxist doctrines soon led to the formation of political parties, including a Social Democratic Party. In response to demands of Indonesian intellectuals as well as Dutch progressives, the *volksraad* (people's council) was created in 1918 with advisory power. Although this council in the next 23 years gained considerable legislative power, it did not meet the demands of those Indonesian nationalists who desired self-rule if not independence. The government repeatedly took strong action against leaders whom it considered extremists, especially after the rebellion of 1926–27 attempted by the Indonesian Communist Party. The nationalist movement, retarded in the 1930s by police action, was galvanized during the Japanese World War II occupation.

Japanese Occupation.—Early in 1942 this met no resistance from the Indonesian people, but eventually the oppressive measures turned the Indonesians against the Japanese. Some Indonesian leaders of the prewar nationalist movement, such as Sukarno and Muhammad Hatta, accepted posts in the Japanese administration; others worked underground. In the face of defeat, Japan invited Indonesian leaders to prepare for independence. On Aug. 17, 1945, two days after the capitulation of Japan, the independence of Indonesia was proclaimed.

4. Independence.—In the Netherlands, only shortly liberated from German rule, there was strong sentiment for a new "equal partnership" with Indonesia, but no willingness to accept independence, which was considered premature and contrary to the desires and interests of the Indonesian people. In the subsequent four years the Dutch tried persuasion and negotiation, punctuated by two periods of military action, to regain control. The Indonesian republican government, supported by Japanese-trained Indonesian troops and by fanatic young volunteers eager to fight reimposition of foreign control, stubbornly resisted. Finally, with the guidance of a United Nations commission and under diplomatic pressure from the United States, the Netherlands on Dec. 27, 1949, formally transferred sovereign rights to a newly formed United States of Indonesia, joined with the Netherlands in a nominal union. The Indonesian government considered the federative structure as a Dutch design to retain influence and soon convinced or forced the member states to agree to a centralized unitary state. This was achieved on Aug. 17, 1950, and the name of the country was changed to Republik Indonesia. The union with the Netherlands, which had no vitality and never really functioned, was formally dissolved in 1954; certain other agreements with the Netherlands, which the Indonesians considered onerous to their interests, were unilaterally abrogated by Indonesia in 1956.

Severe friction remained about the future of Netherlands New Guinea (West Irian). Indonesia had claimed West Irian in 1949 as being legal successor to the Netherlands. The latter country rejected this claim because New Guinea, inhabited by Papuans, was clearly ethnographically outside the new Indonesian nation-state. In 1949 the matter was left to further negotiations between Indonesia and the Netherlands, the latter retaining *de jure* and *de facto* control. When no settlement was reached, the Indonesian government in December 1957 retaliated by expelling Dutch citizens from Indonesia and confiscating their properties and in August 1960 severed diplomatic relations with the Netherlands. Tension heightened with a series of abortive raids by groups of armed Indonesians. The territorial dispute ended, however, with the signing of an agreement in August 1962 which provided for the transfer of West New Guinea from the Dutch to the United Nations for a transition period ending May 1, 1963, at which time Indonesia assumed administrative authority. Provision was made for the native Papuans to exercise the right of self-determination by the end of 1969 (*see* also NEW GUINEA). In May 1963 diplomatic relations with the Netherlands were resumed, followed by steps to reestablish economic relations.

5. Malaysia.—In 1963 Indonesia opposed Malaya's plan to include the British colonies of Sarawak and North Borneo, together with independent Malaya itself and self-governing Singapore, in a new Malaysia federation, declaring it to be merely a device to continue British colonial influence, and against the wishes of the local populations. It appeared that tensions would ease when, in the summer of 1963, the foreign ministers of Malaya, the Philippines (which had a tenuous claim on North Borneo), and Indonesia announced proposals for a mutual defense treaty and a confederation of Malay nations (Maphilindo).

When, however, on Sept. 16, 1963, the Federation of Malaysia came into being, in spite of Indonesia's protests, President Sukarno announced a "crush Malaysia" policy, and later adopted a policy of military and economic "confrontation." Indonesian infiltrations and raids in Sarawak and North Borneo (Sabah) were followed in 1964 by landings of small armed units in Malaya. In 1963 Indonesia placed an embargo on all trade with Singapore, and soon thereafter sequestrated all British and Malaysian enterprises in Indonesia. British forces in Malaysia were reinforced in 1964. When Malaysia was admitted as a member of the UN Security Council, Sukarno announced Indonesia's withdrawal from the UN (as from Jan. 7, 1965).

6. Internal Affairs.—Internally, the republic has been plagued by a series of autonomist military revolts and insurrections such as those in the South Moluccas, West Java, South Sulawesi, and sections of Sumatra. In each case the central government gained the upper hand, but the degree of its control remained obscure. (*See* also *Administration and Social Conditions,* below.)

7. Territorial Waters.—Strategically, the archipelago is important as the bridge between continental Asia and Australia and the barrier between the Pacific and Indian oceans. In 1957 the Indonesian government claimed territorial rights over all the seas around and between its islands, within an outer limit of 12 nautical miles (22.2 km.) measured from straight base lines connecting the outermost points of the islands. Although Indonesia declared that it would permit peaceful passage, the claim would amount to an attempt to close all passages, including that through the Strait of Malacca, to any foreign naval units that might threaten Indonesian security. The claim was rejected by the major seafaring powers.

III. ADMINISTRATION AND SOCIAL CONDITIONS

1. Constitution and the Political Pattern.—Indonesia has had three successive constitutions, all provisional, until a democratically elected constituent assembly could draft a permanent one. The first was proclaimed with independence on Aug. 17, 1945; the second, of Nov. 2, 1949, was drafted during the Round Table Conference and provided for the federated Republic of the United States of Indonesia; and the third, enacted on Aug. 17, 1950, replaced the federation by the unitary Republic of Indonesia. These constitutions varied not only in providing for different forms of state but also in powers and rights of institutions common to all three.

The 1950 constitution provided for five instruments of state: the presidency, the cabinet, the house of representatives, the supreme court, and the general audit council. President Sukarno exercised extraconstitutional status in the affairs of the country by virtue of his ability and leadership in the revolution.

Many political organizations emerged, almost all with socialist aims or tendencies, and nearly 170 parties and factions contested the first national elections of 1955, at which more than 80% of the electorate voted (universal suffrage for men and women over 18 years of age). Out of nearly 40,000,000 votes cast for the election of the House of Representatives, four parties—Partai Nasional Indonesia (Indonesian Nationalist Party or PNI, with a platform of "proletarian nationalism"), Masjumi (Council of Indonesian Muslim Organizations), Nahdatul Ulama (Orthodox Muslim Scholars), and the Partai Komunis Indonesia (Indonesian Communist Party or PKI)—received more than 6,000,000 votes each. The United Muslim and Parkindo (Christian Protestant) parties each polled more than 1,000,000 votes. Elections for a constituent assembly produced a similar representation.

"Guided Democracy."—Feuding among the party representatives in the face of Indonesia's increasing difficulties caused Sukarno to propose in 1957 a "Guided Democracy," which was implemented by presidential decree in 1959. The 1945 constitution, which gave the president virtually unrestricted powers, was reinstated and the establishment of a nonparty presidential cabinet was announced. The Constituent Assembly was dissolved; the legislative function of the House of Representatives was restricted and its character changed by the addition of delegates representing various interest groups. Sukarno also created several institutions (including the National Planning Council and National Front), but the division of authority between the various bodies was obscure.

The continuing threat of insurrections and banditry in various islands led to an increase in power of the central military establishment. The army, under the state of martial law, had discretionary control over much of the civilian administration, which frequently seemed to overlap, if not conflict, with the presidential powers. General elections, scheduled in 1959, were indefinitely postponed. Further steps were taken in 1960 to implement "Guided Democracy." Sukarno suspended Parliament, apparently an attempt to silence growing opposition (especially to the budget), and afterward announced the appointment of a 261-member (later increased to 283) *goyong rotong* (mutual-help) parliament. This was to function similarly to the old Indonesian village system of *goyong rotong* whereby the village elders met to discuss problems until a unanimous agreement was reached—in effect a rubber-stamp parliament. A provisional people's consultative congress (consisting of all the members of Parliament plus representatives of various regional groups and organizations), which was supposed to share legislative authority with the *goyong rotong*, was also created. In April 1961 Sukarno signed a decree permitting only eight political parties, whose existence depended on subscription to the state's philosophy. In 1963 the People's Consultative Assembly declared Sukarno to be president for life.

In view of the criticism of Dutch policy and the great expectations raised by the revolution, the state of affairs in the early 1960s was discouraging to many leading intellectuals, a number of whom joined the insurrectionists in exile or in jungle refuge.

2. Local Government.—Indonesia is divided into 20 provinces (subdivided into *kabupaten* [regencies]), the special autonomous territory of Jogjakarta and the special district of Greater Jakarta (*see* Table). Each province has a presidentially appointed governor and an elected regional legislative council of representatives, but in several areas the regional military commanders are actually in control. Intermittent regional rebellions in the 1950s and 1960s reflected partly Muslim opposition to the secular character of the Indonesian state, partly resentment of Javanese domination or lack of confidence in the policies of the central government.

3. Education.—In the early 1960s estimates of literacy in Indonesia varied widely (from 45 to 80%), but there is no doubt that literacy has increased considerably since independence. Primary education is free. The government has strongly encouraged general school attendance, but the shortage of teachers, buildings, and equipment has hindered the effort. Secondary and higher education has been greatly expanded. Higher education is given at 24 state universities and at a number of private universities. The state universities include the Gadjah Mada University (founded 1949) at Jogjakarta, the first to be established in Indonesia after independence; the University of Indonesia (1950; medicine and law schools established in the 1920s) at Jakarta, with faculties at Bandung and Bogor; and the institutes of technology (having university status) at Bandung and Surabaja. Private universities include two Islam universities at Jogjakarta (1945) and Medan (1952), and the National University (1949) at Jakarta. It is claimed that more than 10,000 libraries have been established in connection with the mass education movement.

4. Living Conditions, Health, and Welfare.—Because of the small output per worker, living conditions remain poor. Life expectancy is 32 years. Food conditions are on the whole worse on Java than on the other islands. The government subscribes to a broad social welfare program and is bound under the constitution to assist the "poor and the waifs." Implementation of legislation, however, is a slow process.

Prior to World War II, the Netherlands government, missions, and estates devoted much attention to the struggle against disease. General vaccination virtually eliminated smallpox, cholera was under control, and plague had become rare. The fight against hookworm, malaria, yaws, typhus, venereal disease, and tuberculosis progressed but was far from won. The health services were disorganized and disrupted during the Japanese occupation, and in the unsettled postwar years the available medical personnel and hospitals were inadequate for the needs of the people. The republican government received much help from the United Nations (notably through the World Health Organization and the UN Children's Fund) and institutions in the U.S.; by the mid-1960s significant progress had been made in solving health problems but the shortage of personnel and equipment remained severe.

5. Justice.—After 1951 the administration of justice was unified. There are courts of the first instance, high courts of appeal in the large urban centres, and a supreme court of justice in the capital. Criminal law follows the Dutch penal code of 1918 and is equally applicable to all groups (Indonesian, European, and foreign Orientals). However for civil and commercial law, different systems are applicable to each group. Judgment of Muslims may be influenced by Muslim law. In the villages the old customary law (*adat*) prevails.

6. Defense.—The Indonesian armed forces were formally established Oct. 5, 1945. Compulsory military service has been nominally in force since March 1959. The president is the supreme commander of the Army (organized territorially), Navy, and Air

Force; the total complement of all three services was said to number about 250,000 in the mid-1960s.

IV. THE ECONOMY

1. Production.—World War II and the subsequent revolutionary struggles caused great damage and neglect to production, especially on estates. The 1950 constitution provided for the economy to be built up as a joint endeavour based upon the family principle, and for nationalization of natural resources and those branches of production affecting the daily necessities of life to obtain the greatest possible prosperity for the people. These principles sum up the intention to convert the colonial economy, which stressed the export of raw materials, into a diversified national economy which would emphasize domestic welfare under strict government supervision. An eight-year development plan designed to achieve "Indonesian socialism" was begun in 1961.

At the root of the difficulties lies the unconcern or inexperience of Indonesians in modern ways of commerce and industry. In the past Chinese, Indians, Arabs, and Westerners conducted virtually all business outside the feudal-agrarian sphere. With independence came an intense desire to replace foreigners by Indonesians, but the wish did not automatically create Indonesian entrepreneurs. In the rural sector, however, the peasants derived considerable benefits from the expansion of cooperative undertakings. In January 1961 the government announced land reform regulations whereby each farming family would have at least 2 ha. (5 ac.) of land, increased to 20 ha. (50 ac.) in sparsely populated areas. The present size of the average holding on overcrowded Java is less than 1 ha.

Agriculture.—Estate output of crops (rubber, tobacco, sugar, palm oil, hard fibre, coffee, tea, cocoa, and cinchona) sharply declined in the 1950s and early 1960s mainly because of insecurity and governmental restraints, and the seizure in 1957 and subsequent mismanagement of Dutch estates further depressed production. The Agrarian Act of 1960 placed restrictions on all remaining foreign estates. The loss of export earnings and employment has not been balanced by an equal rise of output in the national sphere. Before World War II Indonesia's share in world exports was 86% for pepper, 65% for kapok, 37% for rubber, 33% for sisal, 27% for copra, 25% for palm oil products, 19% for tea, and 6% for sugar. None of these crops (except hevea rubber, which has greatly increased) has reached the level of prewar production. In the mid-1960s Indonesia, with about 35% of the world's output, ranked second as producer of rubber, but most of the hevea trees were old and little replanting had been done since 1940, in contrast to Malaysia, where there were high yielding new strains.

Rice is the chief subsistence crop but, in spite of strenuous efforts to increase production, the self-sufficiency of prewar years has not yet been achieved. Production of other basic foodstuffs such as maize (corn), root crops, soybeans, and peanuts has increased, although this must be viewed against population growth. There are rural cooperatives designed to meet the small farmer's need for credit and for aid in marketing his cash crops.

The livestock population in the mid-1960s (mostly concentrated in Java, Madura, Bali, and Lombok) was over 30,000,000 head (cattle, buffaloes, horses, pigs, goats, and sheep).

Fisheries.—Fish is a major source of food and is more important than indicated by official statistics because the considerable subsistence fishing of part-time fishermen is never recorded commercially. The catch of sea fisheries exceeds 500,000 metric tons annually and that of inland waters (rivers, lakes, swamps, artificial ponds, and flooded rice fields) averages 500,000 tons.

Forestry.—Nearly all forest lands are state owned. Timber, mainly for domestic use, is obtained from the more accessible forest areas of Sumatra and Kalimantan. In Java, deforestation through excessive cutting has caused soil erosion, aggravated floods, and impeded irrigation facilities. Reforestation is planned and some progress has been made in the Outer Islands.

Industry.—Manufacturing, mainly of consumer goods, is concentrated on Java. A cement factory and a number of fertilizer and textile mills have been built. Handicrafts and the primary processing of agricultural products are significant. Lack of capital, restrictive measures against foreign concerns, limited energy supply, and complex regulations governing the import of raw materials hamper industrial development.

Trade unions are permitted by the 1945 constitution (although an antistrike ordinance has been in effect since 1951) and are largely confined to Java and Sumatra.

Power.—Indonesia has substantial undeveloped water power potential and oil and coal resources for thermal plants. Development is mostly in Java; in the mid-1960s two multipurpose projects, Djatiluhur in West Java and Brantas in East Java, were designed to provide power, irrigation, and flood control. All electricity and gas undertakings are nationalized. According to official statistics, in the mid-1960s total electricity generated averaged more than 1,100,000,000 kw-hr. yearly and production of natural gas exceeded 2,500,000 metric tons.

Mining.—The petroleum industry, which plays an important part in Indonesian economy and is largely controlled by British-Dutch-American interests, greatly increased its output (1962: 167,000,000 bbl. crude oil) in spite of stringent government regulations. Following the Petroleum Act of 1960 the foreign oil companies operated as government contractors instead of concessionaires. In 1965 the government nationalized the entire industry. In the mid-1960s estimates of the known reserves varied between 1,200,000,000 and 1,900,000,000 bbl. with the possibility of considerable untapped resources. Sumatra is the richest producer with about 70% of production, and Kalimantan the second best. There are scattered wells on Java and Madura.

After Malaysia, Indonesia is the world's second largest producer of tin with an annual production of 20,000 to 30,000 tons. Principal deposits are on Bangka, Billiton, and Singkep in the Riouw Islands. Other minerals include bauxite (especially at Bintan), coal, and manganese; iron ore, nickel, copper, gold, and silver are found in workable quantities.

2. Trade and Finance.—Jakarta, the capital, is the centre of commerce, the main port of entry and distribution centre. Indonesia exports chiefly agricultural products (rubber, tea, pepper, sisal, palm oil products, and copra) and minerals (petroleum and tin). Rubber accounts for more than 40% of the total export value, petroleum and its products for over 30%, and tin for 5%. Java contributes about 20% of the exports and Sumatra 60%, but Java receives most of the imports (about 70%) and Sumatra 20%.

The principal imports are textiles, machinery, rice (about 560,000 metric tons annually), chemicals, gasoline, iron and steel, and paper products. Overseas trade is conducted mainly with Malaysia and Singapore (interrupted by the strained relations with Malaysia), the United States, United Kingdom, Japan, the Federal Republic of Germany, eastern Europe, and the U.S.S.R. Trade with the Netherlands, of primary importance in the past, was halted in 1957 and resumed only in late 1963.

The drastic decline in export earnings has resulted in a very unfavourable balance of trade, necessitating severe restrictions on imports beyond essential goods. The government tried to stop the process of economic disintegration by imposing more regulations on all business activities, which in turn led to widespread illegal practices. To offset smuggling in the Outer Islands, the government permitted limited barter trading.

During the early 1960s the budget deficit remained large and the currency continued to decline in value. The monetary unit is the rupiah with an official exchange rate of 45 rupiah to the U.S. dollar (126 rupiah = £1 sterling), but the effective transaction rate remains much higher (250 rupiah to the U.S. dollar in 1964).

Banking.—The central Java bank was established in 1828 and was replaced in 1951 by the Bank of Indonesia, which is now the largest commercial bank and the most important in resources and statutory power. There are three other state-financed banks; also a post office savings bank, an increasing number of small private banks (many located in villages), and eight foreign banks.

3. Transport and Communications.—Indonesia is politically and economically dependent on good interisland communications and transport. The government controls the postal services, radio stations, and most of the public communication facilities. Until late 1957 about 90% of the sea communications were conducted

by a Dutch-owned shipping company. As a result of Indonesia's actions against Dutch property, this fleet was removed, leaving the island arc without adequate means of sea transport. Replacement by Indonesian ships has been slow. Garuda Indonesian Airways (G.I.A.), a state-owned enterprise, suffered too by the expulsion measures, because a number of Dutch pilots had to be replaced. Most of the G.I.A. routes are internal, but services are also provided to Manila, Bangkok, Hong Kong, Tokyo, and (in normal times) to Singapore.

In the mid-1960s the railway system in operation comprised about 4,126 mi. (6,640 km.) of track of various gauges (about 75% on Java). Rolling stock and maintenance still had not recovered from damages incurred during the World War II. The highway network (40% on Java) was estimated at 50,000 mi. (80,000 km.). The number of motor vehicles in use exceeded 230,000.

See also references under "Indonesia, Republic of" in the Index.

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(J. O. M. B.)

INDONESIAN ARCHAEOLOGY AND ART.

This article gives an outline of Indonesian art and archaeology both in terms of the islands which constitute the Republic of Indonesia (*q.v.*) and in the wider setting of those areas in which speakers of Indonesian languages are to be found or which have cultural affinities with the island region. Reference should also be made to ARCHAEOLOGY; ANTHROPOLOGY; CHINA: *History*.

PREHISTORIC CULTURES

Paleolithic Cultures.—Although much has been written about the cultures of the Pleistocene period in Indonesia, knowledge of them depends upon a very limited investigation of this complex and extensive region. Stone tools are known from various parts of the region, but although the earliest human remains (*Homo modjokertensis*) date from the Lower Pleistocene of Java, tools have not been found in contexts earlier than the later Middle Pleistocene, and even the word context is in some measure unjustified since all the material comes from surface finds. Careful analysis of all data available in the 1960s suggests however that the bulk of the Patjitanian material (named after the site of Patjitan in southern central Java) can be assigned to the later phases of the Middle or very earliest phases of the Upper Pleistocene. The association of the tools with *Pithecanthropus* species depends upon the assumption that, in the absence of other human skeletal material from the area, Java man was responsible for the artifacts (*see* MAN, EVOLUTION OF; PITHECANTHROPUS).

The assemblage of tools was described as "Chellean" by its original finders, but this view has been contested and it has been shown by H. L. Movius that the Javanese material belongs to what he called the chopper-chopping tool complex which forms a cultural continuum in the far east, more or less uninfluenced by western paleolithic cultures. Other industries which belong to this complex are the Sohanian (northern India and Pakistan), Anyathian (Burma), Fingnoian (Thailand), Tampanian (Malaya) and Choukoutienian (China). In China the industry is clearly associated with *Pithecanthropus pekinensis* (Peking man), a further argument in favour of the association of the tools with the fossil hominids from Java. Neither fossil remains of pithecanthropoids nor paleoliths of this type have been found in Laos, Cambodia or Vietnam. The Madrasian industry of peninsular India belongs to a different tradition which has affinities with the paleolithic industries of the near east and Eurafrica. The tools from Java fall into four categories: choppers, chopping tools, hand adzes and proto hand axes. The last category consists of tools, made usually on flakes, which are worked on the upper surface only into a crude pointed hand ax of plano-convex section with cortex remaining on the butt. The upper surface is very seldom worked all over. The form appears to be transitional between the true bifacial hand ax and the hand adze. (According to Movius the large cleavers made on a flake which were found at Baksoka and Tabuhan are quite different from the Madrasian cleavers and were made by an entirely different method.) The hand adze is a roughly tabular cutting or chopping tool with an approximately square or rectangular outline. This feature serves to distinguish it from the chopping tool, a core implement often made on a pebble, with a cutting edge which is frequently worked by alternate flaking from either side to produce a markedly sinuous blade. Choppers were essentially side-used implements which also were used as scrapers; they were made both on cores and on flakes, the larger tools being on cores.

Little is known of paleolithic tools from islands other than Java, but pebble tools and flakes have been reported from near Martapura (in southeast Borneo) which resemble Fingnoian implements from Thailand. Three collections of what are probably tools of the same period have been reported from Sumatra. Most of these are monofacially worked on fossil wood (a favourite raw material in the Burmese Anyathian) and volcanic tuffs.

Upper Paleolithic Cultures.—Excavations in 1931 at Ngandong in Surakarta, central Java, on the Solo river in a well-marked 20 m.-terrace revealed an astonishingly rich fossil bed from which more than 25,000 mammalian bones were recovered (of which two-thirds turned out to be those of prehistoric bantengs, or oxen. *Bos* [*Bibos*] *banteng palaeosondaicus;* the next most frequent form was a fossil water buffalo). This Trinil fauna is comparable with that from the Narbada beds in India. Among this wealth of material there were the remains of 11 human skulls and two tibias (shinbones). All these have been assigned to *Homo soloensis* (Solo man), though whether the creation of a new species for this material was justified is open to question. (The essence of the problem is the relationship between this group of fossils and the pithecanthropoids.) A feature of the skulls is that some show traces of having been broken away deliberately at their bases. It has been suggested that this provides evidence for cannibalism, also held to have been demonstrated in the material from Chou-k'ou-tien in China.

In 1934 G. H. R. von Koenigswald discovered flake implements in the Sangiran area, north of Surakarta. Subsequent study revealed the presence in central Java of a considerable flake industry with a small proportion of blades. The tools were made on chert, chalcedony and jasper. The forms include scrapers, end scrapers, ogival points, borers, core scrapers and a few blades. Investigation at a number of sites has shown that the industry is associated with the Notopuro beds and a Ngandong fauna; it has therefore been concluded that the artifacts should be assigned to Solo man. No comparable industry is known from the Asiatic mainland, but similar tools have been found in southwest Celebes

Patjitan stone choppers from south central Java. Paleolithic

Negative hand stencil on a red background in Burung cave, south Celebes. Mesolithic

Mesolithic bone tools and Neolithic intrusive stone arrowheads from Sampang cave, Java

Winged stone arrowheads from Punung, central Java. Neolithic

Front and side view of a bronze figurine from Bangkinang, south Sumatra. Early metal age

Round axes. Left, from New Guinea; right, from Celebes. Neolithic

Kettledrum from Java. Early metal age

Flexed burial in a small sarcophagus from Petang, Bali. Early metal age

Funeral gift in urn at Melolo cemetery, east Sumba. Early metal age

ARTIFACTS AND BURIALS OF PREHISTORIC INDONESIAN CULTURES

BY COURTESY OF KONINKLIJK INSTITUUT VOOR TAAL-, LAND- EN VOLKENKUNDE

INDONESIAN ARCHAEOLOGY AND ART

Balinese sculpture representing Vishnu; polychrome, height 31½ in.

Wooden effigy representing a hornbill, the common patron of head-hunting expeditions. Dayak, central Borneo; height 11¾ in., length 36½ in.

Bodhisattva Ksitigarbha (detail), stone carving from the Hindu period in central Java (9th century); height 15¼ in.

"Topeng" mask of central Java; polychrome wood, height 7 in.

Coloured pottery jug from the Kai archipelago, southern Moluccas; height 11 in.

Ancestor image carved in hard wood. Tanimbar islands, southern Moluccas, height 15 in.

Red and gilt wood sacrificial box. Bali, height 13 in.

Wayang puppet representing the hero Arjuna; polychrome leather. Java, height 15 in.

Devil-mask, polychrome wood. East Java, height 14 in.

Mask made by the Timor-Batak people of Sumatra. Polychrome wood with black horse mane, height 15¼ in.

Polychrome wooden coffer with flowery ornaments. East Java, height 21 in., length 35½ in.

STONE, WOOD AND LEATHERWORK OF INDONESIA

BY COURTESY OF (ALL EXCEPT CENTRE RIGHT) ROYAL TROPICAL MUSEUM, C. T. BERTLING, AMSTERDAM, (CENTRE RIGHT) C. T. BERTLING; PHOTOGRAPHS, (ALL) R. L. MELLEMA

and the Philippines. There are a few finds from the Solo river which suggest that tools other than stone were used. A number of fragments of deer antler have been found which have clearly been cut and in some cases sharpened. Stingray spines were apparently used as points and these suggest some link with the coastal area. There is also a chopper made on the horn of a *Cervus eldi*, an extinct deer. Stone balls, crudely made from andesite, were probably used as pounders, although it has been argued that they represent some type of bola. The beautifully made bone point with barbs on either edge from Watualang which is usually assigned to Solo man is, from its workmanship, certainly of later date.

H. R. van Heekeren has demonstrated the existence of a similar industry in southwest Celebes which also depended upon local supplies of chalcedony and jasper to make its tools. All the materials were surface finds; the same is true of the faunal material (which has been the subject of detailed studies by D. A. Hooijer). By the 1960s it was obvious that further study should be made of the area, but there was every reason to believe that the industry belongs to the same period and the same cultural group as that from Sangiran. The fossil fauna, however, is quite unlike that from Java and must represent a movement from south China by way of the Philippines and the Sangihe land bridge at a period of maximum marine regression. It is interesting to note, therefore, that comparable flake tools have been found in a Pleistocene terrace at Rizal-Bulaka, Luzon, and from a quarry in Davao, Mindanao, in the Philippines.

Post-Pleistocene Industries.—With the retreat of the ice in northern Eurasia there was a general raising of sea levels, and communication with and within Indonesia could no longer depend on land bridges. *Homo sapiens* appeared in the islands, presumably by raft and canoes. A number of racial groups have been identified: Australoids, Paleo-Melanesoids, Veddoids and Negritos, but all these classifications rest upon scanty data. In the immediate post-Pleistocene period three cultures have been determined: Hoabinhian (a pebble-tool industry), Sampang (a bone industry) and the flake and blade industries grouped under the term Toalian. All these have been described as mesolithic, but the term does not seem appropriate if it is to carry any of its usual connotations. What is found in Indonesia is a cultural phase which is transitional between a true paleolithic and an evolved neolithic.

The true Hoabinhian industry, named after the type site in the Tongking delta, is confined to Sumatra where there evolved an elongated oval unifacial pebble tool known as a sumatrolith. It is noteworthy that the Sumatran Hoabinhian sites are all in the coastal region facing Malaya, where, as M. W. F. Tweedie noted, the Hoabinhian is the only "mesolithic" culture which developed. The Hoabinhian tools are characteristically associated with shell mounds. In addition to the sumatroliths, the transversely cut hand ax with a straight butt (referred to as the *hache courte* in Indochina) is found in Sumatra, together with rough pebble tools, pounders, grinders and large quantities of hematite. A number of cave and rock shelter sites in east Java have also yielded Hoabinhian material, but always in association with a bone industry of a general Sampang type. Associated skeletal material has been described as Papua-Melanesoid and Veddoid. The term Melanesian civilization advocated by P. V. van Stein Callenfels to describe the Hoabinhian culture seems improper, however. A report that pebble tools exist in western Borneo seems to be based on a collection of unfinished neoliths. The great cave site at Niah has yielded pebble tools which the excavator has claimed as belonging to the chopper-chopping tool complex but which others consider to be general Hoabinhian. In Australia the sumatrolith persists in some areas where it is found hafted to a forked wooden stick.

The Sampang bone industry is named after a site near Ponorogo in east Java where L. J. C. van Es excavated a cave called Gua Lawa, subsequently studied in detail by Van Stein Callenfels. The occupation layer was over 3 m. deep and a number of skeletons were also found. W. Mijsberg, who studied the material, concluded that he was dealing with an Australo/Papua-Melanesian hybrid population. The mammalian fauna was subrecent Indo-Malayan. In all, about 17 sites in eastern Java proved to have elements of the Sampang culture which seems also to be represented in Japan, China, Indochina and Malaya (one site only). Van Stein Callenfels considered that its centre was in southern Tongking. The stratigraphy of the Gua Lawa as reported is open to question: the top layer yielded a few bronze and iron objects together with some quadrangular neolithic axes and some pestles and mortars. The layer below this was limited to bone and horn implements and objects: awls, daggers, fishhooks, digging tools and two types of bone spatula; there was no pottery. The lowest layer produced bifacial arrowheads, some of which seem to be bird arrows, and fragments of cord-marked pottery. Shell necklaces were found with the skeletons. There also were perforated animal teeth, two mother-of-pearl discs, a number of fragments of bone amulets which were decorated with incised concentric squares, and many fragments of hematite. Each body had been placed either on the side or on the back with the legs bent and the hands folded on the face. Pottery does not appear with the burials and the presence of pottery in the lowest level at Gua Lawa must be treated with reserve, in the absence of other evidence that the Sampang culture included ceramics. The people seem to have lived on mollusks, wild vegetables and game. The culture is definitely post-Hoabinhian, as is shown at the Da-but shell mound in north Annam where Hoabinhian implements are associated with Sampang bone tools of types not found in Tongking.

The so-called Toalian industry was discovered first by the cousins P. Sarasin and F. Sarasin during their expedition to Celebes in 1902–03. They found a microlithic blade industry which they associated with a primitive, part forest, part cave-dwelling people, the Toale, in the central area of southwest Celebes. Much investigation of the Toalian culture has subsequently taken place and a comprehensive account of it has been published by H. R. van Heekeren (see *Bibliography*) based on material from 19 cave sites, a number of which also have revealed hand stencils on red backgrounds; one shows a fine contour drawing of a leaping boar in a red-brown striped line technique. Skeletal material from the caves suggests that the Sarasins were right to associate the archaeological material with the ancestors of the Toale, but not that these people were relict Veddoids as the Sarasins believed. The material seems to fall into three stages. The earliest includes larger, crudely chipped flakes, plain blades, notched flake tools and pedunculate blade implements. The middle phase shows true microliths, beautiful struck blades and round-butted arrowheads, as well as blade points. In the upper Toalian are found serrated arrow heads, bone points and shell and potsherd scrapers. The last phase certainly persisted well into the first centuries A.D. Related flake and blade industries have been found in Java, Sumatra, Flores, Timor, Roti and Borneo. In the Kei Islands and Ceram there are hand stencils and also human and zoomorphic designs of types also found in New Guinea and Australia. The widespread microlithic cultural zone includes these regions also and it would seem that the Toalian culture is a general phenomenon of southeast Asia and Australasia. The microliths from the region of Lake Kerintji and cave sites in Sumatra conceivably may belong to another tradition. The status of the rock paintings in Niah, Borneo, is yet to be determined.

Neolithic Cultures.—Although the collection of neoliths from Indonesia has continued since the days, in the 17th century, of the German-Dutch naturalist Georg Eberhard Rumpf, who shared the Indonesian belief that the axes he described were thunderbolts, scientific investigation of neolithic sites by the 1960s was still on a very limited scale. It is therefore simplest to consider the material typologically, in terms of the characteristic tool forms.

Quadrangular Adze.—This tool has a rectangular, less often trapezoid or square, cross section. It occurs very widely in Indonesia and is also found in Malaya, Thailand, Indochina and parts of southern China. Associated with it are stone rings and bark-cloth beaters. In parts of Sumatra and Java are examples of the adze (in semiprecious stones and of very fine workmanship) which seem, since they show no sign of use, to have been made for ritual or ceremonial purposes. A number of subdivisions of the quadrangular-adze group have been proposed, some of which

have been found to extend into Polynesia where the use of bark cloth is widespread. It has been argued, mainly by R. von Heine-Geldern, that the distribution of the quadrangular adze coincides with the area in which Austronesian languages are spoken and that this is a significant coincidence. He further assigns the "older Megalithic" complex to this same grouping. The complex includes stone-paved ways, stone terraces and walls, stone spirit thrones, upright stones, pyramids and monumental ancestor figures which can be traced over an area from Assam to eastern Polynesia. There was, however, very little archaeological evidence available in the 1960s to sustain this bold hypothesis.

Round Ax.—This is characterized by a lenticular, oval or round cross section, with a curved cutting edge and a pointed or round butt. The tool seems to have been made by rough flaking, hammer dressing and polishing. The form is found throughout Celebes, the Moluccas, Leti, Tanimbar and Flores, Talaud, Manado and Sangir (islands between Celebes and the Philippines), where two specimens made on Tridacna shell have been found, and is widely observed in New Guinea where round axes are still made and used. They are also known, though infrequent, in Malaya and the east coast of Sumatra, are very common in Japan, and have been found in the Philippines. The distribution makes it almost certain that they belong to the east Asian-east Indonesian migration system (*see* OCEANIA). It has been suggested by F. Speiser that they should be associated with the Buka peoples who are still to be found in parts of Melanesia and attempts have been made to link the plank-built boat and coiled pottery with the round-ax culture.

Both the stepped adze and the shouldered adze show a somewhat similarly restricted eastern distribution, including the Philippines and eastern Polynesia. These are, however, variants of the quadrangular-adze group. The shouldered type, in its crude pebble form, has Hoabinhian affinities.

Megalithic Cultures.—Megalithic cultures are still to be found in the islands of Nias and Flores as well as in central Celebes among the Toradja (*q.v.*) tribes; they occurred throughout Indonesia, though they seem to be somewhat restricted in Borneo, the Philippines and in areas of mainland southeast Asia where elements of Indonesian culture can be detected on other grounds also. There is general agreement that the prehistoric megalithic cultures of Indonesia fall into two groups which Heine-Geldern characterized as older and younger, an unfortunate terminology because their relative chronology is by no means certain and differs from region to region. The main features of the older have already been mentioned, but Heine-Geldern believes that the special preoccupation of the people of this culture was with life after death, the megaliths and the associated sacrifices of cattle being designed above all to protect the soul on its subsequent journey to, and residence in, the underworld. The megaliths also allowed the living to draw upon the wisdom of dead ancestors by providing a link with them, and to perpetuate the power of those who erected them for the fertility of men, crops and cattle. The younger megalithic group is characterized by dolmens, stone coffins and stone-slab graves (which may contain more than one burial, the body being either flexed or extended), weaving, glass and carnelian beads, stone ancestor figures, and figures ending in a tapering butt instead of feet, and bronze and iron objects which are to be associated with the so-called Dong-son culture. The megaliths of eastern Java which belong to this group seem to have been in use until medieval times for some graves contain datable Chinese pottery. The Pasemah group in southern Sumatra, fully studied by A. van der Hoop and first reported in 1850, includes a remarkable series of carvings on boulders of men riding or wrestling with buffaloes and carrying bronze drums. Although these appear at first sight to be three-dimensional carvings, they are in fact bas-reliefs; the illusion is created by the skilful use of the curved surface of the boulders. One or two of the slab graves contained coloured drawings (in white, black, yellow, red and grey) which seem to deal with similar themes. These are mostly too decayed for detailed study.

Bronze-Iron Age.—There are no purely copper objects from post-Neolithic Indonesia, nor are there found the characteristic simple forms that elsewhere in Eurasia mark the beginnings of bronze technology. The occurrence of sophisticated types of socketed adze and ax which elsewhere seem to belong to the bronze-iron transitional period, and the occurrence of iron objects in similar contexts to the earliest bronze finds, all suggest that the use of both metals emerged in Indonesia simultaneously. Very few of the finds have any archaeological context; indeed, many of them are of uncertain provenance. It is clear, however, that many elements have gone to make up the Indonesian bronze-iron culture, though the main link is with the Dong-son culture of the mainland. Heine-Geldern wished to apply the term Dongsonian to all the early metal-using cultures of southeast Asia, but there is evidence from Indonesia itself to show that there are at least two major systems. The relationship between these cultures and the megalithic is shown at Pasemah where a carving depicts two warriors carrying one of the great bronze drums which are a characteristic feature of the Dong-son culture. Drums of this type are known from Indonesia; some certainly were imported from the mainland, but fragments of a stone mold from Bali show that some were manufactured locally. Ceremonial "halberds" from western Java of quite unusable proportions probably derived from the Dong-son periform axes. The decorated axes from Roti, with cast handles as well as blades, are also to be seen as an end product of the Bronze-Iron Age, whatever their date. Small bronze figurines of men and other animals sometimes seem to show affinities with Ordos material from northern China. Urn burials may also belong to this period; examples are known from Java, Sumatra, Celebes, Salayar and Sumba. Three types of burial occur. Skeletons are found in squatting positions with pottery in large jars; in other large jars only skulls and a few long bones are found. This pattern, characteristic of Melolo, is accompanied by a rich variety of pots and quadrangular adzes. Finally, urns of various sizes contain calcined human bones. This last system persisted in south Celebes at least until the coming of Islam in the 16th century.

HISTORIC CULTURES

During the Neolithic period, peoples (Proto-Malays) who spoke Indonesian languages and who brought with them outrigger boats, wet-rice cultivation, the rearing of cattle and pigs and the technique of bark-cloth manufacture, together with the megalithic tradition, moved into the islands from the mainland of Asia. These people were ancestral both in language and culture to the present-day inhabitants of the islands. Their movements from the mainland were spread over many centuries and probably were completed by about 1000 B.C. Later, in the last century or two B.C. the bearers of the bronze-iron cultures, who certainly were related to the preceding groups, and may have been the people whom Chinese texts call Yüeh, also reached the islands. It is from these two cultural traditions that what may be called the native Indonesian culture stems. Originally this was not clearly distinguishable from that of the mainland of southeast Asia, but geographical distance and outside influences contributed the increasing differences. One obvious cause was that while northern Indochina became a Chinese sphere of influence (and indeed a province of China), most of central Indonesia came under strong influences from India. These began in the early centuries A.D., the exact date being a matter for controversy, though by the 1960s evidence was accumulating to suggest that it was later than was thought 30 years previously; *i.e.*, in the 4th century A.D. rather than the 1st. Some aspects of these developments are noted below.

The main development of Indonesian historical cultures can best be observed in Java and Bali (*qq.v.*). There was a phase during which basic Indonesian cultural patterns were established and which has been discussed above. There followed a long period of Indian influence which gave rise to the Indo-Javanese cultures of pre-European historical Java. During this period, however, it is clear that the degree of indianization decreased with distance from the court and lowness of social status. In any event, as happened elsewhere in southeast Asia, rulers had both Indian and native aspects, though the surviving material culture, being destined for conspicuous ends, tended to overemphasize the Indian. This was

more ostentatious and better suited to the needs of courts with pretensions to grandeur and a wish to show their power by the adoption of foreign ways. But Indonesian culture remained active and viable, encapsulated, to re-emerge with increasing vigour from the 13th century onward, considerably modified by the Indian phase. But, in the same way that the degree of indianization varied in relation to distance from the court within Java, so equally did it vary within the islands which make up Indonesia.

In Borneo and parts of Celebes and Sumatra there is considerable evidence of Indian cultural influences. Buddhist images, attributed to the south-Indian Amaravati school, but perhaps derived from Ceylon which was itself influenced by Amaravati, have been found at Samapaga, Celebes, and Seguntang, Sumatra. Inscriptions in Sanskrit have been found in Borneo which date from the late 5th century, and a Buddha figure, rather later than those noted above. Numbers of other Buddhist and Hindu images have also been found in eastern Borneo which date from the 7th to the 11th centuries and which show Javanese influences. In Sumatra there developed a powerful kingdom, Srivijaya, whose importance seems to have stemmed from its commanding position on the east-west trade route. With this realm are to be associated an over-life-size stone image of Avalokitesvara, and fine bronzes of the Buddha, Maitreya and Avalokitesvara as well as a number of inscriptions in Sanskrit and four in Old Malay which, with another inscription from Champa (*q.v.*), constitute the earliest records of Indonesian languages. The Srivijayan inscriptions are dated, in the Saka era A.D. 683, 684 and 686 (*see* CHRONOLOGY: *Hindu*). Buildings in Sumatra include the Muaratukas group (? 12th century), Padanglawas (13th century) which was apparently a centre of Tantrism (*see* BUDDHISM), and Tanjungmedang. In contrast with Javanese practice, buildings from this period in Sumatra are of brick.

Champa.—On the mainland of southeast Asia the major groups of Indonesian language speakers are to be found in Malaya, Vietnam and Cambodia. The latter group includes a number of tribal peoples and the last remnants of the Chams who represent all that is left of Champa, a major kingdom which flourished in Vietnam from the 2nd century A.D. until the 15th century (*see* CHAM). Chinese sources, studied in detail by R. A. Stein, are the main source for the early history of the Cham state which seems to have been established by a dissident native official. He broke away from Chinese domination in the Tongking delta to set up a kingdom which the Chinese knew as Lin-i. Of the material remains of Lin-i there is no trace; the earliest Cham monuments belong to the 7th century A.D., though a Buddha figure of an Amaravati type from Dong-duong is earlier. The site at Mi-son which provides the first surviving buildings remained a kind of Cham national shrine, but the kingdom was never really viable; the coastal strip of Vietnam is much fragmented by river mouths and outlying spurs of the Annamite chain which make the establishment of a unitary state difficult. The natural tendency of fragmentation which the Cham state exhibited was in part a function of its geography but there is some evidence to suggest that Cham society fell easily into small semifeudal groups which lived by raiding by sea and land. (There can be little doubt that the *orang Dampuan*, the dreaded pirates of Filipino legend, were Cham raiders.) The greatest period of Cham material achievement was during the 7th–9th centuries when the capital was in the neighbourhood of Trakieu, a period to which belong the main groups of Mi-son and Dong-duong. A series of Annamite attacks toward the end of the 10th century led to the transfer of the capital farther south to Quinhon where further building took place, as witness the remains of Hung Tanh and others, but the decline can already be detected. The final collapse of the Chams came in the 15th century, by which time the decline had reached its nadir. The last phase is represented by temples in honour of the deified heroes Po Klaung Garai and Po Rome which date from the 14th–15th centuries. A few of the temples are still used as shrines by those of the Chams who have not become Muslims. The biggest community no longer occupies Cham traditional territory but is situated to the south of lake Tonle Sap in Cambodia.

There can be little doubt that the earliest phases of Cambodian monumental architecture owe something to the Chams, but whereas the Khmer (*q.v.*) builders proceeded to develop the single tower (*prasat*) into the familiar temple complex, the Chams persisted with the *kalan* (tower) as their principal architectural feature, nor did they often try, so far as it is possible to judge, to group their single towers into symmetrical patterns. A feature of Cham architecture which distinguishes it from that of the Khmer is its continuing use of bricks as the preferred building material. Nor do the Chams appear to have used wood so readily as their western neighbours. The complex, pyramidal base which forms so marked a feature of Khmer architecture would seem to be unknown in Champa. The earlier buildings are noteworthy for the use of sculpture as an integral part of the structure (*e.g.*, apsarases upon the corners of buildings and an ambitious treatment of the foot of the building) and the Cham decline is, in part, marked by the substitution of terra-cotta moldings for these features, as though there was a shortage of skilled craftsmen in the later stages of the kingdom.

Whatever was subject to Indian influences in Champa does not seem to have been recognizably Indonesian; Cham art at its best is *sui generis*. For although there is little that does not belong to India in its origin, the treatment is distinctive and, in the period of Cham greatness, of considerable aesthetic merit. The handling of movement, in the case of some of the dancing figures, or of repose in the case of ascetics, is skilful and impressive, but with the general decline of Cham culture stereotypes were substituted for creative work.

Malaya.—The Tampanian culture of the Paleolithic in Malaya belongs to the general east-Asian group to which reference has already been made. During the later stages of prehistory, Malaya exhibits the same main features of cultural development as the rest of southeast Asia, and serves, above all, as one of the principal routes into Indonesia. This characteristic, as a transit zone, persisted into historic times. While there is evidence in Chinese texts of settlements, presumably from India, in the peninsula from the first century A.D., archaeological evidence is scanty until the 7th–8th centuries. Certain pieces in Gupta style, and a few others which are reminiscent of Kanheri, together with a few inscriptions which are difficult to date epigraphically, form the greater part of the evidence. In the 8th century a style developed which may be called Indo-Malaysian, and which seems to be connected with the rise of the kingdom of Srivijaya with its capital in Sumatra, probably at Palembang. The origins of this style, which is concerned with Mahayana Buddhist imagery, are a matter for debate, but it is likely that they are basically eastern Indian. A splendid Avalokitesvara from Jaya, now in the Bangkok museum, and the plan of Wat Keo at Jaya both suggest Javanese influences.

Other finds are reminiscent of the earliest stages of Cambodian (almost certainly pre-Khmer) statuary, and in the north of the peninsula Khmer and Mon (*q.v.*) influences are to be seen. It seems likely that during most of the pre-European period Malay's importance was strategic rather than cultural, since it was not an area of marked and distinctive cultural development (*see* MALAYA).

The Philippines.—The islands of the Philippines provided one of the routes by which the Indonesians reached their present home. Exploration of early settlement sites began only in the second half of the 20th century, for there are no surface remains from pre-Spanish historical times. It was deliberate Spanish policy to destroy all traces of paganism. Those sites which have been explored provide a wealth of imported ceramics, mainly from China, with some pieces from Vietnam, Cambodia and Thailand. There are, however, no traces of those strongly indianized cultures which characterize the mainland area and Indonesia proper. The nature of pre-Spanish Filipino culture still remains uncertain but it was certainly related to Indonesia linguistically as well as in its enthusiasm for Chinese ceramics. These were traded widely in southeast Asia in exchange for such native products as pearls, kingfisher feathers, spices and iron ores, the last especially from Borneo, where large Sung and later vessels have survived in long houses in the interior as treasured ancestral possessions.

The Maritime States.—Mention should also be made, in any

history of Indonesian culture, of the states which developed around the southeast Asia littoral and depended upon their maritime trade for their prosperity. These states, which Chinese texts tend to class as *k'un-lun*, were almost certainly Indonesian, or at least ruled by Indonesian overlords. They included Funan, Chenla, P'an-p'an with other small centres on the Gulf of Siam. The site of Oc Èo in Cambodia which has been discussed by L. Malleret is the best known of these port and hinterland states which also made possible the rise of Srivijaya and, later, Majapahit as empires which grew out of the maritime trading structure that developed in the early centuries A.D. The last traces of this system were perhaps to be seen in the small coastal communities of Indonesian speakers who were to be found throughout southeast Asia until latterly, and from whose presence the tradition was maintained that Malay was the lingua franca of southeast Asia. It is characteristic of the international nature of these maritime states that finds from them should include objects from the Roman orient and the middle east as well as from the Indian subcontinent and China. It is probable too that the hydraulic engineering which is so marked a feature of later Khmer civilization developed in the delta areas of the Mekong river where canals served both to control the floodwaters and drain the subsoil to make the habitation of the littoral possible, and as a communication system to link the ports with the interior for the purposes of trade.

See also CAMBODIA: *Archaeology;* JAVA: *Archaeology;* BURMA: *Archaeology;* CELEBES: *Archaeology;* VIETNAM: *History;* BORNEO: *Archaeology.*

INDONESIAN ART

The basic elements of Indonesian art were already present in the islands before the coming of Indian and Chinese influences. Subsequent developments stemmed from the interaction of these elements and those from outside; the result is that there is a recognizable relationship between art products of widely separated areas within Indonesia, even when these have not undergone the same foreign influences. Heine-Geldern has stressed the importance of the Dong-son element. Indonesian art seems to have derived many of its most effective themes from ideas which reached the islands with the people who were responsible for the bronze drums. This argument depends upon the recognition of certain motifs as being present both upon the drums and other Dong-son objects, and upon such other artifacts as fine textiles from Sumba or brocades from Kröe in Sumatra. But in fact there is no reason to accept this explanation as necessarily correct, for it may well be that the bronze founders simply translated into their medium certain themes which were already widespread in the Indonesian world.

The importance of Indian influences is hard to overestimate, for not only did they provide certain technical ideas but, far more important, a whole corpus of motifs which still provide the main stock in trade of artists in Indonesia. During the great formative period which saw the construction of Borobudur and Prambanan, Indian styles of art predominated, even if the final products can be distinguished without difficulty from objects produced in India itself (*see* INDIAN ART; INDIAN ARCHITECTURE). But toward the end of this period, with the rise of the kingdom of Majapahit, if not earlier, there emerged a native style which was characterized by a reversion to a flatter, less three-dimensional method of presentation where the figures most closely resemble the shadow puppets (*see* SHADOW PLAY) of the *wayang purwa*. This puppet theatre plays a central role in the artistic development of central Indonesian art for it provides themes for illustration and a demand for music to accompany the performances as well as preserving the motives and themes which came with Indian culture. The importance of this lies in the fact that Islam officially forbids all representational art, but the art of Indonesia continues to draw upon these traditional sources for its inspiration. In carving, in the forging of kris blades, with their complex *pamor* patterns made by folding and hammering the iron time after time and etching the finished blade with arsenical compounds, and in the manifold designs of the kris hilts, in the textiles in *batik* (wax-resist) and *ikat* (pre-dyed thread), in goldsmithery and in the work of the craftsmen in silver, particularly in Borneo and Sumatra, Indonesian art has shown a continuing vigour, even if some paucity of invention. In painting there has been a notable development particularly in the island of Bali where, between World Wars I and II, Walter Spies taught native painters a new style which clearly owes much to Henri Julien Félix Rousseau (*q.v.*) and which seems well suited to the treatment of traditional themes in a modern idiom which has been adapted easily to Balinese ideals. Painting is an art which seems to suit the Indonesian temperament for it is noticeable that it flourishes also in the Philippines, where it is possible to make a career as a painter.

In the areas away from the Indo-Javanese centre, art has tended to develop along other lines and the mask (*q.v.*), the shield and basketry of various kinds are its most characteristic media, with textiles of great beauty and usually of ritual significance. Neither here nor in the centre has there been any great ceramic achievement, but the appreciation of fine Chinese wares is widespread. Woodcarvings show what has been lost by the destruction of work in this material in the great centres of the Indo-Javanese zone where, it has been argued, the true shrines were in carved wood, the stone temples being no more than mausolea for the kings and nobles. The work of such scholars as F. Speiser, P. S. Wingert, J. Guiart, A. Bühler and R. T. Mellema has shown that the artists of the outer zones, no less than those of the centre, have preserved and developed Indonesian art as a living and vigorous form of cultural expression.

See also EMBROIDERY: *Asia;* TEXTILES; DANCE: *The Orient;* WOOD CARVING: *Oriental;* TEMPLE ARCHITECTURE: *East Indies;* INDIAN MUSIC.

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(A. H. CE.)

INDONESIAN LANGUAGE: *see* MALAYO-POLYNESIAN LANGUAGES.

INDONESIAN TIMOR (TIMOR BARAT): *see* TIMOR.

INDORE, a city, district and division of Madhya Pradesh, India. The city, the largest in Madhya Pradesh, is situated 1,738

ft. above sea level on the banks of two small streams, the Saraswati and the Khan, 340 mi. N.E. of Bombay. Pop. (1961) 394,941. It was founded in 1715 by certain zamindars who settled there attracted by the trade with the Maratha chiefs, it being one of the regular stages on the route to the Narmada (Narbada) valley. In 1741 the zamindars erected the temple of Indreshwar from which the name Indore is derived. The town grew rapidly under the Holkar dynasty and in 1818 it became the capital of the Holkar state.

There are a number of colleges (arts and science, commerce, law, engineering, oriental studies, medicine, veterinary medicine and music) affiliated to Vikram university, Ujjain, established in 1957, and a well-equipped hospital. Indore is the chief collecting and distributing centre of western Madhya Pradesh as well as a commercial and industrial centre. It has seven cotton textile mills, oil mills and engineering works. The town lies on the Delhi-Bombay Trunk road and is a junction on the Ajmer-Khandwa (metre-gauge) and Indore-Bhopal (broad-gauge) lines of the Western railway.

INDORE DISTRICT (area 1,479 sq.mi.; pop. [1961] 753,594) lies mainly on the Malwa plateau. In the south, where it meets the Vindhyan range, it is intersected by hills. It has four *tehsils* (subdivisions), Depalpur, Indore, Sawer and Mhow, the last-named having an important military training centre. The chief crops are wheat, jowar (sorghum), cotton and oilseeds. About 50% of the district is arable and the area under cultivation will be increased on the completion of the Choral river irrigation project in the 1960s. The district, which is rapidly becoming an industrial one, had more than 160 factories and 15 joint stock banks by the early 1960s. The district of Indore is a part of the former princely state of Holkar or Indore which was ruled by the Holkar clan. For the history of the state *see* HOLKAR. (S. M. A.)

INDRA, the foremost god of the Vedic pantheon, celebrated in nearly one-fourth of the Rigveda especially for his conquest of the dragon Vritra. Various naturalistic explanations are offered of this war between Indra and Vritra; for instance, Indra is said to be the rain-god, who, by means of his *vajra* ("thunderbolt"), smites down the cloud-demon (Vritra) and releases the waters. The Rigvedic descriptions of Indra's personality and character, however, suggest that he was originally a historical personage who led the Vedic Aryans against their enemies, collectively designated as Dasas or Vritras, and his epithet *purandara* (city-breaker) may derive from the demolition of the cities of the pre-Aryan Indus people. While Indra is thus the national war-god of the Indian Aryans, because of a religious schism he was represented as a demon in the Avesta. With the rise of the gods of popular Hinduism, such as Shiva and Vishnu, he faded into the background, and in the epics and the Puranas he appears as the powerless regent of *svarga* ("heaven"). In modern Hinduism he is the guardian of the eastern quarter of the compass; he has no cult. *See* also VEDIC RELIGION: *Mythology.* (R. N. D.)

INDRE, a *département* of central France, formed in 1790 from parts of the ancient provinces of Berry, Orléanais, Marche and Touraine (*qq.v.*). Area 2,667 sq.mi.; pop. (1962) 251,432. It is bounded north by Loir-et-Cher, east by Cher, south by Creuse and Haute-Vienne, southwest by Vienne and northwest by Indre-et-Loire. Most of the *département* lies in the limestone belt that is known as the *Champagne Berrichonne,* but the land rises in the south beyond a clay vale to the northern margins of the crystalline highlands of the Massif Central in the district of Combrailles, and in the north the *département* extends on to the chalk, though this rock is extensively covered with a veneer of flinty clay. The axis of the *département* is the fertile valley of the Indre river, a tributary of the Loire, but it extends north beyond Valençay as far as the Cher river and its southwestern part lies in the basin of the Creuse river. Above Châteauroux, the Indre is flanked on both sides by a hilly tract of infertile, wooded country, known as Boischot, where gravel débris from the granite highlands farther south overspreads the Jurassic rocks. Farther west Brenne is another stretch of infertile débris, in the hollows of which are numerous small lakes and ponds. These tracts of infertile soils and marsh were districts of late agricultural colonization, and are still incompletely reclaimed, with much poor woodland and heath; in contrast the extensive platform of limestone in Berry was a nuclear area of settlement, where evidences of prehistoric occupation are numerous. Over large areas the dry limestone surface is continuously occupied by open, hedgeless arable fields, belonging to large farms. Wheat is the chief crop, with important plantings of sugar beet and potatoes, as well as fodder crops; the vine and fruit trees are widespread. Sheep are also important, though less so than formerly. The clay country and hills in the south are more pastoral, concerned chiefly with cattle farming. The whole *département* remains profoundly agricultural, and neither mineral production nor manufacturing plays a significant role in its economy.

Châteauroux, in the valley of the Indre, is the préfecture of the *département,* which is divided into the four *arrondissements* of Châteauroux, Issoudun, Le Blanc and La Châtre. It forms part of the archbishopric of Bourges and comes under the court of appeal there, but for educational administration it is under the *académie* of Poitiers. In the north Valençay has a fine Renaissance château, and the 11th- to 12th-century circular church at Neuvy-St. Sépulchre is also noteworthy. Just to the north of La Châtre town lies Nohant-Vicq and the famous château of George Sand (now a museum). (AR. E. S.)

INDRE-ET-LOIRE, an inland *département* of France, consisting of most of the ancient province of Touraine (*q.v.*), together with adjacent portions of Orléanais, Anjou and Poitou. Area 2,378 sq.mi. Pop. (1962) 395,210. It is surrounded by the *départements* of Sarthe, Loir-et-Cher, Indre, Vienne and Maine-et-Loire, and lies astride the valley of the Loire where it is known as the Val de Touraine. The valleys of major left-bank tributaries (the Cher, Indre and Vienne) there converge upon the Loire valley from the southeast. In the north the *département* extends to the valley of the Loir river. The broad, sheltered valley floors, covered with sandy alluvium, are intensively farmed in small holdings where varieties of vegetable and fruit crops are grown. The products are ready for market appreciably earlier than those grown in the vicinity of Paris. The vine is widespread and is especially important on the downwash of the valley sides, where the wine is matured in caves in the chalk. Vouvray, Rochecorbon and Bourgueil are famous vintages of this area. Between the valleys, the chalk platforms are extensively coated with sandy, gravelly debris and there is still much poor woodland and waste, especially in the Gâtine de Touraine between the Loire and Loir valleys. Use of the Loire river as a navigable waterway has greatly declined and there is little manufacturing activity, but Avoine, near Chinon in the Vienne valley, was chosen as the site of France's second nuclear power station.

The *département* abounds in magnificent châteaux, both of the feudal and Renaissance periods, notable among them being Langeais, Chinon, Amboise, Azay-le-Rideau and Luynes. Chinon was the scene of the meeting of Joan of Arc with King Charles VII in 1429. Richelieu, nearby, is a planned town that dates from 1631. It shows the formal grid layout within walls and moats that are still preserved, but the famous cardinal's château in an extensive park south of the town has been destroyed. The great 12th-century keep of the fortress of Montbazon and the delightful Renaissance church of Montrésor are also noteworthy. Tours, established as a Roman city on the left bank of the Loire, has grown at a major crossing point of the river, and is the capital and largest city of the *département,* which comprises the three *arrondissements* of Tours, Loches and Chinon. Tours is the centre of an archbishopric, but for education and judicial administration the *département* comes under the *académie* of Poitiers and the court of appeal at Orléans. (AR. E. S.)

INDRE RIVER, in west central France, is a left-bank tributary of the Loire which it joins below Langeais in the stretch of the Loire valley known as the Val de Touraine. Rising on the northern flanks of the Massif Central, the Indre flows 165 mi. northwestward through the *départements* of Indre and Indre-et-Loire. At the foot of the crystalline highlands its valley opens out in the clay depression about La Châtre, but the rich pastures of this district are succeeded downstream by infertile, wooded country in Boischot, where coarse gravel debris spreads out on both sides

of the valley. Farther north the Indre traverses the calcareous platforms of Berry and Touraine in a flat-floored trench, with few tributary valleys in the permeable rocks. Throughout the extent of its basin the country is profoundly agricultural, though the farmland is of varied quality. The river is dominated by several picturesquely sited feudal castles. Among them Châteauroux and Loches have provided the nuclei of the chief among the few towns that line its valley. The former, situated where the most important route crosses the valley, is the *préfecture* of Indre *département*. The river is not used for navigation and its valley is followed by only a minor routeway. It is the setting of several of the novels of George Sand, who lived and died at Nohant. (Ar. E. S.)

INDRI, the largest of the existing lemurs (*q.v.*), belonging to the genus *Indri* and allied to the avahis and sifakas (*q.v.*). The tail is rudimentary, only two inches long, while the head and body length is about two feet. It is slender, long limbed and has large feet. The pointed face is naked, the rounded ears furry. Indris are usually blackish, with white markings on the head, throat and buttocks, but individuals may be almost white. These lemurs live in the forests of eastern Madagascar. They are diurnal in habit, feeding on shoots, berries and flowers as well as animal matter. *See* Primates. (J. E. Hl.)

INDUCTION, in logic, usually means reasoning in support of a general proposition by consideration of particular cases which fall under it. Aristotle calls induction "a passage from individuals to universals." John Stuart Mill defines it as "the operation of discovering and proving general propositions" or as "that operation of the mind, by which we infer that what we know to be true in a particular case or cases, will be true in all cases which resemble the former in certain assignable respects."

Induction is called summative (or complete) if it proceeds through an enumeration of all the cases which fall under its conclusion. Aristotle gives an example, which can be rendered as follows: Man, the horse and the mule are long lived; but man, the horse and the mule are all the bileless animals; therefore all the bileless animals are long lived. Summative induction is a conclusive argument.

Induction is called ampliative (or incomplete) if its conclusion goes beyond its premisses in the sense that the former is not a logical consequence of the latter. Ampliative induction is thus an inconclusive argument. It proceeds "from the known to the unknown" (Aristotle, *Topics;* Mill).

Induction is often contrasted with deduction. Induction and deduction are sometimes (*e.g.,* by W. Whewell and by W. S. Jevons) described as "inverse operations" of the mind; induction leading from less general to more general propositions, deduction leading to conclusions of a generality either equal to or less than that of its premisses. This contrast is not an altogether happy one: summative induction can properly be regarded as a type of deductive argument. The appropriate contrast is between arguments which are logically inconclusive—of which ampliative induction is one—and arguments which are conclusive.

Some logicians, following Mill, wish to restrict the term "induction" to ampliative reasoning. In the rest of this article we shall consider induction in this restricted sense only.

Ampliative reasoning need not aim at the establishing of general propositions. It may also conclude from some particular cases to other particular cases. This type of inference is sometimes called eduction (W. E. Johnson).

Induction and Laws of Nature.—The conclusion of an inductive argument can often be stated in the form "everything which is α is β." If x is something of which α and β can be significantly predicated, the general proposition can be used for predicting that if x is α then x is also β. If x, on examination, turns out to be both α and β, we say that x constitutes a confirming instance of the generalization. If x is α but not β, we say that x constitutes a disconfirming instance.

A general proposition of the form "every α is β" is called a law of nature if it satisfies some additional requirements. The following three may be regarded as minimum requirements:

1. The scope of the generalization must not be numerically restricted; *i.e.,* the things of which α and β can be significantly predicated must not be restricted by definition to a finite number of objects. This means that a law of nature, reached by ampliative induction, cannot be subsequently established by summative induction.

2. The scope of the generalization must not be spatiotemporally restricted; *i.e.,* the things of which α and β can be significantly predicated must not be restricted by definition to a certain place or to a certain period of time. The laws of nature are valid always and everywhere.

3. The generalization must be a basis for asserting so-called unfulfilled or contrary-to-fact conditionals; *i.e.,* if a certain x, on examination, turns out not to be α, we shall be willing to assert that if it had been α it would also have been β.

Besides universal generalizations of the type "every α is β" there are statistical generalizations of the type "a certain proportion (percentage) of things which are α are β." Statistical generalizations are often established by induction from samples of a "parent" population. Induction of this kind is a species of statistical inference, which will be excluded from consideration here.

ELIMINATION THEORY

An Important Asymmetry.—A single disconfirming instance of a law of nature is a falsifying instance. If we find an x which is α but not β, then it cannot be the case that everything which is α is β. But a confirming instance of a law of nature is never a verifying instance. Since the scope of the generalization is numerically unrestricted, any number of x's which are both α and β will be compatible with the existence of an x which is α but not β.

Laws of nature are thus asymmetrical with regard to verification and falsification. To have appreciated the importance of this asymmetry to a theory of induction and scientific method is the immortal merit of Francis Bacon (1561–1626). Of induction which proceeds by enumeration of confirming instances Bacon says that it is "exposed to danger from one contradictory instance" and therefore "utterly vicious and incompetent." But "greater is the power of the negative instance": relying upon it we can reject false inductive conclusions and, by this negative approach, so Bacon thought, ultimately single out the true ones. Scientific induction is a selective process of elimination among a number of alternative possibilities as to a nomic relationship (law of nature). Inductive logic is elimination theory, not confirmation theory.

Elimination theory is today chiefly known in the form given to it by Mill in his *System of Logic* (1843). Mill distinguished four variants of induction by elimination. He called them the methods of "agreement," of "difference," of "residues" and of "concomitant variations." He regarded them as methods for ascertaining causal connections. More recent contributions to elimination theory are due to J. M. Keynes (1921), to W. E. Johnson (1922) and to C. D. Broad (1930). Broad placed the study on a new basis, abandoning the traditional causal schemas in favour of the terminology of a logic of conditions (necessary, sufficient, necessary-and-sufficient, contributory, counteracting, etc.).

The Canons of Elimination.—Suppose we are searching for a necessary condition of α. To this end we may compare different cases which agree in exhibiting the feature α. It is clear that a feature, say γ, which is missing in some of these cases, cannot be necessary for the presence of α. It is also clear that a feature, say β, which is present in all examined cases, may be a necessary condition of α. If, "varying the circumstances," we find that the examined instances of α have only one common feature β, we can conclude that, if α has any (simple) necessary condition at all, then β is such a condition. If we are left with more than one common characteristic, we shall have to reckon with the possibility that α has several or a plurality of necessary conditions. If again the instances are found to have no common feature (beside α), we must not conclude that α lacks a necessary condition, since this condition may be complex, which here means that it is a disjunction of two or more features, say β and γ, so that the presence of either β or γ is necessary for the presence of α.

The canon of elimination employed in the search of necessary

conditions corresponds roughly to Mill's "method of agreement."

Suppose next that we are searching for a sufficient condition of α. To this end we compare an instance in which α is present (a positive instance) with instances in which α is absent (negative instances). Obviously any feature, say γ, which is present in the absence of α cannot be a sufficient condition of α. On the other hand any feature, say β, which is absent in the absence of α, may possibly be a sufficient condition of α. If there is only one feature β which belongs to the positive instance under consideration but does not belong to any negative instance, then we can conclude that, if α has any (simple) sufficient condition at all (in the positive instance), then β is such a condition. As long as there remain more than one feature in which the positive instance differs from all the examined negative instances, we have to admit the possibility that α has a plurality of sufficient conditions. If again there is no (simple) feature in which the positive instance differs from all negative instances, we must not conclude that α lacks a sufficient condition, since this condition may be complex, which here means that it is a conjunction of two or more features, say β and γ, so that the presence of both β *and* γ (but not of either of them alone) is sufficient to produce α.

The eliminative procedure thus outlined corresponds roughly to Mill's method of difference. This method has a characteristic use in scientific experimentation, when the "transition" from positive to negative instances is achieved through a removal of one feature from an instance, all the other features being left intact. If this removal is accompanied by the disappearance of one other feature from the instance, we may suspect that the removed feature is a sufficient condition of the disappearing feature.

Sufficient and necessary conditions are interdefinable. The presence of α is necessary for the presence of β if and only if the absence of α is sufficient for the absence of β. If oxygen is necessary for life, then removal of oxygen from an organism's environment is sufficient to extinguish life. This interrelatedness makes it possible, in the search of determining conditions of a given phenomenon, to switch over from one method of elimination to another and is thus responsible for a wealth of possible variations and combinations in the use of inductive canons.

Demonstrative Induction.—Mill says: "Every induction may be thrown into the form of a syllogism, by supplying a major premiss." Inductive inference, when exhibited in syllogistic form, is sometimes called demonstrative induction. Mill thought that the major premiss, needed for making reasoning from elimination demonstrative, was a law of universal causation stating that: "Every event, or the beginning of every phenomenon, must have some cause; some antecedent, on the existence of which it is invariably and unconditionally consequent." The necessity of assuming some kind of deterministic principle is clear from the description of the methods of elimination given above. Unless we assume that α has a necessary condition, we can conclude nothing from the fact that a number of examined instances of α agree in only one other common feature β.

On the other hand, a law of universal causation as formulated by Mill or a deterministic principle stating that every phenomenon possesses a nomic condition of a certain kind, is much too weak to serve its purpose as a supplementary premiss of all induction by elimination. This was never clearly appreciated by Mill. It becomes plain when we pay due attention to the possible plurality and complexity of conditions (as Mill and most subsequent authors on induction failed to do). The number of attributes (characters, features) among which the nomic conditions of a given phenomenon are to be sought may be infinite, or some of them may have escaped our notice or otherwise been ignored. In order to cope with difficulties arising from these possibilities, a second major premiss is needed in addition to a deterministic principle. It may be called a selection postulate. Its function is to limit the range of alternative possibilities in eliminative induction.

Mill ignored the function of a selection postulate and acknowledged only the need of a deterministic principle. Bacon, on the other hand, took determinism for granted but was aware of the necessity of limiting the range of possibilities. He postulated that all variety in nature could be reduced to combinations of a finite number of independent elements or "generic" properties. Thus the number of possibilities with which the scientist has to count in his search of law connections is necessarily finite (and relatively small). This postulate of limited independent variety was reintroduced into inductive logic by Keynes (1921). The postulate, however, is too weak for its purpose as supplementary premiss; and so, too, are any general principles which, like Mill's law of universal causation or Keynes's principle of limited variety, profess to remain the same for all inductions. Each inductive inference requires supplementary premisses (a deterministic principle and a selection postulate) of its own in order to acquire the force of a demonstration. The first writer on induction clearly to have appreciated this "in opposition to the prevalent view" was Johnson (1922).

CONFIRMATION THEORY

Inverse Probability and the Law of Succession.—Ampliative induction from confirming instances admittedly does not yield certainty. But may it not establish its conclusion with a degree of probability? The advent of a mathematical theory of chances in the late 17th and the 18th century opened fresh prospects for a confirmation theory of induction. The calculus of probability was already regarded by its early champions as being an *ars conjectandi* or technique for estimating the value of empirical evidence for conjectures about the unknown. One of its classical problems can be formulated as follows: If, of n examined instances of α, m instances possess the character β, what is the probability that a random instance of α is β? An answer to this and to kindred questions was provided by the doctrine of so-called inverse or inductive probability. Its foundation was laid by Thomas Bayes (1763), and it was greatly developed by Pierre Simon de Laplace (1749–1827) and his school. (*See* PROBABILITY.)

A famous formula of inverse probability is Laplace's "law of succession." It professes to answer the question: If n instances of α all agree in being β, what is the probability that the next instance of α is β? The answer given is: $\frac{n+1}{n+2}$. If n is a large number, this value is very near 1; *i.e.*, if we observed a great number of α's and found that they without exception are β, then it is "practically certain" that the next α which comes within our experience will be β too.

The formula of Laplace was long considered a most powerful means of justifying inductive inference of the type called eduction (*see* above). In view of the debatable and sweeping assumptions on which its derivation from the fundamental principles of probability rests, the faith accorded to the law of succession by many 19th-century writers on induction (*e.g.*, Augustus De Morgan and Jevons) was amazingly uncritical. A critical attitude toward the doctrine of inverse probability was developed, parallel with the revival of the so-called frequency theory of probability, from the middle of the 19th century onward. The law of succession was acutely criticized by C. S. Peirce and others.

The Principal Theorem.—Although inverse probability is also traditionally called "inductive" and a branch of it was known under the name of "probability of causes," the doctrine is not directly concerned with degrees of probability in universal generalizations (laws of nature). The foundations of a confirmation theory dealing with laws of nature were laid by Broad (1918) and Keynes (1921). These authors proved what may be called the principal theorem on confirmation. It runs:

> The probability of a generalization is increased by a confirming instance, provided that the probability of the generalization prior to confirmation is greater than 0 and that the probability of the confirming instance, relative to the previous confirmations, is smaller than 1.

The content of the theorem ought not to be uncritically interpreted as meaning that induction by the multiplication of instances, sometimes also called pure induction, possesses a value independently of induction by elimination. Keynes was of the opinion that the condition, according to which the confirming instance ought not to be maximally probable, can be satisfied only if this instance, at the same time as it confirms the generali-

zation, also disconfirms (and thus "eliminates") some alternative generalization. In opposition to this view, Jean Nicod (1923) tried to show that the conditions for increase in a law's probability through confirmation can be satisfied independently of elimination.

The arguments of both authors are unconvincing. It is hardly possible to settle the controversy over the value of pure induction without giving an interpretation (definition, model) of the notion of probability in the principal theorem. Actually an interpretation can be found, on which the theorem merely reflects, in numerical terms, the working of an underlying mechanism of induction by elimination. This may be said to support Bacon's opinion on the relative value of confirmation and elimination to the systematical pursuit of inductive knowledge.

Some Other Problems of Confirmation Theory.—After Keynes and Nicod, few contributions to confirmation theory were made until the study was revived in the 1940s. To the subsequent period belong the contributions of J. Hosiasson, C. Hempel, Rudolf Carnap and others.

The concept of a confirming instance has turned out to present serious problems. Let the generalization be that every α is β. It is clear that an x which is not α cannot disconfirm the generalization. But can it be said to confirm it? Similarly, no x which is β disconfirms the generalization. But shall we say that it confirms it, irrespective of whether it is α or not? These and some related puzzles are sometimes referred to under the name of the paradoxes of confirmation.

Another problem of confirmation theory is, whether the probability attributed to laws on the basis of confirming evidence is capable of numerical evaluation or whether it is a comparative concept. Most authors seem to agree on the second alternative, but the reasons given for their views vary greatly.

A further problem is, whether the "meaning" of probability as an attribute of laws of nature is the same as the meaning of probability in some other typical uses. To indicate a distinction, some authors prefer to speak of degree of confirmation (credibility, acceptability, reasonableness), rather than of degree of probability, in connection with laws.

THE PLACE OF INDUCTION IN SCIENCE

Induction and Hypothesis.—The framing of hypotheses and theories in science would be arbitrary and useless, could they not be put to a test by deducing from them predictions to be confronted with the testimony of future experience. Likewise, the application of science for technical purposes essentially depends upon the predictive force of scientific laws. The very aim of science is often said to be that of making successful predictions possible: *savoir pour prévoir pour pouvoir*, as Auguste Comte put it. Science cannot be used for making predictions unless its results transcend the data of experience so as to contain an element of conjecture (anticipation) about the future course of events. This transcending of experience is an act of ampliative induction. In virtue of this fact, science which is predictive can rightly be called inductive science.

It would, however, be a mistake to believe that the hypotheses (theories, laws) used for prediction were reached through "mere" inductive inference. This is true only of those cases in which it is readily clear which features of a given situation can possibly lend themselves to generalization. It is not true, for example, of those cases in which, experience having provided us with a set of values of co-ordinates of points in a diagram, the "problem" is to discover the mathematical law (curve) connecting the points. The first step to the solution of the problem here is to suggest a hypothesis about the curve and to see whether values which are deduced from this hypothesis "fit" the points of observation. If they do, we may by induction extend the hypothesis to points to be observed in the future. This second step often follows as a matter of course and presents no "problem." Authors who put strong emphasis on the invention of scientific hypotheses sometimes neglect this generalizing step in their accounts of scientific method.

Thus hypothesis in science has a double function: it introduces a new concept or idea to account for observed data; and it makes a conjecture about the unobserved. To fulfill the first function is to make an invention or discovery; and discoveries are "happy guesses" or "leaps which are out of the reach of method" (Whewell). To fulfill the second function is to reason inductively. Thus the uses of induction and hypothesis in science are not to be contrasted: induction is a step in the use of hypothesis. (*See* HYPOTHESIS.)

The Justification of Induction.—Ampliative induction, as has been said, is an inconclusive argument. Its conclusion does not follow "logically" from its premisses. In what sense, if any, can the use of induction and a belief in the truth of inductive conclusions be "justified"?

David Hume was the first to appreciate the full significance of the epistemological problems which originate from the inconclusive character of inductive reasoning. The problem of justifying induction has therefore also been called the "problem of Hume." Hume's attitude to the problem is his famous "skepticism": induction, in a sense, has no rational justification. Kant's efforts in the theory of knowledge were largely directed toward rebutting Humean skepticism. According to Kant, there exist "synthetical judgments a priori," which are amplifying in the sense of going "beyond the evidence of our memory and senses" (Hume) and at the same time known to be true prior to experience.

This attempt to solve Hume's problem encounters two principal difficulties. One concerns the notion of a synthetic a priori. This notion has been severely criticized, particularly by philosophers of a positivist turn of mind. The second difficulty is connected with the application of the synthetic a priori principles to actual cases of inductive inference. It is notorious that no such principle can, without sweeping additional assumptions, raise a single inductive conclusion to the rank of certainty.

Early in the 20th century the French mathematician Henri Poincaré (*La Science et l'hypothèse*, 1902, and other publications) pointed out the important role played by conventions, as he called them, in science. A well-confirmed inductive conclusion is often raised to the rank of a principle which we refuse to let become falsified in the event of (seemingly) adverse experience. For example, experiments have taught us that pieces of phosphorus, under "normal" conditions, melt at 44° C. From this we inductively conclude that all pieces of phosphorus melt at this same temperature. If later a piece of phosphorus is found not to melt at the temperature in question, we "explain" this failure by declaring either that the experimental conditions were not "normal" or that the substance was not "really" phosphorus. The inductively found melting point has been made a defining characteristic of the substance. The inductive conclusion has gained certainty and thus become "justified."

Poincaré himself did not use these ideas for offering a wholesale solution to Hume's problem. But others have made the attempt. "Conventionalism" was for some time a fashion among writers on induction. Its most serious shortcoming as a contribution to the problem of induction is that it does nothing to justify our reliance on predictions in science.

An approach to the justification problem which has found favour among many authors (R. B. Braithwaite, W. Kneale, H. Reichenbach, J. O. Wisdom) is one suggested for the first time by Peirce in 1877. Induction is a policy which we adopt for predicting the course of events. We cannot know that this policy will be successful, but we can justify its use as being rational on the ground that it is, in a certain sense, the best way of making conjectures about the unknown. The superiority of inductive policies is in the fact that induction is self-correcting. To follow an inductive policy means to let past experience determine one's belief about the future and to let new experience correct false beliefs. If we follow this policy consistently, we cannot, so it is thought, fail to reach true inductive conclusions in the end. "The validity of an inductive argument consists, then, in the fact that it pursues a method which, if duly persisted in, must in the very nature of things, lead to a result indefinitely approximating to the truth in the long run" (Peirce).

The idea of an indefinite approximation to the truth is open

to criticism. It is doubtful whether the Peircean approach can prove more than that to follow inductive policies is part of what we mean by "rationality" in action and beliefs. It is worth suggesting that no justification of induction can be based on the ground of its being rational, but that reasoning is sometimes called "rational" on the ground that it employs an inductive policy.

See also SCIENTIFIC METHOD and references under "Induction" in the Index.

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INDUCTION COIL, an electrical device for producing an intermittent source of high voltage. An induction coil consists of a central cylindrical core of soft iron on which are wound two insulated coils: an inner or primary coil having relatively few turns of copper wire, and a surrounding secondary coil having a large number of turns of thinner copper wire. An interrupter is used for making and breaking the current in the primary coil automatically. This current magnetizes the iron core and produces a large magnetic field throughout the induction coil.

The principle of operation of the induction coil was given in 1831 by Michael Faraday (*q.v.*), who showed that if the magnetic field through a coil is changed an electromotive force is induced whose value depends on the time rate of change of magnetic field through the coil. This induced electromotive force is always, by Lenz's law, in such a direction as to oppose the change in the magnetic field (*see* MAGNETISM; ELECTRICITY: *Induced Electromotive Forces*).

When a current in the primary coil is started, induced electromotive forces are created in both the primary and secondary coils. The opposing electromotive force in the primary coil causes the current to rise gradually to its maximum value. Thus, when the current starts, the time rate of change of the magnetic field and the induced voltage in the secondary coil are relatively small. On the other hand, when the primary current is interrupted, the magnetic field is reduced rapidly and a relatively large voltage is produced in the secondary coil. This voltage, which may reach several tens of thousands of volts, lasts only for the very short time during which the magnetic field is changing. Thus an induction coil produces a large voltage lasting for a short time and a small reverse voltage lasting a much longer time. The frequency of these changes is determined by the frequency of the interrupter.

After Faraday's discovery many improvements were made on the induction coil. In 1853 the French physicist A. H. L. Fizeau placed a capacitor across the interrupter, thus breaking the primary current much more rapidly. Methods for winding the secondary coil were greatly improved by H. D. Ruhmkorff (1851) in Paris, by A. Apps in London and by Klingelfuss in Basel, who was able to obtain sparks in air about 59 in. long. There are various kinds of interrupters. For the small induction coils a mechanical one is attached to the coil, while the larger coils use a separate device such as a mercury jet interrupter or the electrolytic interrupter invented by A. R. B. Wehnelt in 1899.

About the beginning of this century, induction coils were used to provide the high voltage for electrical discharges in gases at low pressure, and as such were instrumental in the discovery of cathode rays and roentgen or X-rays. Another form of induction coil is the Tesla coil, that generates high voltages at high frequencies. The larger induction coils for use with X-ray tubes have been displaced by the transformer-rectifier source of voltage, while the smaller ones were still being used in the 1960s to provide the ignition spark in gasoline engines. (R. J. SN.)

INDUCTION HEATING: *see* HIGH-FREQUENCY HEATING; HEAT-TREATMENT.

INDULGENCE has been officially defined by the Roman Catholic Church as "a remission before God of the temporal punishment due to sins whose guilt has already been forgiven, which ecclesiastical authority grants from the treasury of the Church in the manner of an absolution for the living but for the dead in the manner of supplication" (Code of Canon Law, can. 911). It is a remission before God of punishment due for sins already forgiven, and not merely a social or organizational reinstatement.

Theology.—The theology of the Catholic Church on indulgences is based upon the concept that sin is always evil, and even though the crime and the eternal punishment be forgiven in the sacrament of penance (*see* CONFESSION), through the satisfaction of Christ, yet God's charity and justice demand that the sinner pay for his crime. The fault and the eternal guilt, once forgiven sacramentally, are wiped away; yet some punishment remains to be expiated in this life or in Purgatory. This "temporal punishment" (*i.e.*, in time, as contrasted with eternity) is at least partially removed by the performance of the canonical penance imposed at the time of confession. In the ancient penitential discipline of the church this was often severe, lasting for years or even for life; the growth of the ideas of the communion of saints and of the spiritual treasury of the church (comprising the infinite merits of Christ and the finite merits of Mary and the martyrs) led the church to grant to the spiritually needy some of these riches. The authority to do this, as also the power of forgiving sins, the church bases partially on the power of the keys given by Christ (Matt. xvi. 18 and xviii. 18). At first a particular good work—prayers, almsgiving or fasting—could be performed to shorten the length of the canonical public penance imposed, and the prayers of all the members were asked to assist the errant individual making reparation for his faults. In the modern concept, the same use of the solidarity of the church is granted by legitimate authority, and the supplication of the entire church (both Head and members; *i.e.*, Christ and the members of the Mystical Body of Christ) is applied to the individual through the performance of certain specified good actions. The union of the work to the church is still shown by the evident discrepancy between the action performed and its value, as manifested by an indulgence of 300 days for a devout 15-minute reading of the Bible (*Raccolta*, no. 645).

History.—Historically, there has been much difficulty in understanding what seems to modern Roman Catholics clearly intelligible. In Africa in the 3rd century, St. Cyprian (*The Lapsed*, 17–20) found that even the martyrs, who were prepared to offer their sufferings and death in reparation for the sins of others, sometimes thought that their acts "forgave" the sins. Later, the use of the term *a culpa et a poena* ("from guilt and from punishment") in the grants of indulgences by local bishops (Rome seems never to have used the term) gave rise to misunderstandings. Theologians and the learned understood it to mean that since an indulgence could be gained only after forgiveness, then when it is obtained both guilt and punishment are forgiven; yet the faithful took it in a literal, nontechnical sense.

Especially in the 14th century, the use of *quaestores* (a sort of commissioner or promoter) to popularize the use of indulgenced works, particularly of almsgiving for the erection of cathedrals and universities, led to many abuses both in the handling of funds and in pulpit extravagances. These were decried by the reformers, both Protestant and Catholic, and at the Council of Trent (1562) an end was put to abusive practices; the name and office of *quaestor* were abolished, and with them the privileges attached. Five years later Pius V revoked all indulgences for which money payments or alms were prescribed. (For the situation at the time of Martin Luther, and for Luther's position, *see* LUTHER, MARTIN: *Indulgence Controversy*.)

Popular misconception has also thought of an indulgence as a permission to commit sin, a permission that could never be given by any authority; as a forgiveness of sins or of the eternal punishment due to sins, which are the functions of the sacrament of penance; or even as the forgiveness of future sins, forgetting that sincere sorrow is essential to the forgiveness of any sin. An indulgence can perhaps be best compared to a pardoning of part of the sentence of a prisoner who has performed some good work not

directly connected with either his crime or his sentence.

Gaining Indulgences.—In order to gain an indulgence, it is necessary that the person be in the state of grace (*i.e.*, that his sins be already canonically forgiven), that he have the intention of gaining the indulgence and that he personally fulfill the prescribed good work (a work he is not bound to do anyway). There is one exception to the rule that indulgences can be gained only for oneself, and that is the possibility of their application to the souls of the dead. Here, however, the church cannot grant directly; indulgences can be offered for the dead only *per modum suffragii* (*i.e.*, in supplication), not *per modum absolutionis* (*i.e.*, as a grant).

Indulgences may be either (1) plenary (remission of all temporal punishment due to sin), first granted by Pope Urban II for the first crusade in 1095; or (2) partial, normally given in terms of years, months, days or "quarantines" (Lenten periods). Such numbers have reference only to a relative value of the work; that is, they refer not to a time of punishment but to a time of penance, so that an indulgence of seven years corresponds in value to seven years lived under the penitential discipline of the early church.

Lest the faithful be misled by apocryphal indulgences, which were at one time fairly common, collections of the prayers and good works that have been favoured with an indulgence are published from time to time by competent authority, currently (since 1917) the Sacred Penitentiary Apostolic. Such a listing, *Enchiridion Indulgentiarum*, was issued in 1950; an English version, a translation of the *Preces and Pia Opera* of 1938, is *The Raccolta* (1943). The collection comprises over 700 indulgenced prayers and devotions, ranging from a pilgrimage to Rome to a recitation of the psalmist's aspiration "Blessed be the name of the Lord." The volume includes some indulgenced works of great historical standing, such as the "Jubilee" indulgence (first given by Pope Boniface VIII for the year 1300; *see* JUBILEE, YEAR OF), and others as recent as a prayer to be said during air raids.

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(E. I. V. A.)

INDUS, one of the great rivers of Asia. The name Indus has its origin in the Sanskrit word *Sindhu* meaning ocean. When the Aryans migrated into the Indian subcontinent (*c.* 3,000 B.C.) from their dry homeland, they compared this mighty river with the ocean. Long afterward Darius the Great conquered the Punjab (500 B.C.) and in the inscription upon his rock tomb in Persia the Punjab was called the land of the seven sindhus (Sapta Sindhava—the "Hepta Hendu" or "Hapta Hindu") and from this corruption of the Sanskrit word the modern names Hindu and Indus have been derived.

The river rises in Tibet and flows through West Pakistan into the Arabian sea. Its source (32° N. and 81° E.) is within 100 mi. of the source of the Sutlej and the Brahmaputra, and is formed by the fusion of two mountain streams. In its upper course the river flows northwestward in the trough between the Kailas and the Ladakh ranges. Near Thangra it cuts across the Ladakh range and continues its northwesterly course between it and the Zaskar (Zanskar) range for about 300 mi. It is joined by the Zaskar river about 12 mi. west of Leh, the capital of Ladakh (the chief town on the main central Asian trade route), and recrosses the Ladakh range near Kiris where it is joined by the Shyok and later the Shigar near Skardu, the chief town of Baltistan. It flows another 100 mi. under the shadow of the Himalayas, receiving melt waters from the snow fields and glaciers of the Himalayas and the Hindu Kush, past Haramosh in a 10,000-ft. gorge, then suddenly turns southwest where it is joined by the Gilgit river, having dropped to an altitude of 4,000 ft., and strikes across the Great Himalayas. From Chilas it flows through the Kohistan highlands of Pakistan. On entering Hazara district, 812 mi. from its source, it is about 100 yd. wide, navigable by rafts in August, but of no great depth, and studded with sand banks and islands. It is fordable at many places in the cold season but flooding is common. Near Attock (2,079 ft.) it leaves the Himalayan region through a narrow gorge and is joined by the Kabul bringing water from Afghanistan.

Below Attock (the limit of the upward navigation), the Indus flows along the western margin of the Potwar plateau cutting across the Salt range in a narrow gorge, to enter the Punjab plain near Kalabagh. A few miles above it is joined by the Sohan and below is crossed by the Jinnah barrage. From Kalabagh to the sea the Indus flows west of a flat plain formed by the river and its tributaries. At Dera Ismail Khan it is crossed by a bridge of boats; at Taunsa by another barrage. Above Mithankot it receives the Panjnad ("five waters"), carrying the combined waters of the Jhelum, Chenab, Ravi, Beas and Sutlej. It is also joined by several smaller streams from the western mountains. Throughout the Punjab the Indus is broken by islands and sandbanks, and in winter is divided into numerous channels.

East of Kashmor and 64 mi. downstream of Mithankot is the Gudu barrage, and farther downstream the Sukkur barrage (1932); 80 mi. below Sukkur the river passes by Mohenjo-Daro (Moenjodaro) ("mound of the dead") in Larkana district, where remains are found of an ancient civilization which was contemporaneous with those of Egypt, Assyria and Babylonia (*see* INDUS CIVILIZATION). About 190 mi. below Rohri is the Ghulam Mohammed (the Lower Sind) barrage. In Sind the stream gradient is low and carries down enough detritus to raise the river bed above the level of the surrounding plains, and as a protection against floods the river is confined by bunds (levees). Near Tatta its distributaries begin to spread out on their way to the sea. This deltaic region is almost perfectly level, but generally infertile. The marshes make good pasturage and rice grows abundantly where cultivation is possible.

The Indus is about 1,800 mi. long; its total drainage area is estimated at 372,000 sq.mi. The catchment basin in the Himalayan region covers about 103,800 sq.mi., a greater area than that of any other river in the subcontinent.

The volume of water remains small during the cold season, rising in March, attaining its maximum in July or August and then gradually subsiding. The average monthly discharge for the decade ending 1950 at Kalabagh above the barrage was 27,244 cu.ft. per second in January and 409,670 cu.ft. per second in July. For the same period the average monthly discharge above the barrage at Sukkur was 31,071 cu.ft. per second in January, and 409,670 cu.ft. per second in August. Unusual floods, caused by landslides, breaches, etc. are not infrequent. Because of the large volume of water it carries during the summer and the flatness of the country, the river shows a tendency to shift its course in the plains. Formerly it flowed in the middle of the Thal, in the south of which a long lake still exists as a remnant of this course. In prehistoric times a branch found its way to the Rann of Kutch (Cutch) and gradually the shift westward led to the disappearance of many old towns on its banks. One of the most important changes happened during an earthquake in A.D. 962, when the stream broke through the limestone ridge between Sukkur and Rohri. A westward shift in course occurred near Hyderabad about the middle of the 18th century.

Almost the entire course of the river from Kalabagh to the sea lies in the dry zone, the mean annual rainfall being less than 10 in. Cultivation, therefore, depends mostly on irrigation. The prosperity of Sind has depended especially upon perennial and inundation canals, which irrigate 7,500,000 ac. In order to carry out a vast scheme of irrigation several barrages have been constructed. Barrages operative or planned by 1962 were: the Sukkur barrage (1932), the oldest, serving 8,300,000 ac.; its potential cultivation area is 5,400,000 ac., the area cultivated by 1960 being 4,000,000

ac.; the Jinnah barrage, near Kalabagh; the Thal canal which takes off from it, forming the basis of development of the Thal area, where it was planned to irrigate 2,000,000 ac.; the Taunsa barrage, Dera Ghazi Khan district (March 1959), with road and railway bridge and two canals planned to provide irrigation of a further 156,000 ac.; the Ghulam Mohammed barrage, near Kotri, (1959), and providing irrigation for 2,800,000 ac. of land in Hyderabad, Tatta and Dadu districts; the Gudu barrage providing weir-controlled irrigation for 2,500,000 ac. of cultivable land and making possible the cultivation of 387,000 ac. of virgin land in Sind and Baluchistan; the projected dam at Tarbela, 30 mi. above Attock, with a storage capacity of 5,100,000 ac. ft. to provide irrigation for 300,000 ac. of land and up to 1,000,000 kw. of power.

See also references under "Indus" in the Index.

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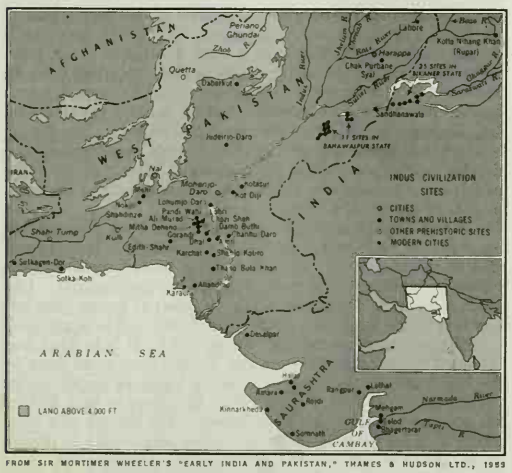
INDUS CIVILIZATION, one of the earliest civilizations known, first identified in 1921 at Harappa in the Montgomery district of the Punjab, and then in 1922 at Mohenjo-Daro (officially Moenjodaro in the 1960s) near the Indus river in the Larkana district of Sind, both in Pakistan. Subsequently, vestiges of the civilization were found as far apart as Sutkagen-Dor, near the shore of the Arabian sea 300 mi. W. of Karachi, and Rupar at the foot of the Simla hills 1,000 mi. to the northeast. Later exploration carried it southward down the west coast as far as the Gulf of Cambay, 500 mi. S.E. of Karachi, and as far east as the Jumna basin 30 mi. N. of Delhi. It is thus much the most extensive of the three earliest civilizations, the other two being those of Mesopotamia and Egypt, both of which began somewhat before it. Sites of the Indus civilization are shown on the map.

The civilization is known to comprise two large cities, Harappa and Mohenjo-Daro, and upward of 100 towns and villages, often of relatively small size. The two cities are each more than three miles in circuit and their outstanding magnitude suggests political centralization, either in two large states or in a single great empire with alternative capitals, a practice for which there are analogies in Indian history. The southern region of the civilization, in Saurashtra (Kathiawar) and beyond, may represent an extension outside the original scheme; so far as it is known, it appears to be of later origin than the major Indus sites. The civilization was literate, but its script was not yet deciphered in the early 1960s. Its nuclear dates appear to be about 2500–1600 or 1500 B.C., though southern sites may have lasted later in the 2nd millennium B.C.



FROM SIR MORTIMER WHEELER'S "EARLY INDIA AND PAKISTAN," THAMES & HUDSON LTD., 1959

DISTRIBUTION OF THE INDUS CIVILIZATION

Origins.—The origins of the civilization are not easy to define in detail. The idea of civilization, *i.e.*, of a considerable literate population living in towns and cities, had been matured in Mesopotamia (*q.v.*) before the end of the 4th millennium and there can be little doubt that the Mesopotamian pattern was in principle present in the thinking of the founders of the Indus civilization. But the differences between the two civilizations are sufficiently formidable to preclude any direct colonization of the Indus from Mesopotamia. In the centuries preceding the rise of the Indus civilization, the hills of Baluchistan already contained village communities subsisting on herds and an undeveloped agriculture based upon floodwater, perhaps with the occasional use of dams. These small mountain societies were still largely in the Stone Age, but they were gradually acquiring a little copper or bronze; in other words, they were in the Chalcolithic stage. Their pottery, often of good quality and wheel-turned, was decorated with lines and panels or with conventionalized animals in which humped cattle (*zebus*) and goats predominated. In the earlier half of the 3rd millennium some of these communities began to venture on to the Indus plain. Thus under Harappa itself slight traces of a village have an affinity with others in northern Baluchistan; at Amri, south of Mohenjo-Daro, a village with an individual culture related to that of other sites in the southern Baluch hills underlay an "Indus" settlement; and at Kot Diji, 25 mi. E. of Mohenjo-Daro, a considerable occupation, including a fortified area, was found beneath a small "Indus" town. There, the earlier culture again showed Baluch features, but also contained elements perhaps anticipating, or even derived from, the major civilization. It would seem that under exceptional leadership the Indus civilization began in similar fashion but evolved more rapidly and successfully than its neighbours or predecessors, using the Mesopotamian model with sufficient skill to reap the advantages of the spacious and fertile valley while controlling the formidable annual flood that simultaneously fertilizes and destroys. Having once obtained a secure foothold on the plain and mastered its more immediate problems, the new civilization, doubtless with a well-nourished and increasing population, would find expansion along the flanks of the great waterways an inevitable sequel.

Mohenjo-Daro.—The most amply excavated Indus site is that of Mohenjo-Daro, beside the Indus river 200 mi. N.-N.E. of Karachi. Aggradation and a rising water table prevented examination of the lowest levels, but, at the earliest period reached, the city was already laid out on a chessboard plan, with at least a dozen oblong blocks of buildings of about 400 × 200 yd. separated by broad unpaved streets up to 25 ft. wide and subdivided by narrow straight lanes. On the western margin of the plan one of these blocks was raised artificially by mud and mud brick to a height of 50 ft. and, girt with baked-brick fortifications, constituted the citadel or acropolis. The consistently regular layout of the city, at any rate to a considerable depth, suggests that the civic idea was already mature (as other evidence also indicates) when it reached the Indus.

With the exception of a few platforms and minor structures, the city was built of good baked bricks. Here again the invention cannot be ascribed to the Indus people, since baked bricks were occasionally used in Mesopotamia as early as 3000 B.C. But the widespread utilization of baked bricks, to the number of many millions, is an Indus feature and may perhaps reflect a wetter climate than prevailed in Mesopotamia or than prevails in Sind and the Punjab. Through the centuries, the destruction of timber and undergrowth to supply fuel for the brickkilns was doubtless a contributory factor in the desiccation of the Indus valley.

On the fortified citadel of Mohenjo-Daro, not fully explored, were erected religious and administrative buildings; among them was a large timber granary built upon a high brick podium on the western fringe of the mound. At the foot of the podium, a bay provided access for the grain carts from the countryside, and a platform halfway up facilitated the sorting and stowing of tributary grain. The top of the podium was pierced by a network of ducts for the circulation of drying air beneath the floor of the granary itself. The structure was manifestly a public building of the first importance and its function, as the container of the

periodical tribute, may be likened to that of a state bank in a more modern economy. Beside it and of slightly later date is a large bath or tank surrounded by porticos and cells and emptied by a high corbel-vaulted drain which cuts across the end of the loading platform of the granary. The tank, 40 × 23 ft., was jacketed with bitumen and was entered at each end down broad stairs of brick with timber treads. Its elaboration and the analogy of the tanks of medieval and modern India proclaim its ritual purpose. Nearby, a range of cells, each carefully fitted with a bathroom, was doubtless occupied by priestly attendants; a large building alongside has been tentatively recognized as a priestly "college." Other buildings on the citadel include two halls, one of them with four pillared aisles. The most intact existing monument is a Buddhist shrine (stupa) of the 2nd century A.D. that, apart from its re-used Indus materials, has nothing to do with the ancient city. But the known buildings of the Indus period themselves suggest that the citadel was the focus of a combined kingly and priestly rule that fits the habit of the 3rd millennium.

Below the citadel the town stretched in orderly array to the Indus river that moved some two miles eastward in later times. The houses, often substantial and sometimes of appreciable size, consisted typically of rooms round a courtyard and contained stairs to a former flat roof or upper story, a bathroom, often a well, and occasionally a privy similar to privies found at Tell Asmar and elsewhere in Mesopotamia. Throughout, the streets and buildings are marked by the brick drains that are a characteristic of the civilization and, with their trim inspection holes, were the most elaborate of their kind in ancient Asia. The whole city bespeaks middle-class prosperity with zealous municipal supervision during its prime.

Temples have not been clearly identified, though further examination would probably reveal two or three in the areas already excavated. Shops, including one with floor sockets for large jars, can be recognized along the main streets; the private wells are supplemented by public wells along the streets and lanes; and here and there are small sentry boxes for the civic watchmen or police. The brickwork is normally in English bond (*see* BRICKWORK), but most of it was originally covered, at any rate internally, with mud plaster.

Harappa.—Harappa, nearly 400 mi. to the northeast, would appear to have been similarly planned, but was much disordered in the 19th century by railway constructors in search of material. It is clear, however, that here too an artificial citadel mound rose on the western flank and dominated the town. The citadel was fortified by a tall mud-brick rampart with an external revetment of baked brick and with rectangular salients or bastions at frequent intervals. In the 300 yd. between the citadel and the former course of the Ravi river, tributary of the Indus, were barracklike blocks of workmen's quarters, serried lines of circular brick floors for pounding grain and two rows of ventilated granaries, 12 in all, marshaled on a podium. The total floor space of the granaries was something over 9,000 sq.ft., approximating closely that of the Mohenjo-Daro granary in its original form. The whole layout, in the shadow of the citadel, suggests close administrative control of the municipal food stocks within convenient proximity to the river-highway. Unhappily, no intelligible remains are recorded of the buildings on the citadel or in the main body of the town itself.

Minor Towns.—Some 80 mi. S. of Mohenjo-Daro, the small Indus town of Chanhu-Daro produced similar evidence of drains, baked-brick houses and mud-brick platforms built in the recurrent endeavour to surmount the rising flood level. There, however, the citadel of the larger cities is lacking. Another small town mound was excavated at Lothal, on the sea plain of Saurashtra, 450 mi. S.E. of Mohenjo-Daro. The mound had been reinforced on more than one occasion with mud and mud brick and six successive layers of occupation were identified. The earlier layers represented the normal Indus culture; small houses laid out in straight lines, drains and the channeled podium or base probably of a small granary similar in principle to the larger one at Mohenjo-Daro. On a flank of the mound, an oblong enclosure, revetted with baked bricks and more than 100 yd. long, may be identified as a dock for shipping. These examples serve to illustrate the lesser Indus towns. Their surviving architecture, like that of the two cities, is plain in the extreme, but the possibility of former elaboration in timber, that has nowhere lasted above the former ground-level, is consistent with the rich Indian tradition in this material.

People.—Of the Indus people themselves, the fullest evidence at present comes from Harappa. There a graveyard south of the citadel yielded 108 skeletons, normally extended with the head toward the north and each accompanied by an average of 15 or 20 pots representing the mature Indus culture. One of the graves had been lined on an oblong plan with mud bricks. In another, the body had been enclosed in a coffin with side walls of a local scented rosewood and a lid of deodar or cedar from the mountains. A majority of the skulls examined were dolichocephalic, ranging from the "Caucasic" to the "Mediterranean" of the older classifications. Ten burials of the Indus or sub-Indus period, also oriented north–south, were later found high up in the mound of Lothal; three of them contained two skeletons each, possibly those of a man and a woman. The skulls were mostly mesocephalic, as are those of much of the present-day population of Gujarat. But all these burials were manifestly those of ordinary citizens; no "royal" tomb was found to lend to the Indus civilization the macabre splendour that the "royal" tombs lent to Ur. No doubt, wealthy burials awaited discovery somewhere near Mohenjo-Daro or Harappa beneath the deep accumulations of the Indus floods.

Among the equipment of the Indus citizens, priority attaches to their famous seals, generally of steatite, which are distinctive in kind and unique in quality. The normal seal was square, with sides from $\frac{3}{4}$ to $1\frac{1}{4}$ in. and with a perforated boss at the back for handling and suspension. Exceptionally, the seal is round, with or without a boss, and there are a few cylinder seals reminiscent of those of Mesopotamia. Carved on the seals with a small chisel and a drill are intaglio designs that are often small masterpieces. They include a wide range of animals that must have been familiar denizens of the Indus valley: elephant, tiger, rhinoceros, antelope and gavial. Above all, the zebu or humped bull is majestically rendered, with a monumental strength out of all proportion to the tiny field available. The commonest type is that of an oxlike beast seemingly with a single horn and nicknamed therefore the "unicorn"; it may be suspected that two horns were in fact intended, one behind the other, but it has been recalled that Ctesias and Aristotle both ascribed the unicorn to India. In front of the "unicorn" is invariably a strange object on a short post, commonly called a "standard" but possibly representing a decorative manger. Composite grotesque animals also occur: one has the face of a man, the trunk and tusks of an elephant, the horns of a bull, the forepart of a ram and the hindquarters of a tiger with erect tail armed with claws. Sometimes human forms are included. Three examples from Mohenjo-Daro have a special interest in that they appear to represent a prototype of the great god Siva of the later Hindu religion. Most of the seals bear a short inscription in the Indus script, but their full function remains (1960s) uncertain until the inscriptions are understood. They were used to stamp clay sealings on bales and other commodities and it is likely therefore that they represent personal or guild names and insignia. The boss or handle pierced for a cord implies that the seals were normally carried by their owners; and a fair measure of literacy in the Indus population is to be inferred also from the recurrence of the script on pots or potsherds as stamps or graffiti.

The Indus script differs from the scripts of both Mesopotamia and Egypt and may be regarded as an essentially local Indus expression of the idea of writing that had for several centuries been variously familiar to the two contemporary civilizations. Like much in the Indus civilization, it has the aspect of having come into existence in the condition in which it is found, and no appreciable evolutionary development has been detected. It is in what may be called the hieroglyphic state and has not been worn down by use into conventional summaries like the Egyptian hieratic or the Babylonian cuneiform. It seems from the outset to have fulfilled the restricted needs of the Indus people. The absence of a bilingual inscription or of an Indus inscription long enough to present significant recurrent features has barred its interpretation.

Sculpture and Tools.—Of Indus stone sculpture scarcely a

dozen examples were found, apart from two doubtful (possibly later) torsos from Harappa. All are small and, save for two animals, one a composite ram-elephant, they represent men or gods, four or five of them in a squatting attitude. The heads are characterized by a low retreating forehead, narrow eyes and a bun of hair at the back. A beard is worn but the upper lip is shaved and the eyes are inlaid with shell; in these respects they somewhat resemble heads from Mesopotamia, but otherwise the owllike stare of the Mesopotamian type is widely different from the more contemplative aspect of the Indus faces. Only a few minor works in bronze have survived: notably a lifelike figurine of a buffalo with swept-back horns and the well-known statuette of a pert and provocative dancing girl, naked except for a necklace and an abundance of armlets. There are great numbers of small terra cottas, including countless oxen and buffaloes, sometimes rendered expressively but more often merely pedestrian trade goods. Human terra-cotta figurines generally represent women wearing only abundant jewelry and, sometimes, bizarre "pannier" headdresses. There are also occasional comic figures of a human or animal character, and toy carts with solid wheels, usually of terra cotta but rarely of copper or bronze, are common enough. Of all these products, a majority were probably toys, but certain of them—female figures and perhaps some of the bulls—may have been votive.

FROM SIR MORTIMER WHEELER'S "EARLY INDIA AND PAKISTAN," THAMES & HUDSON LTD., 1959

BRONZE DANCING GIRL FROM MOHENJO-DARO

Important contrasts between the Indus and the Mesopotamian cultures extend to the tool types of the two regions. Throughout the Indus civilization the common domestic implement was a parallel-sided chert blade struck from a prepared core and, more often than not, without retouch. Stone maceheads also occur, though examples of copper or bronze were not unknown. Other copper-bronze implements include spears, knives, short swords, arrowheads, axes and fishhooks. The spearheads are tanged and cannot clearly be distinguished from knives, though knives are sometimes differentiated by a slightly sinuous recurved point, a peculiarity very rare outside the Indus civilization. The axes are flat and sometimes long, without shaft hole, and were presumably hafted in a split and bound handle. The obstinate retention of this primitive type long after the shaft hole had been developed in western Asia is the more remarkable since examples of this superior method of hafting did on exceptional occasions reach the Indus. Copper seems never wholeheartedly to have occupied the genius of the Indus craftsmen. As a relatively costly import, it was used with economy; however, in addition to implements, bowls, cups and dishes were sometimes made of copper. The ore may have been obtained overland from Rajasthan or Afghanistan, but supplementary imports by sea may be suspected and tin was almost certainly introduced in this manner.

Jewelry.—Unlike the tools, beads show a few clear links with the west and thus help to mitigate the isolation of the Indus culture. Circular gold beads with a prominent axial tube occur at Mohenjo-Daro and in Mesopotamia and at Troy about 2300 B.C. "Segmented" faïence beads are numerous in the Indus and are of various dates between 3000 and 1300 B.C. in northern Syria, Crete and Egypt. Etched carnelian beads are identical in Mesopotamia about 2300 B.C. and in the Indus valley. Other types are local, but they include a distinctive trefoil decoration, possibly of religious significance, which is found also on one of the Mohenjo-Daro sculptures and on stone, pottery and woodwork in Mesopotamia, Crete and Egypt between 2300 and 1300 B.C. The Indus civilization thus provides a clear instance of an interchange of ornaments and charms with a basic technological independence.

Pottery.—The Indus pottery is usually wheel-turned and of pinkish ware with a bright red slip, though a buff background is not uncommon. Decoration, mostly in black, consists either of plain horizontal lines of varying thickness, or of more pictorial motives: notably, intersecting circles, scale pattern, checkers, pipal leaves, rosettes, latticework and occasional peacocks and fish. Forms include a large jar with S-profile and ledged rim, "dish-on-stand" or "fruit-dish" (a widespread Asian type), small vessels bearing a knobbed decoration, large slender-footed bowls, cylindrical perforated strainers and cream-coloured goblets with pointed foot. The last are sometimes stamped, presumably with the potter's name, and are confined to a late period within the Indus valley.

Farming and Commerce.—The civilization subsisted primarily, like its counterparts, by farming eked out by an appreciable but often elusive commerce. Wheat and six-rowed barley were grown, and field peas, melon seeds, sesame and a few date stones have also been found, as well as the earliest traces of cotton known anywhere in the world. Domestic animals included dogs and cats, humped cattle, shorthorns and buffaloes and possibly pigs, camels, horses and asses. Whether the elephant was domesticated is not known, though its ivory was freely used. Minerals, unavailable from the alluvial plain, were brought in sometimes from far afield. Gold was imported from southern India or Afghanistan, silver and copper from Afghanistan or Rajasthan, lapis lazuli from Afghanistan, turquoise from Iran, and a jadelike fuchsite from southern India. Indus pottery, inlays and occasionally seals occur in southern Mesopotamia, mostly in Akkadian levels (about 2300 B.C.). But much of the traffic was presumably in objects such as cotton and certain kinds of wood that are cited on Larsa tablets of about 1950 B.C. from Ur. The tablets show that Telmun or Dilmun (possibly though not certainly Bahrein in the Persian gulf) was used at this time as an intermediate market by Ur shippers, who bartered their stocks there for goods brought from "Makkan" and "Meluhha"; and it has been conjectured that Meluhha, whence copper, stone, wood, ivory objects and certain breeds of animals were obtained, was the Indus valley. But it remains true that, whatever the character and extent of this traffic, there was never any close integration between the civilizations of the Tigris-Euphrates and the Indus.

Destruction of Indus Civilization.—How and when the civilization came to an end must remain uncertain pending much further excavation. In fact no uniform ending need be postulated for a culture so widely distributed. Circumstances that affected it in the exposed submontane lands of the central Indus may well have differed drastically from those it encountered south or east of the Indian desert and the watery coastlands of the Rann of Cutch. In the valley of the Indus, Mohenjo-Daro itself is the chief witness. Its end was dramatic and sudden. It was sacked about the middle of the 2nd millennium B.C. by raiders who swept over the city like a swarm of locusts and then passed on, leaving the dead lying where they fell. In one of the houses sprawled 13 skeletons —men, women and children—two of them with sword- or axe-cuts upon their skulls. Elsewhere lay a group of nine contorted skeletons, among them five children. At a public well two people, one definitely a woman, had been struck down across the approach steps and two other skeletons lay in the lane outside. Elsewhere again, another skeleton was found in a lane. And all these relics lay on the highest and latest level of the city, witnesses to its last moments. Who the attackers were is matter for conjecture. The episode would appear to be consistent in time and place with the earlier Aryan onslaught upon the Indus region as reflected in the older books of the Rigveda, where the newcomers are represented as attacking the "walled cities" or "citadels" of the aborigines and their war-god Indra "rends forts as age consumes a garment." The material evidence of violence is confined to Mohenjo-Daro, but it is possible that the Hari-Yupuya of the Rigveda, scene of an Aryan victory over a non-Aryan tribe, is Harappa. There is at least a case for equating the destroyers of Mohenjo-Daro with the Aryan invaders of the northwest, but evidence from other In-

dus sites must be awaited. One thing is clear: the city was already in an advanced stage of economic and social decline before it received the *coup de grâce*. Houses had become increasingly shoddy in construction and had often been carved up into warrens for a swarming lower-grade population. Everywhere standards had fallen. The final blow was sudden, but the city was already dying. And the sequel seems to complete this picture. As the evidence stands, the civilization was succeeded in the Indus valley by poverty-stricken cultures, deriving a little from a sub-Indus heritage but also drawing elements from the direction of Iran and the Caucasus—from the general direction, in fact, of the Aryan invasions. For many centuries civilization in any comprehensive sense of the term was dead in the northwest of the Indian subcontinent.

But in the south, in Saurashtra and beyond, the situation appears to have been very different. Here it would seem that there was a real cultural continuity between the late Indus phase and the Chalcolithic cultures that characterized central and western India between 1500 and 500 B.C. These cultures themselves scarcely add up to a "civilization," but they were beginning to form a material bridge between the end of the Indus civilization proper and the Iron Age civilization that reached central India from the Ganges river about 500 B.C.

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INDUSTRIAL ACCIDENTS. This term and "work injuries" are often used interchangeably. During the early years under the laws designed to compensate workers suffering injuries (*see* WORKMEN'S COMPENSATION) the distinction between their literal meanings was important. The first workmen's compensation laws enacted in Great Britain and the United States provided benefits for "accidental injury arising out of and in the course of employment." Not surprisingly, early legal interpretations of this phrase required that to be compensable, a job-connected disability had to be due to an accidental occurrence, a traumatic incident. The inconsistencies and injustices of this literal interpretation of "accident" became apparent as the nature of occupational disability, particularly occupational diseases, became better understood. No one could seriously argue, for example, that a worker suffering bone destruction or a tumour due to chronic job exposure to radioactive material was less a casualty of industry than a co-worker who lost a hand in a machine tool accident. Over the years, almost all workmen's compensation laws have broadened the interpretation of "industrial accident" from its original restricted use to include nontraumatic disability such as disease, and in some jurisdictions to include aggravation of existing disabling conditions. Because of this history, and the fact that a substantial amount of work-connected disability is nontraumatic, the phrase "industrial accident" is generally used (and is used in this article) in its more general sense of "occupational disability."

How extensive is job-connected disability? One possible answer is given by comparing the number of work accidents with the number of other accidents. Data for the United States reveal that work accidents each year account for about one-fifth of all accidental injuries, and about one-seventh of the deaths due to accidents. In part, these figures reflect the success of efforts to reduce industrial accident rates. As later sections of this article indicate, the occupational health and safety movements have made remarkable, if not fully satisfying, progress. Two factors could alter this trend: (1) modern technology, which involves the hazards of radiation, chemicals and noise; and (2) better understanding of the complex etiology of disease, which suggests that virtually every activity by which men earn their livelihood involves some threat to their physical or mental health.

This article is organized according to the following outline:

I. United States
1. Accident Experience
2. Accident Frequency Rate
3. Accident Severity Rate
4. Long-Term Trends
5. Accident Costs
6. Time Losses
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I. UNITED STATES

Industrial accidents gained recognition as a serious threat to individual economic security when, in the late 19th century, there was a marked shift in employment from agrarian to industrial pursuits. American history from the Civil War through the close of the 19th century is a story of rapidly expanding industrial capitalism. During the first 15 years of the 20th century, much of the country's energies, particularly at local levels, was directed toward adjusting public policy to the needs of the new economic environment.

The exact magnitude of the occupational health and accident problem of early industrial America cannot be determined accurately. Available data are based largely on estimates. What is known is that the new industrial tempo was more conducive to accidents and that each occupation had its own peculiar hazards; *e.g.*, mine cave-ins and explosions, moving locomotives, lead poisons and overhead cranes. The fatigue of long hours and the employment of children and low-paid immigrant workers, among other circumstances, produced appalling accident records.

1. Accident Experience.—Investigators concluded that industrial accident rates reached their peak in the United States during the first decade of the century, probably about 1907–1908. In the year ending June 30, 1907, 4,534 workers were killed in railroading and 2,534 men were killed in bituminous coal mines. Frederick L. Hoffman of the Prudential Life Insurance company estimated that the total occupational death toll for 1908 was between 30,000 and 35,000.

As early as 1837, the first U.S. report on occupational health was issued. The sharp rise in occupational disabilities aroused mounting concern and led to the organization of occupational health, safety and workmen's compensation movements that helped to reduce accident rates. The rate for the 1950s, for example, was substantially less than for the 1940s. Before judgments can be made about the magnitude of the occupational disability problem in any given employment, however, aggregate data on the number of injuries and deaths must be standardized. This is done by calculating accident "frequency" and "severity" rates.

2. Accident Frequency Rate.—This term denotes the ratio of the number of accidents that occur to the number of workers exposed to risk during a given period and thus make injury frequency rates comparable from time to time and place to place. It is defined by the *Accident Prevention Manual* of the National Safety council as the number of disabling accidents per 1,000,000 man-hours worked and is calculated as follows:

$$\text{Frequency rate} = \frac{\text{number of disabling injuries} \times 1{,}000{,}000}{\text{employee-hours of exposure}}$$

While the frequency rate makes it possible to draw comparisons between industries and plants, and even between departments within a firm, it does not distinguish serious accidents from less serious ones. Analysts therefore make a second calculation, called the severity rate, which states on a standard basis the relative seriousness of occupational injuries.

3. Accident Severity Rate.—This rate denotes the total days lost (or charged) per 1,000,000 employee-hours of exposure, and is calculated as follows:

$$\text{Severity rate} = \frac{\text{total days lost (charged)} \times 1{,}000{,}000}{\text{employee-hours of exposure}}$$

For injuries resulting in temporary disability, the "days lost" figure is the actual number of days the injured worker is forced to be away from his job. Permanent disability and death cases require that days lost be stated in terms of standard time charges varying with the degree of disability. Actual days lost could not otherwise be calculated meaningfully in these two categories. A standard table of time charges is prepared for this purpose by the American Standards association.

4. Long-Term Trends.—The long-term trend of declining accident rates in the United States was reversed in 1959 when disabling work injuries rose 8% over the previous year's figure. This rise in accident rates was attributed to increased industrial activity, an influx of new workers and to more rapid introduction of new processes and activities.

There are great differences in frequency and severity rates from industry to industry, and there is often no close correlation between accident frequency and severity in a specific type of employment. Thus, although manufacturing tends to have a relatively high frequency rate, it also tends to have a low severity rate. Construction, on the other hand, tends to have both high frequency and severity rates. Electrical machinery and aircraft industries often have frequency rates lower than those for employment in elementary and secondary schools.

Work injury statistics are compiled by the U.S. department of labour, bureau of labour statistics. According to the bureau's definition, a work injury is a job-connected accident or sickness that leaves an individual unable to perform his usual work during one or more days after his injury. Disabilities fully repaired by healing are classified as "temporary." Those involving more serious injuries and permanent impairment or loss of a member or of its function are termed "permanent disabilities." Hence work injury statistics may include both the worker who is forced to miss a day's work because of a sprained ankle and the worker who has permanently lost his sight. Included too are occupational diseases, which tend to be understated in reported occupational injury data because many of them evolve over long periods of time.

5. Accident Costs.—The full extent of the financial costs of occupational injuries—to the workers involved, to their families, to their employers and to society as a whole—cannot be stated with accuracy. But conservative estimates of visible and hidden costs to the employers alone place them between $3,000,000,000 and $5,000,000,000 a year, or about 1% of the national income. This figure includes estimates of income losses, medical expenses, workmen's compensation payments, damage awards, damaged property and production losses. It does not include the substantial amounts of money spent by industrial firms to prevent occupational disability through safety programs and health measures. For example, because nontraumatic loss of hearing due to industrial noise has been held compensable in some states, employers have spent millions of dollars to reduce this hazard.

The costs of occupational disability to injured workers and their families are offset only to a small extent by workmen's compensation payments or damages collected under employers' liability. Current estimates show that compensation payments replace only about one-third of the temporarily disabled worker's income losses and considerably less of the permanently disabled worker's losses. Many a severely injured worker faces lifetime wage losses as well as medical costs, pain and suffering and the impact of his disability on his family. Furthermore, accidents occur most frequently among younger workers, whose financial and family obligations are greatest, and among the lowest paid workers, who are least able to meet these family obligations. In addition to these costs, there are other related costs—assistance payments to families impoverished by industrial accidents; administrative costs of the agencies dealing with these problems; and the incalculable damage to the human resources of the nation.

6. Time Losses.—The time lost as a result of industrial accidents can be measured fairly accurately. Work injuries occurring during one recent year in the United States caused approximately 41,000,000 man-days of disability. This total includes estimates only of current losses from deaths and permanent impairments. If the future effects of deaths and permanent impairments were added, the total ultimately attributable to the year's injuries would amount to approximately 168,000,000 days—equivalent to a year's full-time employment for 540,000 workers.

These figures do not include production time lost by workers who were not injured, which has been estimated at over 200,000,000 days. This figure represents time lost when other persons stop to help the injured worker or to discuss the accident; slowdowns resulting from temporary reductions in efficiency by persons witnessing serious accidents; suspensions of work caused by damaged equipment and the time required to replace damaged products, machinery and structures.

7. Development of Safety Movement.—The idea that industrial accidents are avoidable and that a planned and sustained effort could and should be made to prevent them came to the fore in the United States at around the start of the 20th century. Important factors in this development were: (1) the concentration of large numbers of employees in factories and other places of work, where, because of increased exposure, the number of accidents and the seriousness of accident losses became more apparent; (2) the pioneering safety efforts of certain industries, which proved the feasibility and effectiveness of organized and sustained safety programs; (3) the passage of workmen's compensation legislation, which, by placing a sizable share of the cost of accidents directly on the employer, made clear the monetary benefits of accident control. Occupational health and safety work concentrated essentially on two objectives: (1) creation of a safe work environment, including buildings, equipment and materials; and (2) encouraging safe work habits.

The number of accidents is subject to reduction by safety and prevention measures, but accident severity has tended to be primarily a matter of chance. A downward trend in accident frequency can be credited to improved safety practices, but it does not follow that these safety activities will have the same effect on severity rates. In fact, tabulations by the National Safety council show that while over-all work injury frequency and severity rates have declined notably, the severity of the average injury increased from approximately 80 days lost or charged in 1926 (the first year of compilation) to 130 days lost in 1960. Fatal accidents and permanent disabilities constituted approximately 4% of all disabilities in 1926; in 1960 they had risen to nearly 8%.

8. Problem Areas.—Analysis of accident data at the 1960 President's Conference on Occupational Safety revealed that certain characteristics were rather consistently identified with industries with high accident rates and other characteristics with industries having low accident rates. In general, the industries with high accident rates have some or all of the following characteristics in common: seasonal employment, outdoor work, shifting site of employment, heavy manual labour, older industries, small establishments, low plant investment per worker. By contrast, the industries with low accident rates are generally those with steady employment, indoor work, large establishments, a small amount of heavy physical labour, new industries, and high plant investment per worker. Within any industry, however, the presence or absence of a strong safety program is a key factor influencing the accident rate.

A significant number of work fatalities and injuries occur in farm work with its long hours of strenuous labour, natural physical hazards and increasing mechanization. Special programs to reduce the toll of farm accidents have been developed and farm safety committees operate in about two-thirds of the states.

9. Accident Analysis.—One of the important techniques of accident prevention is the analysis of accidents to determine their underlying causes so that positive action can be taken to prevent recurrence. The method of accident analysis used uniformly is set forth in Standard Z16.2 of the American Standards association. The procedure provides for selecting, classifying and summarizing the fundamental factors in accidents, which may be grouped into: (1) agency of the injury; (2) agency part; (3) unsafe mechanical or physical condition; (4) type of accident; (5) unsafe act contributing to the accident; (6) the unsafe personal factor.

10. Organized Safety Movement.—Public and private agencies of various kinds encourage and assist employers in promoting

safety at work. The National Safety council, a private organization founded in 1913 and chartered by congress in 1953, includes in its membership a high proportion of the nation's major industries and makes available a great variety of accident statistics, publications and services in the industrial safety field. City and state safety councils perform somewhat related functions in the areas they serve.

Trade associations show an increasing tendency to make safety promotion an important part of their activities. Their influence has proved to be particularly helpful in reaching and assisting smaller companies, which might not otherwise be well informed on safety methods and procedures. Insurance companies give major attention to the development and maintenance of effective safety programs and also participate with other groups in work safety programs generally.

Labour departments, industrial commissions and other government agencies at local, state and national levels share in the important task of promoting work safety. Although basically concerned with law enforcement, many agencies provide assistance in accident prevention, which goes far beyond the limits of legal requirements.

Labour organizations are also able to exert an important influence on work safety. Through contractual arrangements with employers, support of company safety programs and safety education among their members they can contribute greatly to a safer work environment and safer working practices. An increasing number of safety committees in national, state and local labour groups is added evidence of a large and growing interest in accident prevention. (E. F. CH.)

II. GREAT BRITAIN

1. Legal Framework.—Since the middle of the 19th century the law of Great Britain has required employers to take certain steps to protect their employees against injuries sustained in the course of their work. For the second half of the 20th century, the Factories act of 1961 prescribes, among other things, a legal minimum of safety precautions to be taken in British industry. In many cases factory owners have, on a voluntary basis, gone far beyond the legal requirements and as a result of their efforts the number of industrial accidents has slowly decreased.

In 1937, 1,003 factory employees were killed and 192,539 were injured. In spite of the fact that the factory working population increased steadily after that time, the casualty figures declined. These figures relate only to accidents that result in absence from work for more than three days and are reportable by law. In addition to factory workers, people employed in docks, warehouses, building operations and works of engineering construction are also subject to the Factories act, but the agricultural and mining populations are not and no reference is made to them in this article. These two industries are also subject to stringent safety regulations, but they are not responsible to the ministry of labour. The Factories act is administered by the factory inspectorate of the ministry of labour and it is to this body that all accidents causing absence from work for more than three days must by law be reported. Many individual firms keep records of all accidents—however apparently trivial—and though these are not collected on a national scale, the experience of many firms who keep comprehensive records shows that they outnumber the reportable three-day accidents by as many as 25–30 times.

At first the factory inspectors appointed by the factory inspectorate were regarded as policemen and informers by the factories under their jurisdiction, and in consequence for many years a large portion of industry was, to say the least, resentful and non-cooperative. By the 1950s, however, a great change had come about and their duties in connection with accident prevention, considered to be their major problem, were becoming more and more advisory. The inspectorate has a staff of specialists much of whose time is engaged in research work, in providing material for the publication of technical pamphlets and in the solution of problems submitted to them by individual firms or industries.

In any event, legal control can reasonably be exercised only in certain directions, where the specific action to be taken can be clearly stated by legal definitions; for example, the guarding of dangerous machinery and the methods of using, or protecting against, dangerous substances. However, a comparatively large proportion of accidents occur in connection with activities outside these categories (*see* below). To a very large extent these remaining hazards can be treated only very generally by legal definition and a different approach has therefore to be made in regard to their prevention.

2. Private Organizations.—In Great Britain, the factory owner is responsible for the safety of his employees while they are at work. He is encouraged in his efforts not only by the comparatively high cost of accidents for which he is liable at common law, having to pay compensation if the accidents occur through his negligence, but also by the social movements of the 20th century. Such influences, together with a belief in humanitarian principles, cause employers to support such organizations as the Royal Society for the Prevention of Accidents (RoSPA) and the British Standards institution, as well as voluntary accident-prevention committees set up by industry and committees raised jointly with the government to define standards and to initiate research work on accidents. There is much evidence to show how this work has many times resulted in changes of methods and, through pressure on machine makers, in changes in the design of machine tools. To a certain extent this work is assisted by groups of industrial safety officers meeting at regular intervals in areas of the country where there is a concentration of industry. Many of these regional accident-prevention groups are affiliated to RoSPA, but all of them shape their policy in consultation with the society.

Within each industry, employers' organizations or joint organizations perform similar functions. Proposals to force British industry to set up industrial accident committees by legal statute have been rejected on the grounds that voluntary work has a more effective driving force and that, where legal enforcement is used, progress is stultified and the mere letter of the law observed. In Great Britain some insurance companies take an objective view with regard to industrial risk and engage suitably trained staffs to recommend preventive measures to be taken by the insured in relation to the risk involved; these specialists are solely advisers and have only a limited duty with regard to underwriting.

Whatever private organization supplements legal compulsion, the methods employed are similar. Case histories of industrial accidents are first studied in careful detail and principles formulated to govern preventive methods. Information of this type, provided on a voluntary basis, is made available for the benefit of all industry by various central bodies. In Great Britain the information is generally disseminated by two principal bodies, the factory inspectorate of the ministry of labour and RoSPA. In addition, specialized knowledge for any particular industry is passed to those concerned through its particular association and made available to the two principals mentioned.

RoSPA is a voluntary nonprofit-making body of organizations and individuals concerned in the prevention of accidents of all kinds—on the roads and in the home as well as in industry. It is governed by a committee drawn from its members which, in regard to industrial accident prevention, consists of representatives of industrial firms and interested organizations such as insurance companies and employers' organizations.

The part the society plays in the field of accident prevention is that of education. Its efforts are directed toward management as well as workers and include posters, leaflets and booklets, films, books, competitions, an annual conference and exhibition and residential courses for trainee safety officers. Surveys of the works of member firms are made on request and advice on safety methods is offered. RoSPA maintains a library of books and information. A monthly bulletin of information, a quarterly technical journal, a quarterly paper for employees, and an annual statistical survey are among the regular publications on the industrial safety side of the society. Membership comprises the major industrial undertakings in Great Britain and covers 3,500,000 of the working population covered by the Factories act. Each year a national campaign is conducted on a specific aspect of accident prevention, such as falls or the manual handling and lifting of materials. An

annual award of a trophy (the Sir George Earle trophy) is made to the industrial firm or organization that contributed most to the industrial safety movement in the previous year.

To achieve a world-wide coverage of occupational safety and health information, the International Occupational Safety and Health Information centre (C.I.S.) was set up in Geneva by the International Labour office with the co-operation of several other national and international bodies. National centres for the dissemination and storage of information were established throughout the world, RoSPA being the national centre for the United Kingdom.

RoSPA endeavours to foster the teaching of industrial safety practices in technical colleges and schools and the inclusion of industrial safety in industrial training programs. The society maintains close relations with leading industrial interests and organizations in Great Britain and with similar bodies in Europe and elsewhere.

3. Principles of Safety.—The principles evolved by RoSPA deal with two facets of accident prevention. In the first place, six guiding principles have been enunciated for the organization of an effective accident-prevention campaign within individual industrial concerns: (1) that the driving force must come from the highest level of management, whose interest must be apparent to all levels of workers; (2) that the direction of the campaign must be delegated to a single individual; (3) that comprehensive records and statistics must be maintained; (4) that the campaign must be directed by factual studies of inspection, investigation and job-safety analyses; (5) that much of the organization's work must be delegated to a works safety committee; and (6) that the education of both workers and management through continuous propaganda is a vital part of the organization. These principles, evolved from the continuous experience of the society's members, have the support of the larger industrial firms in Great Britain.

In the second place, general principles as to the method of preventing accidents have been established. If a method of work, a substance, a force or a part of a machine or process is dangerous, then the first consideration should be the total elimination of the hazard at its source. If this proves impossible, or for the time being impracticable, the next step should be to consider whether it is possible to substitute a less hazardous condition. If neither of these approaches is feasible, the unsafe method of work, substance, force or part of the machine or process should be completely enclosed against the intrusion of any part of any worker's body, or so enclosed or controlled that any noxious substance is prevented from coming into contact with the workers. In the rare instance where all these three approaches prove impossible or impracticable, then all workers liable in any way to be adversely affected should be restrained from possible approach to a danger area and the risk of injury should be minimized by the provision of suitable personal protective equipment.

Examples of the first principle, that of elimination, would be the filling in of a pothole in a floor or the removal of a low overhead pipe or beam. Offensive dust from a grinder may be eliminated by the provision of local exhaust ventilation. Examples of the principle of substitution are the use of low-voltage, portable electric tools and lights in place of those operating at full voltage, or the use of a nontoxic or nonflammable solvent instead of one displaying the more undesirable characteristics. The total enclosure of a potential hazard at the time of operation is perhaps the best known of these principles and is the basis of all forms of machine guarding. Such guards range from the loose sleeve employed to fence a rotating shaft to the wire mesh enclosures on belts and pulleys, or the complete cover on a gearbox. There are, however, many other applications such as the provision of adjustable screens over grinding wheels, the screening of electric welding operations to protect passers-by from "arc-flash," and, in the chemical industry, the use of siphons, pumps and enclosed transfer systems for corrosives in place of open pouring. Examples of the protection of the worker by use of clothing and equipment include safety helmets, footwear incorporating steel toecaps, goggles, gloves, aprons and complete suits of impervious clothing.

An example of enclosing the worker instead of the work is to be seen when metal is ground with a portable grinder. This operation gives rise to danger to the eyes, but, as in many cases the wheel is difficult to enclose, goggles are provided for the worker. Again, the use of acid—when it cannot be enclosed—usually necessitates the workers' being totally enclosed by protective clothing of rubber or other impervious material. When in exceptional circumstances it is essential to work on live electric circuits up to 650 v., the worker is protected by insulating mats, gloves, fuse holders, etc. In circuits carrying voltages above 650 v. the apparatus should be made "dead" and a permit-to-work system devised to prevent the apparatus from being put back into use while men are working on it. Where objects may fall unexpectedly or splashes of hot metal cause injury, safety hats and boots and protective leggings or spats should be worn. These are some of the commonest examples, but it has been found that the principles apply alone or in combination in every case in industrial practice.

4. Types of Accident.—Research has shown that the total number of industrial accidents may be analyzed according to the various causes as follows: handling goods, 25%; power-driven machinery, 18%; persons falling, 18%; use of hand tools, 7%; persons struck by falling objects, 8%; persons stepping on or striking against objects, 8%; transport (other than railways), 6%; railway transport, 1%; and miscellaneous causes not specified above, 9%.

The handling of goods is at the top of the list because it is undoubtedly the most common industrial operation. The accidents that arise during this operation are commonly caused by lack of a clear path along which to move the goods, by lack of an intelligible direction when a gang is handling material together, by lack of accurate knowledge of the weight of the materials, by lack of knowledge of the correct way to grasp and to lift and by lack of correct placement and stacking. Obviously, the best means of preventing such accidents is not to handle goods, or at least not to handle them so much. Handling can often be reduced or obviated by studying layouts and methods of work with a view to reducing movements or improving supervision. Keeping workers better informed about weights and teaching them the best methods of lifting, placing and stacking will also reduce the number of handling accidents.

Power-driven machinery commonly causes accidents where it is not properly or adequately guarded. In Great Britain the approved solution is to comply strictly with the law not only to guard machinery but also to use the most effective guards and to maintain them properly in both condition and adjustment. In some countries, less reliance is placed on guarding and more on the training of operators. The best result will no doubt be derived from the intelligent use of both methods. Accidents other than those caused by lack of adequate guarding constitute a small proportion of those connected with power-driven machinery and are largely due to some unsafe method of using the machine; they usually can be prevented only by careful training of the operator.

Construction operations account for a high proportion of the most serious cases of persons falling because of the nature of the work. The most common causes are unguarded openings; platforms without guardrails or toeboards; untidy, obstructed or badly maintained walkways; and slippery walking surfaces and ladders. The methods of prevention are to guard all openings, however temporary; to erect proper guardrails and toeboards on all working platforms; and to ensure that walkways to working platforms are adequate and in good condition. Walkways should be designed to avoid obstacles and should be maintained in a clear condition free of obstruction. Ladders should be lashed at the top or "footed" at the bottom. If providing access to a working platform they should extend at least 3 ft. 6 in. above it. Ladders should be regularly and frequently inspected in order to detect and rectify any damage or deterioration. Only sound ladders should be put into use.

The use of hand tools may give rise to accidents when the tools are in bad condition or are misused. The preventive measures are obvious—to maintain tools in good condition and not to improvise. Worn-out tools should be scrapped.

Persons are most likely to be struck by falling objects when tools or materials are improperly placed on overhead working plat-

forms or in unsuitable places where they are either shaken loose by vibration or knocked over the edge. The preventive measures, apart from the erection of toe boards where necessary, consist of careful consideration of the placement of such materials, the training of workers to use proper methods and the provision of suitable containers for tools when necessary. The wearing of safety helmets has greatly reduced the number of head injuries. Accidental stepping on or striking against objects is most often due to bad housekeeping; *i.e.*, haphazard placing of tools, materials and equipment in relation to walkways.

Transport (other than railway transport) tends to present an increasing problem as more handling is done mechanically. The most common cause of transport accidents is the failure to consider the movements of pedestrians when planning the movements of transport. This is to be expected because of the introduction of mechanical transport vehicles within and about the factories and allowing their use on existing routes not originally designed for such purposes. The cure, often impossible economically, is the replanning and redesigning of the factories; the alternative is very careful training of transport operators and other workers and strict enforcement of factory traffic regulations by all grades of supervisors.

The causes of accidents associated with railways within and about factories are not greatly dissimilar from those of other vehicles. The only effective measures are: careful consideration of design and layout within the factory boundary; strict compliance with operating codes; and the careful training of operators and workmen to meet the hazards in each particular factory.

To speak generally, it is not very difficult to plan preventive measures in connection with most of the causes of accidents in industry. The real problem arises when an attempt is made to put these measures into operation. Though the accident-prevention plan may be perfect in theory, it can be put into practice only so long as it receives the co-operation of the working force. Without this co-operation on the part of the workers the best-planned safety precautions will be of no avail. (H. I. S.; B. A. I.)

III. OTHER COUNTRIES

1. Origins of the Safety Movement.—The beginnings of the machine age spurred the development of a movement to protect workers from industrial accidents and disease. Among the early laws were the British acts of 1802 (for the preservation of the health and morals of apprentices and others employed in cotton mills and other factories); the Belgian act of 1810 concerning the inspection of mines, smelting works and similar undertakings and the imperial decree of the same year concerning dangerous, unhealthful or offensive undertakings; the Danish regulations of 1832 regarding the inspection of steam boilers; and the industrial code of the North German federation issued in 1869.

Although the voluntary safety movement was at first sporadic, it began to acquire a definite organization with the formation of national and local safety associations, the first of which was the Mulhouse Accident Prevention association formed in Alsace in 1867. Other European countries slowly followed this example. The German mutual accident insurance associations, which function as safety associations, came into existence in 1884. The Belgian Manufacturers' Association for the Prevention of Industrial Accidents was founded in 1890, and a similar Italian organization in 1894. In Africa, Asia, Australia and Latin America, national safety councils did not appear until some years after the foundation of the International Labour organization in 1919. By mid-20th century, the aims of these early safety movements had become embodied in the legislation of most industrial nations.

2. Legislative Approach.—In their approach to industrial accidents, members of the British Commonwealth and several of the former British colonies have passed factory acts on the British model, establishing organizations similar to the factory department of the ministry of labour to supervise their enforcement. The acts generally require reports of all accidents causing absence from work for more than three days, and set minimum legal standards for safety precautions. Agricultural and mining populations, however, are exempt from these laws.

On the continent of Europe, organizations similar to the factory departments exist in most countries. Norway, Sweden and the Netherlands also include agriculture within their jurisdiction. The acts in Sweden, the Netherlands and the Federal Republic of Germany go into much greater detail in their requirements than do the British acts. The German acts, in particular, exercise a very close control over industry by a form of licence required by firms before they can start manufacture.

Legal control, however, can reasonably be exercised only where the specific action to be taken can be clearly stated by legal definitions; for example, the guarding of dangerous machinery and the methods of handling dangerous substances. A comparatively large proportion of accidents occur in connection with activities outside these categories. To a very large extent, these remaining hazards can be treated only very generally by legal definition, and a different approach to their prevention has to be made. In Sweden, Norway and the Netherlands regional committees are set up and are given statutory powers over the area that they control.

The committees are sometimes employers' committees and sometimes joint committees of employers and workers. In Poland the formation of committees is usually on an industry basis, with the trade unions initiating preventive measures and social labour commissions controlling safety activities.

The influence exerted on accident prevention by the insurance companies differs in various countries. In Luxembourg the work of factory inspection is done by the insurance representatives, and in Italy the insurance companies are the force behind the industrial accident-prevention movement. In the Netherlands the insurance companies share the cost of accident-prevention research with industry and government.

In the countries following the British pattern some insurance companies take a widely different view with regard to industrial injury risk: while suitably trained staffs are engaged to act in an advisory capacity on preventive measures to be taken by the insured in relation to the risk involved, the specialists are solely advisers and have only a limited duty with regard to underwriting.

3. International Co-operation.—Systematic co-operation between national industrial safety movements began with the establishment at the end of World War I of the International Labour organization (ILO) which provided machinery for the international exchange of information on safety matters, for international research and for the development of international standards of law and practice.

But the ILO had a precursor in the International Industrial Accident congress held at Paris on the occasion of the Universal exhibition of 1889. The congress was organized by a committee of 30 persons appointed by a French ministerial order of 1888. It was concerned both with prevention and with compensation, and its three sections dealt with technical questions, statistics and administration, and economics and legislation. Delegations attended from Belgium, Brazil, Canada, England, Italy, Norway, Portugal, Rumania, Spain and Switzerland, as well as from France. A permanent international committee was formed with a secretariat and 600 corresponding associates by 1891. Further international conferences were held in Bern in 1891, Milan in 1894, Brussels in 1897 and Paris in 1900, when 18 countries were represented.

In 1900 a somewhat broader group was founded, the International Association for Labour Legislation, under whose auspices an international labour office was established at Basel. In 1902 this group began the publication of a bulletin that included numerous safety regulations.

By the time of the Paris peace conference in 1919 industrial safety had assumed such importance that the authors of the treaty of Versailles specifically mentioned in the preamble to its labour clauses "the protection of the worker against . . . injury arising out of his employment" as one of the measures to be promoted by means of the ILO.

4. Safety Functions of the ILO.—The Industrial Safety section of the ILO, operating since 1921, has applied various methods

in its effort to serve all industries and all countries. These include the preparation of proposed international regulations in the form of conventions, recommendations and model codes of safety regulations, such as those for docks, building operations, coal mines and factories; the publication of technical handbooks on dangerous machinery, substances and operations; the dissemination of safety information of all kinds, as in the periodical *Industrial Safety Survey;* special research at the request of governments, safety associations, trade unions; liaison with safety associations all over the world; and assistance to governments in drafting safety regulations.

The ILO has found that while the broad principles of accident prevention may be the same for all industries and for all countries, the detailed practical application of those principles varies enormously. Even in a single industry the amount and complexity of technical equipment to be made safe may result in voluminous codes of safety regulation. Moreover the human element in accident causation has been recognized as even more complex, and may be its most important aspect. Thousands of factory safety organizations and medical services (*see* INDUSTRIAL MEDICINE), psychological research institutions, safety training institutions, safety education courses and safety propaganda activities have been developed from country to country to deal with this problem.

Finally, the ILO through its international conference of labour statisticians has striven to standardize the reported data in the industrial accident field, to develop comparative international statistics, both for injury frequency rates and for injury severity rates (with breakdowns by sex, industry group and age) and for occupational disease. Detailed standards were adopted in 1947 but were not uniformly put into effect.

The data published each year by the ILO are based on special communications to the ILO or on statistics from official publications. Fatal injury rates are given for each of the main branches of economic activity; for mining, quarrying and coal mining, nonfatal rates are also given. Separate figures are given for coal mining because of its economic importance and its relatively high accident hazard.

Use of these figures must take into account their lack of uniformity in methods of compilation, differences in the economic scope of the figures and in the definition of injury adopted. Detailed study of the conditions in the countries compared is therefore necessary. For example, the method of determination of the injury frequency rate varies from country to country. The number of cases of injury may be based on compensated injuries only or on all reported injuries. The number of workers exposed to risk is rarely based on the number of man-hours actually worked because such figures are not available in most countries, but usually on payroll data or accident or other insurance data, with general over-all approximations of days worked or on the average number of wage earners working or average number of persons employed.

The types of industries covered in each group vary from country to country, and may be high-accident-risk industries or low-accident-risk industries. The railroad figures in some cases include railway construction and railway workshops and in some cases exclude them. Where nonfatal injury rates are given, the minimum duration of disability for inclusion of a case varies from nil to 14 days. Detailed notes on each table indicate these variations. Also a seven-year period is listed for each country so that variations in the rates for a single country will accurately reflect changes in the conditions of accident risk in that country.

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INDUSTRIAL ARBITRATION AND CONCILIATION: *see* INDUSTRIAL RELATIONS; INDUSTRIAL COURT.

INDUSTRIAL ARCHITECTURE, in this article, refers primarily to the design of buildings, such as factories, administration buildings, laboratories, etc., for manufacturing and related operations from the time of the Industrial Revolution to the present.

GENERAL DEVELOPMENT

Architecturally, industrial buildings can be said to have had the following sequence of phases: water power was paralleled by buildings in wood and stone; steam power by constructions in brick and metal, at first cast and wrought iron, later steel; electric power by reinforced concrete construction. Externally, the late 18th-century mills were characterized by domestic scale and academic compositions, often with cupolas like public buildings. During the 19th century the factory followed contemporary stylistic fashions, Greek, Gothic and Italian villa. The same details and towers appeared on them as on the owners' houses. In the latter part of the 19th century, most architects devoted their talents to public buildings and palatial residences, leaving the inartistic factories to the engineers who, however, attacked the problem creatively and produced buildings of genuine integrity. The engineers showed so much vitality that in the early 20th century, when a new architecture based on functionalism was being born, it was the engineer-designed buildings that triumphed. They were rational and scientific; they directly and economically expressed the purpose for which they had been built, and their materials did not make irrelevant concessions to good taste. Grain elevators, factories and office buildings of Chicago, Ill., were hailed as masterpieces. By 1925 a new architectural style had been created, known as modern or as the international style. Nothing so wholly independent of the past had been found in western culture since the end of the middle ages; hence a belated consequence of the Industrial Revolution was, incongruously, the creation of a new art. This was to be seen in Peter Behrens' tube company at Düsseldorf, Ger., of 1911, his chemical factory at Höchst am Main of 1920–24, Hans Poelzig's chemical factory at Luban, Pol., of 1912, and Auguste Perret's clothing factory in Paris, 1919, with its elegant reinforced concrete arches. These reflected a vigorous expressionism, also dramatically presented in Eric (Erich) Mendelsohn's sketches of 1914–18. S. van Ravestyn's buildings for the Dutch railways combined clarity, lightness and a sensitive handling of scale and proportion.

This appeal was felt by a few discerning spirits in the 19th century, but the strangenesses of proportion and of scale became more familiar after World War I, and the aesthetic merits of the better ones were then forcefully publicized. Merz and McClellan's power station at Dunston near Newcastle, with its steel frame and glass curtain walls, seemed infinitely preferable to Sir Giles Gilbert Scott's Battersea power station with its inappropriate monumentality.

Of the thousands of meritorious industrial buildings all over the world from the U.S.S.R. to Brazil, it is possible to mention specifically only a few. However, many badly designed industrial buildings continued to be built, emphasizing mass instead of lines and planes—buildings which affected simplicity, buildings which clung tenaciously to tradition in a misguided attempt at beauty. Factories could be seen everywhere hiding behind fancy-dress Georgian or Tudor fronts.

Metal Construction.—The use of iron instead of wood for columns and beams was developing at the end of the 18th century so that by 1801 at Salford, Eng., the Phillips and Lee mill, designed by the engineers Matthew Boulton and James Watt, was a seven-story, fireproof building, its interior cluttered by a forest of columns spaced 9 ft. by 14 ft. The mills at Saltaire, Eng., built in 1853 by the engineer Sir William Fairbairn, marked the increased size attainable a half century later. The top floor was a single room 550 ft. by 50 ft. without any incumbrances to interfere with the most efficient disposition of the machinery. Other buildings there had saw-tooth roofs. These structures had an enclosing envelope of load-bearing masonry walls.

The first factory built without structural masonry, with all the load-bearing parts in metal, was the Menier chocolate factory of

1871 at Noisiel, France. In the meantime the Crystal palace in London of 1851 by Sir Joseph Paxton had demonstrated the advantages of metal construction, glass walls and prefabricated, standardized, mass-produced parts. From 1848, James Bogardus, in the United States, developed ingenious iron-framed structural systems.

Steel, more available after the invention of the Bessemer process, was gradually substituted for iron and permitted wider rooms and larger windows. The daring use of metal trusses for wide spans in bridges, train sheds, and exhibition halls was one of the most notable developments of 19th-century engineering; spans of 200 ft. were being regularly achieved by 1860 and of more than 300 ft. by the end of the century. Masonry and wood throughout history had not often reached spans of 80 ft. These achievements did not influence industrial building until the 20th century. Meanwhile a totally new medium, concrete combined with reinforcing tension rods of steel, was being developed. After many years of experimentation, beginning about 1860, sufficient confidence was gained so that around the turn of the century the medium was being widely applied. François Hennebique's system was used at the Marconi factory at Genoa, Italy. After World War I, traditional masonry systems became obsolete for large buildings. *See* CONCRETE.

20TH-CENTURY INDUSTRIAL ARCHITECTURE

Characteristics.—There were four notable developments in industrial building after 1900: (1) extensive one-story plans; (2) the use of light roof trusses in spans of 40–80 ft.; (3) the thinning down of the enclosing masonry shroud at first to glass and for some processes its elimination altogether; and (4) the dispersion of factory sites from town to open country, partly for security but chiefly because of inexpensive land costs and increased road transport.

One-Story Plants.—Great changes in production methods made possible Albert Kahn's automobile plants. The basic idea was assembly-line production in which, by means of conveyors, exactly machined parts were added until an endless stream of automobiles would roll out of the exit. This called for enormous spaces, preferably one story. The early examples occurred in Detroit, Mich., and in Turin, Italy, where Matte Truco's Fiat factory (1922) had an assembly line 2 km. (1¼ mi.) long. The most expensive plant of this kind up to its time was built at Willow Run, Mich., during World War II.

Reduction of Roof and Wall Supports.—Although factory windows had been generous from the beginning (Stanley mill, 1813), full development of the glass wall as something separate from the structure was slow in coming. During most of the 19th century factories were long severe blocks, three or four stories high, the top floor lit by monitors, the brick walls monotonously punctured by windows at regular intervals. Toward the end of the century the columns which had been used for intermediate supports were also applied to the exterior walls, and the wall itself reduced to a thin, sometimes transparent, curtain against the weather. The structural skeleton, whether of metal or reinforced concrete, was revealed in such buildings as those of Montgomery Ward at Chicago (1909) and the administration building of the Fagus shoe plant in Alfeld, Ger., (1911) by Walter Gropius and Adolph Meyer. In such buildings the proportion of glass to wall was radically shifted from one-third to nine-tenths. This could also be seen in Peter Behrens' turbine factory of 1909 in Berlin, Ger., and in the later Van Nelle tobacco factory outside Rotterdam, Neth., by J. A. Brinkman and L. C. van der Vlught. There the supporting columns were set back from the plane of the wall and the glass ran practically continuously around the building. The final step in this sequence, up to mid-20th century, was the Bluebonnet plant in Corpus Christi, Tex., where it was found that some steps in the manufacturing process did not require either curtain walls or roofs because of the climate. The machines had, in a sense, become the building.

Site Dispersion.—In the early days of the Industrial Revolution factories were perforce located on river banks and at ports. Hence the industrial "cinder belt" spread along the coasts. The use of coal for power and the growth of railways opened up new sites, and finally the efficient transmission of electric power paralleled by the development of motor vehicles made the manufacturer even more geographically independent. If materials and finished articles could be shipped by truck, and if workers could be brought considerable distances by cars and buses, factories could be built on the cheap land outside cities as low, rambling, flow-line-shaped buildings. In some cases these advantages were sufficient to justify the creation of wholly new industrial towns complete with housing, stores and civic centres. This practice was accelerated during World War II when it was realized that the congested industrial area presented too vulnerable a target to long-range bombers; that camouflage was helpless against radar and that dispersion was the best defense. The atomic energy plant at Los Alamos, N.M., was an example of this trend, stimulated by the need for both security and secrecy.

A number of industrial cities had been built during the 19th century. Sir Titus Salt's Saltaire was once a model town of this kind, as was Alfred Krupp's community at Essen, Ger. Some of these offered wholesome living conditions as in the early days of Lowell, Mass.; some were in too subservient a position to the founding company, as Bournville, Eng. (1895). These industrially sponsored communities provided working models for the government-sponsored communities of the 20th century. Industrial towns of later date include Zlín in Czechoslovakia in which factories, stores, public buildings and housing were designed by one architect on one module, for one owner. One of the most important centres from the points of view of manufacturing, health and aesthetics was the group of buildings, factories, houses and stores on the island of Kvarnholm near Stockholm, Swed., designed in the late 1920s and in the early 1930s for the Swedish co-operative societies.

Among the solutions to the industrial city following World War II were the designs by Paul Lester Weiner and José Luis Sert for mining towns in the Venezuelan mountains. These towns, Puerto Ordaz and Ciudad Piar, were communities planned for the pedestrian. They conformed to the economic and social structure of the region. (*See* also CITY PLANNING.)

The U.S. and Great Britain.—Comparable to the magnificent factories built in the United States by Albert Kahn and the Austin company was Sir Evan Owen William's work in England. His best-known plant, that for Messrs. Boots near Nottingham, begun about 1933, was planned around a streamlined flow system, from raw materials at one side to packaged articles at the other. In post-World War II Great Britain the Brynmawr Rubber Factory at Brynmawr (1949), by the Architect's Co-Partnership, utilized a modular, domical, thin-shell concrete construction pierced by skylights to provide admirable, economical lighting and ventilation.

The postwar development of the atomic-energy industry showed that promising architectural achievements could be expected from the new requirements in this field. Plants in the U.S. at Hanford, Wash., and Aiken, S.C., and the Windscale factory at Sellafield in England exhibited aggressive, even if utilitarian, architectural solutions. In the U.S. the postwar addition of the tower laboratory to the Racine, Wis., Johnson Wax complex (1949; earlier buildings, 1938) by Frank Lloyd Wright disclosed interesting and unusual planning and structural features. Among the other outstanding examples, special mention should be made of the General Motors Technical centre, Warren, Mich., a gigantic complex of buildings arranged on a palatial 18th-century scale with fountains that pump more water than those of Versailles. Somewhat less ostentatious, but done with equal precision, were the Heinz laboratories in Pittsburgh, Pa., by Skidmore, Owings and Merrill (1953) and the *Oregonian* newspaper plant in Portland, Ore. (1948), by Pietro Belluschi.

Elsewhere.—In the late 1940s and early 1950s Latin America and Italy excelled in the development of reinforced concrete structures. Felix Candela in Mexico was perfecting the warped shell (Rio's warehouse, 1955; Parasina textile plant, 1953; both in Mexico, D.F.), and was developing greater refinements on the catenary and barrel vault thin shell (Mexican custom's warehouse, Mexico, D.F., 1953; P.I.S.A. factory, S. Bartolo Naucalpan,

1951). In Argentina, the S.I.T. spinning shed at Pilar, by José Delpini (1950), provided exceptionally good lighting conditions by the use of curved concrete shells supported on concrete catenary arches. In Italy, meanwhile, Pier Luigi Nervi continued the tradition of François Hennebique and Robert Maillart and converted the flat slab into a highly articulated and expressive structure (tobacco warehouse, Bologna, 1949; Lanificio Gatti factory, Rome, 1951), and invented methods for using prefabrication techniques in concrete construction (salt warehouse, Tortona, 1952; exposition hall, Turin, 1948). Elsewhere in Europe distinguished solutions to all sorts of industrial building problems, including workers' housing, occurred in such small, integrated countries as Finland, Denmark, the Netherlands and Switzerland. In Finland, the sawmill at Varkaus, destroyed in World War II and rebuilt by Alvar Aalto (1947), was seen to be allied in its mildly expressionist phrasing to the earlier work of Eric Mendelsohn (hat factory, Luckenwalde, Ger., 1923).

See also ARCHITECTURAL ENGINEERING; ARCHITECTURE; ARCHITECTURE (ARTICLES ON); MODERN ARCHITECTURE; and for separate articles on other types of industrial structures *see* AIRPORT; DAM; etc.; *see* also references under "Industrial Architecture" in the Index.

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INDUSTRIAL CERAMICS. Industrial ceramics may be considered to be those materials and products, except for the metals, that are chemically inorganic and that are usually rendered serviceable through high-temperature processing in manufacture or in preparation of the materials used. An earlier more restrictive definition considered ceramics to be concerned with the silicate industry. While silica and silicate materials constitute an important part of the ceramics field, modern industrial ceramics includes much more. Ceramics has also been defined as the field of high-temperature technology because usually, either in the manufacture or in the application and use of ceramic materials, high temperatures are involved. In fact, one cause of the greater demand for ceramic materials was the use of higher and higher temperatures in industrial processes and military applications. Whereas temperatures of 3,000°–3,500° F. (about 1,600°–1,900° C.) formerly were seldom encountered, advancing technology brought demands for materials that could withstand temperatures as high as 10,000° F.

The usual classification of industrial ceramics includes: structural clay products; whitewares; glass; refractories; porcelain enamels; abrasives; and cements, lime and gypsum.

Structural Clay Products.—Common and face bricks, terra cotta, sewer pipe, drain and hollow tile, glazed architectural tile, quarry and roofing tile are some of the important products included in this branch of the ceramic industry. These products are made from naturally occurring clay materials which are widely distributed but vary considerably in their chemical composition and physical properties. Characteristically the amount and composition of the iron compounds present largely determine the colour of the finished products.

In processing, the clays are dug from natural deposits by power shovels, ground into fine particles and mixed with water to make a plastic puttylike mass. Bricks and tile are generally produced by extruding this plastic material in a continuous column through a suitable die, after which the brick or tile are cut to the proper length. After careful drying the ware is fired in continuous or periodic kilns at temperatures between 1,800° and 2,300° F. (about 980° to 1,260° C.). During the firing treatment some vitreous material is formed which binds the altered clay material together to form the dense, hard, chemically resistant product (*see* also BRICK; CLAY AND CLAY MINERALS).

Whitewares.—Under the general term whitewares are included a wide range of products such as art pottery and stoneware; dinnerware, including fine china, semivitreous ware and earthenware; sanitary china plumbing ware; wall and floor tile; chemical porcelain; electrical porcelain; and whiteware products with good mechanical and thermal properties for use as grinding media, cutting tools, heater parts, etc. Electrical porcelains include dielectric materials for use at low and high voltages, ferroelectric materials and ferrites or ferromagnetic materials, as well as films and composites for electronic components.

The typical whiteware body is composed of three major raw materials: a good grade of feldspar, ball clays and kaolins, and finely ground silica. The body materials may be prepared by plastic mixing, mixing with water in a tank called a blunger or ball milling to obtain the desired properties. Products are formed by slip casting, by extrusion, by both manual and automatic jiggering and by pressure forming. There are many types of automatic presses that load, press and eject the pressed pieces at very high speeds.

Every whiteware piece after forming must be dried and then fired in a kiln before it will be strong enough to be used. Firing temperatures may be as low as 1,800° F. for some types of pottery, or as high as 3,000° F. for special electrical porcelains. Continuous dryers and kilns are generally used. Many whiteware products are glazed to improve their durability, usefulness and appearance (*see* also CHINAWARE).

Electrical Porcelains.—In the general area of electrical porcelains for dielectric and electronic applications many special types of compositions are used. Dielectric applications use alumina bodies consisting almost entirely of aluminum oxide with small amounts of clay and alkaline earth fluxes, steatites composed of high grade talc, clay and alkaline earth carbonates, or zircon porcelains composed of zircon, clays and alkaline-earth zirconium silicates; other special bodies are used in high-frequency applications.

There are three general types or classes of ferroelectric materials: temperature compensating, high dielectric constant and piezoelectric. Temperature-compensating materials are employed for stabilizing frequency-temperature characteristics of resonant circuits. The usual composition is based on titanium dioxide or a blend of titania and magnesium titanate. High-dielectric-constant materials show a range in dielectric constant at room temperature from 300 to 10,000. These include general purpose capacitors for a wide range of applications. The material used is barium titanate, with its properties altered as necessary by additions of alkaline-earth zirconates, stannates and other titanates. It is formed into tubes and disks for use in electronic circuits. Piezoelectric materials are used in ultrasonics, in sonar and in transducers. The usual ceramic materials employed are barium titanate, lead zirconate-lead titanate (PZT) and lead niobate, with minor additions in each case. After the polycrystalline material has been formed and fired it is subjected to a strong polarizing field which brings about an alignment of dipoles to make the material piezoelectric.

Other industrial ceramics finding important applications in electronics as ferromagnetic materials are the ferrites. The ferrites are composed of iron oxide with nickel and zinc oxides, iron oxide-manganese oxide-magnesia, and many other more complex combinations. In other formulations iron oxide is used with barium oxide to form barium ferrite as a permanent magnetic material. The ferrites are classified as (1) soft magnetic ferrites; (2) permanent magnetic ferrites; (3) ferrites for the storage of information; and (4) ferrites for microwave and magnetostrictive applications. Ferrites are particularly useful at high frequencies.

Glass.—Glass technology is an important subdivision of industrial ceramics. Products include window, plate and safety glass; container glass for use as jars, bottles, etc.; electric lamp bulbs and fluorescent tubes; optical glass for use in lenses, in telescopes and in microscopes; television tubes, electronic tubes and insulators; structural glass such as tile, block and panels; glass fibre; and special products such as foam glass for insulation, photosensitive glass and devitrified or crystallized glass products. For the history of glass and details of its composition and properties, manufacture and uses *see* GLASS MANUFACTURE.

Refractories.—A refractory is a material that will retain its chemical and physical identity and its mechanical function at elevated temperatures. Refractory materials are widely used in the metal processing industry and in practically all phases of the

ceramic industry. Refractories in metal processing are used to line a wide variety of furnaces such as open hearths, blast furnaces, converters, smelters and ore roasters (*see* FURNACE, METALLURGICAL). Refractories are also required for home heating plants and for industrial furnaces, for marine and stationary boilers and for sintering and calcining furnaces. In the manufacture of ceramics, refractories are used in all types of periodic and tunnel kilns, continuous glass tank furnaces and for heat insulation. Special refractories are used in nuclear reactors and in jet engines, rockets and missiles.

Products made from fire clays account for about 40% of the refractory industry, with silica, chromite and magnesite refractories accounting for about another 40%, and the special refractories of all types the remainder.

Porcelain Enamels.—A porcelain enamel is a thin layer of special glass fused to a metal surface to protect the metal from oxidation or corrosion, improve the hardness, abrasion or thermal properties and make possible products with a wide range of colours or opacity. (*See* PORCELAIN ENAMELING.)

Abrasives.—Fused alumina, silicon carbide and boron carbide are typical of modern abrasives synthesized by electric furnace operations at temperatures up to 4,000° F. (about 2,200° C.). After an artificial abrasive is made it can be crushed, graded for size and used in grinding operations. Of even greater importance is the grinding wheel, made by bonding abrasive particles with rubber, shellac, resin or a ceramic material. A ceramic-bonded wheel is manufactured by casting or pressing a mixture of abrasive grains with clay and feldspar in suitable molds. After forming, the wheels are fired at elevated temperatures to develop the vitreous bond. Close control must be exercised in the manufacture of grinding wheels to ensure uniformity of grinding and cutting action (*see* also ABRASIVE).

Cements, Lime and Gypsum.—In this general classification are included gypsum plaster, common lime, pozzuolana, natural and portland cements. Portland cement is by far the most important as it is the basic ingredient of concrete. For full discussion of these materials *see* CEMENT; CONCRETE; GYPSUM; LIME; MORTAR IN BUILDING; PLASTERING.

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INDUSTRIAL COUNCILS. By this name are usually meant joint councils formed by employers' associations and trade unions for the discussion of industrial problems. They range from general bodies intended to cover all or most industries on a national scale, through national bodies for particular industries, to regional and local bodies either for a number of industries or for a single industry. In Great Britain the name "industrial council" was used for a joint body set up in 1911 by the government to act as a general court of reference on industrial matters and also to act as a conciliator, without compulsory powers, in any particular dispute referred to it. This body never functioned effectively, and was discarded during World War I, when special machinery for compulsory arbitration was established under the Munitions of War acts, 1915 to 1917 (*see* INDUSTRIAL COURT). The name was revived in the reports of the Whitley committee on the Relations between Employers and Employed (1917), which recommended the setting up in all organized industries of joint industrial councils for the improvement of industrial relations and, in less well-organized industries, either of interim reconstruction committees, some of which grew into industrial councils, or of trade boards, later renamed wages councils. (Only these last were given any legal power to fix wages—that is, minimum wages.) The Whitley committee further recommended that under the industrial councils there should be joint regional councils similarly constituted, and also joint works committees. The original intention of the Whitley committee was that the councils should be primarily not negotiating bodies but meeting places for the joint discussion of wider economic and industrial issues. In practice, however, the councils were successful only when they turned into negotiating agencies for settling questions of wages and conditions, chiefly in lesser industries and in the public services; most of the major industries, which had already their own systems of collective bargaining, refused to set up councils of the new type. The government at first refused to introduce the system into the civil service but had to give way; and it was also successfully applied in local government. *See* also INDUSTRIAL RELATIONS.

(G. D. H. C.)

INDUSTRIAL COURT. This designation has been applied generically to a variety of tribunals, existing and proposed, whose purpose is to hear and decide issues which in one way or another involve industrial relations. The name is most frequently associated with agencies for the compulsory arbitration of disputes between employers and organized labour. While these agencies usually resemble law courts in procedure, their function in fixing wage rates and working conditions has been described as more legislative than judicial. In the *Boilermakers' Case*, (1957) A.C. 288 (Austr.), the privy council declared that future conditions of employment are not justiciable issues and that "the function of an industrial arbitrator is completely outside the realm of judicial power." By this view, Australia's Commonwealth Industrial court seems to be the only major tribunal in British-American judicature which is an industrial court in both name and fact.

In Great Britain, the body called the Industrial court was created by the Industrial Courts act, 1919. Under that act and the Conciliation act, 1896, the minister of labour can refer an industrial dispute to *ad hoc* arbitrators or to the Industrial court for an award if the parties consent, and without their consent he can refer the matter to a court of inquiry or commission of investigation for recommendations. However, such recommendations and awards are not legally enforceable.

In 1940, as a wartime measure, there was superimposed upon this voluntary system a National Arbitration tribunal with powers of compulsory arbitration. The tribunal was retained after the war, but in 1951 its name was changed to Industrial Disputes tribunal, its jurisdiction was diminished and the prohibition of strikes and lockouts was lifted. In 1959 the tribunal was abolished, leaving the Industrial court in prewar status.

In the United States there is no forum with the formal name of industrial court. However, the term in its loose sense might be applied to such quasi-judicial agencies as the state commissions which settle workmen's compensation claims, and the National Labor Relations board.

See LABOUR LAW. (C. H. LI.)

INDUSTRIAL DESIGN. Industrial design is, properly, design of wares produced by large-scale industry for mass distribution. Designing such wares means, first, planning their structure, operation and appearance; then planning these to fit efficient production, distribution and selling procedures. Clearly appearance is but one factor in such a complex process. Nevertheless, in consumer goods especially, appearance design is widely accepted as the principal virtue of industrial design; it is that portion of the whole least subject to rational analysis, and like craft secrets of the past, advantageous in commercial competition. On the other hand, design of equipment for production, for services and for sports is expected to demonstrate utility; but in these products too, appearance design is increasingly evident.

Practice.—Industrial design is supplied to manufacturers by three kinds of designers: staff designers, fully employed by one firm; designers under contract, who may serve several clients simultaneously, generally avoiding conflicts of interest; and free lances who sell designs, often with royalty agreements, to the best-paying manufacturer. A designer may practise these last two ways simultaneously. Free lances fit least well into big industry where gradual design development through group consultation is a usual precaution against monetary risk; staff designers often have been opposed effectively by fellow employees—salesmen and engineers; the most vigorous advances have been made by designers under contract. Some large manufacturers have raised the status and salaries of staff designers to match those enjoyed by designers under contract; outside designers are frequently called to consult with staff designers. Industrial design gains economic importance when both technological advance and commercial en-

terprise tend to become competitively equalized within an industry.

Development.—The first known industrial designer worked under admirable conditions: Peter Behrens (1868–1940) in 1907 was hired by the Allgemeine Elektrizitäts-Gesellschaft in Germany to be their architect, industrial designer and graphic designer, in fact to give unified visible character to the numerous activities of a giant enterprise. Behrens had other clients and professional duties besides. A member of the architectural profession, Behrens applied its standards and ethics to his work as industrial designer, founding in 1907 with others an important association of designers and businessmen, the Deutscher Werkbund. As a direct result, the German and Swiss Werkbunds became well-established professional organizations of industrial designers. In the United States and Great Britain industrial designers have initiated legally recognized professional associations, with codes of conduct, educational standards, etc. In other countries practice and organization are less advanced. In London the Royal Society of Arts designates qualifying practitioners as Royal Designers for Industry; in the U.S. both the American Society of Industrial Designers and the Industrial Designers' institute grant memberships only to those subscribing to codes and limitations of practice. In Britain the Council of Industrial Design was established in 1944 to advise on design, recommend designers, provide courses in design appreciation for trade and exhibitions for the public.

Industrial design in the U.S. began to grow after the 1929 depression, in Great Britain even later. Then and since, continual change has characterized the materials, power sources and production and distribution methods of the mass market. Everywhere industrial-design educators are seeking suitable curriculums; the national organizations mentioned furnish current information about schooling. Considering the short time, shifting situations and high stakes, professional attitudes in the English-speaking countries can be considered well advanced. Disputes among designers and with nearly related professionals nevertheless are usually resolved by economic competition rather than by appeal to vested rights, as in labour unions and many professions.

Style.—Industrial design has evolved no unified style, even for industries where handwork is minimized. There have been, however, four controversial style trends. The first is impersonality; here again Behrens established the precedent. Design for industry, whether determined by one man or by a group, shows a certain neutrality of expression. This impersonality has been acclaimed as the natural aspect of mass production and marketing, of average taste in a democratic community. It has been condemned as submission to the machine, contradictory to free individual expression and in consumer goods a cold substitute for the handicraft touch. The style has, so far, persisted. Secondly, industrial design is associated with the trend to provide an envelope for a product, leaving the inner workings to engineers. Complicated mechanical and electronic assemblies which have come into common use require protective shells for safety, cleanliness and orderly appearance. Here industrial designers are accused of superficial embellishment, suitable in package design and fashion. But, in product design, appearance, structure and operation ideally should seem fused, an ideal perhaps too stringent. The third trend, streamlining, is widespread in industrial styling. Originally the term applied to shapes efficient in fast motion through fluids. Such shapes have typical, expressive, curved surfaces and smooth transitions between parts; speeding through their mediums these shapes may leave visible tracks, extending from their extremities like comet tails. Such teardrop shapes and speed whiskers became symbols of speed in an age fascinated by ever-faster motion. These symbols were seized by industrial designers and applied to objects intrinsically unassociated with speed; hence the criticism. But symbols frequently drift away from original significations; here designers may be merely more human than logical. The fourth trend is artificially accelerated obsolescence, that is, design that intentionally tempts owners to replace goods with new purchases more frequently than would be necessary as a result of normal wear and tear or established custom. Beginning in the field of fashion, artificial obsolescence has become something of a custom itself in industrialized countries. It operates through public opinion molded by advertising, through price changes and through improvement and change in utility as well as through appearance change provided by designers. Its assessment must be established on wide social and economic considerations, not on design values alone. Especially in automobile and large home appliance design, artificial obsolescence has aroused strong emotional and rational reactions; yet, because of its demonstrable economic effectiveness, it is used increasingly. At least in fashion, and as disposability in everything to do with cleanliness and health, the trend has been enthusiastically welcomed.

Industrial design is a growing force, influencing and influenced by world economy, private efficacy and enjoyment, the arts, engineering and, not least, education. It has contributed more to economic activity than to achievement in the arts; here lies its most challenging future.

Notable designers for industry in the mid-20th century include in Great Britain, Wells Coates and Gaby Schreiber; in Germany, Egon Eiermann and Wilhelm Wagenfeld; in Switzerland, Emil Guhl and Max Bill; in the U.S., Charles Eames and Harley J. Earl.

See also DESIGN, 20TH CENTURY; FUNCTIONALISM; FURNITURE DESIGN: *Contemporary Design;* and references under "Industrial Design" in the Index.

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INDUSTRIAL ENGINEERING is the branch of engineering technology primarily concerned with organizing and conducting the technical aspects of manufacturing operations. As a technology, industrial engineering utilizes not only mathematics and the physical sciences but also the social sciences (including economics) and the principles of engineering analysis and synthesis. Its primary tasks are to design manufacturing systems and to predict, control and evaluate the results obtained from such systems. Industrial engineering activity commonly appears under the names of motion study, time study, production planning and control, procedure analysis, systems design, quality control, job evaluation, wage incentives, plant layout, organization analysis, work study, etc.

Three managerial groups commonly are found within an industrial organization: (1) management, a group that makes decisions directly affecting the operating divisions; (2) industrial engineers, who make plans for controlling and evaluating work in process and who also make plans for proposed work; and (3) industrial engineering technicians, or management technicians, who gather data upon which the industrial engineers' plans are based.

The techniques of industrial engineering have been applied successfully, in addition to the primary area of activity in manufacturing, to a wide range of activity including medical and dental work, farming, naval operations and household work.

Early Development.—Industrial engineering as a separate technology evolved in the 20th century. By 1930 it was a necessary and integral part of industrial routine in the western countries. Although large-scale systems of men, materials and equipment were used previously in the construction of the pyramids, the building of the Roman roads and aqueducts, military and naval undertakings and large-scale mining, no use was made of complex equipment on such a large scale as in 20th-century industrial enterprises. Also, the economic and social factors were not as pressing in

earlier times, and the degree of integration in early group undertakings was by no means as complex.

The development of quantitative measures with which to design the integration of men, materials and equipment realistically began almost simultaneously with the Industrial Revolution. The amount of capital represented by the machinery that then came into being required that care be exercised in using this capital effectively. Early attempts to predict accurately the man-hours of labour required for a given task reportedly were made by Jean Perronet of France in 1760 and by Charles Babbage of England in 1820; both dealt with the manufacture of pins. Early recognition of the need to pay attention to the human factor is implicit in the comments of Robert Owen in 1813 (reported in Anne G. Shaw, *The Purpose and Practice of Motion Study*, p. 1, Columbine Press, 1952):

> If then, the care as to the state of your inanimate machines can produce such beneficial results, what may not be expected if you devote equal attention to your vital machines, which are far more wonderfully constructed? When you shall acquire a right knowledge of these, of their curious mechanism, of their self-adjusting powers; when the proper mainspring shall be applied to their varied movements—you will become conscious of their real value, and you will readily be induced to turn your thoughts more frequently from your inanimate to your living machines.

Changes After 1900.—The need for the careful design of an integrated system combining men, materials and equipment toward a given objective was given greater urgency by the introduction of interchangeable manufacture by Eli Whitney and Simeon North in the United States during the 1790s. However, a statement of a method of systematically designing a time-integrated system of men, materials and equipment was not made until 1903, by Frederick W. Taylor (*q.v.*). Taylor began the work leading to this paper in 1881 when, at the Midvale Steel company in Philadelphia, Pa., he systematically began to measure and plan the various factors related to such tasks as shoveling raw materials and machining metals. Taylor's work gave rise to a procedure later described as time study.

An analytical method of designing human tasks (with adequate consideration of the human problems—a phase neglected at times during the years that followed) was introduced by Frank B. and Lillian M. Gilbreth in *Motion Study* (1911). The Gilbreths' work was the basis for an industrial activity variously called motion study, work simplification or methods improvement.

During the period from 1903 until about 1917 the application of industrial engineering was known as scientific management. In a study of the applications of scientific management made during the period 1911–15 by C. Bertrand Russell (*The Taylor System of Scientific Management*, A. W. Shaw Co., 1917) 172 applications were reported in the twelve states between Maine, Maryland and Illinois. The author did not claim this as a definitive total; these were all on which he could obtain information. In these 172 applications, there were factories, railroad and steamship companies, public service corporations, department stores, banks, publishing houses, building and construction companies and a professional society.

It was during this same period that a group of men called efficiency experts entered the U.S. industrial scene. Lacking the full comprehension of Taylor, Gilbreth and the men associated with these two pioneers, these so-called efficiency experts created industrial unrest to such an extent that in 1917 the U.S. congress added a rider to the appropriations act outlawing the use of a basic industrial engineering technique, time study, in government establishments. (This rider was last added in 1948.) The term efficiency expert was dropped from common usage in the 1930s.

Industrial engineering during the period 1910–30 achieved its primary development in the United States and Great Britain. The first university course in industrial engineering was introduced at Pennsylvania State college in 1908 under the guidance of Hugo Diemer, and the first two graduates received their degrees in 1910. By the early 1960s approximately 33 U.S. universities offered undergraduate degrees in this field of engineering.

During World War II, methods of creating mathematical models of management problems were introduced. Under the name "operations research," these methods quickly found their way into industrial engineering activity, improving the accuracy of the design of systems and the predictions of how they would perform.

Current practice assigns much work to the industrial engineer between the time a product is designed and the time it reaches the customer. Processes must be planned, equipment physically arranged, work scheduled, workers' jobs planned, workers trained and procedures for the control of labour, production, material, quality and cost must be designed, installed and continually improved.

Societies.—The Society of Industrial Engineers was formed in the U.S. in 1917 but merged with the Taylor society in 1936 to form the Society for the Advancement of Management. The American Institute of Industrial Engineers was formed in 1948. *See* also INDUSTRIAL ARCHITECTURE; PSYCHOLOGY, APPLIED; JOB EVALUATION; WAGES; MANAGEMENT SCIENCES. (M. E. M.)

INDUSTRIAL INJURIES: *see* INDUSTRIAL ACCIDENTS; WORKMEN'S COMPENSATION.

INDUSTRIAL INJURIES INSURANCE, a form of insurance providing compensation for injuries sustained by employees while at work. In Great Britain the responsibility for providing such insurance protection was transferred in 1948 from the employer to the government. For a discussion of both U.S. and British legislation on the subject *see* WORKMEN'S COMPENSATION.

INDUSTRIAL INSURANCE, known in Britain as industrial assurance, is a form of life insurance intended for wage earners. In the U.S. it is usually defined as life insurance under which premiums are payable monthly or oftener and in which the face value of the policy is $2,000 or less. Much the same definition holds in Britain, where the business is transacted by friendly societies and industrial assurance companies (*see* FRIENDLY SOCIETY).

Life insurance for industrial workers and their families in the U.S. originally was supplied by co-operative societies, many of which were financially unstable; in 1875 the Prudential Friendly society (later the Prudential Insurance Company of America) was organized largely after the pattern of the Prudential Assurance Company of London, and other companies soon entered the field. *See* also LIFE INSURANCE.

INDUSTRIAL MANAGEMENT: *see* PRODUCTION MANAGEMENT.

INDUSTRIAL MEDICINE. Industrial, or occupational, medicine is the branch of medicine concerned with the maintenance of health and the prevention and treatment of diseases and accidental injuries in working populations. The term occupational medicine is preferred in the U.S. because of its broader implications. Occupational medicine is properly a part of occupational health, although the two terms are frequently used interchangeably. In their broadest sense both terms include the engineering or industrial hygiene efforts that are exerted to control the environment, as well as medical care. Historically, occupational medicine was limited to the treatment of injuries and diseases occurring to production workers while at work. Over the years this has changed and everyone at a plant, factory or office may now be eligible for medical services. College or school health programs might be considered as extensions of occupational medicine.

Diseases directly related to occupations were recognized by early Egyptian and Roman physicians. Modern occupational medicine may be said to have started with Bernardino Ramazzini, an Italian physician of the 17th century, who has been called the originator of occupational medicine because in his teaching he strongly advised that the physician inquire into the occupations of his patient if he wished to learn about the causation of the patient's complaint. With the Industrial Revolution the number of persons exposed to potential hazards at work increased rapidly. Traumatic injuries became frequent and diseases due to inhaled dusts and noxious gases and vapours were recognized, often by nonmedical persons (*see* also DANGEROUS OCCUPATIONS).

UNITED STATES

Alice Hamilton deserves much credit for demonstrating the existence of occupational diseases in the United States and for call-

ing attention to the need to improve working conditions to prevent these diseases. As a result of her efforts, programs were developed in working places to protect the health of workers. For various reasons the programs were not all immediately effective. In some instances there was poor acceptance both by the management and by the workers, either for economic reasons or because of inadequate education concerning the importance of the program. In other instances the workers had already received sufficient exposure so that disease developed later after the exposure was stopped. Progress was helped by such legislation as the workmen's compensation laws, which were adopted by most of the states in the U.S. between 1907 and 1920. Gradually, as the problem became understood, management and labour unions developed a sincere interest in the health of the worker and this stimulated the establishment of occupational medical programs.

Initially, occupational medical programs were directed toward the treatment of injuries or diseases that resulted from or during work. It was soon apparent that prevention was more economical than treatment. Protective devices were developed and placed around moving parts of machinery. Control programs were developed by engineers to remove harmful dusts and vapours by proper ventilation of work areas or by substitution of less toxic materials (*see* also HEATING AND VENTILATION: *Ventilation;* PNEUMOCONIOSIS). When the engineers could not control the environment the process was contained to prevent or at least minimize the exposure of workers. As a last resort protective devices such as masks and special clothing were worn by the workers.

With the development of preventive controls the amount of occupational disease decreased. The development of new processes and new materials, however, produced new hazards at an ever-increasing rate and constant vigilance was necessary. For example, the recognition that a pulmonary disease can result from exposure to beryllium demonstrated the need for a continued awareness of potentially toxic materials. It also demonstrated that a material once believed nontoxic may actually be toxic; this shift may be caused by a change in the physical or chemical characteristics of the material, an alteration in the method by which the material is used, a change in the amount of exposure of individuals to the material, and possible synergism with other materials.

The concern with diseases due to occupation led to concern with the general health of the worker, not only because of an interest in the welfare of the working man but also because it was good business. A good industrial medical program improved labour-management relations and reduced absenteeism; labour turnover decreased and productivity increased. In many instances the savings produced by the reduction in premiums paid for workmen's compensation insurance paid for the occupational medical program.

The types of programs vary greatly; some of the large industries have broad coverage, while small plants usually have no medical program. The comprehensive programs, in addition to providing treatment of diseases and injuries, may include the following aspects: pre-employment examinations are given the worker to ensure that he is placed in a job within his capacity and in which he will not be a hazard to himself or others. These examinations also act as a base line against which any future illness may be assessed; this protects both the worker and the company. If correctable medical conditions are discovered, the patient is referred to his personal physician for treatment. Periodic examinations may be voluntary or mandatory. The voluntary programs are offered to discover disease early, since it is then easiest to correct. Health counseling is also given as a part of this service and permits the physician and patient to discuss the means of maintaining health, such as diet control, limitation of smoking and proper amounts of rest and relaxation. In addition, the results and implications of the various tests and examinations can be discussed and used to emphasize the need for improved living habits. If specific treatment is required, it is provided by the individual's personal physician. Mandatory periodic examinations are given when there is a potential exposure to a harmful substance, such as lead fumes or certain dusts, or where a regular reappraisal of the individual's capacity to perform his job is necessary, as with airline pilots. These examinations may be made by the full-time or part-time medical staff of a large industry or the services may be purchased.

Medical care may be offered on the premises for the treatment of occupationally incurred injuries or disease. Specific treatments requested by the patient's physician also may be performed. The size and staffing of these care units vary with the policy of the management, the type of industry, the number of workers involved and the location of the plant in respect to local medical coverage. A rough rule of thumb for large plants is one full-time physician for every 2,500 workers, and one full-time nurse and one clerk for every 1,250 workers. The floor space allotted for medical facilities should approximate one square foot per worker on the biggest shift. In small plants a nurse may be available on a part-time basis or some person trained in first aid may be present on each work shift; a physician's services are used only in an emergency and are paid for on a fee basis.

Most of the large industries in the United States have well-developed occupational medical programs. These programs appeared at mid-century to be expanding; sickness benefit or health insurance programs were often administered by them and new projects such as immunization programs, mental health programs and treatment of alcoholism were sometimes added to them. The trend toward expansion represented an increased concern with nonoccupational disease, which was the major cause of job absenteeism due to sickness. The same concern was shown toward nonoccupational accidents, which, in terms of disability and lost time, were beginning to become as important as, if not more important than, those occurring at work.

Less than 10% of all employees in the United States in the early 1960s were covered by comprehensive occupational medical programs because most of the industrial population in the United States worked at that time in small plants where only emergency medical care was available. The reason for this was largely economic. In large plants, *e.g.*, with 3,000 to 4,000 workers, the cost of such a program may be $30 per worker per year and is included as a part of the cost of production. In a smaller plant the cost of such a plan is greater and in a plant with 100 or fewer workers it would be prohibitive if supported by only one plant. Attempts to supply medical service to groups of smaller plants have been made. In Hartford, Conn., a number of plants banded together and hired a physician full time to run a comprehensive occupational medical program. The cost was prorated on the basis of the number of employees in each plant. The physician visited each plant on a regular schedule. As a part of his duties he familiarized himself with the working conditions and operations in each plant. This knowledge is necessary for instituting proper corrective measures, if such are indicated, for placing new workers properly and for determining whether a worker returning to work after illness can do his job.

The U.S. public health service, through its division of occupational health, has made surveys occasionally of the prevalence of diseases in different occupations. These may or may not be followed by specific recommendations. Many states have good local industrial health departments that can be used by industrial medical departments to survey the environment; the local departments also will make recommendations on how to improve the working conditions. Some of the casualty insurance companies offer both medical and industrial hygiene services and advice to companies that they insure. In this way the smaller industrial concerns can sometimes offer a comprehensive occupational medical program with a physician in attendance only on a limited or part-time basis.

Occupational medical programs also offer opportunities for research. Descriptive epidemiologic studies of the prevalence of certain diseases, such as cardiovascular, respiratory or gastrointestinal disease or cancer, can be made in the various occupational groups. Since several examinations can be made over a period of time, it is possible to compile incidence studies. All these findings can be related to working conditions, atmospheric constituents and living habits to determine the role each plays in the causation of disease. The benefits from such work accrue not only to workers and business but also to the entire population. There is a great

need for good research of this sort.

Occupational medicine has been recognized as a medical specialty and it constitutes a subdivision of the boards of preventive medicine. To qualify as a specialist in this field, a graduate physician, usually after his internship, must study for two years in an approved program either at a school of public health or at a medical school. This is followed by another year in an industry and then two years of additional practical experience. Having qualified, he must then pass the examination offered in this specialty.

(B. G. F.)

GREAT BRITAIN

The adverse effects of employment on the physical, mental and social well-being of the individual, and through him on his family and the community, have been recorded throughout British industrial history. But the extent and seriousness of the problems did not impress the public until steam power was applied to the development of the factory system toward the end of the 18th century. Recurrent outbreaks of grave infectious diseases, including typhus, cholera and smallpox, especially among child apprentices in textile mills, compelled the attention of local justices. In Manchester the reports of the board of health, a group of physicians and leading citizens, forced the magistrates to take action to safeguard not merely the health of child labourers but that of the whole community.

Legislation.—Amelioration was effected through legislation, and the Health and Morals of Apprentices act, 1802, was the first of a long series of statutes collectively named the factory acts. The early legislation referred to cotton and woolen mills, but gradually other textile and nontextile factories and industries were brought in and benefits extended—largely indirectly—to adult male workers.

The Factory act, 1833, is noteworthy for the appointment for the first time of inspectors of factories and for the requirement that children between the ages of 9 and 13, employed in factories, should attend school for two hours each weekday. This was the beginning of compulsory education in Great Britain. Under the act of 1844 an attempt was made to remedy dirty conditions by requiring the limewashing of the interior of factory premises. Even more significant was the power given the inspectors to appoint certifying surgeons to examine persons for the "surgical certificates" of age required by the act. This was the beginning of statutory medical supervision in industry, which in considerably extended form came to prevail under the purview of the inspectors of factories and the appointed factory doctors. Meanwhile Edwin Chadwick's report, *The Sanitary Condition of the Labouring Population* (1842), had advanced the cause of public sanitation. As the apostle of the "sanitary idea" he may be regarded as the founder of the modern public health system, which is concerned with the prevention rather than merely the cure of disease and with the application of preventive measures to the group rather than to the individual.

Deaths and serious injuries, largely resulting from the use of horizontal shafting and unguarded machinery, led to the Employers' Liability act, 1880, and so to a series of workmen's compensation acts culminating in the National Insurance (Industrial Injuries) act, 1946. T. M. Legge was appointed the first medical inspector of factories in 1898. During his 28 years in this office he made outstanding contributions to industrial medicine, particularly to the control of lead poisoning and anthrax. Following the inquiries of Charles Booth in London and Benjamin Seebohm Rowntree in York into the social circumstances of the working classes, and later those of the inspector general of recruiting into the defective physique of recruits during the South African War, compulsory medical inspection of school children, supplemented by the provision of school meals, was instituted in 1908. On July 15, 1912, the first National Health Insurance act came into operation and almost concurrently the new tuberculosis service.

The large number of ex-servicemen disabled in World War I focused attention on the employment problems of the disabled. Orthopedic surgeons, notably Sir Robert Jones, concentrated on the restoration of function to injured limbs, while at Papworth village settlement P. Varrier-Jones concentrated on the employment of tuberculous patients. The advances in the rehabilitation of all substantially handicapped persons were given statutory effect in the Disabled Persons (Employment) act, 1944.

From all the developments described above emerged, almost inevitably, the national health service—which included provisions for dealing with industrial injuries—on July 5, 1948.

The factories acts, 1937–59, and certain other enactments relating to the safety, health and welfare of employed persons were consolidated in the Factories act, 1961. The tendency was to extend the provisions for safety, health and welfare and by widening the definition of "factory" to embrace a wider range of premises, industries and occupations. While the 1961 act prescribed minimum requirements and standards generally applicable to all factories (as defined), special preventive measures referring to particular processes and conditions were imposed through specific orders and regulations. The duty of enforcing the legislation constitutes the work of the inspectors of factories.

Industrial Medicine in Coal Mining.—Coal mining is a basic industry in Great Britain. Miners' work has always involved a high incidence of fatal and crippling accidents and such diseases as pneumoconiosis, nystagmus, rheumatism and a group of conditions known collectively as the "beats." Furthermore, all underground workers are subject to the adverse influences of high temperatures, humidity, bad air conditions resulting from mine gases, and the strain of arduous work in cramped conditions. It is therefore remarkable that the statutory provision of health, safety and welfare arrangements in coal mines lagged so far behind those made for factories. The Mines and Collieries act, 1842, prohibited underground work by women and young children. Thereafter, mostly as a result of the recommendations of various commissions, there was a series of acts culminating in the Coal Mines act, 1911, which with amendments, regulations and orders codified the law governing coal mining. This code of legislation imposed a duty on the employers—the national coal board from Jan. 1, 1947—to provide and maintain in efficient order adequate supplies of materials and appliances (including ambulance transport) for first-aid and rescue work, and to train a suitable number of men in that work. At various centres specially trained full-time resident rescue brigades are maintained as mobile squads to operate in disasters resulting from explosions, flooding, fire or other causes. An important regulation permits the administration of morphine, in emergency, by certain nonmedical persons. The Miners' Welfare fund established by the Mining Industry act, 1920, marked a great advance in welfare arrangements not only for the miner but also for his dependents and the local community. The act provided for a levy on all coal produced, the proceeds to be used for "purposes connected with the social well-being, recreation and conditions of living of workers in or about coal mines, and with mining education and research." The most generally acceptable innovations were pithead baths and changing houses and institutes for social recreation. Convalescent homes were established, and these became pioneer rehabilitation centres. Concurrently, the rehousing of miners in modern council houses was greatly advanced, while bus transport largely removed the need for them to live in isolated villages around the pit head. The growth of industrial estates provided more opportunities of employment near home for the miners' families and for aged and handicapped miners. Enforcement of mining legislation is the duty of mines inspectors under the ministry of fuel and power. The first permanent medical inspector of mines was appointed in 1927.

Health and Welfare in Nonindustrial Employment.—Regulation of the working conditions of persons in places of employment other than factories is more difficult and correspondingly restricted. Under the merchant shipping acts provision is made for the welfare of seamen. Shop acts regulating hours and conditions of work are enforced by the local health authority.

Mechanization in farming led to a great increase of accidents due to machinery. The resultant wounds raised the problem of tetanus infection and immunization. The use of complex insecticides, fungicides and pesticides introduced new hazards to health.

In 1956 parliament initiated legislation to safeguard the health, safety and welfare of agricultural workers.

Medical Supervision in Industry.—Medical supervision in industry is of two kinds, statutory and voluntary. Statutory supervision is limited to the enforcement of the law. In factories it is comprised in the duties of the appointed factory doctor—originally the certifying surgeon—under the supervision of the medical inspectors of factories, covering the various administrative districts into which the country is divided. The work includes the examination of young persons, that is, those up to the age of 18 years, on engagement and thereafter annually until their 18th birthday; periodic examination of workers in certain prescribed dangerous processes, such as the manufacture and handling of lead compounds, chemical processes involving nitro and amino derivatives of benzene, the use of radioactive materials as in luminizing, and workers engaged in chromium plating; and, when requested by the inspector of factories, investigation into the circumstances attending cases of industrial accident and disease.

Under the Coal Mines (Medical Examination) general regulations, 1952, all persons under the age of 21 years first employed, or about to be employed, in or about a coal mine were required to undergo medical examination, including X-ray examination of the chest, to ascertain their fitness for mining work. The examinations are completed by the full-time doctors of the national coal board. In 1958 periodic chest X-ray examination of all coal miners was introduced. The pneumoconiosis panels of the ministry of pensions and national insurance undertook the initial and periodic medical examination of certain workers in the refractories, sandstone, pottery and asbestos industries. A grave defect of these examinations was that radiographic examination of the lungs was not made compulsory but was left to the discretion of the examining doctor. Fitness examinations, specially directed to the nature of their duties, were also required for public transport drivers and for officers and men of the merchant marine.

Whereas statutory medical services are limited, the extent and scope of voluntary services are entirely at the will of the individual employer. Thus he may be satisfied that the statutory services are adequate, or he may supplement these by medical, nursing and ancillary services such as physiotherapy, dental examination and treatment, chiropody, ophthalmic examination and treatment and general welfare work. The motive may be a general humanitarian interest in the workers; a recognition that a high incidence of accidents and disease leads to absenteeism and loss of output; or a realization that efficient production and good labour-management relations can be enhanced by regular care and attention to the fitness of the workers as well as to the machines they operate.

Modern Industrial Medicine.—The modern practice of industrial medicine in Great Britain probably originated during World War I when David Lloyd George formed the Health of Munition Workers' committee. At the end of the war, a few enlightened leaders of industry, realizing the importance of health in the factory, sought to promote this by the appointment in their organizations of full-time or part-time medical officers. The movement, however, was restricted and slow in advancing. In 1935 a group of 35 doctors employed full time in industry (almost all of those so employed) formed themselves into the Association of Industrial Medical Officers, which by the 1960s had a membership of more than 1,000.

During World War II the ministry of supply established medical departments in all government ordnance factories. This service not only made a great contribution to the war effort but also provided tested patterns for medical units, staffing and organization suitable for adoption by industry as a whole. There was subsequently some expansion of the movement but chiefly in the large organizations. At the inception of the national health service in July 1948, the Trades Union congress strongly recommended the inclusion of an industrial health service, but chiefly for financial and administrative reasons such a plan had to be deferred. A comprehensive picture of services existing in early 1949 appears in the *Report* of a committee of inquiry on industrial health services (command paper 8170, H.M.S.O., London [1950]). Altogether there were 243,769 factories, and of the 4,884 factories with more than 250 workers, 2,018 (41.32%) had voluntary medical services, whereas only 845 (0.42%) among 202,868 factories with fewer than 26 workers had any such service. The report (generally known as the Dale report) recorded that medical services in industry do not overlap the national health service but are complementary; they must be regarded as a normal function of enlightened management and should be judged important by reason of the contribution they make both to the health of the workers and to productivity. The committee recommended that employers, individually and collectively, be encouraged to provide industrial medical services and that eventually there be some comprehensive provision (presumably through legislation) for occupational health, covering not only industrial establishments of all kinds, both large and small, but also the nonindustrial occupations dealt with in the report of another committee of inquiry, *Health, Welfare and Safety in Non-Industrial Employment: Hours of Employment of Juveniles* (command paper 7664, H.M.S.O. [1949]). Various organizations, including the Trades Union congress, British Medical association, Royal College of Physicians (London) and the Association of Industrial Medical Officers, pressed for implementation of these recommendations. But the government did not act until 1955, when it appointed the industrial health advisory committee under the chairmanship of the minister of labour. The committee, while recognizing generally the case for extension of medical services in industry, considered that the relevant problems demanded further study. Two surveys were arranged; the first comprised all the industries of a representative provincial town, Halifax, Yorkshire, and the second the pottery industry in Stoke-on-Trent, Staffordshire. Facilities for advice on occupational and environmental hygiene in factories throughout Great Britain were investigated. Meanwhile at Geneva in 1959 the International Labour conference recommended, with the support of the United Kingdom delegates, that occupational health services should be established in all types of workplaces. Nonetheless the minister of labour did not develop industrial medical services through legislation but invited voluntary extension by employers. The government's reasons for its attitude were: first, the national health service provides a comprehensive medical service including programs for rehabilitating and retraining disabled persons; second, legislation lays down basic standards for safety, health and welfare in industry and agriculture, and similar legislation is intended for other workplaces and employments.

While private industry revealed a limited response toward expansion of such services, nationalized undertakings, such as coal, dock labour, transport, electricity and gas, and atomic energy, established comprehensive services.

The Industrial Medical Officer.—Experience proves that an efficient casualty service gains the confidence of management and workers more than any other type of service. Particularly acceptable to employers is the reduction of avoidable sickness absenteeism, which in Great Britain accounts for the loss of more than 300,000,000 working days annually. Job placement, based on job analysis, is highly regarded as a means of reducing labour turnover. For workmen temporarily or permanently handicapped, programs for rehabilitation, retraining and resettlement are recognized as invaluable. Pioneer rehabilitation workshops established by the Austin and Vauxhall motor companies became prototypes for government rehabilitation units, while the Rubery-Owen experiment at the company's engineering works in Staffordshire became a model for continued employment of craftsmen who had reached retirement age.

The industrial medical officer also advises management on factory hygiene and on the cause and prevention of industrial diseases and accidents. Practice tended at first to emphasize the clinical functions, while environmental problems were somewhat neglected, but later the urge was to establish an occupational hygiene service throughout the country. Ergonomics, or the application of anatomical, physiological and psychological knowledge to the study of man and his working environment, increasingly attracted attention.

Industrial Health Services.—British industry is largely composed of small units employing only a few workers. It is recognized that these small groups could benefit from industrial medical services, but difficulty arises in organizing such a service. Experimental programs such as those at Slough industrial estate, Buckinghamshire, the new town of Harlow in Essex, and the Central Middlesex hospital, London, indicated possible means of meeting the diverse problems. At Birmingham a special hospital was established to deal entirely with accidents. This proved eminently successful and the staff made valuable original contributions to the study of traumatic shock, the treatment of burns, the application of no-touch technique in the care of wounds and the development of dressings suitable for use under varying working conditions. Roffey Park Rehabilitation centre, Horsham, Sussex, treats patients from offices and factories suffering from subhealth, maladjustment and emotional problems. Experience at this unit focused attention on the influence of human relations on health at work. Haven Products Ltd., Glasgow, established an outstandingly successful experiment in the employment of severely handicapped workers, including cardiac cases, paraplegics and amputees. Remploy Ltd., a government-sponsored corporation, provided sheltered employment for more than 6,000 severely disabled persons in 90 factories and 8 home-work centres throughout the country.

Industrial Accidents and Diseases.—Employment of safety engineers became recognized as important in the control and prevention of accidents, and designers and manufacturers were encouraged to incorporate safety devices in machines. Among the protective appliances available for use by workmen, those that proved particularly valuable were safety boots, goggles, helmets and special gloves. Despite considerable effort and propaganda no significant decline in accidents in factories or mines resulted; indeed, they increased among young persons. The small number of authenticated cases of specific industrial diseases emphasizes the effectiveness of control measures. Pneumoconiosis, dermatitis, various cancers and the risks to health from radiation continued to present serious problems, but substantial advances against them were made.

Research.—Many industries maintain their own research department. Generally, however, fundamental and field studies into health and disease are undertaken by the Medical Research council and the universities. The pneumoconiosis field research of the national coal board attained international recognition. The postgraduate medical school, Hammersmith hospital, London, and the pneumoconiosis research unit, Cardiff, made notable contributions to knowledge of bronchitis and pulmonary function in dust diseases of the lungs.

Teaching.—Departments of industrial or occupational health were maintained in the universities of Manchester, Durham and Glasgow and at the London School of Hygiene and Tropical Medicine and the Royal Institute of Public Health and Hygiene, London. At other schools the subject is comprised in the teaching of social medicine. Postgraduate courses are designed to prepare doctors for the diploma in industrial health and short refresher courses are regularly arranged for industrial medical officers and general practitioners. For state-registered nurses the Royal College of Nursing provides courses leading to the occupational health certificate. Instruction in first aid is organized by the St. John ambulance brigade, the Red Cross society and St. Andrew's ambulance brigade.

For employers and workmen, the Industrial Welfare society through leaflets, a journal, conferences and courses provides popular education in industrial health. The Royal Society for the Prevention of Accidents covers the prevention of hazards to health and industry. Special problems are focused by the British Council for Rehabilitation, the British Epilepsy association and the Empire Rheumatism council. Professional bodies include the Association of Industrial Medical Officers, Occupational Hygiene and Ergonomics societies. Special journals are the *British Journal of Industrial Medicine*, the *Transactions of the Association of Industrial Medical Officers*, *Annals of Occupational Hygiene, Ergonomics* and *Occupational Health*.

See also HEALTH AND SAFETY LAWS: *Rise of Industrial Medicine;* LEAD POISONING; NOISE AND ITS CONTROL; SILICOSIS; SKIN, DISEASES OF. (AW. M.)

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INDUSTRIAL PSYCHOLOGY: *see* PSYCHOLOGY, APPLIED: *Industrial Psychology.*

INDUSTRIAL RELATIONS. In modern usage, this phrase includes all matters that arise in the day-to-day association between employers, managers and workers. Its scope includes three fairly distinct areas: (1) relations between managers and individual workers; (2) the collective relations between employers and labour (trade) unions; and (3) the role of the government in the regulation of these relationships. These three closely related fields of industrial relations are often referred to respectively as personnel management, collective bargaining and labour legislation. Although each area has become a separate specialty with its own professional practitioners and literature, all are concerned, essentially, with two basic questions: Under what conditions shall the work be done? How shall its proceeds be divided?

Employers and workers do not always determine these answers by themselves. In many countries the government participates in working out answers and attempts to settle the disputes that arise when the parties are left to their own devices. Because of their interest in such intervention and in the legislative and economic policies of government, employers and unions have become increasingly involved in political as well as industrial action. Since the subject matter of industrial relations ranges from the grievances of individual workers to organized political activity of large groups, its problems are under study in virtually all fields of social inquiry: economics, law, political science, psychology, sociology, social welfare and history.

The article is organized according to the following outline:

I. Historical Development
  1. Early History
  2. 20th Century
  3. United States
II. Relations at the Place of Work
  1. Personnel Management
  2. Joint Consultation
III. Collective Bargaining
  1. Councils in Great Britain
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IV. State Intervention
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  1. Arbitration of Rights
  2. Arbitration of Interests
  3. Extension of the Arbitration Principle
  4. Emergency Boards and Fact Finding

I. HISTORICAL DEVELOPMENT

1. Early History.—Modern industrial relations developed first during the late 18th century in Great Britain, where the Industrial Revolution (*q.v.*) had its earliest impact on the relations between employers and workers. Introduction of the factory system and the growth of large businesses tended to draw a sharp line

between master and workman, making close personal contact between them less frequent. The development in the mid-19th century of the limited liability system of corporate investment accentuated this separation of interests because it tended to distinguish the owners of a company's capital from its managers and its workers. Since the workers could rarely afford ownership rights, they came to regard themselves as a class distinct from employers and shareholders. The workers recognized their weakness in negotiating individually with their employers and began to form unions to strengthen their bargaining power and to protect their interests. (*See* LABOUR [TRADE] UNION.)

The poverty and exploitation against which the workers were protesting included overcrowded, filthy and unsafe workplaces; hours of work from dawn until dark; and earnings insufficient to feed a family, with the result that children frequently began work at very early ages. It was not unknown in England in the early 1800s for a child of four or five years to "earn his own bread."

Many unions were organized, but in the face of bitter employer opposition, legal restrictions and hostile courts, most had short lives. By the middle of the 19th century, unions of craftsmen in several British industries succeeded in establishing themselves permanently, first locally and then nationally. Formed partly to secure better wages and working conditions, and partly to provide sickness, unemployment and old-age benefits for their members, these unions of relatively well-paid skilled craftsmen accumulated substantial funds for such benefits. The craft unions were well administered, were generally opposed to violence and extreme demands, and were cautious in the use of the strike weapon. As a result, a shift in public opinion brought about great improvements in the legal position of unions during the years 1867–75.

Usually in their early stages of development the unions of skilled craftsmen did not admit unskilled workers to membership. This neglect and the low wages and wretched working conditions among unskilled labourers led in Great Britain to increasingly successful attempts to organize them during the last decade of the 19th century and the early years of the 20th century. In their struggle for recognition and for better conditions of work, these unions adopted more aggressive policies than the craft unions, and began to show interest in political action in the belief that their goals could be achieved by legislation as well as by collective bargaining. Similar developments occurred in other countries, though often a decade or two later than in Britain. The British trade-union movement gave support to the Labour party, with which it became organically associated, whereas in the United States and some other countries the unions kept essentially free from party attachments. The latter type preferred to use their influence as pressure groups to obtain the best results possible from the political party in power.

2. 20th Century.—By the beginning of the 20th century, three main types of organization were in existence: craft unions, industrial unions and general labour unions. This division in the movement gave rise to conflict. During World War I membership of trade unions grew rapidly and at the same time many employers' organizations were formed or increased their membership. National unions or federations of unions were formed in most European countries between 1910 and 1920, as were also industry-wide national organizations of employers, and negotiations and agreements were arranged in many industries. In Great Britain, the Trades Union congress, formed in 1868, began in the 1920s to exercise a more effective co-ordinating influence on the trade union movement, to present its views on policy to the government, and to participate in international labour matters. The Labour party won control of the government in 1924. During the same period the National Confederation of Employers' Organizations (later renamed the British Employers' confederation) was formed as the counterpart of the Trades Union congress. Similar central bodies were formed in France, Belgium, Sweden, Denmark and other countries.

In Russia, where trade unions had been suppressed as criminal conspiracies before the 1917 Revolution, a trade-union movement with a large membership was formed under government control, the industrial basis of organization being adopted. In 1933 the Nazi government in Germany suppressed the trade unions and employers' organizations, and the government became responsible for the regulation of working conditions. After the collapse of the Hitler regime, however, trade unions, employers' organizations and collective bargaining were re-established in the Federal Republic of Germany. In Italy the Fascist government brought trade unions and employers' organizations under government control in the corporative system in the 1920s; the same method was followed in several other countries, including Spain and Portugal. After the fall of Mussolini in 1943 the system was abandoned in Italy and freedom of association and collective bargaining were restored.

The close consultation established during World War II by governments in many countries with representatives of employers' organizations and trade unions was continued after the war. National advisory bodies in which these interests were represented were set up for consultation on industrial, economic and social matters. There was also a tendency for trade unions to recognize that higher standards of living depend upon increased production. There were, therefore, more discussions with management about ways of increasing the efficiency of industry while safeguarding the interests of the workers. High levels of employment in many countries during the early years after the end of World War II were associated with rising costs of living and increases in money rates of wages. Because inflation was feared by governments, employers and workers alike, efforts were voluntarily made in critical periods to restrain wage increases and to limit the payment of dividends to shareholders.

3. United States.—In many respects the evolution of industrial relations in the United States followed the forms of the earlier British experience. Industrialization and its wage system left work relationships less personal and less secure than they had been earlier; business growth and the corporate form of ownership magnified the distinctions between managers and workers; competition between business firms brought harsh work demands and wage pressures on workers, who, like their European ancestors, turned to union organization as a source of strength.

Skilled workers were the first to be affected by the impact of industrialization and were thus the first to organize unions. Like their British counterparts, these craft unions showed no interest in extending the bargaining strength of organization to unskilled workers until much later. The early American unions faced the same legal impediments, judicial hostility and employer opposition that hampered union development in England. In the attempts of workers to gain bargaining strength the same issues that have always prompted organization of workers under a wage system were at stake: How was the work of this new industrial society to be performed? How were its fruits to be shared by workers, managers and owners?

The economic forces that created modern American industrial relations, and the workers' responses to them, followed European precedents, but the institutions and policies that evolved in the United States often did not. These are unique in many respects and are best understood against the environmental backdrop that gave them their singularity.

To begin with, the American labour force was distinguished by its variety of races, nationalities and outlooks. To it belonged such heterogeneous groups as immigrants and farm-to-city migrants whose diverse backgrounds did not easily adapt to labour union organization. Abundantly stocked with rich natural resources, and with geographic space, America offered unparalleled opportunities for individual advancement, improved standards of living for workers, and excellent markets for industry. American workers, as a result, faced neither the economic barriers nor the class traditions common to workers in other parts of the world. Rapid industrial expansion and growth provided American workers with many opportunities for advancement. The American worker, therefore, had little reason to be class-conscious. The alternations of prosperity and depression that accompanied industrial growth in the United States caused an ebb and flow of proposed social panaceas and radical reform movements, but the remarkable progress of industrial productivity and the abundance

of material goods and services which U.S. capitalism produced created a basically conservative outlook that still characterized dominant sectors of organized labour in the early 1960s.

II. RELATIONS AT THE PLACE OF WORK

From management's point of view, the most pressing industrial relations task is to secure the understanding and co-operation of its employees in making the organization productive. For their part, employees are concerned primarily with the security of their employment and the equity of its terms. This is true whether the basic relationship is one of individual agreement or contract, or one of union-negotiated agreement.

In increasing numbers, employers in the 20th century have come to adopt more enlightened methods of administering their work forces. This tendency was accentuated during World War II, when the demand for efficient use of scarce manpower resources was great. Personnel departments concerned with the human problems of employment have become an established feature of most large business organizations.

1. Personnel Management.—The personnel departments of large companies often include an employment manager, a training or education officer, a welfare officer, and a company medical service with nurses and at least the part-time services of a doctor. The personnel department also works closely with staff experts in work measurement.

The major functions of the personnel department include recruiting and training new employees; handling promotions, transfers and dismissals; establishing conditions of employment and methods of wage payment; hearing grievances; consulting with employees or with union committees to improve efficiency; and administering company welfare programs. In unionized firms, personnel management must proceed within the constraints imposed by collective bargaining. This is particularly true with respect to determining methods of work and wage payment, and the handling of grievances.

Many firms seek to create a sense of comradeship by providing social clubs, sports grounds and facilities for hobbies and other forms of recreation. Some also offer sickness benefits and old-age pensions and encourage thrift by providing favourable conditions for saving. Profit sharing and copartnership were introduced voluntarily by firms in France, Belgium, Great Britain and other countries. The number of workers employed by these firms was, however, only a very small proportion of the total number of workers in the country, and the trade unions often viewed these plans with suspicion or hostility. These social, recreational and financial arrangements are generally administered by committees representing both workers and management. Committees similarly composed are also set up to foster the prevention of accidents.

2. Joint Consultation.—In small establishments where employers and workers are in frequent personal contact, grievances and suggestions can be discussed informally. Where hundreds of workers are involved, more formal means of consultation have been found valuable. These means of consultation ordinarily do not consider the matters fixed by collective agreement, but take up specific local questions such as welfare amenities, minor grievances and production problems. The shop steward or other active unionist may be the spokesman for the workers in a shop but joint consultation committees often exist alongside union organization or where unionism is weak.

Works committees may be of two main kinds: those consisting only of workers' representatives meeting alone, or those that include representatives of both workers and employers. Committees of the first kind were made compulsory by law in Germany, Austria, Czechoslovakia and other European countries shortly after the end of World War I. Councils of the second kind were set up voluntarily in Great Britain, France and other countries at many levels—the department, the plant and the industry, regionally and nationally. This occurred in Great Britain at the urging of the Whitley committee established in 1916 to make recommendations for the improvement of industrial relations.

These committees at the local level show great diversity in purpose, function, structure, methods, authority and, particularly, in the results achieved. It is usual for meetings to be held during working hours with wages paid for lost time. Among the subjects discussed are welfare, benevolent, holiday and loan funds; pension plans; sports and recreation; accident prevention; share (stock) purchase plans; and education. In some cases dismissals of individuals or, in the case of slackness of business, of numbers of individuals, are subject to review.

Methods of production, regularity of output and prevention of waste come to the attention of many committees. In some instances the committees are regularly provided with financial information concerning the enterprise. During and after World War II, particularly, many firms in Great Britain and other countries set up joint production committees to consult on ways to increase efficiency.

In addition to these committees operating in the factories, the Whitley committee urged their establishment on an industry basis, nationally and regionally, intending that they should not be primarily negotiating bodies but forums for the discussion of wider industrial issues. In practice, however, they were successful only as negotiating agencies, without compulsory powers, chiefly in construction and small industries and later in the public services.

The works council system in the Federal Republic of Germany differs not only in being compulsory but also in providing that on specified matters councils have the right of co-determination. An act passed in 1952 provided that if the employer and the works council disagree on specified issues, a mediation committee or the district labour court shall arbitrate. The act further required that one-third of the members of the supervisory board (*Aufsichtrat*) of joint-stock and limited-liability companies must be representatives elected by the workers.

The success of works councils and joint production committees depends upon a genuine belief by management and workers in their value. Apathy on both sides is a major problem in this effort toward a more democratic approach in the industrial setting. The interest, co-operation and effort required to make them a success have rarely been achieved. Despite limited results in some areas, many substantial improvements can be credited to the councils.

III. COLLECTIVE BARGAINING

Collective bargaining is negotiation between the management and representatives of workers to determine wages and other conditions of employment. In contrast with individual bargaining, union organization gives workers greater bargaining strength. The union's most powerful weapon is the strike threat. Organization also makes possible the expert presentation of demands by skilled union officials not dependent on the employers for their jobs. Further, a union can bring to bear the full financial, economic and moral support of its national or international membership to assist workers in any one firm.

Following negotiation and agreement, the parties mutually undertake to apply the provisions of the agreement. In Great Britain and many other countries collective agreements are not legally binding but depend for their application on the good will of the signatories. In other countries agreements may be registered with a government department or other authority, whereupon their terms become binding. This system operates, for example, in France and Germany; in Australia and New Zealand, collective agreements are registered with the arbitration courts and acquire the binding force of arbitration awards.

Collective agreements have effects beyond the membership of the signatory organizations because their provisions often influence the terms of employment of nonmembers. Arrangements are made in some countries for the government or an arbitration court to extend to a whole industry the provisions of agreements reached between employers' organizations and unions representing a large part of the industry. This extension of agreements is known as the "common rule" and prevents the agreements from being undermined by outsiders adopting lower labour standards. Agreements may be local, regional or national according to the range of membership of the negotiating parties. In small countries national agreements are more frequent than in larger countries with widely separated firms.

National agreements often include general matters such as length of working hours, relation of piece rates to time rates, overtime and night-shift rates of payment, general adjustments of wages, sliding scales, holidays, apprentice questions, training and employment of workers. Wage details are usually settled locally, the national organizations confining themselves to general changes and to acting as the co-ordinating and appeal authority. Wage rates fixed by national bodies are often graded according to area. The existence of different types of unions with conflicting interests adds to the complexity of collective bargaining. The craft unions, for example, seek to obtain, as far as possible, similar conditions in each industry in which their members are employed. Where several unions have members in an industry, sometimes federations of unions act as a unit for negotiating purposes.

1. Councils in Great Britain.—In addition to direct negotiations between labour and employer organizations with long-established bargaining relationships, bargaining in Great Britain takes two other forms: agreements reached by (1) joint industrial councils and (2) wages councils or statutory wages boards. The joint industrial councils are permanent labour-management bodies with permanent officials, originally established pursuant to the recommendations of the Whitley report (1917). They exist mainly in the civil service, local authority service and building industry; their functions include both the negotiation of agreements and their administration and interpretation. Although these councils have been very successful in certain industries, the hope that they would become the standard type of negotiating body throughout industry has not been fulfilled.

Wages councils exist in industries such as clothing, retail trades, baking and laundering, where workers or employers are too poorly organized to enter into and enforce agreements on their own. Nominees of the minister of labour, representing labour, employers and public, issue binding wage orders.

2. Sliding Scales.—The adjustment of wage rates to changing conditions is a central problem in collective negotiations. The determining variables include the capacity of the industry to pay, changes in the cost of living and the relation between wages in different occupations and industries; unions in one industry often demand a raise in wages because of increases in other industries. The cost of living is almost always a factor in wage negotiations; in some industries agreements provide that wages be adjusted periodically by a sliding scale based on the cost of living index. One advantage of this system is that it reduces the frequency of wage negotiations.

Another form of sliding scale adjustment of wages is that based on the selling price of the industry's product, which is a rough measure, in some cases, of its capacity to pay. For many years collective agreements in the British iron and steel industry, for example, provided for sliding scales of wages based on the selling price of rails, bars and other representative products. In coal mining, wages in some districts were adjusted by sliding scales to changes in the selling price of coal, but in the period between World Wars I and II they were varied at intervals of two or three months according to the net proceeds of the industry, taking into account the selling price of coal, the quantity sold, wages and other costs. In New Zealand the wages of sheep shearers have been adjusted by sliding scales based on the export price of wool, and in Malaya the wages of rubber plantation workers have been adjusted to changes in the price of rubber.

The enormous number of questions that arise in these negotiations is shown by the complexity and length of collective agreements. However, the prolonged association of representatives with experience, responsibility and negotiating ability on both sides increases the chance of reaching amicable settlements of the most difficult problems. This, together with the adaptability and freedom from rigidity of the system, causes collective bargaining to be recognized as the main means of regulating working conditions.

3. United States.—Although the attitude of U.S. managers toward their employees has been more aggressive than that of their British counterparts, it has also been one of willingness to innovate, to compromise, and to accommodate to the needs of the union as an organization, and to accept plant rules that assure the protection of workers' rights. In the meat-packing and west coast longshoring industries, for example, boards have been established to permit joint labour-management determination of the policies governing the transition to automated equipment.

Along with acceptance of collective bargaining has come acceptance of grievance procedures to resolve conflicts in the interpretation of collective agreements. These grievance procedures, usually involving arbitration as their final step, are common to virtually all organized firms, and have developed a set of rules of industrial jurisprudence which management can rely upon in its direction of its workers. Partly to forestall organization and partly due to labour market leverage, some nonunionized firms adopt the union-established wages, rules and conditions of work, as well as modern personnel procedures.

Issues at the bargaining table in the United States traditionally encompass union security, job security, working conditions, hours and wages. The history of employer hostility and lack of working-class solidarity made the union security provision in the contract of special importance in the United States. These closed (and union) shop clauses requiring union membership as a condition of employment (or of continued employment) became the cornerstone of most contracts. The Taft-Hartley act banned the closed shop form of agreement (although many tacit closed shop provisions continued to be mutually enforced) and the union shop gained relative to other forms. It continued to dominate in the early 1960s despite legislation prohibiting it in many (chiefly nonindustrial) states.

Job control provisions which seek to define and make more secure the worker's tenure on the job include rules controlling entrance to the trade, rate of output, transfers, layoffs, discipline and dismissal of workers, the introduction of new equipment or methods, and even in some cases a guarantee of volume of employment. With the increase in the relative importance of industrial unionism, rules governing apprenticeship (to control a skilled labour supply), exclusion of new equipment and limitation of the volume of output became less important, the rules concerned with the distribution of work according to the principle of seniority more important. Make-work rules had their greatest impact in seasonal or declining industries. Management-imposed contractual obligations continued to be concerned primarily with guarding against new or further encroachments into the domain of historical management prerogatives and functions, and particularly with maintaining discipline and efficiency on the job.

Wage objectives of unions encompassed efforts to establish systematic wage structures, to take individual wages out of competition by establishing standard rates for comparable work, and to improve real wages by seeking to negotiate ever higher money wage increases.

During the decade following World War II, collective bargaining produced two important changes. The first was the rise in the relative importance of nonwage demands, especially bargaining for health and welfare and pension plans. Wartime restrictions on money wage increases encouraged negotiation for fringe benefits to which the National War Labor board generally acceded. By 1960 the older unilateral union or management paternalisms had usually been converted into a jointly administered health and welfare plan. The second change was the attempt to rationalize the process of wage adjustments by relating them to estimates of productivity and price changes. This in turn permitted collective agreements lasting for two and three years.

U.S. experience in collective bargaining has created a great variety of patterns. Differences in a number of variables account for this: in market conditions, the security of the trade union, face-to-face relations, origins of the relationship, dominant union or management personalities, ideological views and selection of bargaining techniques (*i.e.*, differences in the surrounding environment). The scope of a bargain ranges from coverage of an entire competitive area, under a single agreement negotiated between the union and an employer association, to coverage of only a single plant of a single employer. With particular industries, key bargains are sometimes struck which then serve as a pattern for subsequent negotiations with other companies.

The trend in the United States was toward the increasing importance of multi-employer agreements, of locality-wide and company-wide bargaining, and toward greater significance for the key bargain in the more important basic mass-production industries. Association bargaining was especially important in the Pacific coast area, where about half the agreements negotiated were of the multi-employer variety. But in other areas of the country bargaining by employer association remained relatively unimportant.

4. Employers' Organizations.—Employers' organizations were formed to ensure greater strength in dealing with claims by the unions and especially to deny to unions the opportunity of using "whipsaw" tactics by which demands and pressure are exerted successively on individual employers. The formation of employers' organizations and the development of collective bargaining between them and the unions proved more widespread in Great Britain, the countries of western Europe and in Australia and New Zealand than in the United States, where working conditions were more often determined by agreements between unions and individual companies. In Great Britain recognition of trade unions by individual employers and employers' organizations was almost universal at mid-20th century. *See* TRADE ORGANIZATION.

IV. STATE INTERVENTION

State intervention varies according to each nation's political doctrine, traditions and economic and social conditions. In the Soviet Union and other communist countries the centralized political, economic and social controls involve government intervention in all aspects of industrial relations. Less complete but still widespread is the regulation of industrial relations by the governments of countries with fascist tendencies. The policy in many other countries is for governments to leave employers, workers and their organizations free to regulate their own relations, and to intervene only when they fail to do this satisfactorily. This policy is applied in varying degree in the United States, Great Britain, countries of western Europe, Canada, India, Pakistan, Australia and New Zealand, among others. In most of these countries intervention was slight throughout the 19th century, but it increased substantially during the 20th century.

Intervention or participation by the state is undertaken for many purposes: to promote the health, safety and welfare of workers; to define the legal relations between employers and workers and the legal status and functions of employers' organizations and labour unions; to facilitate the settlement of disputes; and to provide minimum standards of wages and working conditions where the parties do not do so themselves. In addition, the state takes a direct part in industrial relations as an employer, both in the traditional public services and in nationalized industries. In many countries the state also maintains consultative relations with employers' organizations and labour unions on questions of economic, industrial and social policy which affect their interests.

1. Conciliation and Arbitration.—In every country conciliation and arbitration are undertaken by the state, though with many variations among countries. The main differences are between voluntary and compulsory systems. Compulsory arbitration is limited in some countries to public utilities and other industries in which stoppages would seriously affect the public interest. In the United States, for example, a few states have enacted laws making it obligatory for the parties to arbitrate controversies that threaten to shut down public service industries. A further distinction is between systems of compulsory arbitration with awards binding on the parties and with prohibition of strikes and lockouts, and those under which the parties are free to reject awards and can engage in a strike or lockout after the end of the arbitration without incurring legal penalties. Conciliation is usually compulsory in countries that have compulsory arbitration, notably in Germany, Sweden, Australia, New Zealand, and in Venezuela and some other countries of Latin America. In Australia the parties in disputes must make full use of the processes of conciliation before compulsory arbitration is applied.

The rules of many unions provide that a strike shall not be called unless a ballot of members shows a two-thirds or three-fourths majority in favour. Many collective agreements provide that, if negotiations fail, the differences shall be referred to conciliation boards or in the last resort to arbitration machinery set up by the parties or to state arbitration tribunals. Agreements usually require that there shall be no stoppage of work during these proceedings.

If conciliation fails, the dispute may be arbitrated either by a single arbitrator or by a tribunal. Although arbitration has been highly successful in many countries, it entails practical difficulties. One is to satisfy the parties in dispute that the tribunals are impartial, a difficulty which is greatest in small, especially underdeveloped, industries where members of tribunals are often accused of having a bias. If awards are binding there is the difficulty of enforcing them by penalties where large numbers of workers are involved. Moreover, the fact that either side can force the other to arbitration tends to make direct negotiations and conciliation procedures less effective.

British policy is based on acceptance of the principle of regulation of working conditions by collective agreements and of minimum government intervention. The government does not refer a dispute to arbitration unless agreed arrangements within the industry for the settlement of disputes have been fully used.

Compulsory arbitration, with binding awards and with strikes and lockouts illegal, was applied during both World Wars I and II in Great Britain and in many other countries. After World War II, with the agreement of the British Employers' confederation and the Trades Union congress, this system was continued in Great Britain during the early years of postwar reconstruction, but in 1951 the general council of the Trades Union congress asked for modifications, particularly for removal of the provision making strikes illegal. The principle of compulsory arbitration was retained, and awards of the Industrial Disputes tribunal, which succeeded the National Arbitration tribunal, remained binding but strikes and lockouts ceased to be illegal.

2. Regulation of Wages.—As noted above, one of the main purposes of state intervention in wage regulation is to fix minimum rates in industries in which organization among workers and employers is inadequate for regulating wages by collective agreements and where in consequence some wages are unduly low. In France, Germany, Norway and other European countries the earliest intervention was limited to home workers, while in Ontario and other provinces in Canada it was restricted to women and young persons.

The establishment of a wage board or council for each industry or a central wage commission covering a group of industries is the most widely adopted method for fixing minimum rates enforceable by law. In Great Britain, trade boards were set up in a number of separate branches of industry. They recommend minimum rates for the various grades of workers in more than 50 branches of industry employing nearly 2,000,000 workers; these rates are applied by orders of the minister of labour and national service. Each council consists of three impartial members together with representatives of employers and workers in the industry. A similar system applies to British agriculture, the road haulage industry and the catering trades.

In countries where a central wage commission is used it consists of three or five impartial members together with members representing equally the interests of employers and of workers. The commission is often assisted by a committee for each of the industries in which wages are fixed, with one or more impartial representatives from the industry. In some countries, such as France, for example, minimum rates of general application are announced periodically by the government; in Australia and New Zealand the arbitration courts, in addition to dealing with disputes, periodically fix basic wages that apply to all industries; in the United States minimum wages are set by the state and federal governments. Wages fixed by statutory bodies are enforceable by law, and fines and other penalties can be imposed for failure to observe them. Statutory rates also apply to all firms and workers in a defined industry, whereas rates fixed by collective agreements apply only to those firms that are parties to the agreements. (*See* also WAGES.)

3. United States.—The history of public policy in U.S. industrial relations has been described in terms of five general periods:

open suppression, reluctant tolerance, judicial prejudice, social and legal recognition, and social and legal responsibility. Until the *Commonwealth* v. *Hunt* decision in Massachusetts in 1842, judicial common-law doctrine held that combinations of trade unionists to gain wage increases were illegal conspiracies, although, as noted previously, they did exist. Between 1842 and the 1930s collective bargaining was given minimum legal recognition. The ability and occasional willingness of the courts to vitiate unionism's means of self-help (organization, the strike, picketing, the boycott) by declaring either the ends sought or the means used to be illegal, coupled with the use of the injunction, damage suits, criminal prosecutions, obstructive presidential intervention, and interpretation of the Sherman act as covering labour unions, stood as obstacles in the path of growth. But in 1930 the supreme court sustained the constitutionality of the Railway Labor act of 1926 which enumerated a series of unfair practices as interfering with bona fide collective bargaining and established dispute-settlement machinery in the railroad industry, and this, along with the passage of the Norris-LaGuardia anti-injunction act by congress in 1932, presaged a reversal of earlier policy.

The National Industrial Recovery act in 1933 (invalidated by the U.S. supreme court in 1935) and the National Labor Relations (Wagner) act in 1935 (sustained by the supreme court in 1937) were turning points in U.S. industrial relations history. The Wagner act established, as a matter of national policy, that strong independent trade unions were desirable; that workers ". . . shall have the right of self-organization, to form . . . join, or assist labor organizations, to bargain collectively through representatives of their own choosing"; and that under threat of unfair labour practice charges, employers should not concern themselves with the union activities of their employees. Accompanying these legislative props to a hitherto weak trade unionism, the Social Security act of 1935 and the Fair Labor Standards act of 1938 improved and extended social security and protective minimum wage and hour legislation. This was the high-water mark in government recognition of and assistance to organized labour in the United States. It signaled the shift to the federal government of concern with the conduct of labour-management relations in industries in "interstate commerce," a boundary most broadly interpreted.

The Labor Management Relations (Taft-Hartley) act of 1947 marked a new trend toward more direct government intervention to assure trade-union responsibility. Deriving in part from the efforts of those who had opposed the philosophy of the Wagner act and from public concern over the wave of strikes which resulted in 113,000,000 man-days lost due to work stoppages in 1946, the Taft-Hartley act sought, by a variety of controls, once again to "redress" the balance of power among the labour movement, the individual employee, the employer and the government. Among other provisions, it established six practices as "unfair" for unions. These included: (1) coercion of employees; (2) demands for the closed shop; (3) refusal to bargain; (4) illegal strikes and boycotts; (5) excessive initiation fees; and (6) featherbedding.

Concern in the late 1950s with union corruption and possible abuse of rights of union members prompted the U.S. senate to establish a select committee to investigate these matters. After two years of hearings, marked by both sensation and trivia, congress enacted the Landrum-Griffin act, which extended the Taft-Hartley act's controls in picketing and boycotts, and extensively regulated internal union financial and political procedures.

V. ARBITRATION OF RIGHTS AND INTERESTS

Labour arbitration deals with two distinct classes of disputes. It may deal with disputes over grievances that arise from the interpretation of the collective agreement, or it may deal with differences that arise when new agreements or proposed changes in existing agreements are being negotiated. The first kind of arbitration adjudicates the rights of employees, managements and unions established by the agreements. The second settles controversies about interests, so-called because it deals with proposed new terms of employment when the parties are free to pursue their respective interests. This form of arbitration is, in effect, legislation rather than judicial determination, for the decisions fix rates of pay, rules and working conditions to be embodied in agreements on the basis of which future disputes about rights may be adjudicated.

Although collective bargaining is the prevailing method for establishing wages in Great Britain, it has certain marked contrasts with the U.S. experience. One important difference is the use in Great Britain of arbitration to resolve differences over interests. Another stems from the more frequent resort in Britain to compulsory arbitration, and, more importantly, from government intervention in the wage-setting process. This intervention occurs because, in relation to the total labour force, the British government is a larger employer than is the U.S. government, and because intervention is practised through the use of wage councils.

1. Arbitration of Rights.—This is the most frequent and successful form of labour arbitration. It did not develop on a considerable scale in any country until the last quarter of the 19th century when skilled craftsmen succeeded in establishing more or less permanent organizations. As these unions forced employers to negotiate collective agreements, the practice developed of including a provision for a joint standing committee, equally representative of employees and the employer, to adjust differences of the agreements. If the representatives were unable to settle a dispute they were authorized to select a neutral or impartial person to sit as a member of the committee so that a decision could be made by majority vote.

In the early years of the 20th century, this form of arbitration spread. In the United States, the Railway Labor act, as amended, required railroad managements to bargain collectively and to "exert every effort" to make and maintain working agreements with unions representing their employees, and by providing for compulsory arbitration of employee grievances. In 1935 congress adopted the National Labor Relations act, which placed an obligation to bargain collectively on employers in industries engaged in interstate commerce. Thereafter, voluntary arbitration became the normal method of settling disputes about grievances or rights under agreements in most U.S. industries.

Arbitration became popular because it was fast, inexpensive and helpful to the parties in working out acceptable rules. It largely eliminates work stoppages arising from differences about interpretation or observance of agreements; such arbitration has become so common that decisions are regularly published like reports of court cases.

Before arbitration can be undertaken, the parties must agree on an umpire. To avoid an impasse on this question most collective agreements provide for an outside agency to select an arbitrator if the parties cannot agree. The continuity and consistent application of precedent afforded by the permanent umpire method made it the preferred system in large industries.

2. Arbitration of Interests.—Arbitration of disputes about new terms and changes in agreements has grown much more slowly. It is a characteristic of this form of arbitration that the stronger party is usually inclined to oppose and the weaker to favour it. But even as their strength approaches equality, both parties are seldom willing to accept arbitration as a lesser evil than a strike.

Little arbitration of interests occurred in the 19th century when trade unions were weak and employers generally had the upper hand. But by the early years of the 20th century, when some unions with ample treasuries were able to match their strength with employers in protracted strikes, many arbitrations were arranged as a means of settlement and also to forestall work stoppages, especially in the printing and building trades, on the railroads, and in the anthracite coal industry. In the United States the International Typographical union made an agreement with the American Newspaper Publishers association in 1901 to arbitrate future disputes for five years, and it was renewed several times. About the same time the International Printing Pressmen's and Assistants' Union of North America entered into a similar agreement which, renewed from time to time, was still functioning in the early 1960s. During World War I the U.S. government established a National War Labor board to arbitrate disputes affecting war industries in return for a "no strike–no lockout" agreement entered into by representatives of the American Federation of Labor (A.F.L.)

and national associations of employers.

The impetus to arbitration of "interest" disputes which these developments provided lasted through most of the 1920s but was stopped by the depression that began in 1929. It was revived and greatly extended during World War II by another National War Labor board that arbitrated disputes in war industries pursuant to a no-strike pledge. A similar board was established during the Korean War.

3. Extension of the Arbitration Principle.—The success of arbitration led to its extension in the United States to disputes over union jurisdiction and internal union problems. The Taft-Hartley act, by prohibiting jurisdictional disputes, spurred the A.F.L. building trades department to establish with the Associated General Contractors of America, the National Joint Board for the Settlement of Jurisdictional Disputes. The board through its local tribunals has used mediation, and has successfully reserved its own powers as a court of last resort. To assure that its members' rights were not violated by union government, the United Automobile Workers, following the earlier lead of the smaller Upholsterers' union, established an independent board of prominent citizens to hear and determine grievances against the union.

4. Emergency Boards and Fact Finding.—The method by which a government board hears the parties to a dispute, determines its merits and recommends an equitable settlement has much in common with the arbitration process. It is variously known as fact-finding, investigation or emergency proceedings by boards of inquiry or emergency boards. But since it does not involve a binding decision, it is not arbitration.

The emergency disputes provision of the Taft-Hartley act of 1947 provided for the appointment of presidential fact-finding boards. But it did not empower the boards to make recommendations. Thus, unlike the experience with emergency boards under the Railway Labor act, where the majority of strikes are prevented by the parties' accepting the emergency board's recommendations, the Taft-Hartley act boards have had little influence. The 116-day steel strike of 1959 brought this limitation of Taft-Hartley boards to the critical attention of a public anxious to have an impartial standard against which to judge the parties' position in the impasse. Amendments to permit such recommendations were proposed. This strike, and the prolonged New York newspaper strike in 1963, caused renewed interest in compulsory arbitration, but it was not extended beyond its limited use in the public service industries of a few states until later that year when the threat of a nationwide railway strike led congress to create a rail arbitration board with power to decide the issues of elimination of firemen's jobs and reduction in the number of men on train crews.

See also references under "Industrial Relations" in the Index.

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(J. H. RN.; E. F. CH.)

INDUSTRIAL RESEARCH: *see* RESEARCH, INDUSTRIAL.

INDUSTRIAL REVOLUTION. In the popular sense, this term is generally regarded as being synonymous with the development of improved spinning and weaving machines, James Watt's steam engine, the railway locomotive and the factory system. But these are merely the best known of a long series of fundamental technological, economic, social and cultural changes which, taken together, constitute the Industrial Revolution. By removing large numbers of men and women from the agricultural pursuits that had formed mankind's main occupation since the beginnings of civilization, and by introducing them to novel ways of working and living, the Industrial Revolution transformed society. It thus became one of the chief determinants of the modern western way of life.

Although used earlier by French writers, the term Industrial Revolution was first popularized by the English economic historian Arnold Toynbee (1852–83) to describe England's economic development from 1760 to 1840. Since Toynbee's time the term has been more broadly applied. But historians are well aware of the fact that neither the beginning nor the end of such deep-seated transformations is capable of sharp definition; the Industrial Revolution must be regarded more as a process than as a period of time. This explains why the Industrial Revolution can take place in different places at different times, why some areas, such as China and India, did not begin their industrialization until the 20th century, and why others such as the United States and western Europe have gone on to "second" industrial revolutions.

The tendency to treat the Industrial Revolution as a definite historical period has led some scholars to doubt the validity of the whole concept. They have pointed out that many elements entering into the Industrial Revolution reached far back into medieval times, and they have denied that it was unique or revolutionary in character. Indeed, if one thinks of the term revolution as implying a quick and sudden overthrow of the old order, then the Industrial Revolution was not so much revolutionary as evolutionary. Nevertheless, the process of industrialization so thoroughly transformed society that it may properly be described as a revolution. Furthermore, while some elements of the Industrial Revolution appeared long before 1760, only in the closing decades of the 18th century did these and other factors come together to produce climactic changes. If there was not the convenient term Industrial Revolution to describe the conjuncture of these technological and sociocultural phenomena, there would have to be some other phrase to describe the process by which an agrarian society was transformed into a modern industrial society.

Main Features.—As indicated above, the changes involved in the Industrial Revolution were both technological and socio-economic-cultural. The technological changes included the following: (1) the use of new basic materials, chiefly iron and steel; (2) new energy sources, including both fuels and motive power, such as coal, the steam engine, electricity, petroleum and the internal-combustion engine; (3) the invention of new machines such as the spinning jenny and the power loom that permitted increased production with a smaller expenditure of human energy; (4) a new organization of work known as the factory system, which entailed increased division of labour and specialization of function; (5) important developments in transportation and communication, including the steam locomotive, steamship, automobile, airplane, telegraph and radio; and (6) the increasing application of science to industry. These technological changes made possible a tremendously increased use of natural resources and the mass production of manufactured goods.

There were also many new developments in nonindustrial spheres, including the following: (1) agricultural improvements

that made possible the provision of food for a larger nonagricultural population; (2) economic changes that resulted in a wider distribution of wealth, the decline of land as a source of wealth in the face of rising industrial production and increased international trade; (3) political changes reflecting the shift in economic power, as well as new state policies corresponding to the needs of an industrialized society; (4) sweeping social changes, including the growth of cities, the development of working-class movements and the emergence of new patterns of authority; and (5) cultural transformations of a broad order. The worker acquired new and distinctive skills, and his relation to his task shifted; instead of being a craftsman working with hand tools, he became a machine operator, subject to factory discipline. Finally, there was a psychological change: man's confidence in his ability to use resources and to master nature was heightened.

France and Great Britain Compared.—France in the 18th century, despite calamitous wars, the loss of its overseas colonies and the approach of royal bankruptcy, was still the wealthiest and most powerful nation in Europe. But the Industrial Revolution occurred first in Great Britain, for certain prerequisites of industrialization were better fulfilled there than in France, although both these countries—and Belgium, whose small size prevented it from becoming the leading industrial power—met these prerequisites better than any other European states. A brief comparison of France and Great Britain in respect to these factors sheds light on the nature and course of the Industrial Revolution.

1. Capital investment in mechanical devices provides the basis for technological change, but for this purpose the capital must be mobile; *i.e.*, available for industrial investment. While France had much capital, it was diverted to unproductive uses—forced loans to the state, upkeep of a wasteful court and bureaucracy, and war expenditures—and was dissipated by governmental bankruptcy. Great Britain's capital was rapidly increasing through agricultural improvements and commercial expansion, and the British monetary system was far sounder than that of France. Lowering of the British interest rate in the first half of the 18th century made cheap capital available for industrial investment.

2. Mobility and adaptability in the labour supply are also essential for industrial development, and in these respects Britain surpassed France. Serfdom and the guild system had almost disappeared in Britain by the beginning of the 18th century but were not completely destroyed in France until the French Revolution.

3. Markets are also necessary for industrial growth. A large demand stimulates technological improvement, and mass production must have a large market to consume its finished goods. Given the mercantilistic practices of the 18th century, which entailed strict limitations on imports, both Great Britain and France had their home markets at their command. The population of France was larger than that of Britain but France lost most of its colonies in the 18th century. Britain meanwhile monopolized the trade with its growing colonies; and, though it lost its 13 American colonies, Britain was able during the 1790s to extend its empire and its carrying trade. Thus British markets were expanding at a greater rate after 1763 than were the French. Britain's advantage was further increased because the French specialized in expensive, handmade articles while the British made coarse goods capable of being produced by machines and sold to a mass market at low prices.

4. The British outstripped the French with a great merchant marine for overseas trade and an extensive canal and road system for inland transportation. James Brindley's pioneer efforts ushered in a canal-building era that gave England a network twice as large as that of France by 1800. Similarly, road building in 18th-century England flourished with the new methods of the great Scottish roadbuilders Thomas Telford and John McAdam.

5. Business opportunities were slightly greater for the British entrepreneur than for his French counterpart, for the English political system and scale of social values were more propitious for industrial and commercial activities. While the Bourbon monarchy constantly frustrated the French trading classes, the British parliament, controlled by commercial magnates and landed aristocrats since the English revolution of 1688, was consistently devoted to the expansion of commerce and the prosperity of agriculture.

6. Both France and Britain possessed raw materials and other natural resources, but the British resources were more readily available than the French. Most important was coal, for the production of every ton of iron required from seven to ten tons of coal. It was Britain's good fortune to have this coal located near seaports, making the shipment of ore to coal an inexpensive process. Since the crucial early stage of the Industrial Revolution coincided with the French Revolution, Britain's naval supremacy allowed it to maintain a free flow of raw materials, especially cotton, and to cut France off from colonial products.

7. New inventions and new techniques of manufacturing were an inherent part of the Industrial Revolution, and neither Britain nor France had a monopoly of inventive genius. The names of J. M. Jacquard and Jacques de Vaucanson (1709–82), both of whom contributed to the improvement of weaving machinery, testify to French mechanical ingenuity. But the factors mentioned above combined to give greater opportunity for English mechanical genius, which explains why most of the early inventors were British.

Textile Industry.—The textile industry was the first to undergo industrialization. England's moist climate, which prevented cotton threads from becoming brittle and breaking, made easier the application of machinery to the spinning and weaving processes in Lancashire, but other factors probably account for the fact that textiles took the lead in industrialization. For one thing, faster and cheaper methods of production were necessary to meet the growing demand for textiles, especially the cottons and calicos that had been introduced from India. In addition, techniques for making cloth had already reached a high point of development; only minor changes were necessary to convert the processes from manual operations to semiautomatic or automatic operations propelled by mechanical power. Finally, a large number of persons were engaged in spinning and weaving as a part-time home task under the domestic or "putting-out" system. Under this system, entrepreneurs "put-out" the raw materials to farm workers, who usually included the women and children of the household, and paid them at piece rates. The problems connected with the spinning and weaving processes, already specialized and carried on in separate households, stirred the imagination of many inventors, and the piece-rate payments stimulated thought about techniques for increasing the rate of production. (*See* also WEAVING: *Weaving Machinery.*)

The rapidity with which changes were introduced in the textile industry illustrates the role of one invention in producing another in a related field. The first of the great inventions was John Kay's flying shuttle (1733), a mechanical device for throwing the weaving shuttle more quickly than could be done by hand. Kay's device upset the usual ratio of four spinners to one weaver: either there had to be many more spinners or else spinning had to be similarly quickened by application of machinery. James Hargreaves developed (1764–69) the spinning jenny, which mechanically reproduced the actions of the hand spinner, while Richard Arkwright in 1769 patented the water frame, which produced a strong, well-twisted yarn suited for the warp of cotton goods and so named because it used water power. Samuel Crompton's "mule" (1779), a cross between the water frame and the jenny, marked the next improvement in spinning devices. In the meantime the Rev. Edmund Cartwright set about mechanizing the weaving operation to take advantage of the then abundant yarn produced by Arkwright's and Crompton's machines. The result was the power loom (1785), a major step in applying mechanical power to weaving. Increased production of finished cotton goods in turn created a growing demand for raw cotton, but the supply lagged because of the labour involved in picking the seeds from the cotton bolls. In the United States Eli Whitney solved the problem with his cotton gin (1793), which more than trebled the amount of cotton that a man could pick free of seeds per day and which caused the cotton crop to increase from 1,500,000 lb. in 1790 to 85,000,000 lb. in 1810. The cotton gin also stimulated the extension of the plantation system and Negro slavery in the south; it

was indirectly responsible for producing the regional differences that eventually contributed to bringing on the American Civil War. Meanwhile Samuel Slater and others introduced British machinery into the United States. (*See* also COTTON MANUFACTURE: *Economic Development of the Cotton Industry.*)

In addition to leading in mechanical innovations, the textile industry was also the first to develop the new organization of production: the factory system. This was not the first time that workers had been concentrated under one roof under the close control of their employers; the royal manufactories in France, such as the Gobelin works, had come into existence almost a century before, and there had been factories in the woolen industry in 16th-century England, as well as other isolated examples as far back as some pottery works in ancient Athens. But the factory as the characteristic form for the organization of work grew out of the textile industry at the end of the 18th century. The factory gathered workers together and submitted them to the discipline of the machine; within the factory there was division of labour, the workers performing specialized tasks. Power-driven machinery in the factory resulted in the production of goods in quantities greater than were demanded by the immediate local market, or even the national market, and made world-wide commerce necessary. British raw cotton imports provided an index of the rapid advance in production: these imports quadrupled from 1765 to 1785, almost quadrupled again from 1785 to 1805, tripled during the succeeding two decades, more than tripled in the years between 1825 and 1845, and doubled again in the next 20 years.

Watt's Steam Engine.—By 1800 the chief inventions in the textile industry had been devised and the factory system established, with motive power being supplied chiefly by water. Although the steam engine is sometimes mistakenly credited with "causing" the Industrial Revolution, the industrial transformation had already begun before the steam engine came into widespread use. Water mills actually surpassed steam engines in aggregate power generated during the entire first century of the Industrial Revolution. Thus the Industrial Revolution might have taken place without James Watt. This is not to minimize Watt's role, for his steam engine hastened the revolution and helped establish the industrial pattern of the future, but it did not create it.

James Watt arrived on the scene when the mining and metallurgical industries were rapidly expanding and when there was need for a machine of greater efficiency than those currently used to pump water from the mines. Had his invention come earlier the techniques and machines to produce the metal shapes basic to his engine would not yet have existed; there might not have been sufficient capital available to manufacture it on a commercial scale; and there probably would have been little demand for it. However, the need for Watt's invention and the opportunity for its adoption were provided by a series of prior and contemporaneous developments. The shortage of wood, necessitating a substitute fuel for charcoal in smelting; had given rise to successful attempts by Abraham Darby and his son early in the 1700s to reduce coal into coke by burning off the coal gas in an oven. Henry Cort's invention (1784) of "puddling" (stirring molten pig iron in a reverberatory furnace to burn off impurities) and of a rolling mill with grooved rollers (1783) simplified and cheapened the production of wrought iron. The boring mill developed in 1775 by John Wilkinson made it possible to bore cylinders to the fine limits of accuracy required by Watt's engine. Equally important was a reservoir of knowledge and experience in working with the power of steam for pumping purposes: Edward Somerset's "atmospheric engine" (*c.* 1663); Thomas Savery's first practical steam pump (1698), which raised water through the combination of a vacuum created by the condensation of steam and through steam pressure itself; Denis Papin's demonstration (1690) of the principle that steam could move a piston in a cylinder; the atmospheric engine of Thomas Newcomen, who first (1712) established the steam engine as a practical and reliable machine; and John Smeaton's application of engineering principles to raise the efficiency of the atmospheric steam engine about as high as could be done with that type of engine. By the middle of the 18th century Newcomen's "fire-engine," as it was then called, was widely used to pump water out of the Cornish tin mines. While engaged in repairing a model of the Newcomen engine at the University of Glasgow in 1764–65 Watt came upon his great idea. He took out his first patent in 1769. Watt's engine might never have come into wide use had it not been for Matthew Boulton, a Birmingham industrialist, who provided capital and commercial acumen. By 1786 the firm of Boulton and Watt was prospering and by 1800 more than 500 of their engines had been built and set up both in England and abroad. For the first time mechanical power was independent of the movement of the wind or the location of water; it could be used wherever needed. The steam engine was eventually to become the symbol of the Industrial Revolution. (*See* also STEAM: *Steam Engine.*)

Steam Railways and Steamships.—Manufacturers producing goods in large quantities needed faster and more economical means of transporting raw materials to their factories and sending their products to market. Canals and roads were improved and expanded, but the most significant transportation development of the Industrial Revolution was steam locomotion. Parallel rails of a given gauge, suitably laid on a prepared roadbed, had been introduced in England in the closing years of the 16th century, so there were already "railways" long before Richard Trevithick's high-pressure engine made possible the commercial steam railway and George Stephenson demonstrated the speed and efficiency of steam locomotion. The Stockton and Darlington railway (1825), designed to carry coal from the mines to waterways, proved immediately successful, and within a few years England was covered with a railroad network. Other countries in western Europe and in the western hemisphere also began to build railways. (*See* also RAILWAY.) At the same time, steam was also being applied to water transportation. In 1807 Robert Fulton's steamboat appeared on the Hudson river and was commercially successful, but many years passed before the steamship replaced the sailing ship.

Later Trends.—Britain's leadership in the Industrial Revolution was brilliantly displayed in 1851 at the Great exhibition in London, which focused the attention of the world on British scientific and technological progress. The second half of the 19th century marked a new phase of industrialization, evidenced among other things by the growing specialization of production, the beginnings of the direct application of science to industry, and the further development of mass-production techniques. Old industries expanded, new industries were founded, and machinery was applied to agriculture. At the same time new forms of business organization arose to meet new industrial needs, and the Industrial Revolution spread to countries hitherto unaffected. These elements continued to characterize industrialization during the 20th century, so that some historians view developments since 1760 as a continuous revolution, while others find second or even third Industrial Revolutions occurring in the latter part of the 19th and during the 20th centuries.

As invention proceeded and as industrial machinery became more complex there was need for greater technical knowledge. Most of the early inventors had been tinkerers, but the demands of industry soon gave rise to a new and important professional group known as engineers. As industrial change continued, specialization arose among engineers; mechanical engineers, mining engineers and other varieties began to appear to meet the more intricate needs of an industrial age.

Education in science and technology assumed added importance with the increasing dependence of technological advance on scientific achievements. Here Germany took the lead, building up a great chemical industry on the basis of discoveries in university and industrial laboratories. By the 20th century discoveries in theoretical science were applied so rapidly by industry that the distinction between fundamental, or pure science and applied science tended to disappear.

One of the technological triumphs during this later period of the Industrial Revolution was the perfection and increased use of precision tools. Earlier, John Wilkinson's boring mill (1774) had permitted the boring of accurate cylinders essential for the success of the steam engine. Henry Maudslay's slide-rest (1797), working on an all-metal lathe, facilitated the accurate cutting of

metals and made the screw-making machine possible. Constant improvement in the basic machine tools allowed for continually greater precision, which led to the manufacture of interchangeable parts, an essential feature of mass production.

Most frequently credited with the introduction of mass production is Eli Whitney, best known for his invention of the cotton gin but also noteworthy for his manufacture of firearms. Although he was not solely responsible for the development of interchangeable parts, Whitney's assembling of muskets at his factory in New Haven, Conn., foreshadowed the mass-production techniques that later brought industrial pre-eminence to the United States, and that came to be known in Britain as the "American system."

The period after 1830 brought a tremendous expansion of other industries. The production of coal and iron, for example, was stimulated by increased use of steel through the development of new steel-making methods: the Bessemer process (1856), which burned off carbon and other impurities in the molten pig iron by a powerful blast of air; the Siemens-Martin process (1866), whereby a mixture of gas and air burned off the carbon in a shallow "open hearth"; and the Thomas-Gilchrist method (1878) for smelting iron ores with a high phosphorus content in a furnace lined with magnesium limestone, which absorbed the phosphorus. (*See* IRON AND STEEL INDUSTRY.) In addition, the textile industry further expanded; the manufacture of linens and silks was mechanized and the needle trades were revolutionized by the invention of the sewing machine and the knitting machine (1863). Railway systems of most western European states were extended to all major cities and in the United States the east and west coasts were linked by rail. Steamboats were also further developed, and the day of the sailing ship was almost over.

Some older industries were mechanized for the first time in the second half of the 19th century and developed large-scale operations. Among these was the manufacture of shoes, formerly done completely by hand but now made automatic by the invention of a number of remarkable machines. Flour milling and brewing were similarly mechanized. Completely new industries were born: electrical, photographic, food canning, gas lighting, rubber and petroleum.

Changes in agriculture were an integral part of the Industrial Revolution. Agricultural production had been increased by the use of fertilizers and the rotation of crops, by more careful and scientific cultivation of fields, and by an improvement in the quality of livestock through selective breeding. A tendency toward larger holdings which could be farmed more profitably was evident in Great Britain and in the Americas and Australia. More spectacular was the application of machinery to farming processes, and there the United States took the lead, the steel-blade plowshare and the reaper being invented there in the 1830s. Farming also developed a division of labour, certain areas concentrating on specific products, such as the Danish specialization in dairy products. Farmers concentrated on growing cash crops for an unknown or distant market rather than for their own consumption.

The Industrial Revolution also brought transformations in the capitalistic economy. Capitalism had originated long before the Industrial Revolution, and investment capital had been one of the prerequisites for industrialization. Despite the important role played by capitalism in the Industrial Revolution it would be wrong to equate the two: there have been forms of capitalism at other times without any industrial change, and the U.S.S.R. and China were to undergo Industrial Revolutions in the 20th century under an avowedly anticapitalist system.

The Industrial Revolution changed the chief source of capital accumulation from land, commerce and banking to industrial production, and also changed the area and forms of capital investment. Industry had long outgrown the domestic stage, for power-driven machinery was too cumbersome, too complicated and too expensive to be owned by peasants and artisans and operated by them in their own homes without superintendents. It soon outgrew the small, one-owner factory as the need increased for capital investment in more complex machinery and more far-reaching enterprises. Because these enterprises required more capital than any one man possessed, ownership passed from individuals or partnerships to joint stock companies, or corporations. The growth of corporations was further stimulated by the legalization of the principle of limited liability through legislation passed in England and France during the 1850s and 1860s. Extension of corporative ownership meant that wealth was no longer invested primarily in land but in industrial securities.

Corporate ownership also changed the relationship between owners and employees. Early industrial capitalists were likely to know personally all the employees of their small factories. But when the enterprise became a large corporation with many absentee owners there was little direct contact between owners and employees. The owners were usually represented by a managerial group that did not necessarily own a share of the business. This managerial function assumed increased importance in industrial enterprise in the 20th century. At the same time, the "depersonalization" of the industrial enterprise made the workers feel alienated from the owners and contributed to their grievances.

Commerce and banking were also enlarged by the Industrial Revolution and became truly world-wide in scope. To keep the factories running smoothly and steadily there had to be a regular flow of raw material as well as permanent channels for the sale of merchandise to the consumer. In addition, consumer demand grew because of the greater specialization of production. Formerly the rural toiler had produced most of what he consumed; now the factory worker was forced to buy nearly everything he needed. Commerce was further stimulated by the fact that increasing population meant that there were more consumers. The task of supplying the growing population with the elementary needs of food, clothing and shelter provided a stimulus both to industrialization and to agricultural production. Not only were there more people, but the European peoples in some places improved their standards of living, demanding more in the way of products. The expanded needs of trade and industry also led to the growth of banking enterprises for accumulating capital and savings, for transferring funds and for providing manifold exchange activities.

In addition to its effect on the economy, the Industrial Revolution contributed to the efforts of liberal theorists to liberate man from political institutions and legal restrictions that hampered his freedom. Adam Smith in his *Wealth of Nations* (1776) had sounded the call for economic freedom. Industrial growth demanded the removal of customs barriers inherited from the preceding mercantilistic age. Competition was regarded as the life of trade, and no restrictions were to be placed upon it except in the case of the worst abuses. In Great Britain the concepts of *laissez faire* became public policy when the Liberal party achieved political power in 1830 and governed in the interests of the business classes, with but few interruptions, for the remainder of the 19th century. Bourgeois liberalism also became an important political movement in some of the other countries that followed in the wake of Britain in the Industrial Revolution. The liberal tendency was reversed when international economic competition ushered in a wave of neomercantilism near the close of the 19th century and when working class pressures, manifested through trade unions and socialist movements, forced the state to intervene in business and curb the unrestricted exploitation of the workers.

In the period 1760 to 1830 the Industrial Revolution had been largely confined to Britain. Aware of their head start, the British forbade the export of machinery, skilled workers, and manufacturing techniques. The British monopoly could not last forever, especially since some Britons saw profitable industrial opportunities abroad, while continental businessmen sought to lure British "know-how" to their countries. Two Englishmen, William and John Cockerill, brought the Industrial Revolution to Belgium by developing machine shops at Liège (*c.* 1807), and Belgium became the first country on the continent to be transformed economically. Like its English progenitor, the Belgian Industrial Revolution centred in iron, coal and textiles.

France was more slowly and less thoroughly industrialized than either Britain or Belgium. While Britain was establishing its industrial leadership France was immersed in its Revolution, and the uncertain political situation discouraged large investments in industrial innovations. By 1848 France had become an industrial

power, but, despite great growth under the second empire, it remained behind England. In order to protect their infant industries from British competitors, French industrialists obtained government aid, usually in the form of high tariffs.

Other European countries lagged far behind. Their *bourgeoisie*, the class primarily responsible for the growth of industrialism, lacked the wealth, power and opportunities of their British, French and Belgian counterparts. Political conditions in the other nations also hindered industrial expansion. Germany, for example, despite vast resources of coal and iron, did not begin its industrial expansion until after national unity was achieved in 1870. Once begun, Germany's industrial production grew so rapidly that by the turn of the century that nation was outproducing Britain in steel and had become the world leader in the chemical industries. The eastern European countries were behind. It was not until the five-year plans that the Soviet Union became a major industrial power, telescoping into a few decades the industrialization that had taken a century and a half in Britain. The mid-20th century witnessed the spread of the Industrial Revolution into hitherto non-industrialized areas such as China and India.

The sociocultural accompaniments of the Industrial Revolution are closely interrelated to its technological and economic aspects. Not only did the Industrial Revolution enable man to produce more, travel faster, and communicate more rapidly, but it also provided him with more material conveniences. In its early stages, however, the Industrial Revolution seemed to have deepened man's poverty and misery. In the domestic system of manufacture, the labourer usually had a garden to provide him with food, even when there was no work to be done; with his removal to the city, the worker became entirely dependent upon the functioning of the machine for his subsistence. This, coupled with the fact that the specialization of labour forced the worker to perform the same task continually, gave rise to the charge that the Industrial Revolution reduced man to a machine and made the machine the master, rather than the tool, of man.

Workers laboured long hours for miserable wages and lived in ugly, unsanitary tenements. The working day was 13 hours or longer. The workers seldom saw daylight, for gas illumination enabled them to work from before daybreak until after dark. Above all, the workers were insecure. The presence of a large pool of labourers, caused partly by the employment of women and children, partly by the influx of workers from overpopulated rural areas, meant that industrialized society was faced with a new social phenomenon: chronic mass unemployment.

In addition to those who were unable to find work were others who were thrown out of work by temporary shutdowns, depressions or business failures; some were unable to work because of old age or impaired efficiency; still others lost their jobs because of technological improvements that enabled one machine to do the work of many men. In the early years of the Industrial Revolution, some workers had sought to wreck the machines that were putting them out of work. In 1779, for example, many textile mills were destroyed during serious riots in Lancashire. Despite the possibilities of economic advancement in a society where competition and economic freedom were stressed, the average workingman had little chance to escape poverty.

The harsh exploitation of workers was not lost upon some of the humanitarian spirits of Victorian England. The famous Sadler report of 1832 exposed the brutality practised within factories and stimulated the movement for reform and the passage of Factory acts that removed some of the worst abuses.

Much of the writing on the Industrial Revolution has been affected by this picture of the appalling conditions of the factory workers. Socialist theorists claimed the exploitation of the workers was inevitable under capitalist competition. Others, including romantic writers with a nostalgic medievalism, condemned both capitalism and industrialism. In the 20th century this "pessimistic" interpretation achieved a scholarly foundation in the works of J. L. and Barbara Hammond, who viewed the early days of industrialization as the "bleak age," and in the writing of Lewis Mumford, who claimed that the Industrial Revolution produced a "new barbarism" wherein civilization shifted from an interest in human values to measuring life in material and pecuniary terms.

Some economic historians, notably T. S. Ashton, attempted to "rehabilitate" the Industrial Revolution, claiming that many of the economic and social evils usually blamed on it antedated the mid-18th century and that industrialization raised real wages in certain areas of the economy. The transition from countryside and cottage to city and factory was bound to create social stress; besides, many of the social strains were actually the result of wars or other dislocations and would have occurred even had manufacturing remained undeveloped. Finally, Ashton points out that had the population increased without an Industrial Revolution, the European countries could not have provided minimum living standards for the great mass of the population; instead, Europe would have been subject to the same miserable conditions prevailing in Asiatic countries that suffer from overpopulation and underdeveloped industrialization.

There is some validity in these varying evaluations of the Industrial Revolution, depending upon whether one adopts a short-range or long-range point of view, and upon the yardstick used for comparison. Conditions under the early factory system appear dismal when compared with an idyllic medieval agrarian system, with the early modern domestic system at its best, or with an ideal situation. On the other hand, these conditions seem an improvement when compared with the seamy reality of medieval life, the domestic system at its worst, or the living conditions of the masses in certain Asiatic countries. Furthermore, it is increasingly evident that not all the workers suffered under the factory system, and that in some cases their conditions were improved. Nevertheless, there can be no doubt that in the early phases of the Industrial Revolution human gains were small in comparison with the great strides made in technology. Viewed in the larger perspective of the development of western civilization, however, it may well be that the sufferings of the early 19th-century factory workers are outweighed by the possibilities of greater material goods and the conquest of man's physical environment that have grown out of industrialization.

Perhaps sufficient historical perspective is lacking to make a final judgment of the Industrial Revolution. For one thing, the Industrial Revolution as a process is still continuing, some of the Asiatic countries undergoing its first stages in the 1960s. At the same time, this continued process ushered in what some authorities consider a "new" Industrial Revolution in the western countries already industrialized.

Despite considerable overlapping with the "old," there is mounting evidence for a "new" Industrial Revolution in the mid-20th century. In terms of basic materials, man has begun to exploit many natural resources not hitherto utilized. The rare earths and lighter metals are increasingly employed; at the same time, man has created new alloys and synthetic products in the laboratory; *e.g.*, plastics, which augment the basic materials provided by nature. Similarly nuclear and solar energy promise a revolutionary transformation in power sources. Combined with these are developments in machines and tools which have given rise to the automatic factory. Although some segments of industry were almost completely mechanized in the 19th century, automatic operation, as distinct from the assembly line, first achieved major significance in the 1950s.

Ownership of the means of production also underwent changes. The oligarchical ownership of the means of production that characterized the Industrial Revolution in the 19th century gave way to a wider distribution of ownership through purchase of common stocks by individuals and by institutions such as insurance companies. Many countries of western Europe socialized basic sectors of their economies. There was also a change in political theories: instead of the laissez-faire ideas that dominated the economic and social thought of the classical Industrial Revolution, governments generally moved into the social and economic realm to meet the needs of their more complex industrial societies.

See CAPITALISM; ECONOMIC DEVELOPMENT; ECONOMIC PRODUCTIVITY; INDUSTRIAL RELATIONS; INVENTIONS AND DISCOVERIES; MASS PRODUCTION; *see* also references under "Industrial Revolution" in the Index.

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INDUSTRIAL WORKERS OF THE WORLD, a revolutionary labour organization of the early 20th century, commonly called the I.W.W. or the "Wobblies." It was founded at Chicago, Ill., in 1905 in response to the American Federation of Labor's opposition to industrial unionism for unskilled workers and to the federation's hostility toward revolutionary unionism. The men chiefly responsible for its founding were William D. Haywood, president of the Western Federation of Miners; Daniel DeLeon, leader of the Socialist Labor party; and Eugene V. Debs, leader of the Socialist party. Debs did not have the support of his party in his I.W.W. activities and was not active in the organization after its establishment.

A series of splits and defections occurred during the I.W.W.'s first years and for a time the followers of DeLeon maintained a separate organization with the I.W.W. name at Detroit, Mich. Eventually the I.W.W. came under the control of anarchosyndicalists. Its most prominent leader was Haywood, who stayed with the I.W.W. after the Western Federation of Miners seceded. Having its greatest strength in the Rocky mountain and Pacific coast states, where the tradition of labour-management relations was violent on both sides, the I.W.W. spread the idea of violent labour struggle, sabotage and the general strike for revolutionary purposes. In 1908 the I.W.W. rejected all political action in the class struggle, which according to the organization's constitutional preamble, "must go on until the workers of the world organize as a class, take possession of the earth and the machinery of production and abolish the wage system." This goal, in the eyes of the I.W.W., was to be achieved through labour's economic action alone. The overwhelming majority of American workers, however, adhered to the far more conservative strategy of Samuel Gompers and the American Federation of Labor.

Most of the "Wobblies" were itinerant unskilled workers for whom the American Federation of Labor made little provision. Their rebellious spirit found expression in many working-class songs, some of which became known in the labour movement throughout the world. The I.W.W. organized workers and conducted strikes in some eastern American cities, notably McKees Rocks, Pa., Lawrence, Mass., and Paterson, N.J. Its greatest success was in industries where management was particularly hostile to unionism, where most employees were immigrants who did not speak English and were industrially unskilled, and where the American Federation of Labor had largely ignored the situation. But even when the I.W.W. won a strike in the east it seldom established a lasting position in the industry because it scorned the labour contract, regarding a contract as a despicable instrument of class collaboration. The "Wobblies" fought well but they were not much interested in the routine of union maintenance.

The I. W. W. also used the weapon of passive resistance, particularly in its "free speech fights." When municipal authorities arrested the organization's speakers replacements were sent until jails overflowed and the authorities had no recourse but to permit the speakers on the streets. Having established their point, the "Wobblies" then moved to another town.

The I.W.W. deteriorated badly from 1917 to 1921. It was the only U.S. labour organization that vigorously opposed World War I, and the federal government dealt with it harshly by suppression of its press and by prosecutions under the espionage and sedition acts of 1917 and 1918. In August 1918 about 100 "Wobblies" were sentenced to prison in a Chicago mass trial. During the "red scare" in 1919 many states adopted criminal syndicalism laws that made the I.W.W. illegal and drove it underground, and scores of "Wobblies" became the victims of vigilante mobs. At the same time, the organization was torn by internal disputes over the newly born Communist movement in the United States; much of its energy in the early 1920s was devoted to quarrels with the Communists. By the mid-1920s the I.W.W. had shrunk to insignificance, but it did not disappear entirely. In 1949, when it had only about 1,500 members, it was the first labour organization to be placed upon the federal government's subversive list.

Although there were I.W.W. organizations in many of the port cities of the industrial world, Australia was the only country outside the United States where it became important. It disappeared in Australia and elsewhere when it declined in the United States.

The rise and fall of the I.W.W. coincided with the first high tide of radicalism in 20th century America. In many ways, the "Wobblies" were only the labour arm of the more general radical movement, even though the I.W.W. rejected the political action of the socialists. The long-run significance of the organization for the labour movement lay in the I.W.W.'s demonstration that unskilled labour could be successfully organized into industrial unions.

See also references under "Industrial Workers of the World" in the Index.

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INE (d. after 726), king of the West Saxons from 688 to 726, succeeded his kinsman Ceadwalla, who resigned to go to Rome. In 694 he forced the men of Kent to pay compensation for slaying Ceadwalla's brother Mul in 687. Surrey belonged to Wessex in his reign. About 704, there was strife with the East Saxons, who had been harbouring his exiles. In 710, Nunna, king of the South Saxons, helped him against Geraint, king of the Cornish Britons, but in 722 and 725 Ine fought against the South Saxons, who were harbouring a rival claimant to his throne. In 715 he fought against the Mercians at Adam's Grave, Wiltshire. He is said to have built the minster at Glastonbury. In 705 Wessex was divided into two dioceses, Winchester and Sherborne. Ine was the first West Saxon king to issue a code of laws, preserved as an appendix to Alfred's laws. In 726 he resigned and went to Rome, dying soon after.

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INEBRIETY, LAW OF: *see* LIQUOR LAW.

INERTIA MOTION. In meteorology and oceanography, inertia motion refers to the motion of air or water moving horizontally without horizontal forces. With respect to a co-ordinate system fixed to the rotating earth, such motion is circular, provided that the variation of latitude is small. This "inertia circle" can be most easily explained in terms of the fictitious Coriolis force (*see* MOTION, PRINCIPLES AND LAWS OF).

As long as no other forces act, and the variation of latitude can be neglected, a particle is deflected uniformly (to the right in the northern hemisphere) and describes a circle in the clockwise sense. The size of the circle depends on the initial velocity, and the period to complete the circle is one-half day divided by the sine of the latitude. In the southern hemisphere, the corresponding circle is counterclockwise.

The effect of varying latitude is to increase the trajectory curvature at high latitudes relative to that at low latitudes. Hence, under large latitudinal displacements, inertia circles are modified to spirals, in which a westward drift is superimposed on the inertia circle.

Pure inertia motion has been observed in the ocean, but not in the atmosphere. However, air motion subject to a uniform pressure gradient without friction can be described by the vector sum of geostrophic motion and inertia motion. Indications of damped inertia motion have been obtained from constant-level balloon trajectories.

Because of inertia motion, the atmosphere has a natural period of oscillation, which at latitude 30° is exactly one day. When daily heating causes a periodic force on the atmosphere, resonance occurs at this latitude, and the resulting motions are amplified. Such periodic forces occur at coast lines and cause land-sea breezes with large amplitude near latitude 30°. Over the interior of continents friction caused by momentum exchange is strongly enhanced by daytime heating; at night it nearly disappears. This periodic variation of frictional force results in large diurnal wind variations near latitude 30° with maximum amplitude about 2,000 ft. above the ground. At this height the nocturnal wind speed is substantially in excess of the geostrophic value. Therefore, the wind between midnight and sunrise frequently increases with height to about 2,000 ft. and decreases above, forming the so-called low-level jet stream near 2,000 ft.

Inertia Instability.—A configuration is stable when a particle has a restoring force acting on it after displacement. In meteorology or oceanography, inertia instability denotes the stability of geostrophic flow for displacement at constant entropy (nearly horizontal in most cases). (*See* also GEOSTROPHIC WIND.)

Geostrophic flow is unstable when the geostrophic current of air or water increases poleward more rapidly than $2\ \omega \sin \phi$, where ω is the angular velocity of the earth and ϕ the latitude. On the other hand, a poleward decrease of current is stable, no matter how great the variation of the current.

Inertia instability has been used to explain the observations that both for the atmospheric jet streams, and for fast ocean currents, the current profiles are asymmetrical: the poleward variation of speed can have extreme gradients, whereas on the equatorward side, the gradient of current rarely exceeds $2\ \omega \sin \phi$.

Some meteorologists believe inertia instability to be important in the formation of storms (cyclogenesis). There exists some doubt, however, about whether the motions set up by inertia instability are of sufficient scale and magnitude to be important in this connection.

Inertia instability is further enhanced for anticyclonic curvature of air trajectories (*see* GRADIENT WIND). (H. A. A. P.)

INFALLIBILITY, in the religious sense, is usually associated with the claim of the pope, as head of the Roman Catholic Church, that under certain conditions he cannot err in doctrinal and moral teaching. Papal infallibility, however, is only a part of the overall infallibility of the church; hence this article will treat the general claim of the Roman Catholic Church to be infallible, with specific reference, nonetheless, to the question of papal infallibility.

Infallibility should be viewed against the background of other Catholic beliefs, of which it is a part. Remotely, the doctrine against which infallibility must be placed is the belief that God has intervened in human history, that he has revealed himself to man, and that he has thus given man the possibility of assurance in religious matters that he would not otherwise enjoy. Furthermore, it is the Catholic belief that God's revelation to man came to a climax when the Son of God himself assumed a human nature and became man, and that Christ came into this world as Redeemer, divine lawgiver and supreme and infallible religious teacher.

Proximately, the doctrine against which infallibility must be viewed is that of the nature of the church itself. In Catholic theology the church is not viewed as a human creation; doubtless the accidental occurrences of history have played an enormous role in shaping and modifying its external and secondary characteristics, but its essential structure and nature were determined by Christ. Thus there exists between the church and its Founder an extraordinary bond of union, which Christ himself spoke of when he promised his abiding presence: "and lo, I am with you always, to the close of the age" (Matt. xxviii, 20; *cf.* Luke x, 16; John xx, 21). For St. Paul the union between Christ and the church is so great that he habitually speaks of the church as the body of Christ (of which Christians are the living members), as the spouse of Christ, as the pleroma or completion of Christ. In short, the church views itself as the extension of Christ in time. Clearly this has nothing to do with the human qualifications of its members, their intelligence or virtue or lack thereof. The church is what it is because of the nature that Christ has given to it.

One of the reasons for this extraordinary union between Christ and the church is that the church, according to Catholic belief, must continue the threefold work of Christ in this world until his second coming. It must sanctify, rule (in matters religious) and teach the doctrine of Christ, preserving it faithfully but also interpreting it in the light of changing historical circumstances so that it may remain at all times a vital and relevant Word. Infallibility has to do with the church's authority to teach in the name of Christ. Christ laid special stress on the aspect of teaching, and he, who himself had been filled with the Holy Spirit from his conception, promised the same Holy Spirit, "the Spirit of Truth," to his church (John xiv, 26; xv, 26; xvi, 13–15). The conviction of the early Christian community that it was guided by the Holy Spirit is evident from the Acts of the Apostles; Peter did not hesitate to introduce a disciplinary decision with the words "For it has seemed good to the Holy Spirit and to us . . ." (Acts xv, 28).

For one who accepts the belief in the identification of Christ and his church it follows clearly that the church cannot lead man into religious error, that in proclaiming the message of salvation entrusted to it by its Founder it will be kept from even the possibility of error because of the presence of Christ and the Holy Spirit. Were this not so, error would ultimately be imputable to Christ himself and to the Holy Spirit. Traditional belief, then, asserts the infallibility of the official teachers of the entire church: the bishops, taken as a group, in union with and subject to their head, the pope; and the pope himself as supreme teacher in the church.

Episcopal Infallibility.—The bishops' infallibility may be exercised in two ways. (1) It is exercised in an extraordinary way when a legitimate council composed of members of the entire hierarchy (a sufficient number to show that, morally speaking, the whole episcopate is represented) solemnly proclaims a teaching that forms part of the Christian message of salvation. While such a council and its decisions must have papal approval, the pope himself need not be present or take part in the deliberations (*see* also COUNCIL). (2) It is exercised in an ordinary way through the divine assistance given the episcopate as a whole in the day-to-day teaching of the bishops in their respective dioceses. It is Catholic belief that while an individual bishop may err, nonetheless the group as such will be kept from error in its role of preserving and proclaiming the doctrine of Christ.

Papal Infallibility.—According to Catholic belief the pope is infallible precisely because he is the visible head of the church and its supreme teacher. The decree *Pastor Aeternus* of the first Vatican council (1870) stated the conditions that must be present simultaneously if it is to be said that the pope has spoken infallibly or *ex cathedra* ("from his chair" as supreme teacher). They are as follows:

1. The pope must act as supreme teacher of the universal church. What he teaches as a private theologian or in his capacity as bishop of the diocese of Rome, for example, is not matter for infallibility.

2. He must clearly intend to define a doctrine; that is, he must demand an irrevocable assent from the members of the church. He must intend to settle an issue definitively; simple exhortations or merely temporary disciplinary decisions are not infallible. Again, when a doctrine is defined, it does not mean that everything has been explained; much may be left unsaid, but what has been said has been said correctly.

3. What the pope defines must have to do with faith or morals; that is, with the revealed message of salvation.

4. The pope must clearly intend to place an obligation of belief upon the entire church.

For a discussion of the conflict centring about the definition of papal infallibility and promulgation of the dogma, *see* VATICAN COUNCILS; COUNCIL: *First Vatican Council;* and biographies of the participants—*e.g.*, DOLLINGER, JOHANN JOSEF IGNAZ VON; MANNING, HENRY EDWARD. *See* also GALLICANISM; ULTRAMONTANISM.

See also references under "Infallibility" in the Index.

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P. J. Toner, "Infallibility," in *Catholic Encyclopedia;* E. Dublancy, "Infaillibilité du Pape" and "Eglise," in *Dictionnaire de Théologie Catholique.* For historical difficulties relating to infallibility, *see* Philip Hughes, *A History of the Church,* 3 vol. (1934–47). (F. B. N.)

INFAMY, public disgrace or loss of character, particularly as a consequence of criminal conviction. At common law, conviction of an infamous crime resulted in disqualification to testify as a witness. The test for considering a crime infamous was whether it stamped the offender as untrustworthy. The concept was at first limited to the so-called *crimen falsi,* originally perjury but by extension any crime involving fraud or corruption. Eventually all felonies came to be treated as infamous. Testimonial incompetency for infamy has been abolished by statute in England and generally in the U.S. as well.

The principal importance of infamy in modern times derives from the provision of the fifth amendment to the U.S. constitution requiring grand jury indictment for any "capital or other infamous crime." Infamy for this purpose depends on the character of the punishment which may be imposed rather than on the nature of the crime. In general, any crime which may be punished by imprisonment in a penitentiary is infamous. Congress has provided that only terms of imprisonment for over a year may be so punished. As a result, any federal crime which may be punished by imprisonment for more than a year is an infamous crime, for which an accused person may not be tried without having been indicted by a grand jury. The extent to which congress may have the power to alter the concept of infamy by prescribing different modes of punishment is an open question. (H. L. Pr.)

INFANTE (Lat. *infans,* "young child"), a title borne from the 13th century by the sons of the sovereigns of Spain and Portugal, the corresponding title, infanta, being given to the daughters and to the wife of an infante. From the reign of John I (1379–90) when the custom was begun of calling the sovereign's eldest son principe de Asturias, the latter did not hold the title of infante. While a son or daughter of the sovereign of Spain was by right infante or infanta of Spain, the title, alone, could be granted to other members of the blood royal by the sovereign.

INFANTICIDE, the killing of the newborn, is encountered in many cultures. Commonly, infanticide in the 1960s was held immoral or illegal among advanced peoples. However, in some cases severe economic conditions may prompt cultural sanction of infanticide. Among the Eskimo (*q.v.*) conditions of life were so severe that it was sometimes the practice to kill female children shortly after birth, since there might not be husbands able to support them. In Polynesia, where population often reached high density, similar practices prevailed. In the Hawaiian Islands all children, after the third or fourth, were once strangled or buried alive, and in Tahiti chiefs were obliged to kill their daughters. The famous Areoi secret society that originated in Tahiti imposed infanticide on its women members, but apparently this was mainly to allow freedom in their cult activities. In China female infanticide for economic reasons was once common and girls were also sold as servants.

Children also may be allowed to die or are killed with cultural sanction because of irregular marriages, abnormal births or similar reasons. Plato recommended destruction of unfit children in the *Republic.* Violation of incest (*q.v.*) restrictions frequently leads to infanticide, as well as punishment of the parents. Abnormal behaviour of the fetus and irregular birth presentations (*e.g.,* breech delivery) sometimes have been considered reasons for infanticide (as among the Nandi peoples of Africa). Where premarital relations are not sanctioned, resulting children are often abandoned or killed in a great number of societies, including modern western cultures.

Multiple births frequently are held to signify future prosperity or impending misfortune. Some groups (as the Pima Indians in Arizona) welcome twins and treat them with special consideration. Others (as aborigines in Queensland, Australia, and the Ibo in West Africa) put one or both to death, in the belief that they were evidence of kinship with animals, or because they could not be nursed adequately. In medieval Scotland mothers of twins were believed to have committed adultery. Until modern times multiple births beyond twins rarely survived, and there is little evidence regarding their specific treatment.

In more advanced societies children were sometimes killed in the belief it would ensure health, good fortune and general fertility, or cure such misfortunes as barrenness. Religious offerings, especially of the first-born, are known from the Bible (Gen. 22) as well as from the histories of Egypt, Greece and Rome. Up to the 19th century first-born sacrifice was almost universal in India. Here the motive was the offering of one's most precious possession to the deities.

Practices of infanticide have been linked to such marriage practices as polyandry, but the correlation is not direct. In Africa where the legitimatization of offspring through proper marriage is of great concern and where reincarnation of ancestors is an important belief, irregular offspring are a danger to the maintenance of proper ritual relations. Where age is important, there are often beliefs that elders should cease bearing children after their own children begin to do so, as among certain Chinese groups.

Infanticide has often been interpreted as a primitive method of birth control and as a means of ridding the group of weak and deformed children. But most societies actively desire children, and put them to death (or allow them to die) only under exceptional circumstances. In modern societies regulation of population with contraceptives or through abortion tends to reduce the frequency of infanticide.

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Modern Legal Position.—In those countries (England being the most notable) where the death sentence for the crime of murder was mandatory, the law was exceedingly tardy in recognizing such special psychophysiological elements as postpartum psychoses in the offense of the killing of an infant by its mother. As a result of medical recognition of such conditions, however, no mother convicted of the murder of her child under one year old has been executed in England since 1849 (in each case the executive stepped in to prevent execution of death sentences), nor has one been convicted of the murder of her child of any age since 1889.

Under the Infanticide act (1922; amended in 1938) an English mother who kills her newly born child is guilty not of murder but of infanticide. In Scotland a mother who kills her infant has throughout history been charged with culpable homicide (manslaughter). The sentence of the courts now is frequently either committal to a mental hospital or a probation order.

In most of the states of the U.S. the absence of a mandatory death sentence for murder obviated the need for creating a separate crime, particularly since juries rarely, if ever, passed sentences even of imprisonment in such cases.

Most of the commonwealth countries have followed the example of English legislation. However in Southern Rhodesia (like in the Republic of South Africa) infanticide is not a separate crime, for the same historic reason as in the U.S. The major departure from the English model has been New Zealand's, where, by the Crimes act (1961), the charge is infanticide (not murder) whenever a woman kills any of her children under the age of 10 if, at the time of her offense, she was psychiatrically disturbed by reason of incomplete recovery from giving birth "to that or any other child."

In Europe generally infanticide is recognized in the various penal codes and is equated with culpable homicide. In Norway and Sweden infanticide applies only to the killing by a mother of her illegitimate child, although other countries do not make this special distinction of legitimacy. In Denmark a mother who kills her child commits infanticide when she is "acting in distress from fear of dishonour" or under the influence of weakness, derangement or confusion resulting from the birth. The simplest reflection of the psychopathology of a mother who kills her infant appears in article 116 of the Swiss penal code which provides that "a mother who has intentionally killed her child during childbirth or when still under the influence of puerperal condition" is guilty of infanticide.

See J. A. Hamilton, *Postpartum Psychiatric Problems* (1962); G. L. Williams, *Sanctity of Life and the Criminal Law* (1957).
(L. J. B.-C.)

INFANTILE PARALYSIS: *see* POLIOMYELITIS.

INFANTILISM, a term in medicine that generally implies sexual infantilism. The external genitalia remain in an immature state when the age of the individual would normally be accompanied by sexual maturity. Sexual infantilism occasionally may be associated with dwarfism or short stature, but this is not the rule.

The persistence of an infantile state of the genitalia is the result of the failure of the gonads (ovaries or testicles) to secrete the sex hormones required for genital growth and maturity. Such hypogonadal states in either sex may be attributable to a failure of the pituitary gland to secrete hormones that stimulate the gonads. The pituitary deficiency may involve only gonadotropic secretions or may be more extensive. In the latter circumstance dwarfism may accompany the sexual infantilism.

The gonads, particularly the testes, may also be damaged prior to puberty by injuries or disease. The infantilism resulting from such primary gonadal failure often leads to exceptional height and disproportionately long legs and arms. The hypogonadism may also result from congenital failure of the gonads to develop in a normal fashion. In Turner's syndrome, infantilism in girls is associated with short stature, a webbed neck and a variety of other congenital anomalies. In Klinefelter's syndrome in boys, the hypogonadism is associated with gynecomastia and occasionally mental deficiency.

In hypopituitarism the infantilism may be treated with gonadotrophin preparations. Generally speaking, however, all types of hypogonadism are more usually managed by supplying the patient with synthetic androgen or estrogen and progestin. The results of such replacement therapy are often excellent. Treated patients usually are capable of having normal sexual relations, but reproduction is only rarely possible. (R. L. L.)

INFANTRY, the military term applied to troops who fight on foot, even though transported to battle by horses, ships, aircraft, tanks, skis or other means. The term applies equally to troops armed with such hand weapons as the spear and sword in ancient times and with automatic rifles and rocket launchers in modern days. As foot soldiers their objective has always been to seize and hold ground and, when necessary, occupy enemy territory. In the period following World War II, infantry in some armies came to include elements of the former supporting arms of artillery and armour as an integral part of its organization. (*See* ARMY.) Since ancient times the infantry has been the largest single element in armies, except during the feudal period. It has borne the brunt of human conflict through the ages and has been called the "Queen of Battle."

A study of the history of infantry must take into account the social system which produced the armies of the period. At different ages in history, the same nation may produce an army which carries all before it, or fails to meet history's demands. Greece and Rome in classical history supply excellent examples of the changing character of soldiery. In more modern times the difference between the French of the Revolutionary period and in World War II, or between Spain of the 15th and 19th centuries exhibits the importance of analyzing the social character of a people when discussing their army and its infantry. The history of infantry through the ages should therefore include both the military factors of organization, strength, tactics, leadership and armament, and the social factors of the position of the soldier in the society.

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I. EARLY INFANTRY

Infantry in a sense goes back to the first men who fought on foot in groups against other men or animals. Infantry undoubtedly existed in all the early tribes and it was an accepted part of the fighting forces in ancient Egypt and Assyria. Seven castes existed in Egypt at the time of the Pharaohs and the second caste consisted of the warriors. They fought as infantrymen and were armed with bows and slings and, at one time, with bronze swords. In the Assyrian armies the predominant arm was cavalry, which was reserved for the highest caste, the nobility. Lesser men served as foot soldiers.

From the beginning of organized warfare the infantryman appeared armed with sword and bow. As weapons improved and multiplied, tactics became more complex. But the general object of all change was to balance infantry capabilities more evenly in attack and on defense. Following the breakup of the Roman empire and the obliteration of European roads there was a 1,000-year period in which cavalry dominated the battlefield.

The history of infantry begins with masses of armed men trained to move and fight shoulder to shoulder. Its modern battle array in attack and defense is a succession of thinly deployed lines. The evolution of infantry formations, superinduced by changes in weapons, has required corresponding changes in infantry spirit. When ranks were closed, unity was achieved through the rule of blind obedience. With their thinning, infantry came to depend for cohesiveness on the inculcation of higher initiative and resourcefulness in its individuals.

In their heritage from the Egyptians and the Assyrians, the Persians utilized much the same method of warfare. The foot soldiers were armed with short spears and wicker shields but they depended upon the bow as their principal weapon. The Persians divided their infantry into heavy- and light-armed groups. The latter operated as a skirmish line ahead of the main force, expecting to be driven back on first contact with the enemy. On occasion, the light infantry fought on the flanks with the object of harassing the enemy flanks or rear.

1. Greece.—In the Greek city-states, the infantryman was a heavily armed pikeman, or hoplite. Spear and sword were his weapons. His protection was provided by shield, helmet, breastplate and greaves—the last a guard for the legs. The men fought in the phalanx, a mass formation created by the Greeks, which was also the basis for their tactics. Hardy people, knowing both mountain and sea, the Greeks were natural infantrymen.

Constant civil war drained the Greek states of their best manpower, its place being taken by mercenaries and by slaves who fought to merit citizenship. Athens grew wealthy from its trade, and utilized that wealth to provide mercenaries as substitutes for

its citizen army. Despite the high intelligence of the Greeks, their contributions to warfare were meagre: the phalanx, and the step-ladder oblique tactics of the Theban commander Epaminondas. The phalanx was a mass formation of heavily armed hoplites, initially eight ranks deep, who moved forward with their long spears waist high and straight ahead in a solid bank of spear points. Spartan and Theban phalanxes met at the battle of Leuctra (371 B.C.). Against a Spartan army of 10,000, Epaminondas had a force of only 6,000, half of them doubtful allies.

Epaminondas, from his knowledge that previous battles had followed a set course with each side successful on the right wing, weak on its left, decided to align his forces in a new tactical formation. He placed his strength on the left, employing his Theban hoplites in a phalanx 48 ranks deep, and echeloning his remaining troops to the right and to the rear. His cavalry was placed well to the front of the weaker and "refused" right wing. This tactic was based on the simple fact that each Greek warrior instinctively sought to gain the protection of the shield on his right. As a consequence, the line inevitably dropped back on the left wing. Epaminondas' tactics were to strike the strong Spartan right with a greater-than-usual shock effect, while sending his cavalry to roll up the left of the Spartans. The Spartan right was thrown back, its demoralization being communicated to the left wing simultaneously under cavalry attack. Panic ensued, and the Thebans won a quick, overwhelming victory.

The Greek infantry and the Greek system of fighting reached the highest point under Philip of Macedon and his son Alexander (*see* ALEXANDER III the Great; PHILIP II of Macedonia). The latter placed his army, as was the custom of the time, with the phalanx of heavily armed Greek and Macedonian infantrymen in the centre preceded by slingers and archers; the cavalry protected the flanks.

The phalanx was modified by Alexander so that the human fortress was 16 men deep and had 16 men on the front. Alexander armed his hoplites with a spear between 18 and 21 ft. long. With this weapon the heavily armed infantrymen, shoulder-to-shoulder, were able to present a solid front of spear points to an enemy. The first five ranks held their spears horizontally or with the points slightly depressed while the remaining ranks carried their spears vertically or rested them on the shoulders of the men in front. Though Alexander's phalanx was an improvement over that of his predecessors, its close formation of 256 men was broken when marching over rugged ground. Alexander drilled his phalanx constantly, teaching them to form wedges or "V's" upon signal, and to make a flank movement or a countermarch as if they were a solid mass.

The campaigns in Asia Minor gradually used up the Macedonian and Greek forces, their places being taken by subject races and mercenaries. Alexander's successors, recognizing the deterioration of the infantry, concentrated their better soldiers in the cavalry, and built their tactics around flank attacks by horsemen. Later wars between the Greeks and Romans indicated that heavy infantry was still the backbone of forces, however. Dependence was placed upon the shock attack of the phalanx, and the available Greek soldiers were concentrated in that formation. The quality of the Greek armies steadily declined until the unimproved, inflexible Macedonian phalanx was defeated at Pydna (168 B.C.) by the legions of the great power of the west, Rome.

2. Rome.—The Italian peninsula, like Thrace, presented natural barriers to invasion; mountains cut it into isolated areas where city-states grew. Rome, one of these city-states, was originally the home of a peaceful people, but constant strife and a natural aptitude for military life eventually made them extremely warlike.

The Italian countryside, like that of Greece, was not conducive to the development of cavalry. The people depended upon their feet for mobility, and became in time a hardy foot soldiery. Like Athens' army, Rome's was composed originally of citizen-soldiers, who believed it their privilege to serve as warriors. Every citizen was liable for military service, but freedmen and slaves were not accepted in the army.

For six centuries the Roman legion, an infantry organization, was supreme in warfare. Its composition changed from the citizen-soldier to the professional and eventually to the mercenary and barbarian. The weapons—the two-edged Roman sword and the lance—changed but little; the tactics were revised to suit the capacity of the various elements which made up the legion.

In the early period of the Roman republic, the legion was made up of the finest men in the state. Wealth, usually in property, determined which one of the five classes of infantry a man might enter. The wealthiest class, other than those who joined the cavalry, were the infantry elite with good weapons and heavy armour. The last class was practically unprotected though armed with sword and spear.

Though the Romans of the early republican period were imitators of the Greek infantry and the Carthaginian cavalry, their basic organization, the legion, was superior to the phalanx. At the time of the Punic Wars, the Roman legion formed for battle in what looked like three rows of a checkerboard. Groups of legionaries, comprising 120 men each on a 12-man front and 10 files deep, formed in three lines 250 ft. apart. The width of ten of these maniples, as they were called, was 1,200 ft. The vigorous young Romans were in the front line (hastati), the battle-wise veterans in the second line (principes) and the oldest men in the third line (triarii). The maniples of the last line had a strength of 60 men. The recruits, from 17 to 25 years of age (*velites*), normally occupied a post in front of the hastati, until driven back by enemy attack. They then fell back to occupy the intervals between the maniples of the triarii.

From a tactical standpoint, the Roman legionary was in a loose formation compared with the Greek phalangite. His place in the maniple was about five feet from his nearest neighbour. When under heavy attack, the maniples of the hastati could fall back into the intervals of the principes, or conversely, on the offensive, the principes could move forward to utilize the intervals between the front-line maniples. In combat an enemy would often filter through the Roman front line and become engaged with the second line. The Romans usually threw their javelins upon their first contact with an enemy and then resorted to swords for close fighting.

Ordinary legionaries commanded the legion in battle, these men having risen slowly through experience to the positions of leadership. They were not aristocrats but the best disciplined and most competent professionally of the citizen-soldiers who made up the legion. The Roman centurion, or small-unit commander, became famous for his bravery and his willingness to die fighting at his post.

Discipline among the legionaries was strict; cowardice for example, was punishable by crucifixion. Disobedience on some occasions also received the same punishment. Wherever the legion moved throughout Europe its camp was laid out in exactly the same formation at all times. No matter when the legion was called to action every man knew where his tent and his equipment were located. Failure to conform to this rigid system and to appear at the bugle call was punishable by death.

The Punic wars were fought by Roman legions manned by this middle-class militia. Opposed to them was the Carthaginian army, superbly led in the field and built around a modified Greek phalanx. Aside from the excellent cavalry, which was Carthaginian, the remainder of the army was a mixture of Gauls, Iberians, Libyans and Phoenicians. Hannibal, poorly supported at home by a merchant people who placed the army a poor second to the navy, led these undisciplined, plundering soldiers to a number of magnificent victories. Unaware of patriotic motives for fighting, the Carthaginian army won battles from the Roman legions but lost the three Punic wars. After the destruction of Carthage, Rome became affluent, and the citizen-soldiers, mostly of the farming class, lost their land to the wealthy who brought in slaves to do the work.

In the period of the civil wars and the wars against the Gauls the Roman legion became a professional force. Impetus was given to the professionalization of the legion when citizenship was granted to Italian allies. Voluntary enlistment, replacing compulsory service, brought in freeborn Romans and even slaves. Capacity for soldiering and willingness to garrison the outposts of Rome became the criteria for service. The Roman infantryman thought

of plunder and fought for his own legion, while giving allegiance to his commander.

Such were the infantry soldiers of Julius Caesar who conquered the Gauls. Men of stamina and patience, wedded to soldiering, they fought well whether in the open, in sieges or in outpost fortresses. The heavy infantry continued to form the main line of battle in their centre position, with cavalry and light infantry on the wings. Under Caesar, the Roman legion extended the bounds of the republic to its greatest extent. Hardship was the lot of the soldiers, whether fighting in long-drawn-out campaigns or engaging in the building of the great Roman roads and garrison forts at the outposts.

In the period of the empire, the nature of military service was changed by the requirements for long-term garrison duty on the frontiers. The objective was to protect the empire from barbarian forays. In this new service, barbarians were increasingly enlisted in the legion; the Roman legion became a polyglot band of infantry, relying more upon cavalry and upon new tactics. Consequently formations and weapons were changed. The pike was adopted in lieu of the javelin, and the tactical formation became tighter.

For six centuries the Roman legion was the supreme foot soldiery but it was annihilated by the heavy cavalry of the Goths at Adrianople (A.D. 378; now Edirne, Turk.). For the better part of 1,000 years infantry was replaced by cavalry as the heart of armies, though the infantry of the Eastern Roman, or Byzantine, empire lived on until A.D. 1071. *See* also ARMY: *Ancient Armies;* TACTICS: *Tactics of the Ancient World; The Cavalry Cycle;* CAVALRY.

II. THE MIDDLE AGES

Rome's greatness in developing the legion was passed to the Frankish tribe of Germany whose soldiers had been trained by the Romans. There again every man was responsible for military service. The Franks under Charles Martel defeated the Muslims at Tours in A.D. 732. Under the Franks a system of landholding and military service developed into what became known as feudalism. As in ancient Rome individual wealth was a mark of the soldier's class; the serf became the despised, unwanted foot soldier, more servant than fighter. All eyes were upon the knight in armour mounted on horseback. The foot soldiery was poorly armed and its part in conflict almost negligible.

England remained the last country where foot soldiers predominated. Behind the barrier of the channel the English retained the old military customs, supplementing their weapons with the two-handed axe adopted from the Viking invaders. At the battle of Hastings (A.D. 1066), the Norman cavalry assisted by infantry archers drove the English infantry from the battlefield in panic. However, as feudalism neared its end, the age of gunpowder opened. It "made all men alike tall." Infantry regained its supremacy and the armoured knights gave way to the more numerous and better armed yeomanry.

Historians generally date the decline of the mounted man from the battle at Crécy (1346) when the English longbowmen defeated French cavalry. For the following century the English longbow, which was five or six feet long and shot arrows a yard in length, dominated the field even after the appearance of the first firearms. Though the French cavalry was defeated by the longbow, the latter weapon did not of itself restore the supremacy of infantry. The bowmen were dependent upon the shock action of massed infantrymen to defeat cavalry. It was the Swiss pikeman who confirmed the decision in favour of the foot soldier. The pike brought about the return of the Greek phalanx in a Swiss model which was later developed into what became known as the Spanish square.

For the infantryman it meant that his firepower and the shock of massed action had been substituted for the mobility which had given the cavalry predominance for 1,000 years. The Swiss, a well-disciplined people, copied the phalanx of Alexander, utilizing pikes 20 ft. long as their shock weapons. At that time many of their opponents still wore armour and were mounted. To cut these men down the Swiss used a halberd, an axe with a handle about eight feet long. This style was much imitated, and Swiss troops were readily hired as mercenaries throughout Europe.

The Swiss were rugged mountaineers, unused to horses, and unaccustomed to knightly armour. Peasants and townsmen rose up to protect their cantons from the invasions of the Austrians. Courage, endurance and patriotism were their main strengths, though their tactical formations and weapons were admirably suited to the character of their infantry. Not only did they defeat the Austrians but they also were victorious over the duke of Burgundy. As a result of these wars, the Swiss peasants became renowned throughout Europe as the ablest fighters. Their capacity in battle without armour and fighting on foot established infantry as predominant over the last of the feudal knights.

It being proved that foot soldiers could win in combat, the relatively inexpensive foot soldier came into demand throughout Europe. But because the kings were constantly at war, the burghers and peasants found such service distasteful. Mercenary forces grew in favour since the people preferred to pay for a trade guild of war rather than take time from their own occupations. The Swiss helped meet the demand by supplying foot soldiers for hire. *See* also ARMY: *Medieval Armies.*

III. TO WORLD WAR I

1. Spanish and Dutch Infantry.—In the 16th century, the Spanish and Dutch infantry were imbued with the spirit of professional soldiers. The excellence of the Spanish infantry was ascribed to the strong sense of discipline, good leadership and the capacity for withstanding fatigue and privation. A hardy, temperate and apt people furnished recruits for the Spanish army, one that refused to concede defeat. Spain had just been through the long struggle against the Moors, had discovered America and was animated by a passion for church and king.

The wealth of the new world passed through the hands of the Spaniards into those of the Dutch burghers. The Spanish army, which had become increasingly filled with mercenary troops while the command and hard core remained Spanish, was unable to put down insurrection in the Low Countries. Though the Dutch were unable at first to confront the Spanish troops in the open, they fought with indomitable courage behind the walls of their cities. Artful in the creation of practical fortifications, the Dutch burghers formed a citizen-soldiery reminiscent of the classical age. Antwerp, for example, held off the duke of Parma's Spanish army for 14 months, and Ostende did the same for three years. City after city defied the Spanish in aggressive defenses which included sorties on ice skates, in ships and by land.

The hardy spirit of the Dutch was utilized to advantage by Maurice of Nassau. Establishing the first standing army in Europe, he schooled it in tactics similar to those of the Romans and employed the latest types of firearms. Long-term enlistments, strict discipline and superb battlefield strategy enabled him to employ his Dutch forces in warfare that avoided pitched battles. Capturing city after city which had been taken by the Spaniards, he was vindicated in his confidence in his rugged Dutch infantry. The independence of the nation was won by Maurice and his foot soldiers.

2. Standing Armies.—The Dutch and Spanish had given armies a new appreciation of organization into battalions and regiments. Both nations had also placed their country's security in the hands of standing armies composed largely of infantry troops drawn from substantial middle-class and peasant stock. The combination of good soldiers and well led fighting organizations had changed the character of armies and warfare.

Meanwhile, the mercenary companies were disappearing and cavalry was no longer dominant over infantry. The pike was rapidly being replaced by firearms; cannon were becoming important. All these new developments were drawn together by the Swedish king, Gustavus II Adolphus. With an expeditionary force of 13,000, largely infantry, he arrived in Germany in 1631 to assist the Protestant north against the Catholic south in the Thirty Years' War (1618–48). His sturdy foot soldiers were organized into companies, four to a battalion; two battalions of 400 men each comprised a regiment.

Gustavus also brought to the battlefield a lighter musket, capable of speedier loading through the use of a paper cartridge containing a prepared charge of powder and ball. For the first time, artillery was combined with infantry and cavalry. His tactics included an artillery preparation to soften up an enemy, followed by a cavalry charge to crack resistance, and an infantry assault to mop up a disorganized enemy.

Later in the 17th century Louis XIV replaced the matchlock with the firelock and his great siege engineer Sebastien de Vauban introduced the bayonet. He produced a socket bayonet which did not prevent firing or loading since it was attached around the barrel of the firearm. It had none of the disadvantages of the earlier bayonet which was fixed in the muzzle of the weapon. This contribution enabled the infantry to employ volley fire; troops would move forward, fire a volley, repeat the process and use the bayonet on the final assault.

3. Makers of Modern Tactics.—Three celebrated soldiers of the 18th century made a permanent imprint on infantry tactics, training and organization, leaving an inheritance of knowledge and understanding which formed the basis of modern methods.

Maurice de Saxe, marshal of France, rediscovered cadenced marching, lost since Roman days. It changed European armies from straggling mobs into disciplined soldiery. Saxe also became the first advocate of conscription, the first great opponent of volley fire, the initiator of the company mess, the pioneer of sniper tactics and the first reformer to insist that infantry dress should be designed for field utility rather than show effect. Far in advance of his age in tactical concepts, with deeper insight into leadership than any soldier since the Romans, Saxe also knew the heart and mind of the fighter as profoundly as any general since his day.

Gen. Sir John Moore of the British army extended what Saxe had taught. Unexcelled as an infantry trainer, he brought to it an enlightened humanism. In an age when other disciplinarians favoured the lash and the gallows, Moore stood for methods which won loyalty and heightened the moral qualities. The system gradually bent to his influence.

Frederick the Great of Prussia took over the pattern set by Gustavus. His infantry was recruited by compulsory service. Frederick scorned the individuality of his infantrymen, preferring to mold them in a mechanical form, held by fear of their officers. His major tactical contribution was greater firepower on the battlefield. Iron ramrods and constant drill doubled the fire of his infantry.

Prussian drill was imitated throughout Europe and was taken to America by Baron von Steuben, who became George Washington's drillmaster at Valley Forge, Pa. Steuben's system, however, excluded Frederick's iron-handed discipline and sought to mold infantry spirit and unity by adhering to the humane principles that guided Moore and Saxe. The influence was permanent. What Steuben taught became the basis of U.S. military discipline.

4. Napoleon's Infantry.—The infantryman in France, like his American predecessors, was a citizen-soldier in contrast to the professional soldier of Prussia, Austria and Britain. Napoleon's idea of battlefield tactics was to formalize what became known as the holding attack, while employing reserve infantry and artillery in an assaulting flank maneuver. Thus he utilized initiative common to his men and obtained a flexibility in the employment of small columns.

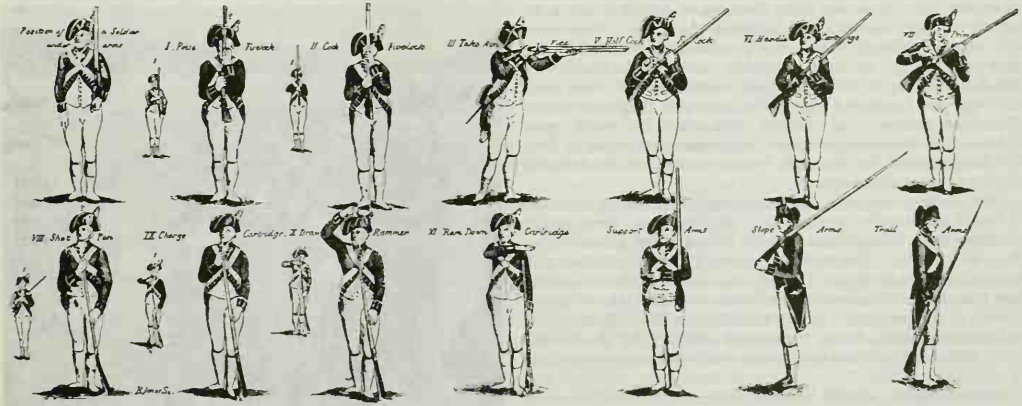
Napoleon's men were formed into three ranks in the infantry and placed trust in the bayonet as a method of making the final thrust at an enemy. As the war continued and the citizen-soldiers were replaced more and more by impressed soldiers from other European nations, Napoleon had to rely upon massed infantry.

While the tactical operations in battle were excellent, the reason for the spirit of the troops was more than one of good leadership. The infantry of the French republic had an *élan* inspired by republican enthusiasm; they had the mental and physical alertness and the initiative to make any system of tactics workable. Their discipline was not one of fear of their officers but was a higher form that was later to become common in democratic armies. Discipline included the will to anticipate orders, to do the necessary things on the battlefield to make victory more assured. Rewards and honour were the reasons impelling soldiers to fight.

Conscription produced Napoleon's armies. At the age of 20 all Frenchmen became liable for four years' service, but the backbone of the army was made up of old soldiers induced by various means to remain. Nor could his men forget that free men could rise through promotion to become marshals of France. The infantryman was released from the bonds of his servitude common to standing armies of the previous century. But as incessant war wiped out the solid French peasant and townsman in the armies of Napoleon, their place was taken by nationals of conquered countries impressed into service. The infantry of Napoleon became debased, its morale declining steadily as Napoleon suffered his great defeats, particularly in the invasion of Russia.

5. The 19th Century.—For 99 years from Waterloo to the German thrust into the Low Countries in 1914 there were relatively few changes in the tactical organization and administration of infantry. The main change was in infantry weapons: first the substitution of the rifle for the smoothbore musket, then the invention of the percussion cap. (*See* SMALL ARMS, MILITARY.)

Increased weapon range made untenable the old battle order in



CULVER SERVICE

THE MANUAL OF ARMS FOR AN INFANTRYMAN FROM A RECRUITING POSTER OF THE AMERICAN REVOLUTION

Data on the caption was: "Position of a Soldier under arms: I. Poise Firelock, II. Cock Firelock, III. Take Aim (and) Fire, V. Half Cock Firelock, VI. Handle Cartridge, VII. Prime, VIII. Shut Pan. IX. Charge Cartridge, X. Draw Rammer, XI. Ram Down Cartridge, Support Arms, Slope Arms, Trail Arms." The notice offered a "truly liberal and generous" encouragement to enlist

which artillery worked within, or forward of, the infantry line, with cavalry disposed to the flank. These other arms were forced back to save the guns and the horses. From this separation of the lines arose the new command problem of controlling all forces of the battlefield when no longer joined immediately under the eye of the commander.

In the American Civil War the northern armies were gradually armed with breech-loading rifles which multiplied the fire of each soldier. The course of that conflict, with its futile bayonet charges, established the reign of the bullet on the battlefield before the first appearance of automatic weapons. Cannon played their part in supporting or resisting attack but it became almost impossible for infantry to close on infantry while the defense was sustained by steady, aimed rifle fire. Every range increase in infantry weapons widened the displacement between artillery and the covering infantry line, thereby inducing the development of cannon with greater range. Yet the battle crisis was still resolved at close range. Taking to ground, the infantryman became more elusive. Even so, better protection and increased range did not give him commensurate effectiveness. Such were his human limits that massed rifle fire did not have stopping effect beyond 300–350 yd.

6. Approach to World War I.—During the years from 1870 to 1914 it became common practice to make every able-bodied man liable for regular army service. Since this continental system brought most men into uniform it made the infantry soldier the symbol and the prototype of the common or average man in many European nations. In some ways he was a common denominator of the people of his country. His reactions to service, his ability to handle new weapons, and his like or dislike of organizational methods became increasingly important. He was not a professional soldier in the full sense of the term, nor was he a mercenary.

In the relatively minor wars of this period—such as the Russo-Turkish, the South African and Russo-Japanese wars—military leaders had an opportunity to analyze the effects of new weapons, tactical and organizational changes and technical improvements. Unfortunately, the lessons taught by these wars were not wholly assimilated by major nations. In spite of successful defensive stands, the attack was still expected to dominate the battlefield. The ghosts of Frederick the Great and Napoleon still hovered over the infantry of the great powers.

The rifled breechloader in the hand of the Turks assured defensive success against the Russians, who closed their skirmish lines to form a mass target as they advanced. They attempted to advance at Pleven, Bulg., in a close formation without firing their rifles or without taking advantage of the natural cover of the ground.

In the South African War, the British found their adversaries an unseen foe. Again and again the lines of British infantry assaulted positions against Boers hidden in the folds of the ground and behind vegetation. Smokeless powder made them a cunning enemy safeguarded from easy detection. It was in the South African War that the British introduced mounted infantrymen—soldiers who used horses as a means of transport but fought on foot, as their Boer opponents did. On the other side of the world, open-order tactics and improvised field fortifications employed by both the Japanese and the Russians were a preview of the infantry combat of succeeding years.

Open-order tactics and the increasingly devastating firepower of breech-loading rifles augmented by machine guns altered tactics to some extent, though mistakenly in favour of the offense rather than the defense. The inclination toward close formations still existed in the major armies. Seemingly, the preponderance of the new potential in firepower coupled with movement was to assure victory to the attacker. As further evidence, the field telephone and telegraph would assure the control necessary for the co-ordinated attack of the immense numbers of infantry troops in the pre-World War I armies.

Organizationally, armies were becoming changed in this period with the increase in strength of technical troops and staffs. Signal, quartermaster and engineer troops were needed in growing numbers as an adjunct to the combat infantrymen. Furthermore, larger staffs were needed to co-ordinate the complex armies totalling close to 1,000,000 men in France and Germany, and even more in Russia. The basic purpose of all such augmentations was to further the infantry battle and reduce infantry losses, but only a relative few shared infantry danger.

Developments in all arms in the wars before World War I called for increased individual initiative from the infantry, with emphasis on personal mobility and protection, according to a few writers and soldiers of that period. They argued that quick-firing artillery and the automatic rifle would wither the infantry assault and defeat control. Whereas safety lay in spreading and moving, from fear infantrymen would converge and huddle. The new weapons could be countered only by a rifleman who would guard, move and fire on his own initiative, exploiting any opening, but using protection when needed. The warning went unheeded. Every general staff remained convinced until the war was nearly over that a conquering will in the infantry mass could prevail over the new multiplied fires and would ensure victory. *See* also TACTICS: *Napoleon and 19th-Century Tactics*.

IV. WORLD WAR I

The defensive power of modern firearms had been underestimated by the infantry combatants at the outset of World War I. In a short time tactics were altered by the need for defense against machine guns. Each nation had its own machine gun which fired bullets of the same calibre as its rifle, at a rate of 250 or more a minute. Though this rate could not be maintained, short bursts of 10 or 15 rounds aimed knee-high across a field in a scythelike sweep made exposure by the infantry extremely hazardous. Tremendous efforts were made to break through the power of the machine gun and the modern rifle at the cost of high casualties. On both sides commanders added machine guns to their infantry units as fast as they could be procured. Failing of decision in repeated efforts to win by mass maneuver, confronted at last by a solid enemy array from Switzerland to the sea, the two sides settled down to trench warfare. Artillery numbers and ranges were multiplied in the hope of smashing the dominance of automatic fire and countering the opposing artillery build-up. This thickening of supporting fires only clamped the vise tighter by making indecisive the infantry's closing power.

In the four years of drawn battle the two sides persistently sought new methods to ensure infantry survival and restore its mobile and decisive role. To minimize artillery effects, defending infantry fought in small groups separated by the bays of deep, heavily revetted and traversed trenches. Infantry lived in dugouts 20 ft. below ground. In the attack under fire, riflemen advanced in short individual rushes, looking for defilade or the unguarded

BY COURTESY OF THE IMPERIAL WAR MUSEUM

BRITISH INFANTRYMEN IN TRENCHES IN FRANCE DURING WORLD WAR I, 1916

flank of the opposing weapon. Their own main weapons were often mounted in concrete emplacements called pillboxes. (*See* also TRENCH WARFARE.)

At first the commanders tried to break the deadlock by sheer weight of preparatory artillery fire, thousands of guns firing millions of rounds for days prior to the infantry jump-off. This proved futile because of the great depth in the entrenched systems and the diffusing of the infantry attack before it could cut through. Later came the tactics called infiltration, the artillery pounding the main bastions in the line opposite, the infantry seeking the weak spots and advancing by concealed approaches in an effort to envelop or take in rear main positions. Infantry tactics have adhered to this pattern down to the present.

The Germans introduced the use of poison gas with the object of neutralizing infantry defense. The British invented the tank, or land battleship, so that infantry could advance behind a strong shield and breach the line. In both cases the new weapon was first used experimentally on a small scale with only marginal effect. Subsequently, both weapons were put into full-scale development and use by the two sides. These changes compounded battlefield danger and radically altered the problem of infantry survival and movement. They were not decisive until toward the close of the war the authority of massed armour restored mobility to the accompanying infantry.

To blast the opposing infantryman out of his trench, the lightweight infantry mortar was added to the weapons family. It provided high-angle fire. The grenade was brought back into use for much the same reason, though it was also useful for trench and dugout mop-ups.

The supply function in World War I gathered tremendous proportions in order to fill the need for ammunition and equipment for the entrenched millions living underground between Switzerland and the channel. The long supply line of the U.S. forces across the sea into French ports and by railroad and truck to the front-line units required much man power. For the first time, total warfare made it possible for a man to go to war and, in the wartime expression, "never hear a shot fired in anger." Understandably the infantrymen who lived under the tension of the battlefield, its dangers, and its grime took offense at the recreational facilities and more normal life of the rear echelon serviceman. The gap between the soldier and the technical or administrative serviceman widened rapidly.

V. BETWEEN TWO WORLD WARS

By the end of World War I, however, infantry prestige was higher than ever before. Historians noted that the tide had not turned until the winning side could at last muster superior strength in infantry divisions. General staffs drew the broad conclusion that automatic fire and the new reinforced structure of direct support artillery had made the infantry defensive array all but invincible. Among the victors, the armies suffered from postwar neglect, but in such development as took place, infantry fared better than did armour and air power, although compared with these infant but promising arms, its potentials were proved and well understood. Only the vanquished state, Germany, saw the main lesson that infantry, hitting in combination with armour, had restored mobility to the offensive order. The British military writers, Maj. Gen. J. F. C. Fuller and Capt. B. H. Liddell Hart, originated this theory and became its most powerful advocates. The idea won some backing in France and became accepted doctrine in the Russian army. But only in postwar Germany existed the will and the means to build upon this pattern a wholly new military foundation which in time would transform infantry usage.

Infantry weapons and tactics in the armies of the world changed little during the two decades between World Wars I and II, but firepower was increased severalfold. The automatic rifle, a self-loading weapon, larger calibre machine guns and bigger mortars were added to the hand weapons of the infantryman. Great changes were going on around him, most of them affecting his combat potential considerably. Motor transportation delivered him to the combat area, and armoured tanks supported him closely. Artillery guns could be moved on their own vehicles or towed by trucks. In the skies the fighter-bomber supported the tank in breaking holes in an enemy line. The job of the infantry was still to be the exploitation of the attack, by employing the usual tactics to push back the enemy on the shoulders of the breakthrough. Also in the air there was some hint of the possibilities of parachute infantry flown to battle in air transports. Before World War II the future for the infantry soldier was much obscured, and the magnitude and extent of infantry combat was unforeseen even by the prophets.

VI. WORLD WAR II

World War I had proved difficult for the infantry soldier but the new devices, new weapons and increased firepower developed during the second world conflict made his job more complicated. In the prior war, artillery calibres were extremely large, but the tanks were lightly gunned and the infantry soldier had to undergo little bombardment from the air. The trenches and the pillboxes that had offered some shelter to the infantrymen of all armies in the previous war gave less protection because of the bazooka, flame thrower and mortar fire. The infantryman's lot was a rugged one since everything was being done to weaken his will, induce him to surrender or annihilate him. No other group in the armed forces took the sustained beating which was expected of the infantryman. Day after day he remained in the line, and added to his burden were all the new developments in tanks, rockets and land mines. Not only did he experience isolation and loneliness, great physical discomfort and constant danger, as was expected of most other soldiers, but he had also to fight aggressively under all kinds of conditions.

In some ways it was a marvel that infantry survived. Because of new developments in weapons it steadily changed its mode of fighting. No longer did a massed infantry unit go forward under its commander with sabre held high as was common in the wars of the 19th century and as occurred even in World War I. The infantryman needed to be constantly alert to act instantaneously and be mentally ready to meet any new situation. He was under constant strain of the pressure brought by artillery fire, the incessant danger and certain death for some of his comrades. He withstood the burden of being wet, muddy and tired most of the time; while soldiers in other arms went into the danger zone in tanks, planes and ships, and could return readily from the battle zone to comparative comfort. The difference was that the infantryman had to wade in the mud, eat in it, sleep in it and oftentimes die in it. No matter what army, the problem for the infantryman was similar.

1. Organization.—Infantry units in all armies during World War II were organized similarly. The potential power on the march or in the line was centred in the tremendous firepower which had been given by new weapons. The infantry regiment (brigade in the British army) was normally the basic fighting unit and varied from 2,100 to 3,300 men, the Soviet army having the lower figure and the U.S. the higher. In practically all armies the strength of the regiment was in its three rifle battalions, varying in size from 550 to 900 men each. The triangular type of organization was carried out through all infantry organizations to include the division with its three infantry regiments. The difference in the numbers in a battalion and regiment was usually in the number of rifle companies and the weight of the artillery weapons assigned to the unit.

All armies had infantry divisions composed of three regiments, the total strength varying from 11,000 in the Soviet army to 15,000 in the United States army. For supply and all maintenance functions, infantry divisions were almost wholly motorized in western armies. German and Soviet armies continued to have divisions with some horse-drawn equipment. In all armies the infantryman remained afoot although he was usually transported to the battlefield in some form of motor vehicle. Technical troops invariably accompanied him. Medical aid men, signallers, engineers and supply troops shared with him the dangers of the forward zone of fire—the first 2,500 yd. from the enemy. Mines, artillery and armour made movement in this zone hazardous for supporting troops. But these were small risks compared with infantry danger.

Gen. George C. Marshall, in his *Biennial Report* (1945), stated that the United States infantry sustained 70% of all casualties in the nation's armed forces, though it comprised only one-fifth of the forces overseas. But even within the infantry division, there were degrees of hazard. The rifle and heavy weapon companies suffered the heaviest losses, followed by the artillery, signal, engineer and other supporting units.

To return to the organization of the infantry division, its regiments usually comprised three battalions, and each battalion three or four rifle companies and a headquarters company which included heavy weapons such as mortars and large-calibre machine guns, or the heavy weapons were grouped in a heavy weapons company. The triangular system was further carried out in that infantry companies contained three rifle platoons, and each platoon three rifle squads (sections in the British army).

All armies included some light support weapons in the rifle platoons or added an additional machine gun unit. The squads (sections) of nine or ten men were the real fighting soldiers of the infantry—the shock elements of the men first in line in battle. Their perennial job was to seek out the enemy. The British rifle section comprised ten men—a leader, a light-machine gunner, a submachine gunner and seven riflemen. The Soviet army and U.S. army had eight riflemen in their squads, though two might be armed with the automatic rifle, or light machine gun.

There was no relaxation for these forward infantrymen; they had to seek cover and concealment, know how to handle a large array of weapons and how to work together as a team. In the U.S. army the weapons platoon armed with 60-mm. mortars and light machine guns stayed up close to give fire support to the infantrymen, who were armed with semiautomatic and automatic rifles and submachine guns. Again this organization was common to practically all armies of the world, slight variations occurring in the types of weapons and in the number of men assigned to the platoons and squads.

In the battalion of most armies supporting fire was furnished by a heavy weapons company containing mortars and heavy machine guns. As a family, infantry weapons had the dual purpose of defense against tanks and against airplanes. Likewise, in combination, they were suitable for defense or attack, though the heaviest mortars and machine guns could not be hand-carried forward.

2. Task Forces.—World War II fighting required tremendous firepower. Even with all his organizational weapons, the battalion commander needed more fire to assist his infantry. On his call, or assigned, were artillery units which worked closely with the infantry battalion. The system used in the U.S. and in several other armies was to group a combination of infantrymen and artillery with tanks and engineer troops into battalion combat teams.

In like manner the regiment was assisted by such additional firepower units as the cannon and antitank companies. Here again the infantrymen's 75- and 105-mm. guns were often augmented by other artillery batteries assigned to the regiment. In the western armies the regimental combat team was strong enough and complete enough in service units to be sent off on missions as a separate force. This was also true of the German and Japanese armies, but the Soviets incorporated the artillery, engineers and service units as an integral part of their rifle regiment.

This grouping of infantry battalions and regiments with additional elements into task forces for the accomplishment of a specific task was one of the significant developments of the war. A task force could be tailored to fit each special operation, the infantry battalion or regiment being assisted by attached tank units, artillery, engineers, all drawn together under the control of the basic headquarters. When the operation was completed, the task force elements were returned to their former commands.

3. Training.—The preparation of infantry soldiers for the intense, often prolonged combat of World War II required an elaborate training system. Universal liability for service produced a steady flow of physically fit recruits, usually between the ages of 18 to 35 years. The universal system was to train the recruits in the basic knowledge of weapons and orientation to military life at a gigantic training centre. After from 8 to 14 weeks, the soldiers were then incorporated into divisional units where tactical training progressed from that of the squad and platoon to the regiment and division. When the infantryman had been thoroughly trained in his own tactics, training was expanded to include artillery, tank and air support. Realism was given to training through maneuvers in which live ammunition was used. Not only did this require that the infantryman learn to seek cover instinctively but also made him aware of the sound of battle.

Throughout the war entirely new divisions were introduced into combat, preferably in a quieter part of the front. A gradual introduction to warfare gave the infantryman an opportunity to acclimate himself to battle. Later in the war when the full supply of divisions had been committed to combat there was a constant requirement for replacements. Individuals who had been trained in the centres were sent in groups to join battle-wise divisions.

The human factor in the placement of the right man in the right job was considered in most armies. Aptitude for combat was determined for individuals entering the infantry and the other fighting services. Men were given a military occupational specialty (MOS) but, unfortunately, the fighting tasks were not so labelled that infantry profited greatly by the workings of the classification system. That was its main shortcoming. It did not permit tapping the erstwhile bookkeeper or truck driver who potentially was a born platoon leader or weapons mechanic.

4. Infantry Weapons.—In number and size the weapons of the infantry steadily had increased through both world wars. Whereas in World War I the infantryman had only a rifle, pistol, machine

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U.S. ARMY INFANTRYMEN IN GERMANY DURING WORLD WAR II, 1944

gun, grenade and bayonet, he added in the second war submachine gun, carbine, automatic rifle and rocket-firing tubes known as bazookas and Piat guns in the Allied armies and as *Panzerfausts* in the German army. Other infantrymen fired mortars, large-calibre machine guns and antitank guns. Later in the war the flame thrower, used in World War I, was restored to infantry usage. The bangalore torpedo, a long explosive tube, used to cut through obstacles, first developed in the 19th century, was brought back. The average infantry company employed more than a dozen different weapons. The average rifleman was expected to be master of at least four or five; relatively few were the men in line who could operate all. As in all wars past, infantrymen also utilized captured enemy weapons, the German Schmeisser automatic pistol becoming highly favoured by United States troops. The "Molotov cocktail," a glass bottle filled with gasoline and supplied with a burning wick, was used to incinerate tank crews. There were numerous variations of this armour-stopping grenade, both handmade and formalized.

In the combat zone the infantryman had to be able not only to use his weapon but to know what to do to get through wire entanglements and around pillboxes. His fighting was against tanks, in mountains and in the jungle. The unexpected was normal for him and his weapons had to be usable against anything that moved on land, or that flew in the air. Therefore his weapons, though best suited to a particular use in battle, had to be effective for general use.

Some armies continued during World War II to use rifles designed before World War I. Others turned to more modern, semiautomatic, rapid-fire weapons such as the U.S. army M1. The carbine came back into use as the arm of personnel likely to need a quick burst of rapid fire at close range; its performance was not conspicuously successful. The bayonet was rarely used except for guard duty; as a weapon of the attack it virtually vanished from operations. The grenadier was no longer the highly trained specialist of World War I days, and in all western armies the art of the sniper also visibly declined.

During the early part of the war the infantryman had to fight tanks at a great disadvantage, armed only with rifle and grenade. The answer to this problem was the bazooka or *Panzerfaust*—a lightweight arm which could be handled by one man. It was capable of stopping light armour at 40 yd. or less and was effective against medium armour at close range when fired from the rear or flank. The automatic rifle and the submachine gun provided the fire base of the infantry squad, the action of individual riflemen developing around the heavier volume of these weapons. Of the two, the automatic rifle was more accurate but less demoralizing in night action.

The armament of an infantry division of approximately 15,000 men included 7,000 rifles, 375 automatic rifles, 327 machine guns of .30- and .50-calibre, 60 37-mm. antitank guns, 117 mortars, 8 75-mm. guns and 48 105- and 155-mm. howitzers. While these totals differed in armies and even within the same army, it was representative of the firepower available in most divisions of the major combatants.

With the above armament, and helped by mine fields and other obstacles which canalized the armoured attack, the infantry could occasionally make a successful stand against tanks by the midperiod of the war. Infantry weapon power did not permit engaging armour directly on a broad front. The infantry either sought foxhole cover or folded flankward, allowing the penetration, then attacked the tanks from flank or rear. Until the war's end the infantry array remained vulnerable to armour attacking in line.

Despite the increased firepower of weapons, however, and their greater mechanical convenience, many infantrymen did not fire in combat. S. L. A. Marshall, in *Men Against Fire*, explored the psychological aspect of modern war, and concluded that in the isolation of the battlefield of World War II men were gripped by a fear and an inertia which he believed prevented them from employing their weapons to capacity. He stated that 75% of the trained, seasoned troops would not fire or persist in firing against the enemy. In the light of his conclusions, training establishments in western armies re-examined the problem of stimulating maximum fire rates in the infantry line by new methods. The undertaking was phenomenally successful. By the time of the Korean War infantry fire rates had approximately doubled.

A. Special Types of Infantry

1. Air-borne.—During the 1930s the Soviet army had a number of air-borne units, but they were never used as such; rather they were employed as infantry in the defensive battles of 1941 when Moscow was almost taken. Air-borne units were present in all armies of the major powers, though it was not until late in the war that the U.S. and British armies produced the most spectacular and largest drops.

Air-borne units were usually small because they did not have the trucks, guns and heavy equipment common to standard infantry units. In all armies the organization was similar to that of the infantry division, with three regiments (or brigades) of three or four battalions each. Air-borne regiments were either parachute or glider types with the proportion varying from two parachute and one glider regiment as the normal formation, to be replaced later by the reverse. The main weapons of the paratroopers were automatic rifles, machine guns and mortars. The air-borne troops were handpicked men and considered themselves the elite infantry in all armies. They were highly trained physically and knew how to employ their weapons. They were trained to jump from planes, usually at an altitude of 1,000 ft., or to drop in gliders which rode to earth and skidded to a stop. The gliders carried some supplies and in the U.S. army included the jeep for transportation. Other supplies were dropped by parachute to be reassembled by the men who had dropped ahead of them. Air-borne troops once they had jumped fought like their line infantry comrades. They were basically infantry, in weapons and tactics, but with higher small-group initiative. (*See* also Air-Borne Troops.)

2. Armoured.—The setting up of armoured divisions brought about the creation of a specialized armoured infantry to accompany tanks. It was armed and attired as any other infantry. Its particular missions were to fight off foot forces threatening the tanks and temporarily hold ground that the armour had captured. However, these were relatively small components within the armoured organization and their separate character was not strongly expressed. Line infantry also accompanied tanks into battle, riding on the armour and providing local security for it when the situation favoured such tactics.

In the Soviet army infantry was used behind tanks on sleds both in snow and on normal ground. Other units which might be called a type of armoured infantry operated on skis in conjunction with tanks. In some ways the tank of World War II became a battering-ram for use against enemy infantry in trench positions or foxholes much like the battering-ram of old against soldiers in a fortress. Another development which came out of the improvised use of tanks by infantry was the personnel carrier, a low-silhouetted, tracked vehicle with a box on top. A number of infantrymen carried in such a tank-type vehicle operated with the same mobility as the tank and yet dismounted and fought as infantry.

3. Mountain.—Practically all armies of World War II contained a few specialized mountain infantrymen. Many were recruited from mountain areas where they had learned how to live on snowshoes and skis. Their arms were necessarily light in weight so that they could be carried by skiers. However, some sled-type vehicles were developed which could be moved by man power to carry mortars and machine guns as well as ammunition. Mountain infantry tactics varied considerably from those of regular infantry units because of their increased mobility and their usefulness in small groups for isolated attacks. Except in the Russo-Finnish war during the 1939–40 winter, there were no large-scale operations staged by ski troops. (*See* also Mountain Warfare.)

4. Commandos, Rangers and Raiders.—World War II saw the development of special infantry units which quickly adopted the traditions of guerrillas. In the Soviet Union, after the German advance had bitten deep into the Ukraine, the Soviet army organized partisan units behind the German lines. From swamps

and forests and in snow-covered wastes they operated in small groups under the direction of Soviet army leaders. They were rugged, hardy infantrymen and infantrywomen, who utilized only light weapons such as the rifle and carbine, though occasionally machine guns were found in the large guerrilla bands. Their tactics, rooted in Russian history, were based upon the idea of a split-second move against the enemy, the carrying off of a few prisoners, the killing of a few soldiers, and a quick disappearance. They were extremely effective against small units or the rear echelons of larger units, but they avoided regular infantry battles as a matter of course. (*See* also GUERRILLA WARFARE.)

The special infantry of the British and U.S. forces were the commandos, rangers and raiders. The British commandos, trained to the peak of efficiency, employed the swoop tactics of the guerrillas but stayed to fight an infantry battle when they chose to do so. The U.S. counterparts of the commandos were known as the rangers. In battalion strength, they participated in all the major landings in the Mediterranean and were the first to go ashore. In the Pacific there were U.S. marine raider units, amphibiously trained, which carried out operations similar to those of the commandos. The Allies other than the Soviet Union seemed to specialize in these extraordinary infantry units including in addition to those mentioned, other units fighting in Burma and China known as Wingate's "chindits" and Merrill's marauders, both of which were trained in jungle warfare as a speciality. *See* also COMMANDO; JUNGLE WARFARE; RANGER; WINGATE, ORDE CHARLES; MERRILL, FRANK DOW.

B. Offensive Tactics

The infantry, of all land forces, had the primary mission in combat of coming to grips with the enemy, capturing him, defeating him. Their weapons, tactics and role in the combined land team were designed to bring about victory on the battlefield.

The uncertainties of infantry combat called for moral strength. Normally infantry fought where fire was most intense; tactical formations, even in the squad, were spread over a considerable area. No matter how excellent his training, nothing prepared the infantry soldier for battle where he saw practically nothing moving and had no sense of large numbers of men being engaged in combat. Local clashes made up the battle; each leader carried forward his own particular part of the panorama of modern battle. Consequently, infantry action demanded fighting spirit and initiative.

Offensive action was needed to obtain decisive results in infantry combat; the spirit of attack was basic to good fighting. But in World War II, local actions by infantry units rarely were continuous attack or defense. While neighbouring units were attacking, some infantry formations were on the defensive. However, for sound and spirited defense, the swift, disorganizing counterattack was essential. In this particularly testing aspect of operations, German World War II infantry was unexcelled.

Rapid movement on the offensive made it possible to exploit the effect of firepower. This was one of the key principles of infantry action. If an infantry platoon or company reached its objective before the enemy reserves had been brought into battle, it saved itself casualties. As a result every wile and stratagem was employed to concentrate against an enemy weak point, or to conceal the time and place of attack.

When the advancing infantry unit, large or small, met strong resistance, overwhelming fire superiority was a necessary adjunct to movement and surprise. Infantry action was made over all kinds of ground. Accordingly, terrain had to be made to serve the interests of the fighting foot soldier. In the attack, every fold in the ground, every tree and bush became important in his mission of advancing by bounds while other soldiers kept up fire against the enemy. The picture of the battlefield was therefore one of small groups constantly moving forward, firing their weapons, seeking cover preparatory to the next dash. In all these attacks there was a common pattern.

1. Attack Maneuvers.—The triangular organization of infantry from the regiment to the squad was peculiarly adapted to the offensive. The normal formation was to place two units in the main attack, with one in reserve or support. Such attacks were rarely frontal, in the tradition of the close formations of the 18th- and 19th-century infantry, but always sought to slide around enemy strong points by enveloping them from both flanks, or by striking on the flank. Therefore, the main attack most often was a hitting operation by one or more units while the elements to the flanks supported the movement with a pinning fire; thus creating a holding effort such as that used by ancient phalanxes. The reserve or support unit was used at an appropriate time to drive home the flank attack or to back up the holding force if it was counterattacked in strength. In some ways the offensive tactics of infantry were similar to those of a prizefighter, always striking with the left or right hand at the side of the opponent's jaw.

Infantry offensive tactics, like those of entire armies, did not always effect an envelopment aimed at an enemy flank or rear. On occasions, the terrain did not permit such a tactic and a frontal or penetration attack had to be made. This required careful preparation, like the envelopment, and demanded a follow-through. Small infantry formations often entered this type of battle by placing their three units in a column, the infantrymen being of course deployed as in other offensive fighting. The first unit attacked. If it broke through, the second unit was available to exploit the breakthrough. If the first unit was held up, the second unit was brought up to add to the firepower, or even passed through the lead unit to make a fresh assault on an enemy position. These tactical methods applied to divisions and other units down to even the infantry squad. In all these maneuvers the infantry was almost never left to fight alone; artillery, tanks and even fighter-bombers were available to add power to the team attack.

2. Preparation for Attack.—In all armies the sequence of moving to the attack followed a similar pattern; the U.S. method used in World War II was typical. The battalion or the regiment (in some armies) was the basic infantry combat unit. Orders came from the next higher headquarters to prepare for an attack. Subordinate commanders were gathered together to receive the attack order, which included the objective to be taken, a line of departure or jump-off line, a zone of action, a direction and time of attack and information about supporting artillery and heavy weapons fire.

Having received the order from the superior headquarters, the commander then had to develop his own method of attack. Before he could analyze the many factors of importance to his own attack plan, he had to make a reconnaissance of the ground. Without the information thus obtained, he could not know the dispositions of the enemy or the approaches which would best serve his own advance. Very rarely was battlefield intelligence more detailed than that. Usually the plan of maneuver was determined without having exact knowledge of strong points in the enemy line, although in some notable instances, such as the Normandy invasion, the defensive pattern was developed with almost blueprint accuracy. The actual situation of the enemy, in contrast with what had been surmised, was most often revealed in the preliminary phase of battle when forces began to exchange flat trajectory fires. So general was this rule that initial skirmishing, aimed to develop the enemy profile, was called reconnaissance by fire.

This and all other forms of reconnaissance were the keys to infantry combat success. Lacking knowledge of the intermediate ground and of the general use made by the enemy of the high ground or any fortified area, the infantry commander was not properly prepared. Familiarity with the scene was the touchstone of efficiency. One method of gaining information was to send out patrols at night, either to capture enemy soldiers or to examine ground beyond the area surveyable from an observation point during daylight. Failure to reconnoitre led almost invariably to wrong estimates, unsound deployments and tactical failure.

Having gained information from all available sources, the infantry commander issued his own attack order, which included a map designation of the objective, the line of departure, the zone of action, the plan of maneuver, the location of the reserve, the protection of the flanks and the avenues of approach to be utilized by the subordinate units. In addition the fire support plan of the heavy weapons was worked out. This included the emplacement

of mortars and antitank guns, and designation of priority targets. Certain key spots in the zone of attack were given to the supporting artillery as possible targets so that they might calculate their firing data and thus be prepared for instantaneous shelling of those points when a telephone call for assistance was received.

The zone of action of an infantry unit in attack gave it a frontage for which it was responsible. A regiment, for example, might be responsible for a frontage of from 1,000 to 2,000 yd., with each succeeding subordinate unit responsible for a front half that extent. The company usually had a frontage of from 100 to 200 yd., and the platoon from 50 to 75 yd.

While a battle reconnaissance was in progress, the units of the attack were made ready. If located in assembly areas too far rearward they were moved forward by motorized transport.

During World War II, in the average situation, the infantry assembly, preparatory to attack, was already within light artillery range, or less than 6,000 yd. from enemy weapons. When advanced to the line of departure, where they deployed for the attack, the formations usually came within enemy small-arms range. Sometimes the final lunge was made under cover of dark. More times than not, it was broad daylight. Frequently assemblies had to be made under observation and small arms fire.

3. Launching the Attack.—Usually a successful infantry attack was conducted in a sequence which obviously required changing to fit the situation. As in World War I, artillery concentration was normally the first move. Artillery also included air bombardment and the infantry mortars so that concentration on the enemy came from three un-co-ordinated or partially co-ordinated directions. The infantrymen moved forward during the concentration, keeping under cover as much as possible until they got within a few hundred yards of the enemy. Not only were they faced with wire entanglements similar to those of World War I but also mine fields. They had to send ahead groups to clear mines or at least make a path through them. The mine field had become one of the primary aids to defense since great quantities of them could be put a few inches under the ground in a field which blocked normal access to the defensive positions. Mine fields not only forced attacking troops into unfavourable terrain but also brought them under the fire of presited machine guns, artillery concentrations and defense lines in depth. When they got within a short range of the enemy the attacking troops brought up all possible firepower in mortars and machine guns and obtained the help of the artillery which placed its shells upon the enemy infantry. In many cases tanks were brought up to the line of departure and led the infantrymen through the gap or prepared lanes in mine fields. The last few yards were gained by the infantry, on its own, using the automatic rifle and covering machine gun fire to bound forward and kill final resistance with rifle and grenade fire.

At the time set for attack, the infantry assault units crossed the line of departure and moved aggressively ahead toward the objective. After the attack was launched the commander had only moderate control over his men. Their individual initiative and abilities determined in large measure how well the attack went. However, the infantry commander had partial control over the action by radio and telephone, with which he endeavoured to maneuver his units, direct supporting fire and seek help from the elements to his flank and rear. His hold upon his reserve was final insurance against the battle crisis.

Infantry assault units were in many cases assisted by tanks, which fired their artillery guns from concealed positions in extremely close support of the infantry, or preceded the infantry from the line of departure and acted as a land battleship for their protection. On some occasions tanks followed the infantry units, passing through them just before the assault on the objective, or perhaps, moving down other avenues, arrived simultaneously from the flank to assist in the assault.

When enemy resistance was too strong, the infantry advance was halted while neighbouring units assisted by attacking the objective from a flank. Meanwhile, the infantry in attack had to dig in, in an attempt to build up enough fire superiority to beat down the enemy. In such a situation, the ability of the infantry soldier was put to the test to improvise means of getting the attack under way even if it meant altering the plan. Sometimes, the support units were brought in on a wide flanking movement, while the main attack continued to move forward aggressively. Before the final assault on the enemy was made, the infantry commander called off the supporting fires by a prearranged signal. It was the task of the infantry to move through the enemy position so as to work through its complete depth and prevent reorganization and counterattacks. After the assault, the attacking infantry had to reorganize its own units before swinging into a pursuit, a tactical action often made by truck or by infantry carried on the tanks.

This entire system of the conventional infantry attack, as presented in sequence, was rarely so well ordered. The "fog of war" often obscured what later was obvious. At such times the aggressive action of a few infantry riflemen or machine gunners pushed the attack through to success. There were also many variations in this conventional sequence and form of infantry attack, particularly where the action took place in towns, or mountains or desert.

C. Defensive Tactics

Infantry tactics were almost as often defensive as offensive in World War II; even a spirited attack called for momentary defensive tactics by certain units in the line. Even when there was a general advance on a portion of a front, other units were in a holding or defensive position. Also, whenever a rifle unit had made an advance, it was compelled to dig in temporarily to gather itself for the next move forward. A defensive position properly laid out was a safeguard against counterattack; selection of a position on the ground was of great importance though often the infantry commander had no choice but to make the best possible use of the front assigned for defense.

As in the attack, co-ordination of troop locations and firepower with respect to the ground to be defended was the best assurance of success. The position was organized in a group of key points, the intervals between them and the approaches covered by the maximum fire. The selection and preparation of these key points into an integrated system was the crux of defensive infantry tactics.

Any defensive position could be penetrated if the enemy was willing to pay the price. Therefore, defense in depth was the solution since it often made the price of attack too high. When an enemy penetrated the main line of resistance, he was certain that he would be met by fire and by reserve infantry units from other defensive key points to the rear. Other principles in the establishment of a defensive position were the necessity of assuring mutual support, a co-ordinated plan for firing all available weapons, an antitank defense and flexibility.

Units across the front of a defensive position and from front to rear disposed their men and sited their weapons to provide mutual support. The aim was to have all units so placed as to assist any unit with fire. Thus stated, the object was elementary. But because of irregularities of terrain and the chronic overextension of infantry forces, the ideal was seldom achieved.

In World War II, because of armoured mobility, attacks often came from the rear as well as from the front and flanks. This was particularly true of air-borne operations and of desert and jungle fighting where the defense was often a closed perimeter or hedgehog. Troops likely to be cut off or enveloped attempted to secure an all-around defense. But because automatic firepower was seldom sufficient to complete the tight-knit circle, the rear continued weak.

A co-ordinated plan for firing weapons on signal was absolutely essential to a good defensive position. Not only was the fire of unit machine guns, mortars and antitank weapons co-ordinated, but they were supplemented by additional artillery support on call of the infantry commander. The objective was to be able to bring down the maximum fire on a certain area where an enemy attack was being organized, or prepared to make an assault.

The antitank defense was all-important for the infantry, even after bazookas became a regular weapon. Against tanks, the defense included the co-ordinated fire mentioned above, assisted by

mine fields and obstacles like antitank ditches.

A combination of the foregoing methods of defense did, of course, provide for flexibility. Other than the massing of supporting fires, and the withholding of a reserve or support force, one of the greatest aids to flexibility was in the preparation of alternate positions. For example, it was common practice for units to have different positions for day and night. In general, however, western forces did not prove adept at forest fighting, and the tactics of using or refusing forest cover advantageously remained unclarified.

Frontages for defense were usually from two to five times the width of attack frontages, contingent on the nature of the ground. An infantry company was usually assigned a front in rolling country of 600 to 1,200 yd., and was expected to defend in depth to whatever limit the fight required.

If time was available, extensive defensive preparations were usually taken, not only to dig foxholes but to link them with shell-resistant tunnels, prepare deep shelters covered over with earth for safety from artillery barrages, and dig several alternate positions for each key point in the defensive system. Similarly, the heavy weapons were first dug in, then the hole covered over with just a firing slit remaining, and then brush and tree branches on the lines of fire cut so that maximum effect was attained.

Ditches, obstacles, mine fields and wire entanglements were added, their number and complexity increasing the longer an infantry unit was located in a defensive position. Time and machinery were the main limitations on the organization of a defensive area. While the infantry was digging foxholes and trenches and laying out obstacles, artillery observers in the front line arranged their schedules for fire support. They selected danger areas such as a valley leading into the position and gave it a number on their map which in turn was communicated to the artillery batteries. In this way artillery support could be called for rapidly without mentioning map co-ordinates.

Defensive positions in many areas were complicated by the soil. On many of the atolls in the Pacific, for example, the matting of tropical roots made digging foxholes impossible. In addition, the jungles raised new problems for the defensive formations of infantrymen. Night noises and the various methods used by the Japanese to prevent sleep made life extremely difficult in the jungle. Defensive positions were fluid, and the men had to be kept fairly close together because of the dangers of losing contact.

Early in World War II infantrymen came under heavy fire from strafing airplanes though antiaircraft weapons attached to an infantry division later made such attacks costly. Ground fire by the infantry from its multiplicity of weapons sometimes brought down enemy planes. As the war wore on the infantry paid less and less attention to dive bombing and strafing aircraft, leaving protection to their own antiaircraft. Also it was found that infantry firing against aircraft gave away positions to enemy artillery. It became common practice in all armies for the infantryman to dive for a foxhole in a plane attack, which was normally short-lived and did little damage to him.

The conduct of the defense offered greater opportunity for control by the infantry commander than did the attack. Usually, he retained the heavy weapon support, the reserve troops and the antitank guns under his central direction so that the entire weight of the defense could be thrown against a critical enemy penetration.

D. Special Operations

Infantry offensive and defensive tactics were not always as conventional as indicated in the foregoing description. However, the principles for such tactics were applicable in special operations, revisions being made as directed by the judgment of the infantry commander.

1. Attack of Fortifications.—During World War II, the normal infantry action was against enemy field fortifications. Their strength depended largely on how long the infantry had had to prepare the defensive position, on the will of the defenders, and on the combined support obtained from the other land forces and from the air forces. In many cases German and Japanese machine gunners held out until infantrymen had actually killed every man. Japanese infantry was also adept at cover and concealment, particularly in cave warfare, and normal infantry weapons were insufficient to dislodge the defenders. Grenades and 25-lb. explosive blocks called satchel charges were used against these refuges, as were flame throwers, but they sometimes failed to shake the enemy's will to resist. After outposting such obstacles, the infantry assault waves usually advanced past them, leaving the task of destroying them to the support elements. (*See* also Fortification.)

2. Infantry in Towns and Villages.—Advances inevitably brought infantry troops in contact with villages and towns which seldom could be by-passed since all armies utilized such communities as fortresses. By sandbagging windows and doorways, setting up machine guns in rubble, laying mines under debris, or preparing booby traps in unoccupied buildings, a town was made into a fortress. Air attacks and artillery only increased the amount of rubble, and tanks were at a disadvantage in enclosed areas. Consequently, small infantry teams were the most potent attacking force. Usually one infantryman proceeded ahead to open doors, pry into heaps of rubble under cover of the guns of his fellow soldiers. Grenades and submachine guns were the preferred weapons in villages. Grenades could be thrown into open windows, and Tommy guns were employed to spray an area with bullets.

House-to-house fighting was the most dangerous kind of combat, since at any moment enemy fire might come from front or flanks, or from the rear. A systematic attack was used to take building after building, establishing a general line through a city. Then moving forward on a wide front, the advance in time reached the far edge.

3. Combat in Woods and Jungles.—Wooded areas were also left to infantry combat. Occasionally a small wood could be by-passed, to be mopped up later by forces following the advance elements. However, large woods like that of the Hurtgen forest in Germany west of the Rhine had to be taken by infantry troops. It was slow going, complicated by lack of control and observation. Artillery and air bombardment were not usually effective.

The edge of large woods was usually the first objective, followed by later attacks when the infantry were organized to move forward. Trench systems, mines and ambush were common to fighting in woods. Much of the battle consisted of man-to-man fighting, with grenades and submachine guns of the greatest use as in towns.

Jungle warfare demanded the greatest resourcefulness of infantry. The dense growth compelled foot soldiers to remain on the roads and trails where there was the greatest danger from enemy attack. The heavy rainfall, debilitating climate and the noises of the jungle were added impediments to the infantryman. Cover and concealment were afforded the enemy, and often a strong point was by-passed unknowingly. Advance elements, after moving forward, were surprised by firing in their rear, usually against larger parties moving up in support or bringing supplies. Painstaking efforts had to be made by infantry in outflanking resistance and, when halted, to assure all-around defense of their position. Again the hand weapons were the main reliance of the infantry, artillery and tanks being useful only when the jungle area was not a mass of dense undergrowth.

4. Amphibious Assaults.—Prior to World War II amphibious attack by infantry had been limited largely to battalion assaults against relatively light opposition or none at all. There was no considerable doctrine for amphibious attacks by units of a division or larger. The foot soldier was put ashore from landing craft and fought his way inland in typical infantry fashion. Training for amphibious assault was a long and involved process in which the armies of the western Allies necessarily took the greatest interest.

Infantry attacks across rivers were similar in some respects to shore-to-shore amphibious operations. Reconnaissance for the best crossing area was absolutely essential. Usually these operations were begun at night so that leading elements could get estab-

lished on the far bank before daylight. A further build-up of forces was then essential so that the attackers could fan out and obtain a bridgehead. Later, various types of prefabricated steel bridges, as well as the pontoon bridge, were used to facilitate movement. (*See* also AMPHIBIOUS WARFARE.)

5. Night Operations.—Infantry combat was replete with night operations, usually involving small patrols and combat teams. In the jungle, the Japanese had a special liking for infiltration at night. Furthermore, all armies found that incessant artillery and small weapon firing served to unnerve the opponent by causing loss of sleep. Night attacks were often necessary to consolidate ground won the previous day, to initiate an operation by the seizure and occupation of an enemy strong point which might hold up a general attack. Night operations required resourceful infantry, well rehearsed in what was expected of each man. Control was obtained by keeping men close together, and by the wearing of a distinguishing armband or headband.

6. Supply.—The usual system of supplying the front-line infantrymen was to bring up food, ammunition and other requirements at night by truck or horse-drawn wagon from regimental dumps several miles behind the line. At dusk each night the U.S. and British troops used jeeps to rush supplies forward to the troops before complete darkness set in. The jeeps were often able to bring supplies to within 100 yd. of the front. Eventually however, supplies had to be carried by man power the last few yards. The rifle companies in many cases furnished their own members to bring forward supplies. Horses and mules were used wherever possible, particularly in the mountains of Sicily and Italy. The bringing up of supplies was usually a difficult job because routes soon became known to the enemy. A heavy shelling could be expected during the time the enemy reckoned supplies would be moving forward.

7. Morale.—In all armies greater efforts were made to keep up the spirit of the soldier, particularly those in front-line combat, during World War II than in any previous war. Radio programs, motion pictures, newspapers and theatrical shows were brought to the soldiers overseas. Even the front-line troops got their news by radio. They also were the subject of enemy interest, being propagandized by the playing of nostalgic music and reporting of news items stressing events at home which would make the soldier lonelier or would cause him to ask himself the question "Why do I fight when others at home have an easy and safe life?" These broadcasts became so persistent that in all armies efforts were made to educate the soldier to the justice of his nation's cause and the necessity to continue the fight until victory was won.

The Soviet army through its political commissars featured a system of indoctrination so persuasive that even the Soviet leaders of the fighting units claimed that their authority was subverted by the political representatives. Though commissars were withdrawn when the fighting was particularly severe on the defensive they returned when the Soviet forces took up a general offensive.

The U.S. army had particular difficulty early in the war in the assignment of men to the infantry. The majority of draftees preferred the other arms and services. Moreover, the early policy was to deny the infantry a fair proportion of superior men. At one time the disequilibrium was such that 72% of the ranks in the air forces were educationally qualified for infantry commission while only 16% of infantrymen were so qualified. The system was changed and infantry prestige was raised when finally it was realized that infantry was still the decisive arm. Infantrymen were given additional combat pay and a special identifying badge. The British and German armies had difficulty with the same problem but in lesser degree.

VII. CHARACTERISTICS OF INFANTRY AFTER WORLD WAR II

After World War II the triangular organization throughout the infantry from platoon to division was maintained as it had been at the close of that conflict. Such changes as were made had either the object of further increasing infantry firepower against other foot forces or of giving it better protection against infantry fire. Bulletproof vests and jackets were perfected for combat issue. Organic armour was brought into the infantry division. A new family of infantry weapons, the recoilless rifles, was developed. These relatively light tubes (which had barely seen service in World War II) could be man-carried and gave infantry the equivalent of a highly mobile light artillery, invaluable for point-to-point firing in rugged country. (*See* ARTILLERY.)

Tactical reform and organizational change did not keep pace with the over-all advance in weapon power which threatened the existence of the conventional defensive order. For at least five years after the first atomic bomb was dropped in World War II, western general staffs took few steps to measure what changes the new conditions required in infantry training, structure and theory to ensure success, or even survival. There was talk among infantry tacticians about the necessity of achieving maximum spacing between deployed men and units, while making infantry more elusive, mobile and aggressive. But no exercises were held and little staff work was done to bring doctrine and practice abreast of the new realities in total war.

From the experience of World Wars I and II had come two dominant tactical ideas, the flankless front in defense and the breakthrough by massed armour on the offense. These defined and limited the infantry approach in future operations. The military schools continued to emphasize the avoidance of open flanks, the correctness of the closely joined order of battle and the preponderant mobility of armour as an offensive shield covering infantry. In this brief twilight period, military thinking proceeded as if nothing had changed radically.

1. Korean War.—Although the doctrinal lag incurred no immediate penalty, the first limited war of the atomic era, in Korea, 1950–53, presented unique problems for all infantry forces. Not only did the Communist armies possess at all times superior infantry numbers, some of which were always in position to harass the rear of the United Nations army and cut its communications, but the latter side was never in strength sufficient to form a continuous, closely knit forward line, supported in depth.

During the highly fluid operations of the first year, the Communist armies, after their initial drive, used little artillery, air power or armour. But in all operations they made prodigious use of ground protection and night cover. In the attack, they advanced against the entrenched ridge tops with hand-carried weapons, relying heavily on the machine gun and slightly less on the mortar. Or else, under cover of darkness, their infantry moved forward through openings in the main line of resistance, either to attack artillery and other rear installations or to set up roadblocks behind forward infantry battalions to compel their withdrawal. These were the chief unorthodoxies in their method of making war.

Against a strongly armed opponent, with ample air and artillery weapons, the defensive system ultimately developed by the United Nations forces to counter these tactics would not have availed. Perimeter defense, by infantry blocks of battalion size or larger, proved to be the correct solution. Its success derived primarily from organic unity within the position, combined with maximum union by communications with all higher headquarters and coequal tactical bodies to the right and left. Mutual fire support was supposed to exist between each block and its nearest neighbours. Such was the infantry shortage and the resultant stretching of the rifle line—understrength battalions sometimes covering 4,000 yd. of front—that this defensive technique was more theory than fact.

In the attack by UN forces, air and artillery preparation and the thrust by armour opened the way for infantry wherever possible. Because the Communist defense was hinged usually to the higher and rockier ridge tops, distant from the valley roads and beyond reach by any vehicle, much of the time infantry had to make its closing rush with little or no effective support except the fire of its own machine guns, recoilless rifles and rocket launchers. For infantry on both sides, it was an infighting war, with an extraordinary incidence of hand-to-hand combat. The hand grenade was heavily used by both sides as a finishing weapon. Because the rugged terrain limited fields of fire and because morale needed stimulating in the crisis of the first winter, the UN command restored active use of the bayonet as an attack weapon.

2. Tactical Changes.—Basically there was little change in in-

fantry weapons use or the tactics of fire and movement except as old methods were modified in conformity to the difficulties of the terrain. The main advance tactically came in the form of new and greatly diversified forms of support provided to the infantry by the younger services. When defensive perimeters became cut off and besieged, infantrymen were sustained by air resupply and their casualties were taken out by helicopter. On many occasions battalions and larger units were saved by flying prepackaged supplies from Japan. More numerous were the incidents in which a platoon or company was rallied in a desperate situation by one or two liaison planes coming in to make a free drop. The rifleman wounded in a fight for a distant and unroaded mountain peak frequently was flown to a base hospital within 10 min., receiving plasma and first aid while still air-borne. Such innovations came of the inspiration of the moment, but they were characteristic of a new tendency under pressure to find wider use for all equipment.

The light liaison plane became a jack-of-all-trades in support of infantry. It served in artillery direction, did observation work over enemy lines, acted as relay and guide for long-range infantry patrols, led in the air strike and became an intermediary in long-range radio communication.

The employment of armour was not less diversified, and many of its most decisive services to infantry ran counter to the orthodox teachings of the schools. In night defense, it formed roadblocks covering critical approaches to the main infantry positions. In the face of fire, it ferried infantry onto the ridge tops when the slopes were negotiable. It acted as escort to patrols. It worked as artillery from within the infantry defensive circle, firing its cannon from 20 yd. or less behind the rifle line. When the infantry was hard pressed and the night situation uncertain, armour occasionally outposted the position. If the position became lost, armour was used to retrieve the infantry dead and wounded. When the infantry numbers became too thin, tanks were spliced directly into the rifle line.

During the last two years of position warfare, armour was consistently employed in that role because of the infantry shortage. Armour was set up to enfilade main roads running laterally behind the key ridges; it mounted guard over first-aid stations and supply points. The conservation of both forces was most perfect only when there was perfect reciprocity between them, and the commander considered one just as expendable as the other when the position became threatened as a whole.

Infantry hardship in Korea was not more than in the earlier wars of the century but on the whole less, though the subject was more fully publicized. Viewing the extraordinary work load which devolved upon infantry, there was obvious need for a pioneer or engineer company within the infantry regiment. The rifle companies always had their hands full, if supply was to be moved forward, if telephone lines were to be laid, if foxholes were to be dug. Still, the wounded had better prospects for survival than ever before and the terrain which made every advance arduous also proved a shield against the heaviest fires. Infantry losses from nervous exhaustion, combat fatigue and desertion became minimal.

3. Communist Chinese Infantry.—Historically the salient military development of the war was the proof of tactical and moral competence in Communist China's almost unlimited infantry mass. Its trained formations could withstand the shock of massed fire despite the fact that its own tactical methods in attack and defense were inflexible. Except for the machine gun and mortar, which the Chinese used expertly, the use of organic weapons, while persistent, was not markedly skilled. Their physical endurance was exceptional.

During the final two years of position warfare, the Chinese Communist defensive system had far greater depth and elaboration than the UN line. The army lived and concealed itself in deep subterranean works, using the surface trench system as an alarm net to rally forces to the ridge tops when attacked. Artillery also was tunnelled into the ridge tops. Bombproof, these works, unlike the opposing defenses, would have been strongly resistant to atomic weapons. Operations consisted mainly of infantry patrolling. By keeping divisions in line until troops were thoroughly seasoned, Chinese Communist forces became unexcelled in this furtive and essential activity.

Tactics tried and proved in Korea by the Communist forces were exported to north Indochina during the concluding phase of a war which until then had been a struggle between elusive guerrilla bands and a conventional army basing on blockhouses along fixed lines of communication. The new methods made firm and decisive the Communist counter to the French invasion by airhead at Dien Bien Phu.

4. Atomic Exercises.—On Nov. 1, 1951, the first test of the behaviour of infantry in the vicinity of an atomic explosion was held at Yucca Flat, Nev. It was not a tactical exercise designed to work out specific infantry problems, such as mass evacuation, preliminary reconnaissance and reorganization of ground forces following atomic attack. The object was to determine whether normal infantry suffers an abnormal psychological or physical reaction when within sight of but at a safe distance from a nuclear explosion. The findings were negative. Since then all tests of infantry forces when disposed toward an atomic explosion have had similar limitations, and the results bear only marginally upon the main question of battlefield reactions.

Atomic exercises, in which corps and armies maneuvered and a number of atomic strikes against the battle order were simulated, were conducted regularly by western armies after the summer of 1953. During the first years of experiment, no radical change in conventional organization and practice resulted. Getting a late start, the development of theory about the character of the front, the regulation of movement and the problem of infantry deployment under the new conditions remained in a highly fluid state, awaiting further exercises, more committee study and a breaking down of traditional resistance to change.

5. Infantry Reorganization.—By 1957 came the first clean break with infantry structure in the preatomic age. In the U.S. army the change preceded systematic field testing to determine what form infantry organization should take to meet the new condition. Regiments and battalions were eliminated and for the old triangular division was substituted a five-sided structure composed of battle groups. Each battle group was formed of five rifle companies, both within air-borne and line infantry divisions. By this reform both types of division became reduced in size. The general purpose of reform was to make the holding structure less rigid, thereby increasing the elusiveness of its parts on the atomic battlefield. Supporting organic artillery was greatly reduced in numbers of men and guns, thereby placing greater reliance on heavy mortars and rocket batteries. Communications (signals) support was heavily increased by the addition of a new division group which was to maintain wire nets, etc., for the fighting groups. The combat supply problem was similarly handled through the forming of a logistical support group which would carry the load for the infantry fighters.

Through the next four years, U.S. infantry within regular and reserve components was reorganized to conform with the new design. Frequently tested in maneuvers, the pentomic structure was never tried in battle, though elements of the 24th air-borne division that participated in the 1958 Lebanon intervention had this form. Then abruptly in mid-1961 the pentomic design was abandoned. The U.S. army adjudged it too inflexible to adjust to the need that national forces be equally ready for full-scale operations or limited and irregular warfare.

Concern with tactics employed by Communist-trained guerrillas in such fringe areas as Indochina partly influenced this change. Lightly armed, mobile of foot, highly elusive, loosely formed and striking always out of natural cover, they were largely independent of main bases. Heavier weapons, by superinducing the need for still larger security forces along lines of communication, make modern infantry increasingly vulnerable to such an opponent. Still unanswered was the question whether U.S. forces could readily adjust to fighting methods which were better understood in the earliest years of the republic.

By the 1961 reform, the U.S. division—foot infantry, air-borne or armoured—ceased to have a standard form and strength. A division base formed a nucleus whose forces would be built up or

contracted in conformity to the specific task. Each division enclosed three tactical brigade headquarters, with each brigade comprising two, three, four or five battalions. Each battalion would be self-sufficient, capable of administering its own affairs and operating independently. Thus the brigade, while partly filling the place of the old regiment or battle group, was relieved of most of its administrative and logistical work load by the battalion.

Attending the shift to a building-block system within the division was an across-the-board increase in nonnuclear weapons within the infantry and supporting arms. Machine gun strength was trebled in the average U.S. division. Recoilless weapons were increased approximately 35%. The over-all increase in artillery support was 17%, most of it absorbed in light artillery, the weapon directly supporting the rifle line.

The standard infantry battalion would count about 840 officers and men, making it lighter than the World War II model, despite its increased administrative responsibilities. It was contemplated that when the reform was at last complete, the average U.S. division deployed overseas would include from 11 to 12 such battalions. If rifle formations predominated, they would still be called "infantry" divisions, but armour would remain organic.

See also ARMY; TACTICS; and references under "Infantry" in the Index.

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(W. H. BAU.; S. L. M.)

INFANTS, CARE OF. Infancy is usually regarded medically as extending through the first year of life or until the child begins to walk alone, at which time he is often referred to as a toddler.

In the mid-20th century infants were healthier and had a better chance of survival than they had at any previous time in recorded medical history. In England and Wales in the 1870s the infant mortality rate was approximately 150 per 1,000 live births; by mid-20th century it had been reduced to 25. The rate in the United States stood at approximately 150 as late as 1900; this had been reduced to less than 27 at mid-century. In Europe infant mortality rates range from as low as 18.2 per 1,000 in Sweden to 110.2 in Yugoslavia.

Important among the reasons for the greatly improved chance of survival was the advance in knowledge of foods and nutrition. Clean milk alone greatly reduced gastrointestinal diseases that formerly were the chief killers. Chemistry and biology contributed chemotherapeutic and biological agents to combat many infectious illnesses.

Any discussion of infant care must include a consideration of the mother and the unborn baby. It is often said that a fetus is a parasite on the mother. Unless the mother is a healthy person and unless the maternal diet is adequate, the fetus may not receive the essential nutrients necessary for optimum development. It has been demonstrated also that certain infectious illnesses during the early months of pregnancy can unfavourably influence the developing fetus. Good health and good nutrition thus are of utmost importance for motherhood, not only throughout pregnancy but presumably even before conception occurs. (*See* also PREGNANCY; MATERNAL AND CHILD HEALTH.)

DEVELOPMENT, HEALTH AND COMFORT

Newborn Infant.—The length of a normal male infant born at full term averages about 20.0 in.; females 19.5 in. The average boy baby weighs about 7.5 lb. and the average girl slightly less, about 7 lb. The circumference of the head of a boy baby is approximately 13½ in., that of a girl approximately ½ in. less. The head grows rapidly during infancy. At the top of the head is a soft spot, the fontanelle, which is well protected by a very tough layer of dense tissue that is gradually replaced with bone; usually the spot is completely closed by the end of infancy.

Infants are usually, but not always, born without visible teeth. The first tooth erupts at about six months. The time of appearance of the first tooth may vary considerably but the place of its appearance is remarkably uniform: it usually appears just at one side of the middle of the lower jaw. By the end of the first year six teeth usually have erupted—four upper incisors and two lower incisors.

The skin of newborn white babies is reddish but rapidly fades to a light pink. Other babies have skin colourings characteristic of their races. By the third or fourth day the skin often takes on a slightly yellowish colour, which normally tends to disappear during the next ten days to two weeks. The skin of well-nourished babies soon takes on a smooth pink velvety appearance and is elastic to the touch. The amount of hair on the heads of newborn babies shows great variation in amount, colour and texture, although it tends to be much more delicate in texture than it is in later life.

Newborn babies are incapable of visual focus; their eyes are likely to move in any direction and their motion is not co-ordinated. Strong light causes discomfort. By the end of a month babies begin to focus momentarily on objects and during the next two months they gradually develop greater skill and begin to recognize objects; their eyes will follow a moving object.

Newborn babies are often quite deaf, but this tends to correct itself rapidly and soon they respond to noise, words and music. Babies are readily disturbed when jarred or touched. Newborn babies are relatively less susceptible to pain than are older infants and children.

Sucking is a reflex act that is fully developed in babies born at full term but weak in premature infants. The ability to continue sucking is influenced by muscle fatigue. Rest periods and artificial assistance are sometimes necessary when the sucking reflex of a weak baby does not permit the taking of adequate nourishment. The ability to swallow, well developed at birth, is related to the sucking reflex.

The newborn baby cries when hungry or cold or otherwise uncomfortable. When appetite is satisfied and the infant is warm and in a comfortable position he sleeps much of the time.

Progress of Development.—During the first year normal development follows a fairly uniform pattern but with considerable individual variation. It is generally not until the age of six weeks or two months that the baby smiles in response to a pleasant approach. Purposeful smiles are not to be confused with facial contortions apparently associated with abdominal distress in the young baby. At about three months the baby begins to use his fingers with purpose and by four months some skill has been acquired with arm movement. The baby laughs, turns his head in response to being spoken to and holds his head up well at about three months. Often he can roll himself over on a hard surface; this is an important point to remember. A baby should never be left on a table or a bed without due precautions to ensure that he will not push himself off and fall to the floor. At five months the baby reaches for objects and soon learns to pick them up. At about seven months he begins to sit alone. At from ten months to a year the baby begins to use a few one- or two-syllable words, and his comprehension of words begins to be shown in response to a few simple commands. Toward the end of the first year he learns to pull himself to his feet and in about one year he begins to take a few steps with support.

Bowel habits and bladder control are matters that may be considered in relation to the child's general development. There is little use in trying to teach infants bowel and bladder control until their development has reached a point where it is possible for them to have enough success to be encouraged. It is often reported that babies have been trained to control bowel movement at the age of two or three months, but one must consider the possibility that this may be a trained mother rather than a trained child. It is seldom advantageous to start bowel habit training before a baby can sit alone comfortably and before he can understand the idea his mother is attempting to convey to him. Training with reference to bladder control habits is generally started after success has been obtained with bowel control. Physical

punishment or scolding should never be the technique used to establish toilet habits. The alertness of the mother to create situations that will ensure successes that can then be praised is by far the most satisfactory method and least time consuming. Failures on the part of the child should be treated as unfortunate accidents.

Parental Love and Affection.—The importance of beginning early to develop a sense of security in the child can scarcely be overestimated. This sense of security is dependent on a feeling of being loved and wanted. Behaviour problems of childhood can be minimized or reduced by giving fully of parental love. Babies soon learn to enjoy being held by their parents; they enjoy play that is suitable for their age and they respond to the multitude of other little evidences of parental love.

However, there are a few cautions to be observed and suggestions that may be made. Babies cannot stand rough play with their fathers immediately after eating; it usually causes regurgitation of food, and, furthermore, this is the time for sleep. Infants should be protected from tickling. The morning bath can be a happy time for both mother and baby. Feeding time should be a pleasant experience without tenseness. The urgency that some mothers feel about the necessity of giving their infants a measured amount of food at each feeding time creates unnecessary tension and establishes bad eating habits. Well babies should not be forced to eat. Late afternoon is a suitable time for play; some regularity is desirable, for the baby must learn that he cannot be played with at any or every time he fancies.

Cleanliness.—Once a day a baby should be given a bath in water at normal body temperature (between 35° and 38° C. [95° and 100° F.]). The temperature should always be tested (using the mother's elbow) before placing the baby in the water; this will prevent accidents and enhance the baby's pleasure. There are a variety of acceptable tubs. It is essential, however, that the tub be firmly placed and incapable of being tipped over, and it should be of a kind that can be readily cleaned. In bathing an infant another point to remember is that the skin of a wet baby is slippery and that the mother must always have a firm hold of her baby when he is in the tub. First she lowers the baby's buttocks into the water. One hand firmly grasps the baby's right arm above the elbow near the shoulder; the remainder of her hand supports his back, and her wrist and forearm support his neck and head. The mother's other hand is then free to cleanse the baby's body with a dampened wash cloth and a small amount of a mild soap. A minimum amount of soap should be used. When baths are skilfully given babies soon learn to enjoy them.

Since it is characteristic of infants to put objects in their mouths and since the mouth is one of the most common portals of entry for disease-producing microorganisms it is essential that hands, toys and eating utensils be kept clean.

Keeping a Well Baby Well.—Barring accidents or the occurrence of the few diseases of unknown cause or those for which there is no known treatment, it is entirely possible through the application of known knowledge to maintain a baby in a state of optimum health throughout the first year and beyond.

The rules for keeping a well baby well are simple but important, as follows:

1. Proper feeding (see *Infant Feeding* below).

2. Preventing infectious disease. The rules governing the prevention of exposure of infants to infectious diseases are a direct application of techniques established years ago in contagious-disease hospitals for the prevention of spread of infectious disease from one patient to another. The success of antibiotics has often led to carelessness in these matters; however, to ignore well-established, effective rules of sanitation because cures are available is comparable to being careless with matches because the city has a good fire department.

The baby should have a room or a corner that belongs to him alone. The most convenient place in the daytime is a room adjoining the place where the mother spends most of her time, usually the kitchen. No one is permitted in the baby's room except well people with washed hands and clean clothes. If any member of the family is suffering from a common cold or other infectious illness he must stay out of the baby's room or corner.

In case the mother has a cold and it is necessary for her to take care of the baby during this period, she can prevent the baby from contracting the cold if she will observe the simple aseptic technique that is known to all pediatric nurses, modified for home use. While caring for the baby the mother wears a mask of gauze over her nose and mouth; she washes her hands with soap and water and dries them on a clean towel and, without touching contaminated objects outside the baby's room, she enters the room and slips into a loose, sleeved cotton gown that covers her clothing. With these precautions she is ready to take care of the baby, and it is perfectly possible for her to do so without transmitting her cold. The gown used in the baby's room should never be used for any other purpose than that for which it is intended and should be kept in the baby's room except when it is being washed. After scrubbing her hands and getting into her gown the mother does not touch her face or things that she has handled with unwashed hands.

Young babies do best when kept at home; traveling with small babies invites the possibility of exposure to infections. Visitors are invited to look at but not handle babies. If the visitor has a cold the baby is not brought out for inspection. Persons with infectious disease should not come closer than six feet to a well infant and must cover coughs and sneezes.

3. Immunizations. These are available for diphtheria, tetanus, whooping cough and poliomyelitis. Babies under six months are not susceptible to measles provided the mother had measles before she became pregnant. After babies lose their natural immunity they may be protected by the use of proper immunization technique.

4. Cleanliness (*see* above). It is important to remember that not all bacteria are harmful and that it is not necessary to observe absolute surgical asepsis in order to prevent the occurrence of illness of infectious origin. Absolute cleanliness (asepsis) is necessary, however, when persons in the household are suffering from or have recently suffered from colds or other infectious illness, or when the baby may be exposed to persons whose state of health is unknown to the mother. When all members of the household are well and free from illness simple cleanliness suffices for all health purposes.

5. Preventing accidents (*see* below).

6. Good hygiene. This requires provision of opportunity for restful sleep, frequent changes of linen, daily outdoor airing (weather permitting), sun baths when recommended by the baby's own physician, opportunities for free play consistent with the age of the infant, an abundance of love and affection, together with the application of all the foregoing rules.

7. Pediatric care. The mother and the father can act sensibly and with good judgment only when they are informed concerning the above rules. The pediatrician will assist them with problems they do not understand.

Accident Prevention.—Accidents that can happen to the infants are relatively few, and if the subject is given a little thought most of them can be prevented. A thoughtful mother can invent most of her rules and they can be effective. However, the following are given as examples: (1) when carrying a baby always be sure to have a firm hold—babies wriggle, squirm and jump at unpredictable times; (2) never leave a baby alone on a bath table or examining table or any other surface from which he might fall; (3) when bathing a baby always hold him securely; (4) never hold or carry hot objects above a baby; (5) remove pointed or sharp objects from the baby's reach; (6) be sure the slats on the side of the baby's crib are close enough to prevent the baby from getting his head through; (7) do not give the baby easily breakable toys; (8) very small toys are to be avoided; the baby may choke on them; (9) toys covered with lead paint or water-soluble stains are to be avoided; (10) plastic sheets and bags must be kept completely out of reach of babies and small children, since they may be slipped over the head and may then cling to the face and cause suffocation.

Sun Baths.—When weather and temperature permit, sun baths are usually recommended, since exposure to the sun's rays, and

to sky shine for that matter, transforms substances in the skin to materials that have vitamin D activity. While vitamin D preparations can be given by mouth when sun-bathing is impossible or impractical, it is believed that sensible exposure to the sun is beneficial. While there is no agreement with reference to the precise age at which sun-bathing can best be started, it is probable that most babies can be safely exposed outdoors, temperature permitting, after the age of two or three months. The baby's eyes should be protected from direct exposure to sunrays, and direct exposure to the glare of a cloudless sky on a summer day is also evidently unpleasant for the infant.

The time of exposure naturally varies with the season of the year, the time of day, the age of the infant and character of skin. It is wise to avoid exposure in midday when the sun is hottest. It is often recommended that first exposure be for as short a time as two minutes. Succeeding exposures can be gradually increased until tanning occurs. It must be remembered that babies do not tan so deeply as adults do and that they burn much more easily. The physician should be consulted on how much sun each baby needs.

Clothing.—The chief object of clothing is comfort. Babies should wear only a sufficient number of garments to keep them warm and comfortable. In newborn babies the temperature regulating mechanisms may not be fully developed and therefore they may need extra clothing to maintain body temperature. If there is suspicion in the mother's mind that her infant is wearing too many clothes, it is usually possible to tell by observing the presence or absence of perspiration on the baby's back. The mother may pass her hand over the baby's back under the shirt and if she finds the skin wet with perspiration it is almost certain that the child is overclothed; if on the other hand the skin is warm and dry to touch and the baby is otherwise apparently comfortable and happy, the amount of clothing is probably appropriate. Cotton clothing is generally most comfortable next to the baby's skin and is easier to wash than most other materials. The baby should wear a hat or a bonnet on cool days out-of-doors.

Sleeping Out-of-Doors.—Fresh cold air is stimulating and invigorating even to quite small babies. However, good judgment must be used in placing babies out-of-doors to sleep. Weak or very small babies require control of external temperature and are best kept in the house. A healthy, vigorous baby gradually can be accustomed to cool or cold air provided he is appropriately covered. Some overzealous mothers have permitted frostbite to occur in babies' cheeks and on the backs of their hands. While these usually are not serious, they are to be avoided. After frostbite, hard lumps may appear beneath the skin of the frostbitten area and persist for weeks.

INFANT FEEDING

Breast Feeding.—The ideal food for the young infant is human milk. It supplies all of the nutrients in amounts and variety necessary for good growth and development provided the mother is in good health and is eating a nutritionally satisfactory diet. One possible exception to the nutritional adequacy of human milk is vitamin D, but this can be obtained from exposure to sunlight.

The yellowish fluid that is secreted before breast milk makes its appearance is known as colostrum. The amount varies greatly. Colostrum alone is secreted for a period of from two to four days after delivery; after this comes a transition to breast milk that is complete at the end of about three weeks.

It has long been held that colostrum may confer some degree of immunity on infants but, however that may be, its removal from the mother's breast by the infant is of importance to the establishment of lactation. Early nursing also encourages early contraction of the mother's uterus.

The composition of human milk varies, as does that of other foods, within a rather wide range. According to P. C. Jeans the approximate percentage composition of human milk is as follows: fat 3.5%; sugar 7.5%; protein 1.25%; lactalbumin 0.75%; casein 0.50%; total ash 0.20%; calcium 0.032%; magnesium 0.004%; potassium 0.041%; sodium 0.011%; phosphorus 0.013%; sulfur 0.014%; chloride 0.032%; iron 0.0001%; copper 0.00003%. In addition breast milk contains traces of other minerals plus identified and unidentified vitamins. The amount of breast milk is usually suited to the needs of the infant. Some mothers can nurse two babies when necessary.

Successful nursing implies that the mother must be free from debilitating disease, that she eat adequately (but not excessively so that she gains unneeded weight) and that she be emotionally adjusted. Adequate rest is necessary. Exercise should be moderate. Home surroundings should be as pleasant and as congenial as possible, and in all these things the husband plays no small part. Professional medical attention is also sometimes required and is always helpful.

In addition to the other good reasons for encouraging breast feeding it is emotionally satisfying to both the mother and infant. Nursing time is often the one time when the mother can relax and enjoy her baby. When she nurses her baby there is no formula to worry about and there is no concern when the infant does not take all of an allotted formula.

Cow's Milk.—When the nutritional needs of infants cannot be met with human milk, other means of supplying these needs are available. Infants who do not receive human milk, however, may require certain nutrients in amounts greater than are present in breast milk. Cow's milk approaches a perfect food only for the baby calf. Furthermore, in no species of animal is milk alone the sole source of food for more than a relatively short period after birth. Infants soon require supplementary foods just as young animals do.

The milk formula for the newborn baby is generally made up of milk, added water and a carbohydrate (one of several sugars or mixtures such as lactose, maltose-dextrin mixtures, glucose and sucrose). It is common practice in the calculation of formulas to give from 1 to 1½ oz. of milk per pound of body weight. One and one-half ounces of milk supplies approximately 3.4 g. of protein and 0.12 g. of calcium per kilogram, together with other minerals, lactose, fat (apparently sufficient for the infant's needs), water and vitamins—notably vitamin A, riboflavin and some thiamine and niacin.

At first the total fluid volume of the formula is in the neighbourhood of 2½ to 3 oz. per pound of body weight. Later the volume is diminished. Thus after determining the amount of milk required, the difference between the calculated amount of milk and the calculated volume of the formula is made up by adding boiled water.

Babies need approximately 50 cal. per pound of body weight. This is easily calculated. The amount supplied by the milk in the formula is calculated on the basis of the fact that average cow's milk supplies 20 cal. per ounce. The difference between the total caloric need and the caloric value of milk in the formula represents the number of calories that need to be added to the formula to make it supply the necessary energy value. This is usually done by adding an appropriate amount of carbohydrate in the form of one of the sugars. Most sugars contribute approximately 120 cal. per ounce. More than 1½ or 2 oz. of sugar is seldom required.

The rapidly growing healthy infant soon is able to take whole undiluted pasteurized milk or unsweetened evaporated milk diluted to the equivalent of whole milk by the addition of an equal amount of water. Full-strength powdered whole milk also may be used.

In bottle feeding infants it is essential to observe strict cleanliness in the preparation of formulas and to refrigerate all bottles whose contents are not consumed at once. There are many ways of preparing formulas, but the object of all of them is to attain a clean (pasteurized or sterilized) product and to keep it safe until the time of use.

Goat's milk approximates cow's milk in nutritive value and generally may be used as a substitute, particularly if the infant is allergic to cow's milk. When using goat's milk it is especially important to be certain of the cleanliness of the supply and that it has been properly pasteurized. Powdered and evaporated goat's milk are also available. Soybean preparations may also be used as substitutes for cow's milk.

Supplemental Foods.—Except in the case of breast feeding, and then only for a short time, the infant can rely on no single

food to supply his total nutrient needs. The early supplementation of the diet with nutrients known to be essential for good growth and development is necessary. Furthermore, it is desirable to start early the cultivation of good food habits with relation to foods other than milk.

The first supplement for babies fed both human and cow's milk is vitamin D. It may be started in the first week with the addition of vitamin D concentrates or the pure vitamin. The infant apparently needs no more than 350 units of vitamin D per day, although the dose usually given is 400 units. Doses above 1,500 units per day tend to inhibit the appetite when given over a period of time, with the result that the growth rate is impaired.

Because the vitamin C content of cow's milk decreases on storage it is necessary to supplement the infant's diet at an early age with foods containing this vitamin. In North America it is a common practice to use orange juice, tomato juice or other fruit juices blended with acerola (West Indian cherry) juice, which is by far the richest of all fruits in vitamin C. In Australia, black currant juice and papaw juice sometimes replace citrus juices. In the United Kingdom rose hips syrup is popular. Orange juice can be started a few days after birth and increased rapidly up to two or three ounces at the age of three months. Advances in the technique of canning and freezing orange juice make it possible for these juices to supply an abundance of vitamin C at all times of the year, even during the season when fresh oranges are not easily obtainable. In addition to supplying natural vitamin C, fruit juices contain other valuable nutrients.

Iron-bearing food supplements are also essential for the infant fed on cow's milk, because a baby fed on this type of milk alone will tend to develop an iron deficiency anemia after a period of several months. For this purpose and to encourage the baby to learn to like a variety of foods it is common practice to start strained vegetables and fruits, meat, egg yolk and cereal at an early age. All these supply needed iron. Good cereal sources of iron are the whole grain cereals, notably oatmeal, and specially fortified cereals.

Home-prepared strained fruits and vegetables for infants have been replaced largely by specially prepared, high-quality, commercially processed foods, available in jars and cans and, after 1960, also as instant dry frozen foods requiring only the addition of water before feeding.

The supplementation of the cow's milk diet with food sources of thiamine and possibly other members of the B-complex group of vitamins is generally regarded as desirable. Strained meat, whole grain cereals (oatmeal or specially fortified cereals) and many fruits and vegetables all provide supplements of thiamine. Egg yolk is a good source, and fruits and vegetables are better sources than highly refined cereals.

At about six months the baby has often developed sufficient skill with his hands to permit him to start feeding himself with a spoon. At this time he sits easily and comfortably and should be encouraged to feed himself. Supplemental foods have the added advantage of assisting in the cultivation of a taste for a variety of foods that later on are even more important in the diet. The smooth strained foods of early infancy may be gradually changed to coarser foods beginning at about six or seven months and to distinctively coarser foods soon after the baby is a year old. While it would appear that most babies tend to demand coarser foods voluntarily when given a choice, failure on the part of the mother to supply them sometimes results in the persistence of the desire for smooth foods long beyond the end of the first year.

It is important also to mention the fact that the parents' attitude toward foods is unquestionably recognized by infants at an early age. Thus it is very helpful for the parents to adopt the habit of regarding all good foods as pleasing and pleasant to eat. The opposite attitude often results in refusal on the part of the infant.

Water should be available at all times for drinking purposes and can be given at any time to satisfy thirst. Generally speaking it is desirable not to give water within 15 minutes before a regular feeding time.

A good working philosophy is to regard eating as a pleasure and not a duty. Well babies should never be forced to eat.

See also references under "Infants, Care of" in the Index.

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INFANT SCHOOLS (GREAT BRITAIN), a division of the primary education system of England and Wales for children between the ages of five and seven years. *See* ELEMENTARY EDUCATION; EDUCATION, HISTORY OF.

INFANT WELFARE: *see* INFANTS, CARE OF; MATERNAL AND CHILD HEALTH.

INFECTION: *see* BACTERIAL AND INFECTIOUS DISEASES; PARASITOLOGY. For infection in the sense of boils, abscesses, etc., *see* INFLAMMATION.

INFECTIOUS FEVERS: *see* CHICKEN POX; MEASLES AND GERMAN MEASLES; SCARLET FEVER; TYPHOID AND PARATYPHOID FEVERS; WHOOPING COUGH; etc.

INFECTIOUS MONONUCLEOSIS (GLANDULAR FEVER) is a common infection in man that has been observed in many parts of the world. It is probably caused by a virus. The disease occurs predominantly in persons from 10 to 35 years old but may appear at any age; it is rare in infants and young children.

Infectious mononucleosis is probably contagious, being transmitted primarily by oral contact with exchange of saliva. The incubation period is thought to be about 30 to 40 days. The commonest symptoms are malaise and sore throat. Enlargement of the lymph nodes in all parts of the body is frequent; those in the neck are most often affected. Fever of varying degree is usual. In some cases the only signs of the disease are fever and generalized discomfort; in these cases, the diagnosis is made by study of the blood. The throat is often red; a membrane, white to dark gray in colour and resembling that of diphtheria, may be present; ulceration of the pharynx occurs occasionally. There is a petechial rash on the soft palate in many cases.

In about two thirds of patients the spleen is enlarged; death has occurred in a rare case from rupture of this organ. A rash consisting of multiple small hemorrhages or resembling that of measles or scarlet fever sometimes appears. Pneumonia is present in about 2% of the cases. Involvement of the liver, as shown by chemical tests, is almost universally present; severe disease of the liver with jaundice is rare. Encephalitis, meningitis or peripheral neuritis occur uncommonly; death has followed the encephalitis. The heart is rarely affected. Swelling of the upper eyelids is a common finding. In rare cases, the urine may contain blood.

The disease is suspected when fever, sore throat and enlarged lymph nodes are present. A presumptive diagnosis is made from study of the blood. The white blood count is usually elevated but it may be low; there is an increase in the relative number of lymphocytes, a varying percentage of which appear abnormal. The number of eosinophils may be increased. In from two to seven weeks after the disease begins, there appears in the blood a substance (a so-called heterophil agglutinin) that causes clumping of sheep red blood cells. When the test for this agglutin is properly performed, the procedure is positive and diagnostic in about 95% of the cases.

Infectious mononucleosis usually lasts for about 7 to 14 days. In some instances it may persist for several weeks, especially when the liver or nervous system is affected. Relapse occurs uncommonly and second attacks are probably very rare. There is no specific therapy. Antibiotics are of value only for the secondary bacterial infections of the throat that occur in some cases.

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tious Mononucleosis," *Clin. Sympos.*, 10:17–31 (1958); S. Leibowitz, *Infectious Mononucleosis* (1953). (Ls. W.)

INFERENCE: *see* INDUCTION; PROBABILITY. For oblique inferences *see* LOGIC, HISTORY OF: *Modern Logic: Jungius.*

INFERIORITY COMPLEX, a term used by some psychiatrists and psychologists, particularly the followers of Alfred Adler, to denote a feeling of inferiority that is wholly or in part submerged in the unconscious. The term "inferiority feeling" was used frequently by Adler, who held that many outstanding achievements, some antisocial behaviour and other continuing aspects of the personality could be traced to overcompensation for this feeling. The use of "complex" later gained acceptance to denote the group of emotionally toned ideas, partially or even wholly repressed, organized around and related to such feelings of inferiority. The term "inferiority complex" has lost much of its significance through imprecise, popular misuse—for example, as an attempt at a facile explanation of any show of ambition by a man of small physical stature. *See* ADLER, ALFRED.

(H. F. HT.)

INFINITE PRODUCTS, in mathematics, are products in which the number of factors is without limit. The capital pi, Π, indicates a product. Suppose $a_1, a_2, a_3, \cdots$ is a number sequence, m a positive integer, $\prod_{p=m}^{m}(1+a_p) = (1+a_m)$ and, if n is an integer greater than m, then

$$\prod_{p=m}^{n}(1+a_p) = (1+a_n)\prod_{p=m}^{n-1}(1+a_p).$$

If there is a positive integer m such that $\lim_{n\to\infty}\prod_{p=m}^{n}(1+a_p)$ is a number distinct from zero, then $\prod_{p=1}^{\infty}(1+a_p)$ is called an infinite product and its value is $\lim_{n\to\infty}\prod_{p=1}^{n}(1+a_p)$.

The infinite product has the value zero only in case a factor $(1+a_p)$ is zero. Also, there is a positive integer k such that $|a_p| < 1$ if $p > k$, inasmuch as

$$\lim_{n\to\infty}\left[\prod_{p=m}^{n}(1+a_p)\Big/\prod_{p=m}^{n-1}(1+a_p)\right] = \lim_{n\to\infty}(1+a_n) = 1.$$

Infinite products appear frequently in function theory. The infinite product for the Riemann zeta function is of great historical and considerable present importance in number theory (*see* NUMBERS, THEORY OF: *Topics in Analytic Number Theory*). In particular, infinite products form a basis for investigation of entire functions. A function f, that is not identically zero, having a power series representation $f(x) = \sum_{p=0}^{\infty} a_p x^p$, valid for every number x, is called an entire function. Any entire function having infinitely many roots may be represented as an infinite product. For example, $\sin \pi x = \pi x \cdot \prod_{p=1}^{\infty}(1 - [x^2/p^2])$, for every number x. If, in particular, $x = 1/2$, this gives Wallis' infinite product for the number π. The reciprocal of the gamma function, a generalization of the factorial, is an entire function given by the infinite product: $1/\Gamma(x) = e^{cx}x\prod_{p=1}^{\infty}(1 + [x/p])e^{-x/p}$, where $c = .5772\cdots$. These two facts reveal a relationship between the sine function and the gamma function, namely: $\Gamma(x)\Gamma(1-x) = \pi/(\sin \pi x)$. If $x = 1/2$ this gives: $\Gamma(1/2) = \sqrt{\pi}$.

There are several existence theorems for infinite products: (A) If $a_p > 0$, p = 1, 2, 3, $\cdots$, then the infinite product $\prod_{p=1}^{\infty}(1+a_p)$ exists if, and only if, the infinite series $\sum_{p=1}^{\infty} a_p$ converges. This follows from the inequality $\sum_{p=1}^{n} a_p < \prod_{p=1}^{n}(1+a_p) < \operatorname{Exp}\sum_{p=1}^{n} a_p$.

(B) If the infinite product $\prod_{p=1}^{\infty}(1+|a_p|)$ exists, then the infinite product $\prod_{p=1}^{\infty}(1+a_p)$ exists. Suppose $P_n = \prod_{p=1}^{n}(1+|a_p|)$ and $Q_n = \prod_{p=1}^{n}(1+a_p)$. Then, $|Q_{n+m} - Q_n| = |Q_n|\cdot\left|\prod_{p=n+1}^{n+m}(1+a_p)\right| - 1| \le P_n\left(\prod_{p=n+1}^{n+m}(1+|a_p|)\right] - 1) = P_{n+m} - P_n$ so that $\lim_{n\to\infty} Q_n$ exists. Suppose $c_p = -a_p/(1+a_p)$, $p \ge k$, where k is a positive integer such that $|a_p| < 1/2$ if $p \le k$. Since the series $\sum_{p=k}^{\infty}|c_p|$ converges, then the $\lim_{n\to\infty}\prod_{p=k}^{n}(1+|c_p|)$ exists and therefore the $\lim_{n\to\infty}\prod_{p=k}^{n}(1+c_p)$ exists. But the latter is $\lim_{n\to\infty}[1/\prod_{p=k}^{\infty}(1+a_p)]$ so that $\lim_{n\to\infty}\prod_{p=k}^{\infty}(1+a_p)$ is distinct from zero. This completes the proof.

Other theorems may be obtained by considering the logarithm of the partial product $\prod_{p=m}^{m+n}(1+a_p)$.

There is another kind of infinite product that is analogous to an integral and is called an integral product or continuous product. If each of f and g is a function on an interval $[a, b]$, the integral product $\prod_{a}^{b}(1+f\,dg)$ is a limit of products $\Pi(1+f(x)[g(q)-g(p)])$ taken for all intervals $[p, q]$ of a finite collection of nonoverlapping intervals filling up $[a, b]$, with x a number in $[p, q]$. For example, if I is the function such that, for every number x, $I(x) = x$, then $\prod_{0}^{x}(1+dI)$ is the exponential function E such that $E(x) = 1 + \int_0^x E\,dI$. This idea can be extended to large classes of differential and integral equations.

See also SERIES.

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(H. S. WL.)

INFINITESIMAL originally meant a quantity less than any finite quantity. In dealing with non-negative real numbers, an infinitesimal must necessarily be zero; hence the use of the word in the calculus has led to much confusion. However, once the notions of limit and continuity were invented and the calculus was based on the real number system, the term infinitesimal was found to be unnecessary for the concepts of derivative and integral and has gradually begun to disappear from use. *See* CALCULUS, DIFFERENTIAL AND INTEGRAL. (I. M. S.)

INFINITESIMAL GEOMETRY, an alternate term for differential geometry. *See* DIFFERENTIAL GEOMETRY; GEOMETRY.

INFINITY AND THE INFINITE. These terms (from Latin *in-*, "un-," and *finis*, "end" or "limit") in common usage express our felt inability completely to carry out the procedures of counting, measuring, comparing, etc., by means of which size, number or degree can be assessed. Thus we say that there are an infinity of stars in the heavens or of colours on a bird's wing, that someone has been infinitely kind, etc. With this inability to assess go strong emotional overtones; the infinite usually astonishes, wearies or confounds us. In stricter contexts a predication of infinity implies a considered belief that the repeated

application of procedures of counting, measuring, comparing, etc., will always be demanded by the material on hand and will never lead to a final assessment of size, number or degree. Thus we say that there are an infinity of fractions between 0 and 1, implying that we shall always be able and obliged to discover new fractions between these limits. In more religious and metaphysical contexts, the notion of the absolutely infinite is developed, the idea of something whose size, number, degree, etc., cannot be assessed *in any respect whatsoever* and which is therefore omnicomprehensive and omnicompetent: this notion is obviously of greater difficulty and of more doubtful consistency than that of the simply infinite. We may note that there are always both positive and negative aspects to our notion of the infinite: a predication of infinity is, from one point of view, negative, being a confession of our inability to assess size, number or degree; but it tends also, from another point of view, to be regarded as a positive assessment, one demanded by the character of our object and one that is, in many respects, extremely hard to understand or to justify.

The Infinite in Ancient Thought.—Infinity appeared to ancient Greek thought in two contradictory guises. To the thinkers of Ionia it was attributed to the boundless environment of our cosmos and was an object of honorific assessment. Thus Anaximander (*q.v.*) set our world, together with countless other similar worlds, in a boundless environing material medium, "that becoming might not fail"; he also spoke of this medium in laudatory and religious terms. Even Melissus the Samian, whose notion of unchanging being was Italian rather than Ionian, felt obliged to hold that "that which is" was infinite in magnitude, while Anaxagoras (*q.v.*) of Clazomenae constructed his world out of an infinity of particles called "seeds," which were also infinite in variety and in "smallness." As opposed to this positive, favourable attitude to the infinite, the Italian attitude (represented by Pythagoras) was unfavourable and negative: the infinite was put into the class of things obscure, variable, unfinished and therefore bad. It stood in essential opposition to the "limit," whose work was the simplifying ratio or the precise mathematical proportion. The infinite showed itself in the "boundless breath" of darkness from which the starry units were separated, in the boundless variability of the crooked line or of the oblong as opposed to the constancy of the straight line or of the square, in the irrational and in the incommensurable of which the Pythagoreans (in search of a simple ratio between the diagonal of a square and its side) had had bitter experience. This unfavourable view of the infinite was passed on to Parmenides (*q.v.*) of Elea, who refused to make his unchanging being infinite "since it is in need of nothing, and since what is infinite is in need of everything"; and to Parmenides' disciple Zeno, who found a sufficient reason for denying that "things are a many" in the fact that, if such plurality were admitted, it would lead to the admission of an infinity of units between any two distinct points, and that such an infinity was not a number at all. Zeno also based his famous proofs of the impossibility of movement on the fact that it involves passing through and completing an infinity of successive stages.

This negative, Italian view of the infinite was adopted by Platonism, for which the infinite was essentially the irrational, flowing or formless principle, capable of indefinite increase and diminution which has to be subordinated to the "one" or the "limit" in order to give rise to whatever is intelligible and good. It is the indefinite element in the ideal world, which has to be bounded by the One in order to give rise to those precise, quantitative patterns with which Plato ultimately identified his "ideas." It is also the indefinite element in the world of the senses, whose bounding by numerical ratios gives rise to whatever is healthful, strong, musical or visibly excellent. In itself, however, it admits only of a contradictory characterization: it is essentially "the others," "the great and small." It shows itself, particularly, in the way in which quantitative parts evanesce into other parts without end and in the way in which a new beginning, middle or end always appears before, within or after any beginning, middle or end that we try to fix. (For Plato's attempt to describe the continuum, *see* his *Parmenides*. For further interpretation of his doctrine, *see* the works cited in the bibliography below.)

This mystical Platonic view of the infinite was replaced by the clear formulations of Aristotle, which have, to a large extent, remained definitive for western thought. For Aristotle the infinite exists only "after a fashion": after another fashion it does not exist at all. It never exists in the sense that we ever actually have an infinitely large number of things or of parts of things or anything which exceeds in size all things of limited bigness. The infinite is something potential or facultative: its presence in a field means that one always can go on to ever larger sizes, divisions or number in that field, that one can go outside of any given size or number to one that lies beyond it. So understood, the infinite is incompatible with wholeness and perfection; for something to be infinite means that one never can have all of it, only more and more of it. Mathematicians, Aristotle observes, talk as if they needed infinite quantities in their calculations; in reality they need only finite quantities, but as large as they require. Nor can our world contain anything infinitely great, since Aristotle shows it to be finite and spherical. It is not actually, but only potentially, infinite by division: this fact is used by Aristotle to refute Zeno's "disproofs" of the possibility of motion. Time, indeed, goes on endlessly in either direction, but it is not infinite in the sense of ever being there all at once. Even the potential being of the infinite is, for Aristotle, a queer sort of potentiality: unlike the potentiality of the statue in the block of stone, it can never be translated into actuality. (J. N. F.)

The Infinite in Theology.—The word "infinite" has been used in religious thought, both eastern and western, to designate one of the attributes of God and to express the whole nature of the divine; and indeed the expression "the Infinite" occurs as a name for the religious object, sometimes replacing the traditional term "God." Many meanings have been comprehended under the concept of infinity as employed by theologians: being without end or limit; being original and without beginning; being the inexhaustible source of all things; being indeterminate; being wholly self-determining; being incomprehensible and beyond the reach of human thought.

The theological use of infinity reflects the ambiguity found in Greek thinking about the infinite (apeiron) expressed in the different attitudes of the Pythagorean and Ionian traditions (*see* above). There was, on the one hand, uneasiness about saying that God is infinite because of the imperfection thus implied: what is infinite is unfinished and belongs to a lower order of things. When, on the other hand, infinity was understood as the original source or all being, implying the absence of limitation in power, truth and goodness, it became possible to speak of God as infinite.

Thinkers within the Judaeo-Christian tradition have long included infinity among the attributes or names of God. Among those accepting the term, two different lines of thought developed. Some held that the infinity of God is a negative concept serving to express the absence of limitation in the divine perfections and to indicate the inability of finite reason to comprehend the divine nature. Others have taken infinity as a positive concept expressing the inner nature of God rather than indicating the unendingness associated with the denial of limits. The first approach envisages a complete discontinuity between finite and infinite; the second seeks intelligible connections between them.

Philo of Alexandria, interpreting the Hebraic tradition in the 1st century A.D., understood the divine infinity as a positive perfection. Thomas Aquinas held that God is absolutely infinite, but, like many other medieval thinkers, he understood this in a largely negative sense. Henry of Ghent stands out in the 13th century for his claim that the infinity of God means more than a denial of limits. Nicholas of Cusa was influential in establishing the idea that infinity is the distinguishing mark of God and that finite and infinite are essentially related.

Spinoza and Hegel gave to modern religious thought the concept of the "true infinite" as the self-determining. In Hegel infinity became associated with subjectivity and self-consciousness. Hegel gave metaphysical expression to the tradition of German mysticism (Meister Eckhart and Jakob Böhme), according to which finite and infinite, man and God, are correlative. Instead of being for-

ever beyond the finite, the infinite is realized in man's experience of self-consciousness and self-transcendence. Kant was more cautious and denied that man is able to have theoretical comprehension of the infinite God on the basis of his finite reason. In much 19th-century religious thought, infinity signified the incomprehensibility of God, and it appeared more often as an expression of mystery than as a precise theological concept.

The charge has been made that the traditional infinity ascribed to God does not do justice to the reality of time, change and evil in the world. Some have proposed to substitute a "finite" God in order to solve the problem of evil. God is thus reduced to a being in the world.

A combination of German idealism and existential philosophy has produced theologies in which the infinity of God appears as complete self-transcendence; man is directed toward the real infinite God through the limited self-transcendence which he experiences in himself.

Major problems involved in speaking of the infinity of God are: first, that of giving some positive meaning to the concept—whether it be self-transcendence, according to Paul Tillich; or self-representation, according to Josiah Royce; or inexhaustibility, according to A. N. Whitehead—that will enable us to avoid taking it in a merely negative sense; secondly, that of distinguishing finite and infinite so that we can understand the difference between them while preserving their essential connections; and thirdly, that of showing the compatibility between the divine infinity and the reality of time, history and future creativity. (J. E. Sm.)

The Infinite in Modern Philosophy.—Modern post-Renaissance thought shows the same tension as does ancient thought between the acceptance of an actual and a merely facultative view of the infinite. In the main, the continental European rationalists espoused the former, while the British empiricists favoured the latter. Thus Descartes held infinity to be a positive notion: it is only by contrast with the infinity involved in my inborn idea of God that I can become conscious of my own finitude. In Spinoza the infinite becomes the omnicomprehensive or absolutely infinite: reality or substance is for him infinite in a sense which renders illusory any division of it into clear-cut finite parts and which entails its including not merely infinitely many finite "modes" but also all possible modes in each basic kind or attribute. In Leibniz, too, there is a ready acceptance of the view that in every organized part of nature there is an actual infinity of subordinate parts, each expressing a governing monad or entelechy. He is careful to explain, however, that (apart from God) he does not believe in a single substance which is infinitely great or infinitely small: the infinitely great and small (as employed by him in the calculus) are for him merely useful mental fictions not admissible in philosophy (*see* his letter to B. des Bosses, March 11, 1706). But if Leibniz had reserves in this regard, his contemporaries or successors had none: they talked without scruple about infinitely small or vanishing quantities and spent much time over such problems as that of the value of the infinite sum $1-1+1-1+1-\ldots$.

As opposed to this uncritical acceptance of an actual infinite, the British empiricists were more wary. Thus Locke spoke of our idea of infinity as an "endless growing idea" and denied, as against Descartes, that we could ever form a positive and distinct idea of infinite magnitude In like fashion Berkeley, in *The Analyst,* subjected contemporary mathematical treatments of the infinitesimal to a devastating critique. Hume, too, refused to allow that we had an impression, and could consequently form an idea, that admitted of the infinite division demanded by the mathematicians. It is this critical approach to the infinite which is, in the main, characteristic of the German idealists. Thus Kant gets round his antinomies involving infinite series—the antinomy, for instance, as to whether the world ever had a beginning in time or not, or as to whether its series of events goes back to a first cause or admits of an infinite regress in causation—by holding that, while we are obliged to go back indefinitely from any empirical feature of the world to other features presupposed as its conditions, it makes no sense to try to sum up the totality of conditions thus involved. For Kant as for Aristotle, infinity is incompatible with completeness. The same point of view is given a somewhat mystical expression by Hegel, when he contrasts his own "true infinite" with the "bad infinite" of the mathematicians, the bad infinite being characterized by an endless vain effort to transcend the finite, which it only succeeds in reinstating, whereas the true infinite is achieved when the finite is seen in its place in the whole system of finites, as expressive of a unity which pervades them all.

The Mathematical Infinite.—Modern mathematical thought has devised various conceptions which have enabled it to avoid confused and self-contradictory views of the infinite. Thus the useful phrases "tending to zero" and "tending to infinity" have been, since the time of Augustin Cauchy (1789–1857) (*q.v.*), so interpreted that they no longer seem to involve a reference to single quantities which are infinitely large or infinitely small. To say, for instance, that a certain function of a variable x "tends to infinity" as x "tends to zero" is merely to say that one can make the value of that function of x exceed any finite number, however large, provided that x is given a value sufficiently close to zero. In the same way, useful geometrical talk about points, lines and planes "at infinity" involves no reference to anything infinitely remote. Thus to say that parallel lines intersect at a point at infinity is only to say that the point of intersection of lines which are *not* parallel will recede to any finite distance, however remote, the more nearly such lines approach the parallel.

In another region, however, modern mathematical thought has tended to reinstate the actual infinite; *i.e.*, the field of Georg Cantor's transfinite numbers. This development rests on a view of number which connects it with the establishment of one-one correlations between the members of different classes and which applies this notion to the case of series or progressions which lack a final term; *e.g.*, the series of positive integers 1, 2, 3, 4, etc. If we now ask ourselves what number can be assigned to the whole set of terms belonging to such a series or progression, it will be plain that we cannot assign to it the number of any subset reached in the successive running through of such a series or progression. We shall have to widen our notions of number and assign to it a number differing from, and also exceeding, any such successively reachable number. It will have to be the number *of* an ordered progression lacking a final term, not any number exemplified *in* such an ordered progression. Though such a number cannot be reached through stepwise increases by unity (which Cantor calls his first principle of the formation of numbers), it can be reached by considering the whole set of terms which are reachable by such stepwise procedures (this Cantor calls his second principle of the formation of numbers). The functioning of this new type of number will be in many ways peculiar. Thus a transfinite aggregate will not be increased by the addition of a unit or by that of a finite number of such units: it can even have infinitely many units added to it or taken away from it, while remaining as infinite as ever. Thus the series of odd integers can be put into one-one correlation with the complete series of integers and is therefore of the same number. This capacity to have proper parts which are equal in number to the whole can be taken as definitory of transfinite aggregates. It can, however, be shown that not all transfinite aggregates can be put into one-one correlation with one another: there are some (*e.g.*, that of the real numbers in the continuum) which elude reduction to an ordered list or progression and which must therefore be said to be of a higher, nondenumerable type of infinity. The theory of Cantor deals with many distinct orders of nondenumerable infinity.

The Cantorian theory has built up an account of transfinite number in which no inconsistency is discoverable. There are, however, profound obscurities in regard to the precise meaning of the theory: it gives rise to problems deeply involved with questions concerning the foundations of mathematics and the analysis of numerical statements. On certain views (*e.g.*, the somewhat different views of Ludwig Wittgenstein and L. E. J. Brouwer), we can make use of the idea of infinity only in cases where we have a rule to guide us through its labyrinth: it is senseless to talk as if we could ever have an infinite aggregate before us or could ever complete a process involving an infinite number of steps or cases. Such views give small

meaning to Cantor's denumerable type of infinite and no obvious meaning at all to his higher, nondenumerable types of infinity. On other views, *e.g.*, that of Bertrand Russell, talk about the infinite involves us in finding some actual class somewhere in the universe, correlation with which will constitute the infinity of any class; such an "axiom of infinity" is, however, profoundly dubious, more particularly in view of the findings of modern physics, which make the world finite in extent and in divisibility. It may, however, be argued that there is no more to the "existence" of transfinite numbers than the *possible* existence of aggregates exemplifying any and every finite number in their proper parts, and that we perfectly understand what this means. On such a view, the main use of Cantorian concepts is to dispel the atmosphere of awe and mystery attaching to the mathematical infinite and to restore it to those ethical, aesthetic and religious objects to which it more properly belongs.

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INFLAMMATION, in medicine, is a complex mechanism developed in the course of evolution as an adaptation to life on earth. In it are seen the fundamental attributes of life—response to stimuli, ingestion, digestion and synthesis of new material—organized to combat assaults and invasions of the physical and organic world. From amoeba to man, the mechanism increases in complexity with subdivision of functions among cells and the appearance of new chemical and morphological structures. Its operation, like that of all other mechanisms, has limits; if pushed beyond these limits, it will fail. And like all mechanisms, it can go awry and in doing so may produce disease. When it operates smoothly the mechanism of inflammation helps guarantee the individuality and integrity of an organism and facilitates the continuation of life.

General Pattern.—Some aspects of inflammation, such as pus formation, were recorded as long ago as the second millennium B.C. in Egyptian papyri. The gross manifestations, *rubor* (redness), *tumor* (swelling), *calor* (heat) and *dolor* (pain), were described in the 1st century A.D. by Celsus, who regarded inflammation as a disease in itself. Although Galen in the 3rd century A.D. hinted at the idea that the process could be initiated by injury, it was John Hunter in the 18th century who first clearly recognized that inflammation is the important common reaction of local tissue to any injury. The basic process of inflammation in higher animals can be divided into three parts: (1) blood vessel changes; (2) exudate formation; and (3) repair.

Blood Vessel Changes.—Much of the present understanding of the process of inflammation has come from microscopic and chemical studies of experimentally induced lesions. J. F. Cohnheim, a 19th-century German experimental pathologist, made use of transparent structures of the frog, such as the tongue, the webs of the feet and the mesentery. In order to excite inflammation he used such agents as silver nitrate or croton oil. With the microscope he observed the sequence of vessel changes that occur regularly after injury. The main change is dilation of vessels, sometimes preceded by transient constriction. The arterioles dilate first, then the veins and finally the capillaries. As this dilation occurs, blood flow in all the vessels becomes greatly accelerated. Following this, the rate of flow slows to less than normal, dilation of vessels persists and capillaries may become even more apparent. After some hours all vessels appear abnormally distended with blood; large numbers of white blood cells are seen in the peripheral layers of the flowing blood stream and adhering to the vessel walls. Clumps of erythrocytes are visible. In some vessels blood flow may stop temporarily. Adherence of leukocytes to the endothelium may persist for hours. After a mild injury, such as pinching or pressure, the blood flow soon resumes its usual pattern and adherent leukocytes return to the stream. Following more severe injuries the vascular alterations frequently persist and some vessels may become blocked (*i.e.*, thrombosed).

The Exudate.—The formation of an exudate, one of the characteristic features of inflammation, is related to alterations in the endothelium of the small blood vessels. An exudate is a colloid-rich accumulation of fluid usually containing cells and cell debris that appears in the locale of an injury. The bulk of its colloid and cell constituents derive from the blood; some may also be contributed by the tissue parenchyma. Normally only small amounts of plasma proteins appear in the extravascular fluid, but in inflammation there is an increase in the permeability of the walls of the small vessels. If a dye that attaches to the plasma albumin is injected into the blood stream and a local area of inflammation induced, an accumulation of the dye in and around the injury can be observed shortly.

As Cohnheim and others observed, the leukocytes of the exudate come largely from the blood. In preparations made by placing a transparent chamber in the ear of a rabbit, the migration of leukocytes into the areas of inflammation can be watched. After the stage in which leukocytes stick to the endothelium, these cells can be observed emigrating through the endothelium. By amoeboid motion the leukocytes pass through the vessel wall and into the space between tissue cells. The passage of leukocytes is probably between the endothelial cells. The speed of emigration depends on the nature and severity of the injury.

Although others had observed leukocytes in inflammation before him, the Russian zoologist Elie Metchnikoff (1845–1916) was the one who emphasized their importance as phagocytes; his series of comparative pathological observations is now classical. In simple transparent invertebrates without a circulatory system he observed wandering cells in the mesoderm. The mesoderm is the equivalent of mammalian connective tissue. When a foreign body penetrated the ectoderm of the animal the wandering cells surrounded it. When microorganisms entered the body cavity these amoeboid cells phagocytosed the organisms and digested them. If they did not do so the microorganisms multiplied and killed the host. He further pointed out that in higher animals the polymorphonuclear leukocytes, monocytes and eosinophiles of the blood, the macrophages of the tissues and the cells of the reticuloendothelial system perform the phagocytic functions. (*See* also PHAGOCYTOSIS.)

Repair.—Reparative phenomena, including proliferation of blood vessels and connective tissue, are a usual part of inflammation. Repair occurs not only following tissue destruction but also in some cases without microscopically visible tissue loss. In some inflammations, repair is the dominant feature. Capillaries originate by sprouting from existing vessels. Connective tissue fibres are produced by fibroblasts. Fibroblasts are probably formed mainly from macrophages and perhaps also from existing fibroblasts.

Explanation of Signs.—From what has been described thus far it is possible to obtain much of the explanation of the four cardinal signs of inflammation. Redness is due to the dilated blood vessels; swelling results partly from vessel dilation but mainly from exudate formation; heat is produced by an increased blood flow; pain is caused in part by local swelling and pressure and also by chemical

substances that are liberated in the process and act on nerve endings.

(*See* also BACTERIAL AND INFECTIOUS DISEASES: *General Features of Infectious Diseases;* PATHOLOGY: *Defense Reactions of the Body.*)

Varieties of Inflammation.—Although all inflammations exhibit a similar basic pattern, there are many variations. The designation acute is applied to inflammations of rapid onset and of a duration of up to several weeks. Chronic is applied to lesions of long duration, *i.e.*, of several months or more, and subacute is used to designate intermediate varieties. In the exudate of acute inflammations the polymorphonuclear leukocytes are most prominent. In subacute inflammations mixtures of cells including lymphocytes, macrophages and plasma cells occur along with some polymorphonuclear leukocytes. Chronic inflammations generally have a significant and large component of fibroblasts and their associated fibrils. Usually lymphocytes and other mononuclear cells are present in large numbers.

Patterns of inflammation vary also with different causative agents. For example, a local spreading, acute inflammation of the skin called erysipelas is caused by the β-hemolytic streptococcus. Characteristically the area is dusky red, swollen, hot and painful. The tissue cells are separated by exudate fluid containing the bacteria, some plasma proteins and a moderate number of leukocytes and erythrocytes. The small vessels are dilated. Tissue destruction is minimal. About nine days following onset, the lesion usually resolves as result of development of specific antibacterial antibodies that accelerate phagocytosis, digestion and removal of bacteria. Absorption of the fluid and colloids of the exudate occurs during resolution of the lesions. Phagocytes disappear and the ordinary pattern of vascular response is restored.

An abscess is an acute local inflammation frequently caused by staphylococci; pus is a characteristic feature. Pus is a form of exudate occurring in the centre of an abscess and comprising dead host tissue, many dead leukocytes and some living leukocytes. The semiliquid pus is surrounded by a fibrin network that has fluid and leukocytes in its interstices. Next to the fibrin is a layer composed of living tissue. From the vessels of this layer come the exudate constituents. In a chronic local abscess, a vascular connective tissue layer is proliferated and forms a capsule surrounding the pus. When the pus is evacuated from an abscess, healing occurs by new growth from this layer.

Introduction of particulate substances into tissues excites a foreign body reaction. Bits of talc or stone, sutures, splinters and glass, if not infected, excite only a mild acute inflammatory reaction with the characteristic vascular and exudative components. Most prominent is the appearance of mononuclear cells (macrophages) that surround and enguli small particles. Particulate material too large to be engulfed by single cells is frequently surrounded by multinucleated giant cells that arise either by fusion of the individual smaller phagocytes or by enlargement and nuclear multiplication of a single cell without division.

When an animal is invaded by certain organisms, such as the tubercle bacillus, granulomatous inflammation is the usual response. A military granuloma, called a tubercle, is the characteristic lesion of tuberculosis. Its centre comprises an avascular accumulation of mononuclear cells, called epithelioid cells, derived from monocytes. These cells contain tubercle bacilli. Intermingled with them may be a few multinucleated giant cells. On the circumference of the cell group is a network of fibroblasts infiltrated with lymphocytes. The centre of an area of tuberculous inflammation frequently is the site of caseation necrosis. This necrosis produces a cheese-like residue of dead host tissue. In a first infection with tubercle bacilli caseation takes several weeks to appear. Following a reinfection it appears in only a few days. This shortening of time is due to sensitization of tissues to products of the tubercle bacillus.

Allergy or immediate hypersensitivity reactions to antigens manifest themselves as inflammation. Two common examples are hives and hay fever. In hives, which are set off by ingestion or injection of the antigen, local areas of redness, swelling and itching appear. Microscopically the changes are those of mild acute inflammation with few cells in the exudate. In hay fever there is profuse secretion of mucus by the epithelium of the nasal mucosa as well as escape of fluid from vessels. Eosinophilic leukocytes are prominent in the cells present.

The injection of foreign protein antigens, *e.g.*, horse serum, in a sensitive individual can produce a severe local inflammation called an Arthus reaction (*see* ALLERGY AND ANAPHYLAXIS: *The Anaphylactic Reaction*). The Arthus reaction can also be produced by local injection of antigen-antibody complexes. Necrosis of the walls of blood vessels with infiltrations of leukocytes and thrombosis appear to be characteristic of this reaction. The process starts within minutes after injection and proceeds to its peak within hours. The fully developed reaction has a centre of dead tissue that is ultimately cast off and repaired by connective tissue.

Tuberculin-type, or delayed, hypersensitivity is another form that occurs when purified tuberculoprotein is injected into a person previously infected or immunized with tubercle bacilli. The reaction begins after an hour or more but takes two or three days to reach its peak. The early change is death of tissue cells (*e.g.*, epithelium and fibroblasts and vessel walls in the skin). In this instance the antigen-receptor and responding mechanism is associated not with circulating antibody but with tissue cells, including the mononuclear cells of blood and lymph.

Many special types of inflammation associated with particular organs are known. For example, meningitis, peritonitis and pleuritis are inflammations, respectively, of the surface membrane coverings of brain, gastrointestinal tract and lung. Myocarditis and valvulitis occur in the heart in rheumatic fever. Glomerulonephritis and pyelonephritis are two types of inflammation occurring in the kidney. Each of these is a special entity having characteristic causes and specific pattern variations dependent upon the causative agent, the organ affected and modifying factors in the host; yet all have the same basic pattern.

The Mechanism of Inflammation.—The sequence of vascular changes in inflammation is complex. Calibre and flow in blood vessels are controlled in part by the nervous system. Some of the early transient constriction and vasodilation may be due to a local nerve axon reflex, but inflammation follows its usual pattern even in denervated areas; therefore the bulk of the reaction must be mediated chemically.

A British physician, Sir Thomas Lewis, showed that histamine can reproduce the vasodilation and increased permeability associated with inflammation. When injected into human skin in minute amounts it causes the classical redness and swelling, but little or no sticking and emigration of leukocytes. Histamine is found in mast cells, which are frequently situated near blood vessels, and is released from these cells in inflammation. In mild inflammations, such as hay fever or hives, antihistamines will prevent or reduce the local reaction, but the vessel reactions in many inflammations are not inhibited by antihistaminics; therefore substances other than histamine must be involved.

5-Hydroxytryptamine, derived from the amino acid tryptophan, and also found in mast cells, causes reactions similar to histamine in some species. Certain polypeptides derived from interaction of proteins and enzymes can excite vascular reactions. Another agent known to increase permeability is a globulin of the blood plasma. Other constituents of cells may also operate. In addition, bacteria produce materials, *e.g.*, the erythrogenic toxin of β-hemolytic streptococci, that are capable of causing vasodilation.

Components of the causative agent and the host interact in the inflammatory process. Bacteria produce many substances: some are liberated from intact cells, some are liberated when the bacteria die. Staphylococci, for example, produce a coagulase that causes fibrinogen to clot. This fibrin clot acts as a minimal barrier to spread of infectious agents from the local area via tissue spaces and lymphatics. Other bacteria, streptococci and pneumococci, produce hyaluronidase, an enzyme capable of reducing viscosity of intercellular ground substance and thereby enhancing spread of fluid and particulate substances. The spreading inflammations caused by certain bacteria may owe this property to hyaluronidase or other spreading factors. Lecithinases, collagenases, proteolytic enzymes and enzymes that split nucleic acids are all produced by

bacteria. Each plays a role in the chemical dynamics and manifestations of inflammation. Some are excitants and others may inhibit parts of the process.

Mechanical injury, corrosive chemicals, bacteria and antigen-antibody complexes all excite inflammation by injuring tissue cells. Substances liberated from dead and dying cells stimulate the inflammatory response. Some of the liberated substances are polypeptides derived from the splitting of cell proteins, some may be amines from injured mast cells and perhaps some are derived from the breakdown of nucleic acids. In the Arthus reaction, antigen-antibody complexes have been demonstrated in the subendothelium of the venules. Antigen-antibody complexes associate with complement, which has enzyme activities. The antigen-antibody-complement complex together can lyse cells and initiate inflammation. Much of the mechanism of inflammation appears to involve enzymes and some inflammation can be partially suppressed by enzyme inhibitors.

Several mechanisms have been proposed to explain the passage of plasma colloids and the permeation of leukocytes and particulate substances through endothelium. Some investigators have deduced that pores present in the vessel lining are just large enough to permit plasma proteins to pass. No pores of this size (about 40 Å) have been seen with the electron microscope but observation with the electron microscope has revealed passage of particles through endothelial cells enclosed in small vacuoles. This mechanism is known as pinocytosis. A third mode of passage is via the spaces between endothelial cells. In inflammation, particulate substances (and presumably soluble colloids and fluid also) traverse the widened spaces. Leukocytes of all types, after adhering to endothelium, migrate through these spaces. The specific substances and the chemical mechanism involved in adhesion of leukocytes to and emigration through endothelium are unknown. In an area of inflammation leukocytes are attracted to bacteria; once in contact with the bacteria they engulf or phagocytose them. Within the intracellular vacuole formed during phagocytosis, death and digestion of the bacteria usually occurs. The substances responsible for killing and digesting are the granules of leukocytes. These contain many agents including histone, an enzyme called lysozyme and phagocytin—all with bactericidal capacity. Other enzymes of leukocytes granules are phosphatase, peptidase, peroxidase and nucleosidases. When phagocytosis occurs the granules disappear; their enzymes are released within the cell and enter the digestive vacuole. The optimum activity of many of these enzymes occurs in an acid medium and the vacuoles, as a result of partial metabolism within the leukocyte of glucose to lactic acid, usually have an acid reaction. Mononuclear leukocytes also have enzymes, including esterases and lipases. These, too, participate in intracellular digestion. When leukocytes disintegrate, the end products of digestion and their enzymes are liberated into the area of inflammation, where they operate locally to liquefy pus, to perpetuate the vascular reactions and perhaps to stimulate repair.

Modification of Inflammation.—In lower animals that lack blood vessels, inflammation is manifested only as a cellular response by migration, phagocytosis, cell secretion and repair. Higher forms have a complex blood vascular system and with it can direct specialized defensive cells and chemical substances to the area of injury.

With higher specialization have come other control mechanisms, such as nerve and endocrine systems. Endocrine hormones of the adrenal glands can modify inflammation. For example, local injection of epinephrine (adrenaline) can briefly suppress the hyperemia and part of the exudative component. The adrenal cortical hormone, 17-hydroxycortisone, will depress all phases of the inflammatory response for extended periods. When the agents of injury are not viable virulent bacteria, these hormones form a useful part of treatment, but in bacterial infection suppression of all or part of the inflammatory response can be deleterious.

The jeopardizing effects resulting from the absence of key elements in inflammation are seen in certain individuals. For example, some persons hereditarily lack the capacity to produce antibodies. These people are unusually susceptible to infection. In agranulocytosis, in which there is a deficiency of circulating leukocytes, there is decreased resistance to infection. Inflammatory lesions in such states show hyperemia and tissue necrosis without pus. Another peculiarity exhibited by some individuals is a hypersensitive inflammatory mechanism that responds in an exaggerated way to what in others are mild stimuli; such reactions are shown by sufferers of hay fever and, perhaps also, of rheumatic fever and arthritis.

See also references under "Inflammation" in the Index.

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(E. P. BT.)

INFLATION AND DEFLATION. The terms inflation and deflation have strong emotional connotations, and their loose and varying use often causes confusion. Both of them are usually employed to describe situations that are regarded as undesirable. Inflation is often used to denote price rises in their most marked and disagreeable forms and deflation frequently indicates not only declining prices but also falling business activity or unemployment on a large scale. Those writers whose use is most precise define the terms as relating to movements in the general level of prices.

Definition and Measurement.—At any one time prices of various goods and services are moving differently; some move at faster rates than others, either upward or downward. The general price level is an average or central tendency, and its changes describe only one feature of the great variety of individual price movements. Nor is the general level of prices an altogether clear concept since, as an average, it is expressible only in terms of an index number. Even if it were perfectly clear it would not be desirable to equate every rise or fall in the level with inflation or deflation. Such a procedure would carry the implication that inflation existed if the price level rose slightly from one month to another, and that a period of some years was inflationary if the price level at the end was a little higher than at the beginning. The concept of inflation and deflation should not depend on a fine calculation as to whether price rises outweigh price falls or not.

Inflation or deflation cannot be defined more precisely than as an increase or decrease of more than an acceptable minimum amount in an acceptable index of the general price rise. There is a considerable range of choice as to the type of index to be used. If it is to measure inversely changes in the value of the monetary unit, the index should include representations of all prices of goods and services on which money is spent. Such a breadth of coverage in a "transactions" index is never attained in practice. The nearest approach is provided by a price index of final output, *i.e.*, of goods and services, home-produced or imported, available for consumption, investment or export in the private or the public sector of the economy. More commonly, however, a narrower index is taken: a price index for all consumers' goods and services. Inflation and deflation are then regarded from the point of view of the final consumers and of the value of money to them. (*See* INDEX NUMBERS.)

Modern History.—In the 100 years before 1914, the movement of prices followed somewhat similar trends in the main industrial countries. Prices declined until about 1830, moved around

a level trend until the early 1870s, fell again until around 1895 and then rose in the period before World War I. Deflation on a modest scale was the rule rather than the exception; there was general inflation only in the last 20 years of the period and it amounted to no more than 20% in all. Even in the short run, over a few years, major inflations were usually followed by corresponding deflations and occurred only in association with massive expansions in the quantity of money created to finance government expenditures during and immediately after wars. The main examples are the severe inflation in the United States in the early 1860s during the Civil War and that in Europe after 1870 arising from the Franco-German War. In Great Britain prices rose by 10% between 1870 and 1873. (*See* PRICE.)

The period from 1914 to 1949 was dominated by major inflations caused by World Wars I and II and by severe deflation in the early 1920s and during the great depression of the 1930s. The most spectacular inflations of the runaway type occurred in central and eastern Europe after World War I. Productive capacity was largely destroyed in the defeated countries and the need for great expenditures on reparations and rehabilitation led governments to resort to the printing presses. Once started, the inflationary spiral was given extra spins by the general loss of confidence, by the breakdown of tax collection and by the widespread disruption of business as speculation replaced productive activity. In the great German deflation after defeat in World War I the circulation of paper marks reached astronomical figures by the end of 1923, when such an ordinary matter as the sending of a local letter cost 100,000,000,000 marks in postage. Inflation on this scale required major currency reform before confidence could be re-established. The German reichsmark of 1924 meant a complete repudiation of the previous paper currency.

The deflations of the 1920s and 1930s had no counterpart in the 15 years after World War II. On the contrary, after the widespread currency devaluations of 1949, inflation continued in most countries, usually on a modest but persistent scale. A new problem for governments arose, unknown in the previous 150 years of industrial growth, that of framing economic policy to maintain a high level of employment, and an economic activity near capacity, while avoiding a continual rise in prices. It was this problem which, in one form or another, dominated economic thinking in the 1950s and early 1960s.

Causes and Consequences.—Until the 1930s, inflation had been generally regarded as an infrequent problem, but a major and sometimes catastrophic one when it did arise. During inflation prices increased and the value of money declined at such a rapid pace as to disturb all previous trends. It was a situation in which there was an abnormal increase in the supply of money without a corresponding expansion in the volume of goods and services available: too much money chasing too few goods. The growth in the quantity of money was the cause, the rise in the price level an inevitable effect. No important inflations or deflations had in fact occurred for more than 100 years before 1930, except as a consequence of a war and of the resulting need to finance large government deficits. The creation of new money by the government could proceed in various ways but always with the same effect. The inflationary process is not much different if the government simply prints more paper currency, or if it borrows from the banking system and so creates new bank deposits.

One reason, and probably the most powerful, for the infrequency of major inflation or deflation before the great depression of the 1930s was the widespread use of the gold standard. This system limited the issue of paper money and bank deposits to the level which the public, able to exchange money freely for gold, was willing to hold instead of gold. Free gold convertibility under the gold standard proper, or a fixed money-to-gold ratio set by legislation as an alternative, was almost completely effective (except when abrogated in wartime) in setting limits to the power of governments to acquiesce in inflation. However, during the 1920s, it became increasingly the view that a rigid metallic system, for all its advantages, hindered economic progress. Increasingly, governments asked for and were given discretionary powers of control over the supply of money. For example, there was in Great Britain the unpopular return to the gold standard in the 1920s and the early failure of the move.

The experience of the great depression and the growing influence of the work of Lord Keynes in the 1930s led economists to take a different view of inflation. Moderate changes in the price level, both in the short run and over longer periods, were described as inflationary or deflationary, quite apart from variations in the supply of money. Emphasis was placed rather on decisions to consume and to invest out of income. An excess or deficit of planned expenditure over capacity to produce could lead to wide variations in the level of output and of prices. The relation of inflation and deflation on the one hand to over- and under-employment, to boom and depression on the other, is both important and complex, not direct and simple. Prices, employment, wages and profits are interrelated and it is not easy to measure these relations or even to specify the sequence of changes among the variables during inflation and deflation. The complicated nature of the problem was already clear by the end of the 1930s and it became increasingly urgent to find solutions as the policy of full employment took precedence in the politico-economic field, following World War II and particularly in the 1950s and early 1960s.

Even in the 19th century falling prices were generally associated with quite high levels of unemployment. Under the conditions prevailing from the middle of the 20th century onward, strong deflationary measures were likely to reduce output and employment more than prices. Modern business was almost as strongly opposed to price cutting as organized labour was to wage reductions. Political and economic pressures for expansionary measures were strong and governments found the line of least resistance along inflationary paths. It was quite generally agreed, moreover, that a moderate rate of increase in prices stimulated output and employment when an economy was operating below capacity. It was less clear whether the social dangers of serious inflation as full employment was approached offset the fact that business thrived on inflation at a moderate pace. Similar analyses of the situation could lead economists to different conclusions according to where they placed the emphasis. If the avoidance of underemployment took priority, an economist might prefer a continual rise in the price level, taking the risk that inflation accelerated as full employment was achieved and that continued use of inflation might tend to destroy its effectiveness. On the other hand, if the dangers of rapid inflation were to be avoided, he might prefer a check on rising prices, at the risk of some underemployment of resources at times.

The need for statistical and quantitative assessment of inflationary and deflationary processes, as opposed to a qualitative analysis, was apparent in the 1930s and urgent by the 1950s. Early work aimed at a system of relations completely describing the economy, including explanations of wage and price movements, and with particular reference to business cycles. Such a system for the United States was published by J. Tinbergen in 1939 and it was later developed by L. R. Klein. Subsequent British studies by A. W. Phillips and R. G. Lipsey and by L. A. Dicks-Mireaux and J. C. R. Dow, at the end of the 1950s sought for the determinants of inflation and, in particular, for economic models explaining the rate of change of wages. The feature of the 1950s examined was the continued rise in prices and wages despite quite considerable variations in business activity. Such recessions as those of 1952 in Great Britain, of 1954 in the United States and of 1958 in both countries could be described as deflations only in the sense that the rise in prices and wages became slower as output and employment declined. Two views of the increase in wage rates were advanced, roughly the "demand-pull" and "cost-push" interpretations. More precisely, one influence on the rate of change of wages is excess demand, making its impact in the labour market through less unemployment and more vacancies; another influence is that of the past rate of change in the price level on current wage determination and the consequent effect through higher costs on future prices. Both influences would seem to be important though with varying weights at different times since the middle of

the 19th century. *See* also CURRENCY; MONEY; WAR FINANCE; and references under "Inflation and Deflation" in the Index.

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INFLORESCENCE generally means a flower cluster, but specifically refers to the arrangement of the flowers on the floral axis. *See* FLOWER: *Position of Flowers on the Plant: Inflorescences.*

INFLUENZA is an acute infectious respiratory disease caused by a virus. The disease commonly occurs in epidemics; they develop quickly, spread rapidly to as much as 25% to 40% of the population, with low fatality, and terminate abruptly. Within a short period of years the illness reappears in the same geographic area. It is abrupt and of brief duration, characterized more by prostration and aching than by obvious signs of respiratory disease. Complications of bronchitis and pneumonia are common. At times the epidemics become world-wide or pandemic, and during these periods, as in 1918, the severity of the disease and the frequency of complications may attain terrifying proportions. Some authorities have considered the severe pandemics a different disease from those of intervening years, but the resemblances between the two are so great as to suggest that they are of the same basic nature. The specific cause of epidemics previous to 1933 was not known. After that time, however, viruses (*q.v.*) were identified as the primary agents of influenza A and influenza B. Swine influenza, studied extensively by R. E. Shope, is caused by a virus related to type A influenza virus, in conjunction with a bacterium, *Hemophilus influenzae*.

History of Epidemics.—Influenza has a long history. An epidemic described by Hippocrates in the 5th century B.C. has been called influenza, but the first clear description is that of the epidemic of 1610. The descriptions of numerous outbreaks through the succeeding centuries reveal a tendency to surprising uniformity of behaviour but considerable variation in time of occurrence and severity. The severer outbreaks have been the most completely described, culminating in the extensive reports of the pandemics of 1889–90 and 1918.

Many of the epidemics were thought to have arisen in Russia, where a reservoir of influenza was said to exist and to have spread into Europe by the routes of travel. As rates of travel increased it became more and more difficult to trace a progressive extension until in 1918 the disease seemed to erupt almost simultaneously in widely separated geographic areas. In Oct. 1889 influenza was recognized in Siberia; in November it had reached Germany and France, and in December extended to Spain, Italy and England. In the same month the cities of the Atlantic seaboard of the United States were involved; in early January the cities of the middle west and, somewhat later, San Francisco, Calif., on the Pacific coast, had their peaks of incidence. In the autumn of 1918 much of the northern hemisphere was blanketed by influenza in approximately one month. Australia and certain rather isolated areas were not affected until later. These examples clearly illustrate the rapid, widespread distribution of the severe outbreaks; evidence indicates that in its milder forms the same tendency exists.

Epidemics of influenza commonly affect a high percentage of the population although accurate data have been uncommon. In pandemic times incidence rates as high as 30%–40% were repeatedly reported; in milder epidemics estimates of 10% were common. The frequency of illness is greatest in children, although the impression widely prevails that adults are most commonly attacked. It is true, nevertheless, that young adults are prominently affected.

Despite the high incidence, mortality is commonly low, and deaths from uncomplicated influenza are infrequent. On the other hand, there is usually an increased mortality from complications such as pneumonia, and excess mortality among patients with cardiac or other debilitating disease, especially at ages over 50 years. The 1918 epidemic was the most destructive in history; in fact it ranks with the plague of Justinian and the Black Death as one of the severest holocausts of disease ever encountered. It was estimated by E. O. Jordan that more than 20,000,000 persons perished of influenza in a few months and more than 50 times as many were sick. In India 12,500,000 persons, or 4% of the total population, are said to have been killed by influenza in the autumn of 1918. In the United States 548,000 died. In contrast, the pandemic of 1889–90, which also had a high attack rate, had a mortality of less than one-tenth that of 1918.

Influenza is most commonly a disease of the colder half of the year, but it is not strictly limited. The severer episodes appear to be less controlled by season than those of intervening years. In tropical and subtropical areas, epidemics occur with a frequency similar to that seen in the temperate zones.

Another feature encountered prominently in the pandemics of 1889–90 and 1918, as well as in earlier ones, is the tendency toward "waves" of infection. This is seen by the appearance of an epidemic, the first wave, in the winter of 1889–90; the second wave, a severer episode, 14 to 15 months later in the spring of 1891; a third mild disease in the late fall and winter of 1891–92. A mild, world-wide epidemic in the spring and early summer of 1918 was followed by the astoundingly severe epidemic in the autumn; a third rise in the spring of 1919 was quite irregular and was of doubtful relation to the preceding two. Reports are confusing as to whether an attack in the first wave gave resistance to the second.

Later Epidemics.—In 1933 influenza virus, type A, was first isolated by W. Smith, F. W. Andrewes and Patrick Laidlaw in London, and the following year in the U.S. by Thomas Francis, Jr. Thereafter a number of outbreaks of influenza A were observed at intervals of two to three years. There was variation in the extent of the epidemics; some were extremely mild and irregularly encountered, but those of 1936–37 and 1940–41 spread throughout the world. In most instances the influenza A epidemics were sharp and brief, beginning in the late autumn or winter of the temperate zones, while areas such as Hawaii and the West Indies were often affected earlier. Data of the percentage of population attacked are inexact, but 8% to 15% appears to be a reasonable estimate in the more clear-cut epidemics. It was shown, however, that the disease may be encountered in small, localized, almost sporadic outbreaks which sometimes precede the epidemic wave. The mortality has been low; scarcely 1 case in 1,000 was fatal. Nevertheless, an excess in mortality from pneumonia and in the general mortality accompanies the disease.

Influenza B was first identified in the U.S. in 1940 by Francis, who demonstrated also that an epidemic in that country early in 1936 was caused by the same virus. It also gave rise to an extensive epidemic in 1945. Influenza B seems to have been more scattered in its distribution, and the epidemics, which recurred at intervals of four to five years, were less sharply defined in scope. The incidence tends to be somewhat lower than with influenza A, and the accompanying mortality is proportionately reduced.

In some epidemics a proportion of cases have not been identified as influenza A or B, but no definite epidemic has been observed which might be attributable to still another type of influenza. Swine influenza virus has not been reported in the human population. The fact that these two types recur at intervals of a few years offers a possible explanation of the so-called three waves of a pandemic period.

It seems likely, with the appearance of these diseases in the northern and southern hemispheres in alternate halves of the year and with the recognition that they may exhibit limited, spotty tendencies, that influenza is maintained by a constant circulation in the human population, reaching epidemic proportions only when a sufficient number of susceptibles has reaccumulated to furnish fuel. (*See* BACTERIAL AND INFECTIOUS DISEASES: *Virulence.*)

Chronic carriers of the virus have not been demonstrated. Under this interpretation the severer pandemics represent variations in scope of a basic disease and may be related to the circulation of modified strains of virus and to the frequency and virulence of bacterial accompaniments. Laidlaw suggested in 1936, and the suggestion was supported by Shope, that swine influenza represents the human disease of 1918, which became established in hogs and persisted there. Shope presented evidence that the swine disease is maintained in a concealed form in worm parasites of that animal from which it erupts when the animal's physiology is disturbed.

The idea that there are geographical foci in Russia and the east in which influenza is maintained is a similar concept of a limited reservoir.

The epidemic of Asian influenza of 1957 apparently began in China early in the year. It was detected in Hong Kong among refugees early in April and extended soon to Singapore and Formosa (Taiwan). From there the distribution became quite wide and by June 10 the disease had circled the globe. Its course was readily traced along lines of transportation and numerous foci were described developing from affected groups.

The incidence was high, particularly in crowded areas of the orient; it was generally mild although, as usual, an increased mortality from respiratory disease took place. It appeared that the highest frequency was in adolescents and in people generally under 30 years of age.

In the United States a distinct increase in respiratory disease was noted beginning in August; the peak, both of incidence and excess mortality was reached by the end of October, after which a progressive decline took place. A significant proportion of the deaths apparently was associated with staphylococcus, and also cases of rheumatic heart disease with mitral stenosis.

The severity of the disease was reported to vary somewhat in different countries, but experience generally was that of a mild illness with high incidence and low mortality. In all regions crowding appeared to have been a significant factor in morbidity.

The virus, belonging to type A influenza virus, exhibited antigenic characteristics different from those of recent years, but serological evidence indicated that it is related to strains circulating earlier. Sera from the older segments of the population contained antibodies to the strain, suggesting that it may possibly have been prevalent in the 1889–90 pandemic period.

Intensive efforts were made in the United States in 1957, through the collaboration of all agencies concerned, to prepare for the epidemic. Large-scale production of specific vaccine was instituted and became available in significant amounts before the epidemic developed. Data indicated that with the proper concentration of virus, protection of 80% could be obtained. Much illness and mortality were prevented by widespread use of vaccine.

Etiology.—The name influenza was introduced by John Huxham in 1743, apparently derived from the Italian phrase which ascribed the origin of the disease to *un influenza di freddo*, the influence of the cold. It was not until 1890 that the idea that influenza was borne by the prevailing winds was dispelled. In 1892 Richard Pfeiffer described the influenza bacillus, *Hemophilus influenzae*, commonly a tiny organism, but of varied forms, which requires for its proper growth substances present in blood. Subsequent studies appeared to support Pfeiffer's conclusion that this organism was the cause of influenza. The pandemic of 1918 resulted in extensive studies of its role. It was generally concluded that while this organism was of considerable importance, perhaps greater than that of other bacteria, it did not satisfy the requirements of a primary causative agent. The concept of a filterable virus gained in prominence, and as a result studies in England, France, Germany, Japan and the United States were made in an effort to transmit the disease to human subjects and experimental animals. Results were quite variable, and, even in instances which were apparently successful, no agent was well established. As a result the cause of that epidemic was not clearly demonstrated.

In 1931 Shope demonstrated that swine influenza, hog flu, was caused primarily by a virus which in conjunction with a bacillus similar to that of Pfeiffer's produced extensive disease in hogs throughout the United States.

In 1933 Smith, Andrewes and Laidlaw produced an experimental infection in ferrets with a virus from the throats of influenza patients. This was confirmed in 1934 in the United States by Francis. It was then found that the virus infection could be transmitted to mice. In both species of animals continued transfer gave rise to extensive fatal, nonbacterial pneumonia. The virus produced infection only when given by the respiratory route. Animals which recovered were immune for a period of months to reinfection, and their blood serum contained immune substances (antibodies) capable of protecting normal animals. It was shown that a high percentage of the human population had immune bodies in the blood as a result of earlier infection and that the recovered person developed more. This fact could be used for diagnosis and studies of the distribution of the disease, designated influenza A. After 1939, following studies of F. M. Burnet, the incubating egg containing the embryonic chick was an increasingly effective tool for isolation of virus and studies of the disease. G. K. Hirst, L. McClelland and R. Hare observed that influenza virus caused clumping of the red blood cells of chickens and that the phenomenon could be applied to the measurement of virus and antibodies.

The virus of influenza B was isolated in 1940 by both Francis and T. P. Magill. Its general characteristics are similar to those of influenza A. It is, however, more difficult to establish experimental disease in ferrets, mice and frequently in eggs than with type A virus. Moreover, infection with one gives no immunity to the other, so that in this sense they represent two different diseases. The strains of type A or of type B also differ among themselves. Swine influenza virus is related to type A.

Infection does not give permanent immunity, but in experimental animals it can be renewed by reinoculation. In the general population there appears to be a decline of immunity between epidemics and thus an increase of susceptibles. Even after induced infection under experimental conditions the immunity may be of only a few months' duration. However, a good percentage of the population develops a resistance effective for a much more prolonged period, as shown by the fact that only a minority takes sick during epidemic periods.

Clinical Features.—Influenza spreads through a population by the transfer of virus by sneezing, coughing, etc., of the excretions from the respiratory tract of the infected person to that of a susceptible. In the majority of instances the process is a direct infection, although indirect transfer through contamination of hands, handkerchiefs or eating utensils is obviously possible. There is little reason to consider the disease air-borne except in crowded, poorly ventilated quarters when contamination of the air may be marked. As the virus gains entrance to the respiratory tract of the susceptible, it selectively attacks and destroys the cells lining the respiratory tract. These cells are superficially situated, not intimately bathed in the fluids of the blood stream, and apparently protected to a great extent by their own physiologic mechanisms. Following injury of the cells, fluid from the blood is poured out, and the supporting tissues give evidence of acute, inflammatory changes. The changes are essentially limited to the nose and the larger respiratory passages. When pneumonia ensues, the type of subsequent injury will depend upon the character of the bacteria encountered. If the pneumonia is related to virus infection alone, which is uncommon, the injury is usually an extension of that previously mentioned with a considerable amount of fluid accumulating in the lungs, areas of collapse and a few cells of a large type. Specific changes in other organs are not ordinarily observed although toxic effects are evident.

Symptoms and Clinical Course.—The incubation period of epidemic influenza is one to two days. The majority of cases present a striking uniformity of symptoms and clinical course. The onset is abrupt with sudden chilliness or distinct chill, fatigue and achiness. Severe prostration is noted early. The temperature rises rapidly in 12 to 24 hr. to a level of from 101° to 104° F. Diffuse headache and severe muscular aches throughout the body become prominent features. Whereas the patient may experience a feeling of nasal irritation or a sense of rawness in the nasopharynx,

symptoms referable to the respiratory tract are few. In this respect the disease is sharply different from the usual common cold in which congestion and runny nose with little or no fever are customary. Sore throat similar to that of acute tonsillitis is rare. In the next 24 hr. the temperature reaches a sustained level. Aches and pains may be the chief complaint. Laryngitis and hoarseness may be present and a short, hacking, unproductive cough may become annoying. Symptoms referable to the gastrointestinal tract are ordinarily no more common than in other acute upper respiratory infections, and the so-called intestinal flu is a misnomer. A nervous form has been described which seems to be essentially a designation of the severe prostration or delirium which may occur.

In three to four days as the temperature begins to fall the patient's general symptoms improve and recovery from the acute phase begins. In 90% to 95% of the cases, even in the severest outbreaks, the disease is a "three-day fever" followed by relatively rapid convalescence; but protracted weakness and exhaustion in adults are traditional. In children, except infants, the disease is generally mild, while in older persons it is severer than the average. When the temperature remains elevated beyond the fourth or fifth day, involvement of the lower respiratory tract is usually present and is ordinarily evidence of complications resulting from associated bacterial infection.

In addition to the usual course of the disease, a number of cases present a much severer infection from the onset. In these there is early evidence of respiratory distress and pulmonary disease. The course is stormy and unpredictable. On the other hand, there is a large group of cases in which the evidence of infection is negligible. These patients may experience nothing more than a mild apathy and a slight discomfort in the upper respiratory passages for a period of 24 hr. The temperature is either not elevated or elevated slightly. In others the symptoms may be so slight as to be unnoticed. Nevertheless, these inapparent infections constitute a serious menace in that they can transmit infection. In some instances, by appropriate tests it was shown that during the course of an epidemic 20% to 25% of persons were actually infected with influenza virus without significant signs of illness.

Complications.—By far the greatest number of and most important complications of epidemic influenza involve the respiratory tract. The various forms of bronchitis and pneumonia may ensue, and in some instances pneumonia apparently begins with onset of the disease. They are usually associated with invasion by pneumococci, staphylococci, *H. influenzae* or other bacteria which invade the lungs. In the U.S. army camps in 1918 purulent or capillary bronchitis was observed in as many as 35% to 40%, and pneumonia occurred in 10% to 20% of the cases. The incidence of complications varies in different epidemics; it is usually low but the frequency may depend upon the amount of virulent bacterial infection prevalent at the time. Paranasal sinusitis is not uncommon. Otitis media similarly occurs. Influenza acquired during pregnancy often results in miscarriage or abortion. There is consequently an increase in both maternal and infant mortality. In many respects influenza is one of the most dangerous complications of pregnancy.

Treatment.—There is no specific treatment for influenza virus infection. Drugs are used to relieve discomfort or control fever. Confinement of the patient to bed in a warm room conserves his resources and limits the possibilities of complicating infections. Although sulfonamides, penicillin and streptomycin have no effect upon the virus disease, they do have a therapeutic, possibly some prophylactic, effect upon the bacterial pneumonias which are the chief causes of death.

Control.—The continued recurrences of influenza clearly demonstrate that there has been no effective procedure for control. Rigid isolation may limit infection under special conditions. But under epidemic conditions the amount of infection to which the person may be exposed and the high infectiousness of the virus clearly nullify minor precautions. In the presence of virulent influenza, crowding may increase the risk of picking up secondary infections as well.

Efforts to control respiratory disease through sterilization of the air by installations of ultra-violet light or by bactericidal vapours (aerosols) were investigated.

Prophylactic Inoculation.—The fact that influenza virus produces disease only when it enters the body by the respiratory tract led to the demonstration that if given subcutaneously or by other routes, illness did not occur in animals or humans but that in the former a resistance developed and in both the accumulation of immune substances in the blood was stimulated. Various studies were undertaken to ascertain the effect upon susceptibility to the natural disease with no more than suggestive results.

The ready growth of influenza virus in the chick embryo results in the accumulation of virus in the allantoic fluid surrounding the embryo. This has served as a bountiful source of virus for vaccine. In 1943 the commission on influenza of the U.S. army epidemiological board carried out studies with a vaccine of virus concentrated from the egg fluid. The virus was obtained from the fluid by permitting it to become attached to the red blood cells of the chicken and then removing it into a reduced volume of sodium-chloride solution. The virus was inactivated by treatment with formalin. Both type A and type B influenza viruses were incorporated into a dose of one cubic centimetre to be given subcutaneously to adults. The results of the study showed that the incidence of influenza A in a vaccinated group of 6,250 men was about one-fourth that observed in a similar group of unvaccinated men. In 1945 the entire U.S. army was vaccinated with this material. Observations during the epidemic of influenza B that winter showed that 1% or less of vaccinated army personnel took sick while 10%–13% of unvaccinated service groups were affected.

The duration of resistance induced by vaccination is not known. It seems improbable that available preparations would have a uniform effect beyond three to four months. The antibodies developed from vaccination reach their peak in two weeks, decline somewhat in four months and still further in one year, but it is not established that the resistance is retained to the same extent as the immune substances. Moreover, the strains of virus encountered in different epidemics vary in chemical constitution, and this may limit the efficacy of vaccine until more strains or a collection of suitable ones are placed in the vaccine. Nevertheless, the information points to the probability that prophylactic vaccination would be effectively developed for use in the control of influenza—a disease which has been called the last of the unconquered scourges.

See also references under "Influenza" in the Index.

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INFORMATION in the United States is a formal written accusation of crime prepared and presented to the court by a prosecution official without intervention of the grand jury. Minor offenses may be prosecuted by information in the federal courts, as may infamous crimes not punishable by death when the accused waives his constitutional right to trial on indictment. Informations are employed in prosecutions for all serious crimes in some states of the U.S., but in others their use is limited by state constitutional provisions. Under certain circumstances informations are used in English criminal cases and in civil proceedings. *See* Criminal Law: *Criminal Procedure.* (F. A. A.)

INFORMATION AGENCY, THE UNITED STATES, was created on Aug. 1, 1953, to conduct the overseas information program of the U.S. government. Foreign information activities formerly conducted by the International Information administration and the Technical Cooperation administration of the department of state and by the Mutual Security agency were consolidated in the new agency. The foreign information program was established to promote support among other peoples for the foreign policies of the United States. Field operations of the agency were carried out by the U.S. Information service, which established posts throughout the world. The posts, under the general direction of the U.S. chief of mission in each country, were staffed by public affairs officers and specialists in news, radio, film, library and other cultural activities.

The agency provided field posts with various services: the "Voice of America", which broadcast on a world-wide network in many languages and serviced field needs for recorded film and television programs for use by local stations; the press service, which provided news and prints; the motion-picture service, which prepared documentary films on the United States in various languages; the information centre service, which supplied materials for library programs and community activities and also was responsible for the translation and distribution of U.S. books overseas. The agency also co-operated with private U.S. organizations and individuals.

INFORMATION THEORY. One of the most prominent features of 20th-century technology is the development and exploitation of new communication mediums. Concurrent with the growth of devices for transmitting and processing information, a unifying theory was developed and became the subject of intensive research.

This theory, known as communication theory, or, in its broader applications, information theory, is concerned with the discovery of mathematical laws governing systems designed to communicate or manipulate information. It sets up quantitative measures of information and of the capacity of various systems to transmit, store and otherwise process information.

Some of the problems treated relate to finding the best methods of utilizing various available communication systems, the best methods of separating signals from noise and the problem of setting upper bounds on what it is possible to do with a given channel. While the central results are chiefly of interest to communication engineers, some of the concepts have been adopted and found useful in such fields as psychology and linguistics.

Information is interpreted in its broadest sense to include the messages occurring in any of the standard communication mediums such as telegraphy, radio or television, the signals involved in electronic computing machines, servomechanism systems and other data-processing devices, and even the signals appearing in the nerve networks of animals and man. The signals or messages need not be meaningful in any ordinary sense. This theory, then, is quite different from classical communication engineering theory, which deals with the devices employed but not with that which is communicated.

Central Problems of Communication Theory.—The type of communication system that has been most extensively investigated is shown in fig. 1. It consists of the following:

1. An information source which produces the raw information or "message" to be transmitted.
2. A transmitter which transforms or encodes this information into a form suitable for the channel. This transformed message is called the signal.
3. The channel on which the encoded information or signal is transmitted to the receiving point. During transmission the signal may be changed or distorted. In radio, for example, there often is static, and in television transmission so-called "snow." These disturbing effects are known generally as noise, and are indicated schematically in fig. 1 by the noise source.
4. The receiver, which decodes or translates the received signal back into the original message or an approximation of it.
5. The destination or intended recipient of the information.

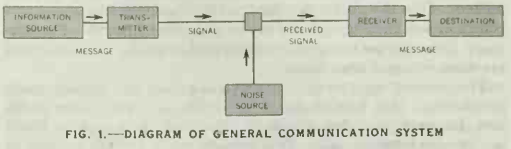

FIG. 1.—DIAGRAM OF GENERAL COMMUNICATION SYSTEM

It will be seen that this system is sufficiently general to include a wide variety of communication problems if the various elements are suitably interpreted. In radio, for example, the information source may be a person speaking into a microphone. The message is then the sound that he produces, and the transmitter is the microphone and associated electronic equipment which changes this sound into an electromagnetic wave, the signal. The channel is the space between the transmitting and receiving antennas, and any static or noise disturbing the signal corresponds to the noise source in the schematic diagram. The home radio is the receiver in this system and its sound output the recovered message. The destination is a person listening to the message.

A basic idea in communication theory is that information can be treated very much like a physical quantity such as mass or energy. A homely analogy may be drawn between the system in fig. 1 and a transportation system; for example, we can imagine an information source to be like a lumber mill producing lumber at a certain point. The channel in fig. 1 might correspond to a conveyor system for transporting the lumber to a second point. In such a situation there are two important quantities: the rate R (in cubic feet per second) at which lumber is produced at the mill, and the capacity C (in cubic feet per second) of the conveyor. These two quantities determine whether or not the conveyor system will be adequate for the lumber mill. If the rate of production R is greater than the conveyor capacity C, it will certainly be impossible to transport the full output of the mill; there will not be sufficient space available. If R is less than or equal to C, it may or may not be possible, depending on whether the lumber can be packed efficiently in the conveyor. Suppose, however, that we allow ourselves a sawmill at the source. This corresponds in our analogy to the encoder or transmitter. Then the lumber can be cut up into small pieces in such a way as to fill out the available capacity of the conveyor with 100% efficiency. Naturally in this case we should provide a carpenter shop at the receiving point to fasten the pieces back together in their original form before passing them on to the consumer.

If this analogy is sound, we should be able to set up a measure R in suitable units telling the rate at which information is produced by a given information source, and a second measure C which determines the capacity of a channel for transmitting information. Furthermore, the analogy would suggest that by a suitable coding or modulation system, the information can be transmitted over the channel if and only if the rate of production R is not greater than the capacity C. A key result of information theory is that it is indeed possible to set up measures R and C having this property.

Measurement of Information.—Before we can consider how information is to be measured it is necessary to clarify the precise meaning of "information" from the point of view of the communication engineer. Often the messages to be transmitted have meaning: they describe or relate to real or conceivable events. However, this is not always the case. In transmitting music, the meaning, if any, is much more subtle than in the case of a verbal message. In some situations the engineer is faced with transmitting a totally meaningless sequence of numbers or letters. In any

case, meaning is quite irrelevant to the problem of transmitting the information. It is as difficult to transmit a series of nonsense syllables as it is to transmit straight English text (more so, in fact). The significant aspect of information from the transmission standpoint is the fact that one particular message is chosen from a set of possible messages. What must be transmitted is a specification of the particular message which was chosen by the information source. The original message can be reconstructed at the receiving point only if such an unambiguous specification is transmitted. Thus in information theory, information is thought of as a choice of one message from a set of possible messages. Furthermore, these choices occur with certain probabilities; some messages are more frequent than others.

The simplest type of choice is a choice from two equally likely possibilities; that is, each has a probability $\frac{1}{2}$. This is the situation, for example, when a coin is tossed which is equally likely to come up heads or tails. It is convenient to use the amount of information produced by such a choice as the basic unit and this basic unit is called a binary digit or, more briefly, a "bit." The choice involved with one bit of information can be indicated schematically as in fig. 2(A). At point b either the upper or lower

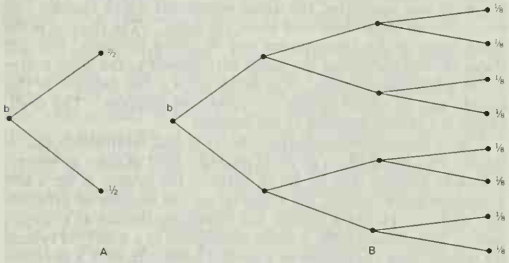

FIG. 2.—A CHOICE FROM (A) TWO POSSIBILITIES; (B) EIGHT POSSIBILITIES (*see* TEXT)

line may be chosen with probability $\frac{1}{2}$ for each possibility.

If there are N possibilities, all equally likely, the amount of information is given by $\log_2 N$. The reason for this can be seen from fig. 2(B), where there are eight possibilities each with probability $\frac{1}{8}$. The choice can be imagined to occur in three stages, each involving one bit. The first bit corresponds to a choice of either the first four or the second four of the eight possibilities, the second bit corresponds to the first or second pair of the four chosen, and the final bit determines the first or second member of the pair. It will be seen that the number of bits required is $\log_2 N$, in this case $\log_2 8 = 3$.

If the probabilities are not equal, the formula is more complicated. When the choices have probabilities $p_1, p_2, \ldots, p_n$, the amount of information H is given by:

$$H = -(p_1 \log_2 p_1 + p_2 \log_2 p_2 + \ldots + p_n \log_2 p_n)$$

This formula for amount of information gives values ranging from zero—when one of the two events is certain to occur (*i.e.*, has a probability of 1) and all others are certain not to occur (probability 0)—to a maximum value of $\log_2 N$ when all events are equally probable (probability $1/N$). These situations correspond intuitively to the minimum information produced by a particular event (when it is already certain what will occur) and the greatest information or the greatest prior uncertainty of the event.

The parlor game "Twenty Questions" illustrates some of these ideas. In this game, one person thinks of an object and the other players attempt to determine what it is by asking not more than 20 questions that can be answered "yes" or "no." According to information theory each question can, by its answer, yield anywhere from no information to $\log_2 2$ or one bit of information, depending upon whether the probabilities of "yes" and "no" answers are very unequal or approximately equal. To obtain the greatest amount of information, the players should ask questions that subdivide the set of possible objects, as nearly as possible, into two equally likely groups. For example, if they have established by previous questions that the object is a town in the United States, a good question would be, "Is it east of the Mississippi?" This divides the possible towns into two roughly equal sets. The next question then might be, "Is it north of the Mason-Dixon line?" If it were possible to choose questions which always had the effect of subdividing into two equal groups, it would be possible to isolate, in 20 questions, one object from approximately 1,000,000 possibilities. This corresponds to 20 bits.

The formula for the amount of information is identical in form with equations representing entropy in statistical mechanics, and suggests that there may be deep-lying connections between thermodynamics and information theory. Some scientists believe that a proper statement of the second law of thermodynamics requires a term relating to information. These connections with physics, however, do not have to be considered in the engineering and other applications of information theory.

Most information sources produce a message which consists not of a single choice but of a sequence of choices; for example, the letters of printed text or the elementary words or sounds of speech. The writing of English sentences can be thought of as a process of choice: choosing a first word from possible first words with various probabilities; then choosing a second, with probabilities depending on the first; and so on. This kind of statistical process is called a stochastic process, and information sources are thought of, in information theory, as stochastic processes. A more general formula for H can be given which determines the rate at which information is produced by a stochastic process or an information source.

Printed English is a type of information source that has been studied considerably. By playing a kind of "Twenty Questions" game, suitably modified, with subjects trying to guess the next letter in an English sentence, it can be shown that the information rate of written English is not more than about one bit per letter. This is a result of the very unequal frequencies of occurrence of different letters (for example, E is very common in English while Z, Q and X are very infrequent), of pairs of letters (TH is very common and QZ very rare), and the existence of frequently recurring words, phrases and so on. This body of statistical data relating to a language is called the statistical structure of the language. If all 26 letters and the space in English had equal frequencies of occurrence (*i.e.*, each had probability $\frac{1}{27}$) and the occurrence of each letter of text was independent of previous letters, the information rate would be $\log_2 27$, or about 4.76 bits per letter. Since only one bit actually is produced, English is said to be about 80% redundant.

The redundancy of English is also exhibited by the fact that a great many letters can be deleted from a sentence without making it impossible for a reader to fill the gaps and determine the original meaning. For example, in the following sentence the vowels have been deleted:

MST PPL HV LTTL DFFCLTY N RDNG THS SNTNC.

As might easily be deduced, redundancy in a language plays an important role in the science of cryptography.

Encoding Information.—An important feature of the measure of information, H, is that it determines the saving in transmission time that is possible, by proper encoding, due to the statistics of the message source. To illustrate this, consider a model language in which there are only four letters—A, B, C and D. Suppose these letters have the probabilities $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$ and $\frac{1}{8}$. In a long text in this language, A will occur one-half the time, B one-quarter of the time, and C and D each one-eighth of the time. Suppose this language is to be encoded into binary digits, 0 or 1, as for example in a pulse system with two types of pulse. The most direct code is the following:

A = 00; B = 01; C = 10; D = 11

This code requires two binary digits per letter of message. By proper use of the statistics, a better code can be constructed as follows:

A = 0; B = 10; C = 110; D = 111

It is readily verified that the original message can be recovered from its encoded form. Furthermore, the number of binary digits used is smaller on the average. It will be, in fact,

$$\tfrac{1}{2}(1) + \tfrac{1}{4}(2) + \tfrac{1}{8}(3) + \tfrac{1}{8}(3) = 1\tfrac{3}{4}$$

where the first term is due to the letter A, which occurs half the time and is one binary digit long, and similarly for the others. It may be found by a simple calculation that $1\frac{3}{4}$ is just the value of H, calculated for the probabilities $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{8}$.

The result verified for this special case holds generally—if the information rate of the message is H bits per letter, it is possible to encode it into binary digits using, on the average, only H binary digits per letter of text. There is no method of encoding which uses less than this amount.

This important result in information theory gives a direct meaning to the quantity H which measures the information rate for a source or a language. It says, in fact, that H can be interpreted as the equivalent number of binary digits when the language or source is encoded in 0 and 1 in the most efficient way. For instance, if the estimate of one bit per letter, mentioned above as the rate for printed English, is correct, then it is possible to encode printed English into binary digits using, on the average, one for each letter of text; and, furthermore, no encoding method would average less than this.

Capacity of a Channel.—Now consider the problem of defining the capacity C of a channel for transmitting information. Since the rate of production for an information source has been measured in bits per second, we would naturally like to measure C in the same units. The question then becomes, what is the maximum number of binary digits per second that can be transmitted over a given channel? In some cases the answer is simple. With a teletype channel there are 32 possible symbols. By calculating $\log_2 32$ it is found that each symbol represents 5 bits, provided the possible symbols are used with equal probability. Therefore, if we can send n symbols per second, and the noise level is not high enough to introduce any errors during transmission, we can send $5n$ bits per second.

The problem of calculating the capacity of a channel is usually more complex than this example because of disturbing noise. As an example, suppose there are two possible kinds of pulse that can be transmitted in a system, a 0 pulse and a 1 pulse. Suppose further that when 0 is transmitted it is received as 0 nine-tenths of the time, but one-tenth of the time noise causes it to be received as 1. Conversely, suppose a transmitted 1 is received as 1 nine-tenths of the time but distorted into a 0 pulse one-tenth of the time. This type of channel is called a binary symmetric channel. It and other noisy channels have definite capacities that can be calculated by appropriate formulas. In this particular case, the capacity is about 0.53 bits per pulse.

The meaning of the capacity of such a noisy channel may be roughly described as follows: It is possible to construct codes that will transmit a series of binary digits at a rate equal to the capacity. This can be done in such a way that they can be decoded at the receiving point with a very small probability of error. These codes are called error-correcting codes, and are so constructed that the type of transmission errors likely to occur in the channel can be corrected at the receiving point. Finally, it is not possible to transmit at a higher rate than the channel capacity and retain this error-correcting property.

The functioning of error-correcting codes can be likened to the ability of a person to correct a reasonable number of typographical errors in a manuscript because of his knowledge of the structure and context of the language. Much of the work in information theory centres around the theory and construction of such error-correcting codes.

Band-limited Channels.—A frequently occurring restriction on communication channels is that the signals must lie within a certain band of frequencies W cycles per second wide. A result known as the sampling theorem states that a signal of this type can be specified by giving its values at a series of equally spaced sampling points $1/2W$ seconds apart. Thus it may be said that such a function has $2W$ degrees of freedom, or dimensions, per second.

If there were no noise whatever on such a channel it would be possible to distinguish an infinite number of different amplitude levels for each sample. Consequently, in principle, an infinite number of binary digits per second could be transmitted, and the capacity C would be infinite. In practice, there is always some noise, but even so if no limitations are placed on the transmitter power P, the capacity will be infinite, since at each sample point an unlimited number of different amplitude levels may be distinguished. Only when noise is present and the transmitter power is limited in some way does the capacity C become finite. This capacity depends on the statistical structure of the noise as well as the nature of the power limitation.

The simplest type of noise is resistance noise, produced in an electrical resistor by thermal effects. This type of noise is completely specified by giving its average power N.

The simplest limitation on transmitter power is the assumption that the average power delivered by the transmitter is not greater than P. If a channel is defined by these three parameters W, P and N, the capacity C can be shown to be

$$C = W\log_2 \frac{P+N}{N} \text{ (bits per second)}$$

The implication of this formula is that it is possible, by properly choosing the signal functions, to transmit $W\log_2 \frac{P+N}{N}$ binary digits per second and to recover them at the receiving point *with as small a frequency of errors as desired*. It is not possible to transmit binary digits at any higher rate with an arbitrarily small frequency of errors.

Encoding systems in current use, pulse-code modulation and pulse-position modulation, use about four times the power predicted by the ideal formula. Unfortunately, as one attempts to approach more closely this ideal, the transmitter and receiver required become more complicated and the delays increase.

The relation

$$C = W\log(1 + \frac{P}{N})$$

can be regarded as an exchange relation between the bandwidth W and the signal-to-noise ratio P/N. Keeping the channel capacity fixed, the bandwidth can be decreased provided the signal-to-noise ratio is sufficiently increased. Conversely an increase in bandwidth allows a lower signal-to-noise ratio in the channel.

One method of exchanging bandwidth for signal-to-noise ratio is shown in fig. 3. The upper curve represents a signal function whose

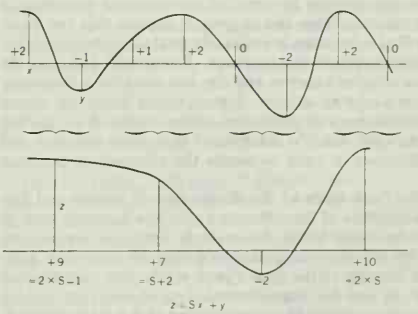

FIG. 3.—THE EXCHANGE OF BANDWIDTH FOR SIGNAL-TO-NOISE RATIO

bandwidth is such that it can be specified by giving the samples shown. Each sample has five amplitude levels. The lower curve is obtained by combining pairs of samples from the first curve as shown. If the pair of samples from the upper curve have amplitudes x and y, a single amplitude z for the lower curve is computed from the formula

$$z = 5x + y.$$

The five possible values of x combined with the five possible values of y produce 25 possible values of z which must be distin-

guished. However, the samples now occur only half as frequently; consequently the band is reduced by half, at the cost of increasing the signal-to-noise ratio. Operating this in reverse doubles the band but reduces the required signal-to-noise ratio.

To summarize, there are three essentially different ways in which bandwidth can be reduced in a system such as television or speech transmission. The first is the straightforward exchange of bandwidth for signal-to-noise ratio just discussed. The second method is utilization of the statistical correlations existing in the message. This capitalizes on particular properties of the information source feeding the channel. Finally, particular properties of the ultimate destination of the messages can be used. Thus in speech transmission the ear is relatively insensitive to phase distortion. Consequently, phase information is not as important as amplitude information, and need not be sent so accurately, resulting in a saving of bandwidth or of power. In general, the exploitation of particular "sensitivities" or "blindness" in the destination requires a proper matching of the channel to the destination.

Filtering and Prediction Problem.—Another type of problem that has been studied extensively in the field of information theory is that of determining the best devices for eliminating noise from a signal and predicting the future value of the signal. These are known as the filtering and prediction problems. The two problems may also occur in combination if it is desired to predict the future value of a noisy signal. Possible applications of the filtering problem occur in the detection of various types of communication signals which have been corrupted by noise or in the smoothing of data subject to observational error. The prediction problem, with or without filtering, may arise, for example, in weather or economic forecasting or in the control of gun directors, where it is desired to predict the future position of a moving target.

The most successful work in this general field has been carried out under the following two assumptions. First, the best prediction or filtering is interpreted to be that which minimizes the mean-square error between the computed value and the true value. Second, the devices performing these operations are assumed to perform linear operations on the signals which they filter or predict. Under these conditions, substantially complete solutions have been found specifying the characteristics of the predicting or filtering device in terms of the power spectra of the signal and of the noise.

Cryptography, Linguistics and Other Applications.—Some applications have been made in the fields of cryptography and linguistics. It is possible to formulate a theory of cryptography or secrecy systems in terms of the concepts occurring in information theory. When this is done, it appears that the information rate R of a language is intimately related to the possibility of solving cryptograms in that language. The smaller this rate, the easier such a solution becomes and the less material is necessary to render such a solution unique. Indeed, within limits, the theory becomes quantitative and predictive, giving means of calculating how much material must be intercepted in a given language and with a given cipher in order to ensure the existence of a unique solution.

A study has been made of the distribution of lengths and frequency of occurrence of the different words in a language such as English. It has been found, for example, that the relative frequency of the nth most frequent word may be expressed quite closely by a formula of the type $P(n + m)^{-b}$, with suitable constants for P, m and b. Experimental data of this type can be explained as consequences of the assumption that a language gradually evolves under continued use into an efficient communication code. (*See* CRYPTOLOGY; LINGUISTICS.)

Psychologists have discovered interesting relationships between the amount of information in a stimulus and reaction time to the stimulus. For example, an experiment can be set up in which there are four lights and four associated push buttons. The lights go on in a random order and the subject is required to press the corresponding button as quickly as possible after a light goes on. It develops that the average time required for this reaction increases linearly with an increase in the amount of information conveyed by the lights. This experimental result holds true under a wide variety of changes in the experiment: the number of lights, the probabilities of different lights, and even varying correlations between successive lights.

These results suggest that under certain conditions the human being, in manipulating information, may adopt codes and methods akin to those used in information theory.

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INFORMER, a term variously used to mean (1) a person who, usually in secret, gives information to law-enforcement authorities about an offense, committed by somebody else, which does not necessarily involve injury or loss to the informer himself; (2) an accomplice in crime who earns immunity from prosecution by turning "state's (or queen's) evidence" (*see* EVIDENCE: *Privilege and Public Policy*); and (3) the party who openly initiates criminal proceedings by "laying (or swearing) an information" before a magistrate or sheriff. In England, the status of the so-called "common informer," who was rewarded by the whole or by part of the fine imposed on the offender whom he denounced, was abolished in 1951, and the fines for offenses thus disclosed (*e.g.,* on gaming houses, for breaches of Sunday observance, etc.) are now by statute payable to public funds. Accordingly, both in the U.S. and in Great Britain the word "informer" in its commonest usage means a person, more often than not with a criminal past which he is now capitalizing, who denounces offenders to the police or to other law-enforcement agencies, for payment either *ad hoc* or by retaining fee. (C. H. R.)

INGASSANA, the Arab name for the Negro people of the Tabi hills in Darfur province (eastern Sudan), who have no common name but call themselves JokTau (people of Tau), Jok-Kuthulok, JokGor, etc., after the hills they live upon. Estimated to number about 8,000 in the 1960s, they are horticultural and keep some livestock including cattle, pigs and horses. Each hill is under a religious and political leader, and there is a multiplicity of secular officials. The Ingassana have a sun cult and a sacred stone called *soba* or *mit i tel* (stone of the sun).

See E. E. Evans-Pritchard quoted in C. G. and B. Z. Seligman, *Pagan Tribes of the Nilotic Sudan* (1932); Ernesta Cerulli, "Peoples of Southwest Ethiopia and its Borderlands," *Ethnographic Survey of Africa* (1956). (G. W. B. H.)

INGE, WILLIAM RALPH (1860–1954), English theologian and dean of St. Paul's, was born June 6, 1860, at Crayke, Yorks., the son of William Inge, sometime provost of Worcester college, Oxford, and was educated at Eton, and at King's college, Cambridge. From 1884 to 1888 he was an assistant master at Eton, and during the last two years of that time was fellow of King's college, Cambridge. From 1889 to 1904 he was fellow of Hertford college, Oxford. In 1907 he was made Lady Margaret professor of divinity at Cambridge, and in 1911 he became dean of St. Paul's. His sermons attracted attention because of their criticism of modern life and their pessimistic tone, which earned him the sobriquet "the gloomy dean." Inge died Feb. 26, 1954, at Wallingford, Eng.

Among Inge's numerous theological and devotional works may be mentioned *Christian Mysticism* (Bampton lectures; 1899); *Types of Christian Saintliness* (1915); *Philosophy of Plotinus* (Gifford lectures; 2 vol., 1918); *Outspoken Essays* (1919, 2nd series 1922); *Personal Religion and the Life of Devotion* (1924); *The Platonic Tradition in English Religious Thought* (Hulsean lecture; 1926); and *Christian Ethics and Modern Problems* (1930).

INGEBORG (*c.* 1176–1237 or 1238), queen of France, was the sister of Canute VI. king of Denmark. She married in 1193 Philip II Augustus, king of France, but on the day after his marriage the king took a sudden aversion to her. The French council of Compiègne acceded to his demand for a declaration of nullity, but popes Celestine III and Innocent III successively took up

Ingeborg's defense. Philip, having married Agnes of Meran in June 1196, was excommunicated; and, as he remained obdurate, France was placed under an interdict. Agnes was finally put aside, but Ingeborg was held in the château of Étampes until, in 1213, Philip, hoping perhaps to justify by her claims his pretensions to England, acknowledged her again as queen of France. She survived him more than 14 years, respected by all.

See R. Davidssohn, *Philipp II August von Frankreich und Ingeborg* (1888); E. Michael, "Zur Geschichte der Königin Ingeborg," *Zeitschrift für Katholische Theologie* (1890).

INGELOW, JEAN (1820–1897), English poet and novelist, popular in her own day, and now remembered for one narrative poem, "High Tide on the Coast of Lincolnshire, 1571," which exemplifies her command of language, skill in handling metre, and power to evoke feeling. Born at Boston, Lincolnshire, on March 17, 1820, and educated in a cultured family circle, she moved to London in 1863 and spent the rest of her life there, dying in Kensington on July 20, 1897. Modest and retiring, she used much of the income from her writings in charitable works and, though acquainted with Tennyson, who greatly admired her work, Browning, the Rossettis and many other painters and writers, took little part in social life. *Poems* (1863) contains her best work. It also brought her fame, 23 editions being published by 1880. A second series appeared in 1874, and a third in 1885. *Sarah de Berenger* (1879) is perhaps her best novel, and her excellent books for children include *Mopsa the Fairy* (1869; reprinted, 1964).

INGEMANN, BERNHARD SEVERIN (1789–1862), Danish poet and novelist, whose works glorifying his country in the middle ages remained popular reading in Denmark for several generations, was born at Torkildstrup, Falster, on May 28, 1789. He was educated at Slagelse grammar school and admitted to Copenhagen university in 1806. His early poetry was influenced by German romanticism, and much of it is sickly and sentimental. His first volume of poems (1811) and his verse tale, *Varners poetiske Vandringer* (1813), had a certain popularity in the romantic age but are hardly readable today. His verse romance, *De Sorte Riddere* (1814), and his tragedy, *Blanca* (1815), were well received by the public but strongly attacked by the critics. After his appointment as schoolmaster at Sorø in 1822, he wrote a series of historical novels, of which the first, *Valdemar den Store og hans Mænd* (1824), and the last, *Dronning Margrethe* (1836), were in verse, the other four in prose: *Valdemar Seier* (1826; Eng. trans., *Waldemar, Surnamed Seir*, 1841), *Erik Menveds Barndom* (1828; Eng. trans., *The Childhood of King Erik Menved*, 1846), *Kong Erik og de Fredløse* (1833; Eng. trans., *King Erik and the Outlaws*, 1843) and *Prins Otto af Danmark* (1835). Among his poetic works are the impressive verse cycle *Holger Danske* (1837) and, most significant of all, his many beautiful and simple *Morgen- og Aftensange* (1839), written over a period of years and still very popular in Denmark. One hymn by Ingemann has become well known in English translation, "Through the Night of Doubt and Sorrow." He died at Sorø on Feb. 24, 1862.

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INGENHOUSZ, JAN (1730–1799), Dutch-English physician and scientific investigator, who discovered the principles underlying photosynthesis. Born in Breda, Holland, on Dec. 8, 1730, he received his medical degree at Louvain in 1752. After advanced studies in Leiden, Paris and Edinburgh, he returned to his native city in 1757 and then about 1765 moved to London, where he achieved prominence by his success with variolation, the use of human virus in inoculation against smallpox. In 1768 he went to Vienna at the invitation of the empress Marie Therese, inoculated her family and became court physician. He returned to London in 1779 and in that same year published a small book entitled *Experiments on Vegetables, Discovering Their Great Power of Purifying the Common Air in Sunshine, but Injuring It in the Shade or at Night*. His work described gaseous interchange between plants and the atmosphere and the influence of light upon this process. He also conducted investigations in electricity, inventing improved apparatus for generating large amounts of static electricity. His other fields of interest included soil nutrition and heat conduction in metals. He was elected to the Royal society in 1779. Ingenhousz died at Bowood on Sept. 7, 1799.

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INGERMANLAND, or Ingria, is the name formerly given to that part of Russia lying along the southeastern shores of the Gulf of Finland, which Peter the Great conquered from Sweden in 1701–04, between Leningrad and Narva. It is now known as Izhorskaya Zemlya and lies largely within Leningrad *oblast* and parts of Pskov *oblast*. (R. A. F.)

INGERSOLL, ROBERT GREEN (1833–1899), U.S. orator, politician and lawyer, who popularized the higher criticism of the Bible, a humanistic philosophy, and a scientific rationalism which qualified him as the "bull dog" for Charles Darwin in the United States, was born in Dresden, N.Y., Aug. 11, 1833. The self-educated son of a peripatetic Congregational minister, he had little formal education. Admitted to the Illinois bar in 1854, Ingersoll subsequently enjoyed a lucrative law practice in Peoria, Washington, D.C., and New York city. His Civil War service as a colonel of Illinois volunteer cavalry was terminated in 1862 when he was captured and paroled by Confederate General Nathan Bedford Forrest. As an orthodox Republican he was attorney general of Illinois, 1867–69, the "big voice" of the party in the presidential campaigns of 1876 and 1880 (he gave James G. Blaine the soubriquet "The Plumed Knight"), and leading counsel for Republican defendants in the Star Route Scandal of 1882. In spite of his contributions to the party as a speaker, his unorthodox religious views deterred Republican administrations from appointing him to the cabinet or diplomatic posts which he desired. Nationally known as a lecturer, he was in great demand and received as much as $3,500 for a single evening's performance. He died at Dobbs Ferry, N.Y., July 21, 1899. His principal lectures and speeches—which bear such titles as *Some Mistakes of Moses* and *Why I Am An Agnostic*—are found in *The Works of Robert G. Ingersoll*, edited by Clinton P. Farrell, 12 volumes (1902).

See C. H. Cramer, *Royal Bob*, a biography (1952). (C. H. Cr.)

INGERSOLL, ROBERT HAWLEY (1859–1928), U.S. merchant and manufacturer, was born at Delta, Eaton, Mich., Dec. 26, 1859. He spent his youth on his father's farm and had a very limited formal education. At the age of 20 he went to New York city and, with his savings of $1,600, established a business manufacturing and selling rubber stamps. With his two brothers he expanded it to include a wide variety of novelty products including the dollar Ingersoll watch. This became known as "the watch that made the dollar famous," about 70,000,000 being sold by 1919. He lost control of the firm in 1921 but in 1924, in a new venture, successfully introduced a dollar razor strop. Ingersoll died in Denver, Colo., Sept. 4, 1928. (H. J. Sg.)

INGERSOLL, ROYAL EASON (1883–), U.S. naval officer who commanded the Atlantic fleet in World War II, was born in Washington, D.C., June 20, 1883, son of Rear Adm. Royal Rodney Ingersoll. He graduated from the U.S. Naval academy in 1905 and thereafter held a wide range of naval assignments. He became a rear admiral in 1938, a vice-admiral in Jan. 1942 and an admiral in July of that year. As commander in chief of the Atlantic fleet from Jan. 1942 to Nov. 1944 he had the responsibility of conducting antisubmarine warfare, escorting convoys and transporting both troops and supplies to Europe and north Africa. In Nov. 1944 he became deputy commander in chief U.S. fleet and commander of the western sea frontier, in which post he continued until Dec. 1945. He retired on Aug. 1, 1946. (J. B. Hn.)

INGLEWOOD, an industrial and residential city in west-central Los Angeles county, Calif., U.S., a part of the Los Angeles metropolitan area and site of the Los Angeles International airport. Inglewood's industry includes aircraft manufacturing, metal products, pottery production and oil refining. An additional feature is the large race track, Hollywood Park.

The first settlers to enter the area were attracted by the *Aguaje de la Centinela* ("Sentinel Springs"). In 1822 Antonio Avila was given permission by the Mexican government to keep stock around the springs. The Avila family continued to hold the springs area until 1855, when the grant was confirmed by the California state government after a three-year land-claim survey. In 1887 it was acquired by the Centinela-Inglewood Land company, made up of seven Los Angeles real estate investors. Surveyors laid out the townsite during August and September. A railroad connecting Inglewood with Los Angeles was completed the next spring. By that time several small businesses and a hotel were already in operation. Inglewood was incorporated as a California city in 1908 and gained a freeholder charter in 1927. Its greatest proportional growth came between 1920 and 1925. The 1960 census showed a population of 63,390. For comparative population figures *see* table in CALIFORNIA: *Population*. (J. M. Wo.)

INGLIS, CHARLES (1734–1816), first Anglican colonial bishop, was born in Donegal, Ire. In 1754 he emigrated to Pennsylvania where he taught at a school in Lancaster for four years. After ordination in England (1758) he worked at the Dover mission station, Delaware, and from 1765 to 1783 he was assistant, then rector, at Trinity church, New York. He furthered the conversion of the Mohawk Indians and advocated the setting up of an American episcopacy. Because of his fervent loyalty to the crown, his property was confiscated during the American Revolution and he fled in 1783 to Great Britain. In co-operation with the Society for the Propagation of the Gospel he persuaded the British government to pass a statute that permitted the consecration in England of bishops for the new American republic. He himself was consecrated bishop of Nova Scotia in 1787.

Bishop Inglis had oversight of a vast diocese which included for a time not only the Atlantic provinces but also the present Quebec and Ontario. He faithfully performed his ecclesiastical duties and was responsible for building over 20 churches. Through his efforts an academy and a college were founded at Windsor in 1788 and 1789, now known respectively as King's Collegiate school and the University of King's college (later moved to Halifax). In 1808 the bishop was made a member of the executive council of the province. He died at Clermont, near Aylesford, N.S., Feb. 24, 1816.

See J. W. Lydekker, *Life and Letters of Charles Inglis* (1936); R. V. Harris, *Charles Inglis, Missionary, Loyalist, Bishop* (1937).
(T. R. M.)

INGLIS, SIR CHARLES EDWARD (1875–1952), British professor of engineering distinguished as a teacher and for his researches into bridge vibrations, was born at Worcester on July 31, 1875. His early researches concerned mechanical vibrations, but in 1913 he published an important paper on the stresses in a plate due to the presence of cracks. He investigated railway bridge vibration from 1923 to 1934. During World War I he designed an easily transportable bridge, bearing his name, which was adopted by the British army and much used in 1917–18. In 1919 Inglis was appointed professor of mechanical sciences and head of the department of engineering, Cambridge university, in succession to Bertrand Hopkinson. On his retirement in 1943 the department had become one of the most important engineering schools in the world. He died in Suffolk, April 19, 1952. (J. F. Br.)

INGLIS, SIR JOHN EARDLEY WILMOT (1814–1862), British major general, son of John Inglis, third bishop of Nova Scotia, was born at Halifax, Nova Scotia, on Nov. 15, 1814. In 1833 he joined the 32nd foot, in which all his regimental service was passed. He saw active service in Canada during the rebellion of 1837 and in the Punjab (1848–49), being in command at the storming of Multan and at the battle of Gujrat. In 1857, on the outbreak of the Indian mutiny, he was in command of his regiment at Lucknow. Sir Henry Lawrence being mortally wounded during the siege of the residency, Inglis continued the defense for 87 days against an overwhelming force, for which he was made a knight commander of the Bath and promoted to major general. After further service in India, he was given command of the British troops in the Ionian Islands in 1860. He died at Hamburg, Ger., on Sept. 27, 1862. (C. B. Fe.)

INGOLD, CHRISTOPHER KELK (1893–), English organic chemist, born Oct. 28, 1893, at Ilford, was educated at University college, Southampton, and the Imperial College of Science and Technology, London, where he received a doctor of science degree in 1922. After lecturing at the Imperial college, Ingold became professor at Leeds, 1924–1930, University college of London university, 1930–37, and director of the chemical laboratories at University college in 1937. Ingold excelled in studies of resonance, mesomerism, electronic interpretations, clarification of constitution of organic substances and their reactions, developments of steric hindrance and use of deuterium in research. He received many honours and awards, including the royal medal of the Royal society (1952) for investigations of the mechanism and factors affecting organic reactions. He was Baker lecturer at Cornell university, Ithaca, N.Y., in 1950, and published *Structure and Mechanism in Organic Chemistry* (1953), authoritative for stereochemistry and reaction mechanics. (V. Bw.)

INGOLSTADT, a town of Germany, *Land* (state) of Bavaria, which after partition of the nation following World War II became part of the Federal Republic of Germany, is situated on the Danube, 80 km. (50 mi.) N. of Munich by road. Pop. (1961) 53,405. The old town is partly surrounded by the early Gothic (14th-century) town walls with the picturesque Cross gate, and is intersected by four main streets lined with old houses in various styles. The massive Late Gothic brick cathedral of the Virgin (1425) is a landmark, and nearby stand the former university buildings and the late baroque church of Maria de Victoria. In the eastern part of the town is the ducal castle (1417) with fine interior, museum and art collection. A ring of parks separates the town from the surrounding factory and residential districts.

Ingolstadt is a junction where the Regensburg-Ulm and Nürnberg-Munich railways cross. The Nürnberg-Munich *Autobahn* touches the town's eastern boundary. Industry includes the manufacture of automobiles, machinery, textiles and electrical equipment. With the linking of Genoa, Italy, and Marseilles, France, by pipelines and the construction of refineries, Ingoldstadt area has become the Bavarian centre of petroleum refining.

First mentioned in 806 as a crown estate, "villa Ingoldestat," it became a city in the 13th century and in 1392 a ducal seat. In 1447 the duchy of Bavaria-Ingolstadt passed to the Landshut family and later to the Munich line of the Wittelsbachs. The Bavarian university, important in the German humanist movement and the Counter-Reformation, was founded in 1472, but in 1800 was transferred to Landshut and in 1826 to Munich. In the 19th century Ingolstadt was made a garrison and fortress town. After World War II, despite serious damage, industry developed rapidly.
(R. Ko.)

INGRAM, JOHN KELLS (1823–1907), Irish scholar and economist who made a reputation in the fields of literature, philosophy, science and political economy, was born in County Donegal, Ireland, on July 7, 1823, and educated at Newry school and Trinity college, Dublin. Elected fellow of his college in 1846, he became successively professor of oratory and English literature (1852–66), regius professor of Greek (1866–77), and librarian (1879–87). Remarkable for his versatility, he contributed a historical and biographical article on economics to the 9th edition of the *Encyclopædia Britannica* which was translated into many European languages. He died in Dublin on May 1, 1907. His principal works are *Greek and Latin Etymology in England; The Outlines of the History of Religion* (1900); *Human Nature and Morals According to A. Comte* (1901); *Practical Morals* (1904); and *Sonnets and Other Poems* (1900).

INGRAM, JONAS HOWARD (1886–1952), U.S. naval officer who during World War II supervised the convoy of thousands of U.S. troops to the European theatre, was born in Jeffersonville, Ind., Oct. 15, 1886. He entered the U.S. Naval academy in 1903 and graduated in 1907. He became a rear admiral on Jan. 10, 1941, vice-admiral on Feb. 2, 1942, and admiral on Nov. 15, 1944. In 1941 he commanded a cruiser division in the Atlantic, and afterward he became commander 4th fleet and commander South Atlantic force with headquarters in Brazil. He was most successful in his dealings with the South American nations and with Brazilian

naval units serving under his command. His fleet was very efficient in antisubmarine warfare. On Nov. 15, 1944, he became commander in chief U.S. Atlantic fleet, and continued in this post until Sept. 1946. He retired April 1, 1947, and died at San Diego, Calif., Sept. 10, 1952. (J. B. Hn.)

INGRES, JEAN AUGUSTE DOMINIQUE (1780–1867), French painter, the leader of the classical tradition in French 19th-century painting, was born at Montauban in Gascony on Aug. 29, 1780. His father was an impecunious ornamental sculptor, painter and drawing master who encouraged his eldest child from the very early moment that the boy's gifts for drawing and music became apparent. In 1791 Ingres first attended classes at the academy at Toulouse. The personalities of none of his early teachers left their mark, though Ingres' lifelong love of Raphael dates from his boyhood. In Aug. 1797 he went to Paris and entered the atelier of J. L. David, moving two years later to the École des Beaux-Arts. After no more than a few weeks there he won the torso prize; and in 1800 he was equal second in the Prix de Rome, which he won outright the following year with a painting in the style of David's "Sabine Women," "The Envoys From Agamemnon Before Achilles" (École des Beaux-Arts, Paris).

Unsettled political and economic conditions led to the postponement of the award, and Ingres had to wait until the autumn of 1806 before he could leave for Rome. In the meantime he was given important official portrait commissions, and was provided with a studio in the old Capucine convent, now state-owned, where A. Gros, A. L. Girodet and Ingres' student friends François Granet and Lorenzo Bartolini worked. "The Envoys From Agamemnon" was warmly praised by John Flaxman, whose influence may be seen in several of Ingres' early works, among them the sketch "Venus Wounded by Diomedes" (*c.* 1803, Hirsch collection, Basel) and "Jupiter and Thetis" (1811, Aix-en-Provence). Flaxman was at this time famed throughout Europe as a vase painter for Josiah Wedgwood and as an illustrator of Homer, and his friezelike compositions and bold use of unshaded line were regarded as quintessentially classical qualities by Ingres and his friends. They found Flaxman's style more convincing than the new "Greek" manner of their master David. Ingres borrowed freely from Flaxman's illustrations and from contemporary engravings of Greek sculpture and vase designs. He was deliberately building up a repertory of forms that he continued to use in classical compositions throughout his life. Perhaps aware of the poverty of his imagination, Ingres made a virtue out of copying.

MUSÉE DU LOUVRE

"LE BAIN TURC" ("THE TURKISH BATH") BY J. A. D. INGRES, COMPLETED 1863. IN THE LOUVRE

Apart from the classical figure compositions the young Ingres was also painting portraits. Several were shown at the Salon of 1806, where they were met with incomprehension and ridicule. Ingres' portrait style was indeed an unusual one, owing much to Raphael. In self-portraits and portraits of friends, the sitters are strongly individualized and given a mysterious, almost tormented air—the touch of romanticism often found in Ingres. But in commissioned works, like the three Rivière portraits (Louvre, Paris) or Mme. Aymon (Rouen), the artist does not attempt to express the character of his sitters, though their bourgeois origins are plain.

Ingres is not concerned with naturalism of any sort but with the creation of an abstract design in which the forms of the natural world are shaped into an eloquent surface pattern. His remarkable natural feeling for line allows him to describe form by contour alone. In the most revolutionary portraits, like that of Mme. Rivière, an arabesquelike pattern of lines dominates the picture, and Ingres seems to have abolished space, reducing body, clothes and cushions to a single unified plane. Natural forms are given an unreal near-geometrical smoothness, and are then held in perfect equilibrium by the linear pattern of the picture. Colour is always subservient to line, though Ingres has a strong feeling for texture and delights in rendering rich stuffs. These same qualities may be found in the great series of female nudes which begins in 1807 with the Bonnat and Valpinçon "Baigneuses" ("Bathers," Bayonne and Louvre) and reaches its climax in "Le Bain Turc" ("The Turkish Bath," Louvre).

The "Baigneuses" were painted in Rome; Ingres had finally left Paris in 1806 and did not return when his scholarship expired in 1810. He stayed in Rome, earning a living from the portraits and portrait drawings in pencil, now so admired, which to Ingres were a form of drudgery that prevented his working on the large history pieces he wished to paint. Ingres was planning both classical (Homeric) and historical (Raphaelesque) compositions: two distinct manners that persist in his work. The first large Homeric composition, "Jupiter and Thetis," met only with disapproval when sent back to Paris in 1811. Because he disliked all Italian painting after Raphael, Ingres was accused of archaizing tendencies.

In 1814 and 1819 Ingres again sent work to the Paris Salon, including some pictures in the new "troubadour" style—scenes of medieval history depicted in quasi-realistic manner (events in the lives of Henri IV, of Aretino, of Raphael; and a series of great lovers). He was still much criticized. In 1820 he moved from Rome to Florence; his altarpiece, "Christ Giving the Keys to Peter" (Louvre), had won some favour, and he was now at work on another religious picture, "The Vow of Louis XIII," commissioned for Montauban cathedral. Ingres returned to France in 1824 to show this at the Salon. It met with universal approbation, appealing to classicist, romantic and troubadour taste alike. A most ambitious design, it represents the culmination of Ingres' Raphaelesque manner.

After 18 years' absence in Italy, Ingres became a Parisian celebrity overnight. He was given the cross of the Legion of Honour by Charles X, elected to the French Academy, and asked to paint "The Martyrdom of St. Symphorian" for Autun cathedral and "The Apotheosis of Homer" for the ceiling of the new museum in the Louvre. He opened a studio and quickly had more than 100 students. The Louvre picture was completed by 1827. It celebrated an early enthusiasm of Ingres', one that also inspired the "Homer Deified" on which he was working at the time of his death. In the "Apotheosis" Ingres' Raphaelesque and Homeric manners are combined. The second commission, for Autun, gave Ingres much difficulty and when exhibited at the Salon of 1834 it was adversely criticized. Greatly upset, Ingres vowed never to show at the Salon again. He stopped painting for a time and left Paris to become director of the French academy in Rome.

He returned to Paris in 1840 and the last 26 years of his life were comparatively uneventful. The most considerable project was a decorative scheme for the château of Dampierre, which occupied Ingres from 1843 until 1850 when work was abandoned. "The Golden Age," unfinished and ruined as it is, marks the revival of mural painting in France which culminates in the work of T. Chassériau and Puvis de Chavannes.

Ingres also continued to paint portraits, religious pictures, nudes and figure compositions, of which "Le Bain Turc" (Louvre), completed 1863, is the most important. Into it he introduced, almost without change, the figure of the "Valpinçon Baigneuse" which he had painted in 1808. Ingres was never against imitation or copying, and replicas by his own hand abound. In 1846 and 1855 retrospective exhibitions of his works were arranged. Ingres died in Paris on Jan. 14, 1867.

Charles Baudelaire, although as the champion of Eugène Delacroix he cannot be regarded as unbiased, laid the foundations of later estimations of Ingres. He perceived that Ingres was a draftsman of genius, who, seeing colour as no more than an inessential prettifying ornament, ruthlessly subordinates it to line. He noticed Ingres' lack of creative imagination, and the way in which he develops little, but switches from style to style. The entire production of Ingres' long output is implicit in the impressionable early years, and, as Baudelaire says, *comme il n'a pas progressé, il ne vieillera pas* ("because he has not progressed, he will not age").

Though affected by romanticism, the David-trained Ingres was a classical artist. His classicism made him abstract from the natural world for the sake of pictorial composition. This and his powers of draftsmanship help to explain why he has never lacked admirers, and why Degas, Gauguin, Matisse and Picasso were all profoundly influenced by his work. Many of Ingres' major works are now in the Louvre museum; he bequeathed the contents of his studio, including 4,000 drawings and 30 paintings, to his native town of Montauban.

Bibliography.—H. Delaborde, *Ingres* (1870); H. Lapauze, *Ingres* (1911); G. Wildenstein, *Ingres* (1954); N. Schlenhoff, *Ingres—ses sources littéraires* (1956). (A. Bs.)

INGRESS, entrance as opposed to exit or egress; in astronomy, the apparent entrance of a smaller body upon the disk of a larger one, as it passes between the latter and the observer; in this sense it is applied especially to the beginning of a transit of a satellite of Jupiter over the disk of the planet.

INGUSHETIA: *see* Chechen-Ingush Autonomous Soviet Socialist Republic.

INHERITANCE. This article deals with the anthropological and historical background of the inheritance of property and with the policies by which its regulation is determined. The basic features of the Anglo-American law of inheritance are presented in the articles Intestate Succession; Will; Estates, Administration of; Probate; Estate and Inheritance Taxes.

In its broadest sense inheritance or heritage means transfer of something from earlier to later ages or generations. We thus speak of an individual's inherited traits of body or character and of the cultural heritage of one civilization from another. In a more specific sense inheritance signifies the devolution of property upon the death of its owner intestate. In modern society this devolution is regulated in minute detail by law. In continental Europe the pertinent branch of law is generally called the law of succession. In England until 1926 it was usual to distinguish between descent of real estate and distribution of personal estate. The rules applicable to the two kinds of property have since been greatly assimilated to each other, but no common term has as yet come to be universally accepted. In England books dealing with the subject are frequently entitled "On Executors and Administrators." In the United States the term probate law is frequently, although inaccurately, applied to the field as a whole. Following the title of an important statute of the state of New York, the term "law of decedents' estates" has been gaining ground, and occasionally one finds the term "law of succession upon death." The word inheritance is used as the technical term of Scots law. The title of the present article has been chosen in accord with the usage of anthropologists and other social scientists.

Inheritance and Individual Ownership of Property.—Inheritance of property cannot occur unless goods are regarded as belonging to individuals rather than groups and unless such goods are of such permanence that they continue to exist and to be useful beyond the death of the owner. Among primitive food gatherers and hunters it has not been uncommon for such personal belongings as weapons or bowls to be destroyed after the death of the owner in order to protect the survivors from being molested by his spirit. Among the Papua of New Guinea or the Bergdama (Mountain Damara) of south Africa the hut of the dead man was abandoned or burned down so as to ban the magic of the disease of which the owner died. Among the Herero of southwest Africa the dead man's goats were slaughtered and eaten; this seems to have been connected with the fear that they were affected by his magic, but also with the belief that the spirits of the slaughtered goats would follow the dead owner into the realm of spirits where he would need them. This belief in providing for the needs of the dead seems to have been the root of the widespread custom of burning or burying with the body victuals, utensils, treasure, slaves or wives. Tombs have yielded rich evidence of such practices in the cultures not only of North American Indians or European Stone and Bronze Age man but also of the high civilizations of ancient Egypt or pre-Columbian Mexico. Another way of disposing of a dead man's effects in primitive society was to distribute them among more remote relatives and friends, as has occurred among Indian tribes such as the Delaware and the Iroquois. Distribution of this sort, in the absence of rules of inheritance, could easily lead to quarrel and violence, as was evidently the case among the Comanche.

The view of the classical writers of Marxian socialism that common ownership of all goods, or at least of land, once constituted a universal stage of mankind, can be neither proved nor disproved. While the absence of individual ownership of land among nomadic food gatherers, hunters and herders should not be regarded as group ownership of the land over which the group roams, group ownership has been widespread, but by no means universal, among primitive and archaic agriculturalists. It has, indeed, persisted into modern times in India and parts of Africa and Asia, and it played a considerable role in the development of the Teutonic and Slavic peoples of Europe. In parts of Yugoslavia ownership of the land by zadruga, *i.e.*, large groups of progeny of a common ancestor, has continued into the 20th century. In western Europe the common ownership of pastures and woods, which grew out of the former system of common ownership of the land of a village, can still be found, especially in the Alpine regions of Switzerland and Austria. The impact of modern mechanization and industrialization upon the village community can currently be observed in India. While in earlier times colonization of new land tended to be carried on by groups, for instance, the German settlement of the regions east of the Elbe in the 10th to 13th centuries, the settlement of Europeans in North America, Australia, Africa and other parts of the world took place in accord with the economic ideals of the classical economists of the 18th and 19th centuries, who regarded individual ownership of land as the type most favorable to efficient land use. Socialist ideas combined with large-scale mechanization have resulted in new forms of land ownership in common: the *kolkhozy* of the Soviet Union, the communes of Communist China, or the *kibbutzim* of Israel. Wherever land is held in common, the death of a member of the group results not in inheritance but in a rearrangement of duties, and of rights of participation in the produce or rights of temporary usage of the land itself. (*See* also Communism, Primitive; Land Tenure, Primitive.)

Critiques of Inheritance.—The institution of inheritance has been attacked because it renders possible the acquisition of wealth without work, and because it is regarded as a principal source of inequality of income. Such attacks have come not only from certain extremists to whom complete equality of income appeals as a social ideal, but also from more thoughtful observers to whom great differences in the distribution of wealth appear to be incompatible with modern views of the dignity of man. Against such attacks inheritance has been defended on economic as well as on moral grounds.

Most of the attacks appear to be directed against the institution of private property as such rather than merely against its transfer upon death (*see* Socialism). Within the framework of an economy of individual property, inheritance has been said to be necessary to guarantee the continuity of enterprise, without which long-range economic activity could not flourish. The argument has lost much of its force in an economic system in which large-scale enterprise has come to be carried on in corporate form, and thus to be directed not by owners but by specialists in management succeeding each other in the manner of officeholders. For the same reason there is also less force in the argument that without the incentive of handing on the fruits of one's work, competition, and consequently the growth of the total economy, would be hampered.

Theoretically, it is possible to conceive of a social system in which a person's property rights would end with his death. If the assets left behind were not reassigned to some other individual, the eventual result would be complete ownership of all wealth by the community, and the system of individual property would end. A new individual owner could be determined in one of four ways: reassignment to the first taker, a practice that would produce strife and disorder; reassignment by a governmental agency, which would constitute an exercise of power regarded as incompatible with a free society; reallotment in accordance with set-

tled rules generally fixed for all; or reallotment in accordance with the wishes of the decedent. The last two are exactly the ways in which the modern western systems of inheritance work: the estate is realloted according to the rules of intestacy law or according to the will of the decedent.

The only debatable issues within a system of private ownership are: who are to be the takers in intestate succession and whether or not and, if so, within what limits, freedom of testation shall be permitted. In all societies inheritance has developed as an incident of kinship. Even in a society in which ownership of property is regarded as belonging to individuals rather than kinship groups, the feeling of belonging to one's group is still so strong, especially between parents and children, that a man's sense of freedom from governmental power would not be complete unless he knew that he could pass on his possessions to his children. There arises, however, the question of whether inheritance shall extend beyond the circle of those persons with whom the decedent was connected by ties of affection or about whose well-being he was, or should have been, concerned. In the urbanized and migratory population of highly industrialized nations, the family as a felt unit has tended to shrink to the small circle of husband, wife and children. Ties of relationship tend to be weak even among first cousins. Shall the estate of a person dying intestate without close relatives pass to some distantly related "laughing heir"? In an age of expanding demands on government, there has been an inclination to prefer the needs of the public treasury over allotment to a distant relative based upon no ground other than the necessity of finding an individual heir. A further argument for limiting intestate succession to the circle of close relationship is based on the difficulty of tracing remote heirs, the fractionalization of estates that easily occurs in such cases and the temptation to litigation. In England, the circle of intestate takers has thus been limited by the Administration of Estates act, 1925, to descendants of the same grandparents as the deceased. More limiting are the intestacy laws of the Soviet and the Peoples' republics. Under the law of the U.S.S.R., which constitutes the general model of these laws, intestate succession is limited to descendants, the surviving spouse, non-able-bodied parents and other persons who were actually dependent upon the decedent for the year prior to his death.

Another way of limiting the rights of remote relatives for the benefit of the public treasury consists in increasing the rates of inheritance taxes in proportion to the remoteness of the relationship between the takers and the decedent. In the United States the federal tax on succession depends solely on the size of the estate, whereas the additional inheritance taxes levied by the states are widely patterned upon such a scale. This can also be found in numerous other countries, but not in England since 1949.

Inheritance taxation is also used to reduce that effect of inheritance for which it has been most consistently blamed: namely, its tendency to increase the inequalities in the distribution of wealth. This effect has, it is true, been praised as a virtue by conservative advocates of a class society who were impressed with the creation and preservation of cultural values that only an aristocracy seems to be able to develop. Those claims for unpartitioned inheritance by one heir which found expression in the English tradition of primogeniture were aimed at the exact opposite of what societies more interested in equality seek to achieve by compulsory partition, as under French or German law, or by means of progressive inheritance taxation, as in the United Kingdom or the United States, or by a combination of both. The law of inheritance and inheritance taxation thus constitute an effective means of social policy.

The critique of inheritance as such based upon the ground that it tends to increase inequalities of wealth has lost much of its significance not only because it has been found possible to counteract that effect by the means mentioned but also by the general development of modern society, which may have well been helped by these measures. In contrast to the conservative class society of 19th-century Europe, new countries like the United States presented opportunities not only for the active to acquire wealth on his own but also to the less capable of quickly losing what he might have inherited. Above all, the spread of general education has tended to diminish the advantage which the child of the wealthy would have over that of the poor, and the general suffrage, partly a result of these developments, has further tended to broaden the sphere of sharing the wealth.

An impressive illustration of the connection between a society's basic policies and the shape of its law of inheritance is constituted by inheritance legislation in the Soviet Union. In the early stage of the Bolshevik revolution, inheritance was limited to the descent of a moderate amount of property to close relatives or to the surviving spouse, provided they were in need. The limit upon the size of the property, 10,000 gold rubles, roughly equal to $5,500, was lifted in 1926, and the requirement of need was abolished for inheritance by the surviving spouse, descendants, parents, brothers and sisters. If there are no intestate heirs, the estate may (since 1945) be freely disposed of by will. Since private property cannot exist in means of production, inheritance, too, is limited to goods of use or consumption and to individual savings invested in government bonds or saving accounts. Within the limits stated, inheritance and freedom of testation are regarded as constituting useful incentives to creative productiveness without constituting a danger to the socialist system. Inheritance in those objects in which private property is permitted is thus listed in the constitution of 1926 as one of the rights in the enjoyment of which the citizens are protected by the law (art. 10).

Divided or Undivided Inheritance (Primogeniture).— The problem whether, and to what extent, freedom of testation should be permitted is discussed in the article WILL. Of significance for both testate and intestate succession, however, is the question whether a person's estate shall pass undivided to one person or whether it should be divided among several takers. This issue has been especially important in the history of Anglo-American law, where it is usually referred to as the problem of primogeniture. However, the term is too narrow, because the sole heir need not necessarily be the eldest son (primogenitus).

Under the system of ultimogeniture, which existed for instance in parts of England as the custom of Borough English (*q.v.*), or under the German National Socialist law of 1933, the person favoured was the youngest son; under the systems of seniorate or juniorate it would be the oldest or youngest member of the family; under that of majorate or minorate, it would be the oldest or the youngest person standing in equal degree of consanguinity to the decedent. There have also been cases where certain lands have been reserved to the second-born son and his line (secundogeniture) or the third-born and his line (tertiogeniture).

In England, undivided inheritance was applied to real estate, but not to personal property. The distinction between the two kinds of property was important in the struggle for power between church and state.

In medieval England, the organization of society in general, and of the army and the public offices in particular, was based upon the distribution of the ownership of the land, over all of which the king was lord paramount. The church, on the other hand, concerned itself with divine worship, the care of the sick and the poor and the cultivation of learning and the arts. After the Norman Conquest a compromise was worked out between the king and the church, under which the royal courts exercised jurisdiction over real property, while personal property was to be the concern of the ecclesiastical courts. Until 1926 descent to real property thus was subject to rules different from those applying to the distribution of personal property. For the former, the common-law courts developed a system which tended to maintain the existing military and social order through unpartitioned descent of land to one heir rather than division among several co-heirs, and through reluctance in admitting freedom of testation. Under the canons of descent the freehold real estate descended undivided to a single heir, who among several relatives of equal nearness to the ancestor was determined by the rules of preference for males and of primogeniture. Among several children the eldest son thus excluded all daughters and younger sons. If the decedent was not survived by issue, the real estate descended undivided to the collateral heir, who would be the eldest brother or,

if there were no brothers or sisters surviving, would be determined by the rule of ancestral estate, under which real estate that had come to the decedent from his father reverted to his father's line of the family, and real estate descended to him from his mother's side reverted to her line.

As to personal property, the ecclesiastical courts, however, favoured freedom of testation which allowed a decedent to leave part of his property to the church for the promotion of its manifold activities. In the case of intestacy, the church favoured equal distribution among relatives of equal nearness to the decedent, especially children. It thus applied the rules which had been laid down in the *Corpus Juris Civilis* by the Roman emperor Justinian and which were ultimately codified in England in the Statute of Distribution of 1670. Under these rules the estate was equally divided among the children of the decedent, or, if he was not survived by descendants or parents, among the decedent's brothers and sisters and their children and, in default of such relatives, among the next of kin of equal degree of consanguinity. A surviving husband or wife was to receive one-third or one-half of the personal estate, depending upon whether or not the decedent was survived by descendants. The problem about which the two sets of courts differed, namely, whether an inheritance should be split up among several co-heirs or pass undivided to a single heir, has, of course, not been limited to England.

Unpartitioned inheritance has indeed occurred in the most diverse civilizations. It has been reported from the Hottentots of southwest Africa, the Maori of New Zealand, from the Tonga Islands, from parts of China, from Siberia, as well as from parts of western Europe. Why and how primogeniture became the common-law system of inheritance of freehold real estate is not sufficiently known. Certain it is, however, that its existence favoured the needs of feudalism, in which the ownership of a parcel of land tended to be connected with a public office or with military duties that could not be well divided among several people. At the peasant level, holdings tended to be too small to allow a partition without destroying a family's basis for making a living and thus producing a result equally obnoxious to peasant and landlord. Attempts to avoid physical partition by a sale of the land and division of the proceeds were impracticable in a society in which it was considered important to preserve family ownership of the farm and in which money was not readily available. Partition was also likely to result in confusion regarding the services the peasants were bound to render to the landlord. In spite of these circumstances undivided descent of land to one heir never was the exclusive system of the European peasantry. It became, however, the almost universal system among the nobility, who were anxious to preserve intact the family wealth. In order to achieve this purpose it became necessary, after alienability of land and freedom of testation had developed, not only to establish unpartitioned descent as the rule of intestate succession but also to "entail" the land; *i.e.*, to prevent the owner from selling, giving away or encumbering the land, as well as from disposing of it by will (*see* ENTAIL). The success of such efforts depended on changing political constellations. In England varying legal devices were used from the 13th century on. After its invention in the 17th century the so-called strict family settlement became the principal device, while on the continent the fideicommission of late Roman law was adapted to serve the purpose. The political power secured in this way to the nobility and gentry enabled it, as the necessary counterpart of primogeniture, to secure for the younger sons the lucrative positions in the church, the army and, on the continent, the expanding bureaucracy. In the 18th century the system was attacked both by the supporters of democratic ideals and the economists of the classical school. To the latter entails were objectionable because they not only stood in the way of mortgaging the land for purposes of improvement but also because inalienability prevented its coming into the hands of the most efficient cultivator. The place where the system was to fall first was the British colonies in New England, and in the course of the American Revolution it was swept away also in the other states. In Europe, the decisive attack was launched by the French Revolution, and in the Napoleonic Code care was taken to prevent its re-establishment. Not only were all descendants or other relatives of equal degree to take equally in intestate succession, but by giving each child the right to a minimum share it was made impossible for the testator to give all to one child.

In England, the main object of the economists' attack upon settlements was removed, when through a series of successive statutes, especially the Settled Land act, 1882, settled lands were gradually restored to the market; life tenants were thereby given the power under certain circumstances to mortgage or sell the land. Stocks and bonds, which had meanwhile become the form of wealth more important than land, could, and still can be, tied up by means of a trust, but through the impact of heavy death duties this power has now been restricted. As the rule of intestacy primogeniture was abolished by the Administration of Estates act, 1925. (*See* also REAL PROPERTY AND CONVEYANCING, LAWS OF.)

On the continent, equal division among descendants and other relatives in equal degree became the general rule in the codes of the 19th century, but in certain countries, especially Austria and Germany, possibilities of entail lingered on as a privilege of the nobility until the revolutionary events of 1918. In the 19th century, a new argument came to be used, however, in favour of unpartitioned inheritance of land. First in France, and then in central Europe and Scandinavia, it was argued that through the splitting up of holdings in consecutive cases of succession, agricultural holdings were being diminished below the size necessary to provide a living for a family, and that the old peasantry was thus in danger of being driven from the land, which could then easily fall into the hands of speculators without traditional ties of blood and soil. The movement succeeded in the enactment of special laws on farm inheritance in sections of Austria, Germany and Scandinavia; while providing unpartitioned inheritance in the case of intestacy, most of these laws left unimpaired the power to provide for multiple succession by will and the power of alienation by sale. More radical was the farm inheritance law that was enacted in Germany in 1933 as one of the earliest measures of National Socialism. It provided not only undivided inheritance, as a general rule by the youngest son, but also forbade partition by will and even the sale of the farm or its encumbrance by mortgage. The peasantry was to be secured as a social class living on the soil, removed from the vicissitudes and temptations of a market economy. In order to secure maximum production, it was found necessary, however, to allow the state to remove an inefficient holder. The law was repealed upon the collapse of the National Socialist regime, but statutes attempting in milder ways to counteract the partitioning of farmsteads have been re-enacted. Even in France, the civil code was amended by successive laws of 1938, 1940, 1943 and 1955, so as to postpone, at least temporarily, the physical partition of a peasant holding.

See also references under "Inheritance" in the Index.

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ININI, an *arrondissement* of French Guiana, South America, comprising the densely forested interior of the territory. Pop. (1959 est.) 5,000, includes Creoles, Negroes and American Indians. Area 30,309 sq.mi. The subprefect's seat is at St. Laurent. There is some cultivation of manioc and bananas around the villages. The chief product is alluvial gold, exploited by individual pros-

pectors as well as by the Bureau Minier Guyanais. *See* GUIANA: *French Guiana*. (HU. DE.)

INITIATION RITES: *see* PASSAGE RITES.

INITIATIVE: *see* REFERENDUM AND INITIATIVE.

INJECTOR, a device for injecting liquid fuel into an internal-combustion engine; also an apparatus for injecting feed water into a boiler.

In diesel engines fuel must be in highly atomized form for proper combustion. Usually this is accomplished with a plunger and cylinder arrangement (solid injection) which forces accurately measured amounts of liquid fuel into the combustion chambers through atomizing nozzles; compressed air (air injection) is sometimes used in place of a plunger. These injectors are widely used in such diesel equipment as railroad locomotives, trucks, buses, earth movers, ships and stationary power plants, and are sometimes found in aircraft and motor truck spark-ignition engines.

Boiler feed water injectors employ a high velocity steam jet to force water into the boiler. Because it was difficult to believe that boiler steam could force both itself and the feed water back into the boiler, the introduction (1859) of such injectors by their inventor, Henri Giffard, created great interest. They can use exhaust steam at atmospheric pressure to deliver feed water at 150 lb. per square inch. The principle is similar to that employed in the ejector (*q.v.*). In mixing with the relatively cold feed water, the steam condenses, imparting most of its momentum to the water. The kinetic energy associated with the resulting high velocity is converted to pressure in a convergent-divergent passage, delivering the water to the boiler. Now almost completely replaced by centrifugal boiler feed pumps, such injectors are primarily of historical interest.

See L. C. Lichty, *Internal-Combustion Engines* (1951); Terrell Croft (ed.), *Steam Power Plant Auxiliaries and Accessories* (1922). (RD. A. BR.)

INJUNCTION, an order of the court in civil proceedings requiring a party to those proceedings to do or not do a specified act or acts, disobedience to the order being punishable by imprisonment for contempt of court. An injunction is prohibitory if it forbids the doing of an act and mandatory if it orders an act to be done. Each type of injunction may be perpetual or interlocutory. A perpetual injunction is granted only on the final conclusion of the proceedings, and it operates either in perpetuity or for some stated period; *e.g.*, the duration of a lease. An interlocutory (interim or temporary) injunction is normally granted until the hearing of the action or for some lesser period, and is intended to preserve the *status quo*, or prevent irreparable harm, until the case can be fully heard.

ENGLAND

Origin.—By the end of the 14th century the court of chancery had begun to grant injunctions; and although later the common-law courts acquired jurisdiction to issue injunctions, the remedy has always been recognized as essentially an equitable remedy. The basis of the intervention of equity was the inadequacy of the remedy at law. The usual remedy at common law was an award of damages, and where this would sufficiently protect the plaintiff, equity would not intervene. But often an award of damages will not fully protect the plaintiff, as where the defendant intends to continue a trespass or a breach of covenant, and in such cases equity became increasingly ready to grant an injunction. The equitable origin of injunctions is manifest in a variety of ways. Equity acts *in personam*, and an injunction, supported by the threat of committal to prison for any breach, exemplifies equity acting on the person. Again, in most cases the remedy, like other equitable remedies, is discretionary. At law, a plaintiff who proves his case is entitled to damages; in equity, the court in the exercise of its proper judicial discretion may refuse an injunction to such a plaintiff; *e.g.*, if he comes to the court with unclean hands or is guilty of unreasonable delay. Yet again, the jurisdiction, being equitable, has always been exercised by the judge or court and not by a jury.

Principles.—The principles thus established by equity remain the basis of modern law. The Common Law Procedure act, 1854, empowered the common-law courts to grant injunctions in certain cases; the Chancery Amendment act, 1858, authorized the courts of equity to award damages in lieu of an injunction; and when the Judicature act, 1873, fused the courts of law and equity into one supreme court, it empowered that court to grant all remedies, legal or equitable (*see* now Judicature act, 1925, ss. 18, 37, 38). Nevertheless, the main principles upon which injunctions are granted or refused remain unchanged. In the case of perpetual injunctions, these principles may be summarized as follows: (1) Damages must be an insufficient remedy. (2) The grant of an injunction is usually discretionary, and so the plaintiff must establish sufficient grounds for the court to exercise its discretion to grant an injunction. Circumstances that may point against the grant of an injunction include the smallness of the damage suffered by the plaintiff, the cessation of the acts complained of, any undertaking offered by the defendant to abstain from the acts or mitigate their consequences, and the impracticability of compliance with the injunction, as where it is sought to preserve some trees and they have already been cut down. However, in one class of case the plaintiff may obtain an injunction as of right, namely, to enforce a negative restrictive provision in a contract; *e.g.*, a covenant not to build on land; for here the court merely enforces what the parties have expressly agreed. (3) The plaintiff must establish that some legal or equitable right of his is being invaded. It is not enough for him merely to show that he will suffer great inconvenience, as where his neighbour builds a wall obscuring the view, or gives his house the same name as that already borne by the plaintiff's house; for there is no legal or equitable right to the exclusive use of the name of a private residence. However, it suffices if the injury to the plaintiff's rights is merely threatened, for the court has jurisdiction to grant an injunction *quia timet* ("because he fears"); but a high probability of irreparable injury must usually be established, as when the sovereign of a foreign country shows that the defendant is about to manufacture spurious banknotes for that country. (4) The plaintiff must not have disabled himself from applying to the court, as by long delay or by inequitable conduct. Thus no injunction to restrain a breach of contract will be granted at the suit of a plaintiff himself in breach of that contract.

In the case of interlocutory injunctions, these principles can be applied only in a modified form, since the rights of the parties have yet to be ascertained. If the plaintiff establishes that he has a *prima facie* case in his action, he will usually obtain an interlocutory injunction if the balance of convenience favours it; the court will normally tend to preserve the existing state of affairs until the trial, and prevent any irreparable injury occurring. An interlocutory mandatory injunction is rarely granted, though it will be if the defendant tries to steal a march on the court, as by hurrying on with building an obstruction to a right of light after receiving notice of proceedings to enforce the right. In cases of urgency an interlocutory injunction may be obtained very speedily: an application may be made *ex parte*, supported by evidence on affidavit, as soon as the writ is issued. Such injunctions are usually granted only until the defendant can appear and present evidence, and so enable the court to decide whether or not to continue the injunction, with or without modifications, until the trial. No interlocutory injunction will be granted, however, unless the plaintiff gives an "undertaking in damages"; *i.e.*, a promise to pay damages for any loss caused to the defendant if it ultimately appears that the injunction was wrongly granted. Further, the court may impose limitations or restrictions on the operation of an injunction or suspend its operation for a period, as where immediate compliance would be impossible.

Range.—Injunctions may be granted in a wide range of cases. For example, an injunction may be granted to restrain a breach of contract, such as a contract against engaging in a competing business, or not to carry on any trade in a house; the commission of a tort, such as a nuisance or a libel; a breach of trust, such as selling trust property at an undervalue; an injury to property, such as erecting a wall standing on the plaintiff's land; wrongful expulsion, as from a club or trade union; the wrongful disclosure

of confidential information, as by a solicitor revealing his client's secrets; wrongful passing-off, as where one manufacturer dresses up his goods so as to resemble those of another; and infringements of patents, registered designs and copyrights. These examples, though important, are not exhaustive; an injunction is not only one of the court's most powerful weapons but also one of the most flexible. An individual cannot, however, obtain an injunction restraining a breach of some statutory duty unless some right of property of his is being injured. The attorney general, as representing the public, may obtain an injunction in any such case, even if the statute has duly provided a penalty for breach of the duty; thus such an injunction has been granted against an omnibus proprietor who, refused a licence to run his buses, nevertheless found it profitable to run them and repeatedly pay the fines prescribed by statute. (R. E. My.)

UNITED STATES

In the United States, despite the administration in most states of law and equity by a single court, the injunction retains its essentially equitable character and, as in England, covers a wide spectrum of types of injurious or potentially injurious conduct. The most significant developments have taken place in connection with labour disputes, government regulation and the protection of constitutional rights.

Labour Injunctions.—In the United States, beginning in the 1870s when many railroads were in the hands of receivers and thus administered by the courts, strikes were regarded as an obstruction to the courts, and injunctions were widely used to restrain various acts. Beginning in 1884 injunctions were issued in labour disputes not involving receiverships. When the U.S. supreme court gave its sanction to the use of the injunction in *In re Debs* (1895), it soon became an established weapon in the strategy of industrial conflicts. Its effectiveness in strikes is due largely to the procedure involved. It is only after trial and entry or denial of an injunctive decree that there is an adjudication of the merits, but in a strike situation, the restraining order and temporary injunction have the effect of bringing about a disposition of the strike so that the case seldom goes to final decree. The result is a determination of rights of basic character without a trial on the merits. In most cases the situation is handled through affidavits. The absence of oral testimony and cross-examination removes the principal safeguards in the fact-finding process, and the opportunity to correct error by appeal is extremely narrow and seldom exercised. Moreover, elaborate and ambiguous injunctive decrees reaching far beyond outlawed excesses and frequently barring trade union activities of a legitimate character have been entered. Dragnet decrees of this type were the rule rather than the exception.

The abuses in connection with the injunctive process in labour disputes resulted in a demand for legislation. The Clayton act, passed by congress in 1914 and designed to restrict the jurisdiction of federal courts to issue injunctions, was construed by the U.S. supreme court as "merely declaratory of what had always been the law and the best practice in equity"; the injunction might still issue against picketing deemed unlawful by the court (*American Steel Foundries* v. *Tri-City Trade Council* [1921]) and against the secondary boycott (*Bedford Cut Stone Co.* v. *Journeymen Stonecutters' Assoc.* [1927]). Subsequent state legislation, following sec. 20 of the Clayton act, received a corresponding construction (*Gevas* v. *Greek Restaurant Workers' Club* [1926]). Sec. 22 of the Clayton act granted the right of jury trial in proceedings for indirect contempt, where the act alleged to constitute the contempt is also a crime. This provision survived an attack based upon the doctrine that the power of a court of equity could not be restricted because inherent and derived from the constitutional grant of judicial power (*Michaelson* v. *United States* [1924]). The Norris-LaGuardia Anti-Injunction act of 1932 contained a detailed revision of equity practice in labour litigation which confined the discretionary jurisdiction of the federal courts in industrial disputes to very narrow limits, generally permitting injunctions only upon showing of violence or property damage not adequately dealt with by local authorities; withdrew the support of federal courts from anti-union agreements (so-called "yellow-dog" contracts); provided trial by jury for contempt growing out of claimed violation of an injunction; and sought to correct procedural abuses. More than half the states passed statutes patterned after this act. The effect of the Norris-LaGuardia act and the state statutes was to reduce substantially the use of injunctions in labour disputes.

The Labor Management Relations act of 1947, popularly known as the Taft-Hartley act, revived the use of injunctions in labour disputes. In addition to giving the National Labor Relations board the right to seek injunctions against employers and unions for certain defined unfair labour practices, a provision for an 80-day injunction was incorporated in the act. Federal district courts are authorized to issue such an injunction upon a finding that the threatened or actual strike affects an entire national industry, or a substantial part thereof, and imperils the national health or safety. The proceeding may be instituted by the attorney general upon direction of the president after a report of a board of inquiry which the president is empowered to invoke whenever he is of the opinion that a strike or lockout will endanger the nation. At the end of a 60-day period from the inception of the injunction, the board of inquiry is required to report to the president the current position of the parties and the efforts toward settlement. Within 15 days thereafter, the National Labor Relations board is required to take a secret ballot of the employees involved in the dispute on the question of whether they wish to accept the final offer of settlement made by their employer and to certify the results to the attorney general within 5 days. Upon certification of the results, or upon settlement, whichever happens first, the attorney general must move to dismiss the injunction and the court is required to do so. Thereafter the president has the duty of making a full report to congress with recommendations for appropriate action. The supreme court has upheld the validity of these provisions. (*See* also Labour Law: *United States.*)

Government Regulation.—The broadest extension of the injunctive remedy has been in the field of governmental regulation. Many federal and state statutes specifically authorize the use of the injunction as an alternative to seeking a criminal conviction. In the enforcement of federal statutes, particularly in the area of regulation of business, injunctions are sought with far greater frequency than criminal penalties in order to secure effective compliance. The injunction has been most effectively used in the enforcement of antitrust laws, federal wage and hour laws, securities and exchange legislation, pure food and drug laws and many other regulatory statutes. Similarly, in the area of state law enforcement, injunctions have been used to bring about compliance with a great variety of state regulations. With regard to economic regulations, which embrace almost every phase of business and industry, criminal sanctions have obvious drawbacks. Effective enforcement would involve the bringing of numerous criminal cases, which, in turn, would result in overloaded court dockets. In addition, there is the added burden of presenting cases to grand juries and the problems of burden of proof. Moreover, the entry of a fine, the only criminal sanction available against a corporation, does not deter future violations. Particularly is this true where very large interests are involved. Fines imposed may be nominal compared with the substantial gains achieved by illicit conduct. These reasons for resort to the injunction are especially pertinent to regulations adopted during wartime and other periods of national emergency.

Constitutional Rights.—Protection of the rights of individuals as guaranteed by the U.S. constitution has been the object of an increasing number of injunction proceedings. In this field the courts have departed from the common-law requirements of a showing of injury to property. Injunctions have been permitted to prevent violations of the rights of free assembly and speech, violations of religious freedom and the denial of equal opportunity for education on racial grounds alone. The leading precedent establishing the rights of Negro students to education in a nonsegregated school was an injunction proceeding (*Brown* v. *Board of Education of Topeka* [1954]). The basis of granting relief is the actual or threatened violation by local or state authorities of rights guar-

anteed by the 14th amendment of the U.S. constitution. By way of implementing the elective franchise and to prevent denial of the right to vote on the ground of race, colour or other restrictions, congress has authorized the attorney general to institute injunction proceedings in the name of the United States to prevent such action.

Criticism and Change.—The use of the injunction has been the subject of substantial criticism and complaint. Peculiar to the United States federalist system is the problem of a federal court enjoining a proceeding in a state court and vice versa. The general principle is that no such injunctions shall issue; but being courts of concurrent jurisdiction the court that first obtains jurisdiction of the subject matter regards its authority as exclusive and employs the injunction in aid of this purpose. The friction that might result from a liberal use of the injunction in this way was foreseen at an early date, and in 1793 congress prohibited such use by the federal courts except in bankruptcy cases. The federal courts have, however, by a series of judicial decisions, established numerous exceptions to this broad statutory provision, such as in the field of constitutional rights.

A second ground of irritation concerned the use of the injunction by the federal courts to restrain the enforcement of state statutes on the ground of their unconstitutionality. An appeal from such action lay to the U.S. supreme court, but during the interim a single federal judge was able to set at naught the entire administrative authority of a state. A related problem is the use of the injunction against administrative acts of public officials, such as in the regulation of business, the collection of taxes and the fixing of rates by public utility commissions. While the injunction here has the advantage of raising questions of the validity of the administrative actions at an early date, the effect of such injunctions, which federal judges readily granted, was to impede seriously the activities of one branch of the government. These problems led congress, by a series of statutes beginning in 1910, to prohibit the issuance of such injunctions except by a court consisting of three judges, one of whom should be a judge of a court of appeal, and to provide for expediting an appeal therefrom to the supreme court. Another area of complaint, and one which has been voiced against the use of injunctions generally, is that the right to a trial by jury is not available, particularly with relation to contempt proceedings growing out of the claimed violations of injunctions. The Clayton act made provision for jury trials in certain contempt cases, and other federal statutes have imposed similar requirements. In the federal statute protecting the right to vote, defendants found guilty of criminal contempt, fined in excess of a stipulated amount or imprisoned in excess of a specified number of days, are given the right to a new trial before a jury. (A. EN.)

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INK, a liquid or paste that contains pigments or dyes and is used chiefly for writing or printing. An ink consists of two fundamental components: (1) a pigment or dye; and (2) a liquid, called the vehicle, in which the pigment or dye is dispersed. Ink may contain other ingredients that adapt it for special uses. This article discusses first writing ink and then printing ink.

WRITING INK

Inks used for writing are solutions of colouring material and other substances in water. The first inks, dating from about 2500 B.C. and used in the early Egyptian and Chinese civilizations, consisted of lampblack ground with a solution of glue or gums. This mixture was molded into sticks and allowed to dry. The sticks were mixed with water before use. Coloured juices, extracts and suspensions of many plant, animal and mineral substances have been used as inks, including alizarin, indigo, pokeberries, cochineal and sepia. A soluble iron salt forms a dark-coloured solution with an extract of tannin. Such mixtures have been used as writing ink for many centuries and are the basis of modern blue-black inks.

General Properties.—Writing ink should leave a neat, legible mark. The marks left by a permanent ink should remain legible after soaking in water and after exposure to strong light. The ink mark should not accelerate deterioration of the paper. The ink should dry fairly quickly on paper and not smudge. It should not produce a feather-edged line; it also should not penetrate through the paper or offset onto the adjacent sheet. The ink should have good writing qualities, including free and even flow from the pen without flooding or clogging. It should resist drying and thickening on the feed and point of fountain pens. The liquid should remain stable on standing; it should not form scum or sediment or permit the growth of mold or other microorganisms. It should be inert to steel pens and to the rubber, plastic and other parts of fountain pens.

Types and Contents.—Numerous special materials, in addition to the colour, are added to inks to modify their properties for the purposes outlined above.

Blue-black inks usually contain ferrous sulfate as the iron salt. At one time the tannin for inkmaking was obtained by extracting oak galls with hot water as part of the process. In the United States, however, most inkmakers adopted purified gallic and tannic acids. A small amount of mineral or organic acid is usually added. Such a solution has a light bluish-black colour, and the writing on paper is faint initially but on standing becomes darker and insoluble in water. The latter property gives the ink its permanent quality. If the record becomes wet, the characters do not wash out but instead remain legible. Blue dyes are added to blue-black inks to enhance the appearance and to make the writing legible at the outset. The following formula is from Federal Specification for Writing Ink, no. TT-I-563b:

Gallic acid crystals	5.0 g.
Ferrous sulfate crystals	7.5 g.
Tartaric acid	1.0 g.
Soluble blue (Colour Index no. 707)	3.5 g.
Distilled water, to make (25° C.)	1 l.

Aqueous extracts of logwood with various metal salts, principally those of chromium, were extensively used as inks for many years but by mid-20th century they were little used in the United States. A small amount of ink that uses colloidal Prussian blue for the colour has been produced.

Coloured inks contain soluble dyes as the sole colouring matter. Such inks are for school and home and such business use as does not require a permanent record because the writing on paper fades in strong light and washes out if immersed in water. However, the writing on paper will last for many years if protected from such deteriorating effects.

Washable inks are dye-base inks that may be washed from washable fabrics more readily than permanent inks. A typical washable ink has the following formula:

Soluble blue (Colour Index no. 707)	5.0 g.
Glycerol	10.0 g.
Thymol	0.5 g.
Water, to make	1 l.

India ink is a dispersion of carbon black in water. Numerous substances have been suggested for stabilizing the suspension, including various alkaline solutions, shellac dissolved in borax solution, soap, gelatin, glue, gum arabic and dextrin. It is used mainly as drawing ink, though some is used as writing ink.

Manufacturers sometimes add optical bleaches, or "white dyes," to writing inks. These colourless substances leave a deposit on paper that fluoresces under ultraviolet radiation after the visible portion of the writing has been decolourized by ink eradicator or by soaking in water. This permits the eradicated record to be read.

Manufacture.—The manufacture of writing ink consists of purifying the water by distillation or deionization, dissolving the ingredients in large tanks, clarifying the resulting solution by decanting, filtering or centrifuging, and packaging.

The packaging is usually done by a series of automatic machines that put the right amount of ink in each bottle, put on caps and screw them down, attach the label and insert each bottle in a carton. Such an automatic production line can produce more than 50,000 small bottles per eight-hour day. Economically, the pack-

age and the handling, storing and shipping are by far the most important parts of ink manufacture, because they represent a large fraction of the total cost.

In the mid-1960s, an increasing amount of writing ink was being marketed in fountain pen refill cartridges.

Ball-point and Other Special Writing Inks.—In a ball-point pen the ink is transferred from the reservoir to the paper by a rotating ball held in a socket at the writing tip of the pen. Ball-point pen inks consist of pigments, or more frequently dyes, dispersed in a nonvolatile solvent consisting usually of glycols or glycol derivatives. Since ball-point pens lay down on the paper a very thin line of ink, the concentration of the dyes must be 20 or more times that used in writing inks.

Stamp-pad inks, *i.e.*, those used with rubber stamps, are solutions of dyes in glycerol or a glycol and water.

Inks for various duplicating processes contain a high concentration of colouring matter.

Inks for numbering and canceling machines that use metal type are dispersions of dyes or pigments, or both, in an oil base.

(R. S. Cy.)

PRINTING INK

Printing inks are used in printing on paper, parchment, cellophane, Celluloid, metal, plastic, leather, wood, cork, rubber, cloth, glass, ceramics and similar materials. Printing inks generally are less fluid than writing inks, in most cases possessing a consistency resembling paint. Printing ink is applied to a surface as a light liquid film that dries to a solid after imprinting. The important characteristics of an ink are its colour strength, opacity or transparency, body or working properties, and drying properties. The viscosity, density, volatility and diffusibility of ink are varied so as to adapt the ink to the printing process employed, the speed of the press and the material printed upon.

Origin and Development.—In Asia, where the Chinese experimented with printing (*q.v.*) at least 1,000 years before the time of Johann Gutenberg, printing inks were made from plant substances mixed with coloured earths and soot or lampblack. When Gutenberg invented printing in Europe in 1440, inks were still being made by mixing varnish or boiled linseed oil with lampblack. Such inks continued in use with little modification for more than 300 years.

The first patent for making coloured inks (*i.e.*, those other than black) was issued in England in 1772 and by the latter part of the 19th century the application of driers made possible the use of a wide variety of pigments in the manufacture of coloured inks. However, the method of inkmaking differed very little from the processes used in the time of Gutenberg.

Later developments included the use of varnishes of varying degrees of stiffness to provide inks for different kinds of paper and different kinds of presses. With the introduction of web-fed newspaper presses, mineral oils (*i.e.*, those from petroleum) began to replace varnish as the ink vehicle. Despite the gradual changes that were made in the composition of ink over three centuries, it was not until the beginning of the 20th century that inkmaking became a complicated industrial process based on chemistry.

Types and Contents.—*Variables.*—Inks must be compounded to take into account the surface to be imprinted, the printing process to be used and customer requirements such as colour, opacity or transparency, brilliance, permanency (fastness to light), surface hardness, pliability, wettability and freedom from odour or contaminants. The ink manufacturer also must consider the type of manufacturing equipment he will use, the length of the manufacturing process and the amount of handling the ink will be subjected to during processing or in transit to the customer. Because of the large number of variables to be considered (usually about ten), the compounding of ink is an intricate process. Since some variables depend upon the requirements of the user, manufacturers frequently mix an ink to a special formula agreed upon by the user and the inkmaker. Despite the wide use of custom-formulated inks, stock inks are available and can be ordered by name or code number.

The three main methods of printing are letterpress (or relief), which uses raised surfaces; intaglio (gravure), in which depressed or incised wells carry the ink; planographic (offset lithography), in which ink is deposited on grease-treated printing areas while the nonprinting parts, which hold water, reject the greasy ink. (*See* LITHOGRAPHY.) Other methods include screen printing, in which the areas to be printed are inked in by brush, dauber, squeegee or roller applied over open or mesh-covered cutouts (*see* SILK SCREEN PRINTING); and electrostatic, in which ink in mist form is pulled through a shield or mask by an electric charge to form the desired image. Inks suited to one process of printing may not be suited to another process. For example, ink for letterpress need not be water-repellent, although this is a primary requisite in planographic ink. Ink for intaglio printing must be of a thin consistency that will permit it to be lifted from the wells whereas ink used in screen printing can be much thicker.

Fluid Ingredients.—The two basic ingredients of printing ink are the vehicle (also called the body) and an organic or inorganic pigment or dye (also called the colorant). Inks used for low-speed letterpress printing consist of carbon black mixed with a heavy varnish and a drier. The purpose of the drier is to reduce the drying time.

For more complex methods of printing, especially at high speeds, numerous other vehicles and pigments are used along with a wide variety of modifiers or additives that make the ink perform in the manner desired and also produce the appearance and durability required. Specially formulated inks may contain as many as 15 different ingredients.

Regardless of the printing method used, the speed with which the ink dries is important. Drying may occur by oxidation, penetration (absorption), evaporation, gelation, coagulation, precipitation or polymerization. The type and speed of drying depend upon the vehicle, which may be linseed varnish, alkyd or other synthetic resins, mineral oil or other petroleum derivatives, alcohol or glycol compounds, hydrocarbons, shellac, lacquers and oils such as castor, tung, soya, cottonseed or perilla. Vehicles may be used separately or in combination with each other. They may be blended by dissolving, cooking, or mixing in an ink mill. Driers made of salts of cobalt, lead and manganese have the property of absorbing oxygen from the air and thus speeding up the formation of a film over the surface of the ink. Special additives may be included to prepare inks for special uses; for example, synthetic resins that dry quickly when heated are added to produce heat-set inks (*see* below) or a mixture of glycols and resin is added to produce moisture-set inks. Because they penetrate rapidly into newsprint, inks made with a mineral oil base are generally used in printing newspapers on high-speed presses. Intaglio inks are composed of petroleum naphthas, resins and coal-tar solvents; the intaglio process is used chiefly in printing rotogravure newspaper supplements and cartons, labels and wrappers. Cellophane, glassine and other plastic materials are usually printed with aniline (or, flexographic) inks, which contain methyl alcohol, synthetic resins and shellac.

Pigments and Colorants.—Pigments used in printing inks were derived originally from mineral, vegetable and animal sources in nature. Most natural pigments can now be duplicated chemically by synthesis and compounding; most modern dyes, for example, are derived from coal tar.

Prominent among the mineral pigments found in nature or obtained from natural sources is ultramarine blue, made from powdered lapis lazuli, a complex silicate containing sulfur (*see* ULTRAMARINE). Other pigments made from earth substances include sienna, which derives its colour from oxides of iron and manganese and is brownish-yellow when raw and orange-red or reddish-brown when burned; ochre (*q.v.*), an impure ore of iron that is found in both red and yellow colours; umber, which provides a brown-red-yellow hue, the saturation and brilliance of which may be controlled by burning; and Indian red, which is found in nature or may be produced by calcining iron salts. Although natural mineral pigments are more stable and therefore are more resistant to deterioration by light, heat and moisture than are pigments produced synthetically, they also are more abrasive and tend to cause the printing surfaces to wear. Synthetic pigments are less abrasive since they are produced by filtration, whereas milling and grinding

are used in processing natural pigments.

Pigments from vegetable sources include indigo (*q.v.*), a blue dye obtained from the leaves of several plants; gamboge (*q.v.*), a reddish-yellow gum resin from certain tropical trees; and yellow lake, derived from the inner bark of the black oak tree.

Pigments from animal sources include those obtained by burning vegetable oils to produce carbon black (*q.v.*); Indian yellow, derived by evaporating the urine of camels or cows; sepia (*q.v.*), a dark brown obtained from the secretions of the cuttlefish; carmine(*q.v.*), a red or purplish-red pigment obtained from cochineal (*q.v.*), which in turn is a red dye obtained from female scale insects. (*See* also DYES AND DYEING.)

Colour and Covering Characteristics.—Colour printing in magazines and similar publications is achieved through the overlaying of three primary colours—yellow, red (magenta) and blue (cyan)—and black by means of toned or screened plates. When the colour and black plates are printed in sequence on a surface, the result is a series of intermingled or overlapping dots of the separate colours, shaded with black. (*See* also PHOTOENGRAVING.)

In colour inks, the shades (light to dark) and hues (colour strength) of the basic spectrum colours (red, orange, yellow, green, blue, indigo and scarlet) are of almost unlimited number. Each colour is available in about 100 shades or hues. However, efforts to describe and catalogue the colours and shades scientifically have not won general acceptance; consequently, colours usually are matched by eye comparison in the printing industry.

When inks are matched or compared, their abilities to cover a surface must be considered along with their light reflective characteristics (colour). The covering qualities of inks vary with the colour. For example, a pound of high-grade black ink will cover 100 sq.in. of surface for approximately 1,000 impressions. A pound of blue ink will cover approximately 90 sq.in. of surface in 1,000 impressions; a pound of red will cover 80 sq.in.; a pound of yellow, 70 sq.in.; a pound of white, about 60 sq.in.

The inks used in printing on rough or coloured papers differ from those used for printing on smooth white papers. For example, a transparent red ink designed for use on white paper will produce a brown colour if printed on green paper. Also, almost twice as much ink is required when printing on rough paper as is used in printing on a smooth white paper.

Special Inks.—Although, as has been mentioned, almost all inks are compounded for a specific purpose, the term special is applied to many inks used outside what is generally called commercial, or job, printing. The number of special inks is quite large; examples are those that are heat-set, cold-set, steam-set, metallic, fluorescent and magnetic.

Heat-set Inks.—Inks of this type are stable at room temperature but solidify (dry) when heated. On the press they are changed from a semiliquid to a solid form by heaters, burners or steam-heated drums. Heat-set inks are useful on high-speed presses or in other instances in which slow-drying inks would produce smearing or unwanted offset impressions. Some heat-set inks are manufactured from finely pulverized polyvinyl chloride mixed with a plasticizer and a solvent. Drying temperatures may exceed 350° F. (about 176.7° C.). After heat-set ink has been dried by heating, the paper that has been printed upon must be passed over cooling rollers to cool it to near-normal temperatures.

Cold-set Inks.—A variant of heat setting is cold setting, in which ink is applied at an elevated temperature and then solidifies upon cooling. Such inks are called cold-set inks.

Steam-set Inks.—Steam-set inks, which are made with a glycol-resin vehicle, dry upon contact with moist steam through coagulation and penetration. Such inks usually are applied as a vapour or mist. The drying rate of steam-set inks may be controlled by using different glycols and different resins. If the paper or cardboard being printed upon is porous, steam-set ink can be dried by maintaining a high relative humidity in the pressroom.

Metallic Inks.—Many kinds of metallic inks are used in printing on packaging and metal sheets or foil. Such inks consist of microscopic flakes of metal suspended in an appropriate vehicle. They may be compounded to emphasize a colour as well as the metallic sheen, or to resemble gold, silver or other metals. Gold inks are usually made with bronze powder but in some instances (*e.g.*, in stamping book covers) gold leaf may be used. Silver inks are ordinarily compounded of aluminum powder.

Fluorescent Inks.—When a high degree of colour brilliance is desired, fluorescent inks are used. Such inks, which also are called optical brighteners, absorb ultraviolet and other nonvisible forms of radiation and emit this energy as visible light. Fluorescent ink pigments that are three to five times brighter than ordinary colouring materials can be made from zinc, cadmium or strontium sulfide. Phosphorescence may be provided by blending sulfide pigments with radioactive uranium salts or activated barium sulfate. Fluorescent inks retain their brightness for 30 days to one year, depending upon the extent of exposure to light. Consequently, a protective coating is sometimes added to prolong the period of fluorescence. (*See* also LUMINESCENCE.)

Magnetic Inks.—Checks and other business forms that are sorted in electronic scanning or sensing devices are imprinted with magnetic inks. The inks transfer signal patterns to machines that automatically punch cards, perforate paper tapes or record signals on magnetic tapes. Magnetic inks contain finely ground particles of iron oxide or similar materials suspended in vehicles of high viscosity.

Manufacturing Process.—In the first step in manufacturing printing ink, the pigment or colouring matter is mixed with the vehicle by stirring, whirling or churning. This mixture is then ground in a mill in which a thin film of the mixture is forced between steel drums or rollers. The rollers, turning at various speeds and clearances, break the pigment into particles of microscopic size that become saturated, or wet, with the vehicle. The mixture is passed through the mill from three to ten times, depending on the hardness or softness of the pigment and its suspension or wetting qualities. During the mixing, or milling, process or at a later stage, driers and other modifiers are added to complete the formulation.

The above description applies primarily to the manufacture of inks in which natural colourants are used. When synthetic pigments (*e.g.*, those made by mixing two or more chemical solutions) are used, the tiny particles of pigment may be filtered out and mixed with the vehicle in machines devised especially for this purpose. Any water remaining from the chemical solution is flushed out and drained off in the mixing process. Chemically produced pigments normally require less milling or grinding than natural pigments.

Consumption and Research.—The amount of ink used on a printing job may vary from a fraction of an ounce for a small run of letterheads or calling cards to as much as 200,000 lb. for the Sunday edition of a metropolitan newspaper. In a commercial job-printing plant of medium size, about 30,000 lb. of ink is used annually and in a large book or magazine plant it may be ten times that amount. To print all of the newspapers in the United States in a single weekday requires between 600,000 and 700,000 lb. of ink.

Most large printing inks manufacturers conduct research. The National Association of Printing Ink Makers operates the Printing Ink Research institute at Lehigh university, Bethlehem, Pa.

See also references under "Ink" in the Index. (G. U. C.)

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INKBERRY (*Ilex glabra*), a North American shrub of the holly family (Aquifoliaceae), known also as evergreen winterberry, bearbush and Appalachian tea, native to sandy soil from Nova Scotia to Florida and west to Louisiana, mostly near the coast. It is a small shrub, two feet to six feet high, with leathery, evergreen, oblong, usually slightly toothed leaves; small white flowers, solitary or sometimes two or three together, borne on short slender stalks in the axils of the leaves; and small black berries (drupe), about ¼ in. in diameter, ripening in autumn. Among other plants called inkberry are the West Indian indigo berry (*Randia aculeata*) and the widely distributed pokeberry (*Phytolacca decandra*). The Australian or Queensland inkberry is *Mollinedia macrophylla*, a plant of the family Monimiaceae. *See* HOLLY; POKEBERRY.

INKERMAN, BATTLE OF, an engagement during the Crimean War (*q.v.*), was fought on Nov. 5, 1854, when Russian forces under General Dannenberg unsuccessfully attacked the Anglo-French army besieging Sevastopol. The Allied positions on a ridge lying between the Chernaya river and the Careenage ravine were attacked by two Russian columns: one in the north moved across the river to face the 2nd division supported by the guards brigade; the other, from Sevastopol, faced the light division on the west of the battlefield. The attack was supported by artillery on Shell hill to the northwest. In uncertain and foggy morning light the Russians surprised British forces who stemmed the advance by throwing themselves into action as soon as they became aware of the danger. This remained the pattern of the day. There were about 42,000 Russians in the field, but they were committed piecemeal and unimaginatively to a persistent action that centred around a stone strong point to the north of the Allied-held ridge. As the day advanced the British force grew in size until it reached 8,500, but the Russian final offensive would have been successful had it not been for timely French support sent by Gen. P. F. J. Bosquet. The Russians began to retreat about noon; Shell hill was in Allied hands and the battle over by about 1:30 P.M. Casualties were heavy: the Anglo-French exceeded 3,000 and the Russian were more than 10,000. The surprise of the Russian attack, the nature of the ground and the poor visibility all contributed to the engagement being a soldier's rather than a general's battle, for over-all direction was impossible. (D. M. Sc.)

INLAND MARINE INSURANCE: *see* MARINE INSURANCE.

INLAND SEA (SETO-NAIKAI), the body of water lying between the Japanese islands of Honshu, Shikoku and Kyushu. Its east-west length is approximately 250 mi. and its waters are easily navigable. The sea has an extremely irregular coast line and is dotted with hundreds of small islands. Entrance to the Inland sea from the Philippine sea and the Pacific ocean is by the Bungo strait and Kii strait. The narrow Shimonoseki strait at the western end leads to the East China sea. *See* JAPAN: *Physical Geography.*

INLAYING: *see* WOODWORK, DECORATIVE; METALWORK, DECORATIVE: *Techniques of Metalworking.*

INMAN, HENRY (1801–1846), U.S. painter of portraits, genre and landscape, was born in Utica, N.Y., on Oct. 20, 1801. Apprenticed to the painter John W. Jarvis at the age of 14, he left him after seven years and set up for himself. He was one of the organizers of the National Academy of Design in New York and its first vice-president (from 1826 to 1832). As a portrait painter he was highly successful both in New York and Philadelphia, and going to England in 1844, he had for sitters the lord chancellor (Cottenham), the poet William Wordsworth, Thomas Chalmers, Lord Macaulay and others. His American sitters included Pres. Martin Van Buren and Chief Justice John Marshall. Inman died in New York city on Jan. 17, 1846.

INN (ancient AENUS), a major right-bank tributary of the Danube, rises in the small lake Lughino in Graubünden (Grisons), Switz. Length 510 km. (319 mi.), drainage area about 9,923 sq.mi. Its first section, to the Austrian border, is the Engadine; the Oberinntal, above Zirl, is narrow; the lower Inn valley, which includes Innsbruck, is wide, except where the river has cut through the Limestone Alps at Kufstein. Entering Bavaria it crosses the Quaternary Rosenheim basin, then turns eastward along the Tertiary hills. After receiving the Salzach, its major tributary, it forms the Austro-German border to its confluence with the Danube at Passau. Because of the glaciers of its catchment area it has a pronounced glacial regime. The river is utilized for hydroelectric power with important plants at Kirchbichl, Wasserburg, Braunau, Ering, Obernberg and Schärding. (K. A. S.)

INNATE IDEAS, ideas supposed to be inborn in the human mind, as contrasted with those received or compiled from experience. The doctrine that at least certain ideas must be innate (*e.g.*, those of God, perfection and infinity), on the ground that no satisfactory empirical origin for them could be conceived, was widely held in the 17th century and had Descartes for its most prominent exponent. The theory took more than one form, some holding the naïve view that the human mind must from the start of the child's life have an explicit awareness of such ideas, others, more commonly, maintaining innate ideas in some implicit form, either as a capacity for formulating them, which remained dormant until suitable conditions for its actualization occurred in experience, or as a tendency, which again would require favourable conditions for its development. Descartes professedly adopted the last view, although his writings contain indications of the more naïve version; and, having at first maintained that only some ideas were innate (others being either "adventitious" or "factitious"), he was driven by his metaphysical dualism into concluding that all ideas were innate.

The whole doctrine was vigorously and effectively criticized by Locke in the first book of his *Essay Concerning Human Understanding*, where his main target was innate principles (supposed axioms, both theoretical and practical, of which the mind had inborn knowledge, as they had been implanted in it by nature), with as secondary target the innate ideas which were claimed as the terms of the principles. He refuted the arguments for the naïve form of the theory and showed that in its dispositional form the theory defeated its own object by making it impossible to distinguish between those ideas which were and those which were not innate. His refutation was undertaken by way of introduction to his own positive thesis, that all ideas are empirical, the only two sources being, in his own terminology, sensation and reflection. That he did not succeed in his thoroughgoing empiricism, even to his own satisfaction, he recognized in the case of certain key concepts, such as Substance, "which we neither have nor can have by sensation or reflection," and Cause, where he largely anticipated Hume's difficulties.

While Locke seems to have shared some of the assumptions of his opponents (*e.g.*, that if an idea is innate it cannot be wrong), he shows signs of recognizing, at least in the case of principles, that the philosophically important question was not one of genetic psychology, about origins, but one of logic, about the status and validity of an a priori or necessary proposition. Leibniz, in his criticisms of Locke, carried the matter further; and Kant, completing the distinction that Locke had begun, replaced questions about innate ideas with questions about a priori concepts, which he characterized in terms, not of their origins, but of their necessity as conditions of our experience of an objective world. (A. D. W.)

INNERLEITHEN, a small burgh of Peeblesshire, Scot., lies on the Leithen water, near its junction with the Tweed, 7 mi. S.E. of Peebles by road. Pop. (1961) 2,299. The town is flanked on the west by the hill fort of Caerlee and on the east by that of Pirn. The district is known to have been inhabited by Celtic peoples in 55 B.C. Its chief industry is the manufacture of tweeds, hosiery and other woolen goods, which, together with the fame of its medicinal springs, brought the burgh into prominence toward the end of the 18th century.

St. Ronan's well, known for centuries before Sir Walter Scott made it famous in his novel of that name, has a pump room and well house; however its mineral waters are now very little used.

Farther east, close to the village of Walkerburn, is Purvis hill with a remarkable series of terraces or earthen banks, the origin and purpose of which are unknown. Traquair house, or palace, on the right bank of the Tweed, is one of the oldest mansions in Scotland, the most ancient portion dating from the 10th century and the main block from 1642.

INNES, JAMES DICKSON (1887–1914), British landscape painter, noted for bold, flat masses of pure colour, was born at Llanelly, Carmarthenshire, Wales, on Feb. 27, 1887. In 1904–05 Innes studied at the Carmarthen art school; then he spent three years at the Slade school, University college, London. Works exhibited in 1907–08 showed him strongly influenced by P. Wilson Steer and W. R. Sickert.

Water colours by J. S. Cotman and J. M. W. Turner and John Constable's paintings were other formative elements, and Innes discovered his aptitude for water-colour landscape. In 1908, inspired by the sun-drenched Pyrenean landscape around Caudebec, Bozouls and Collioure, he adopted a brilliant palette. The next year he visited St. Ives (Cornwall) and Paris, and in 1910–13 he returned often to Collioure and visited Spain. Two expeditions to Wales in 1911–12 with Augustus John further shaped Innes' style. He then painted in oils and became interested in Japanese colour prints. Besides the English roots of Innes' art, parallels with Paul Gauguin and the *Fauves* can be perceived. Innes' delicate health failed rapidly and, after wintering in Morocco in 1913, he died at Swanley, Kent, on Aug. 22, 1914.

See Lillian Browse (ed.), *James Dickson Innes*, with an introduction by J. Fothergill (1946). (D. L. Fr.; X.)

INNESS, GEORGE (1825–1894), U.S. painter of landscapes in the romantic style, was born near Newburgh, N.Y., May 1, 1825. During his boyhood at Newark, N.J., he was interested in drawing but not in school or clerking, whereupon he was allowed a few lessons. There followed work with a map-engraving firm in New York city, an interval of country sketching and a brief study of painting under Régis Gignoux. About 1845 Inness established a studio in New York city and in 1846 exhibited at the National Academy of Design, New York. The next year friends made possible a stay of several months in Italy. Back in Newark, Inness married his first wife; she died about six months later. In 1850 he married a second time and made a second trip to Europe.

Inness became an associate of the National Academy of Design at 28, but was kept waiting 15 years for full membership. A third trip to Europe (1854) ended his initial period of experiment in subject and struggle against technical tightness. This stay abroad confirmed the already discernible releasing influence of the French Barbizon school led by Théodore Rousseau. It was through the two decades of his middle period (1855–74) that Inness ascended to the height of his powers. The famous and impressive "Peace and Plenty" (1865) remains exceptional in his work for physical dimensions; his more characteristic smaller canvases depict both far-reaching expanses and lesser areas intimately rendered. His increasing control over space relations and scale, drawing and colour was directed to achieving the idyllic and the tranquil; he often brought in storm clouds for the sake of their grays and blues, but he never let them break into tempestuous violence. Yet all the while his temperament continued stormy and passionate. He was interested in social questions, and argued heatedly for the single tax and for abolitionism, but the deepest effect on him and his art came from his conversion to Swedenborgianism. The beginning of the final period (1875–94) was marked by pictures with great concentration of feeling ("Evening at Medfield") and by others which foretold the later sacrifice of strength to vaporous colour ("Autumn Oaks"). For most of these latter years his home was at Montclair, N.J., and his studio in New York city, but his notable prosperity permitted frequent trips to distant places. As his nature mysticism intensified, his pictures volatilized into shimmering colour, frequently gorgeous in itself but no longer supported by form construction. During a trip to Scotland he died at Bridge of Allan on Aug. 3, 1894. His painter son, George Inness, Jr. (1854–1926), remained faithful to the practices of Barbizon and resisted Impressionism in obedience to his father's violently expressed convictions.

BY COURTESY OF THE METROPOLITAN MUSEUM OF ART, GIFT OF GEORGE I. SENEY, 1887

"AUTUMN OAKS" BY GEORGE INNESS, ABOUT 1875. IN THE METROPOLITAN MUSEUM OF ART, NEW YORK CITY

See George Inness, Jr., *Life, Art, and Letters of George Inness* (1917); Elizabeth McCausland, *George Inness* (1946). (Vl. B.; X.)

INNOCENT (Innocentius), the name of 13 popes and 1 antipope.

St. Innocent I (d. 417), pope from 401 to 417, was the son, according to St. Jerome, of Pope Anastasius I. During his papacy the siege of Rome by Alaric (408) took place; the pope was absent from Rome on a mission to Honorius at Ravenna at the time of the sack in 410. He maintained and extended the authority of the Roman see as the ultimate resort for the settlement of all disputes; his still extant communications to Victricius of Rouen, Exuperius of Toulouse, Alexander of Antioch and others, as well as his action on the appeal made to him by Chrysostom against Theophilus of Alexandria, are examples of his intervention. In Jan. 417 he made a decision on the Pelagian controversy, confirming the views of the synods of Carthage (for proconsular Africa) and of Mileve (for Numidia), which had addressed letters to him in 416. He died on March 12, 417, and in the Roman Catholic Church is commemorated as a confessor with St. Nazarius, St. Celsus and St. Victor, martyrs, on July 28.

Innocent II (Gregorio Papareschi dei Guidoni) (d. 1143), pope from 1130 to 1143, was a Roman by birth. His ability, pure life and political connections raised him rapidly to power. Made cardinal deacon of Sant' Angelo in Pescheria by Paschal II, he was employed in various diplomatic missions. Calixtus II appointed him one of the ambassadors who made peace with the empire and drew up the Concordat of Worms (1122); and in 1123, with his later rival Cardinal Peter Pierleoni, he was papal legate in France. On Feb. 13, 1130, Honorius II died, and on that night a minority of the Sacred College elected Papareschi, who took the name of Innocent II. After a hasty consecration he took refuge with a friendly noble from the supporters of Pierleoni, who was elected pope under the name of Anacletus II by a majority of the cardinals. Innocent refused to recognize the choice; by June, however, he was obliged to flee to France.

Much of Innocent's pontificate was spent in vindicating his title. He owed his success chiefly to the tireless energy of St. Bernard of Clairvaux, who at the council of Étampes swayed the French church in his favour (?Sept. 1130). In Jan. 1131, Bernard arranged a meeting between Innocent and King Henry I of England at Chartres. A similar lead was given to the German church by St. Norbert at the synod of Würzburg (Oct. 1130). In March 1131 Innocent met the German king Lothair at Liège and induced him to undertake a campaign against Anacletus. The German army invaded Italy in Aug. 1132 and, early in the following summer, occupied all Rome except the Leonine City, which was held by the Anacletans. Lothair was crowned emperor at the Lateran in June 1133, and Innocent gave him the territories of the Countess Matilda of Tuscany as a fief but refused to surrender the right of investiture. Left to himself Innocent again had to flee, this time to Pisa. There he called a council which condemned Anacletus. A second expedition (1136–37) of Lothair expelled Roger of Sicily (to whom Anacletus had given the title of king in return for his support) from southern Italy, but a quarrel with Innocent prevented the emperor's attacking Rome. At this crisis, in Jan. 1138, Anacletus died, and a successor elected by his faction, as Victor IV, resigned after two months. The Lateran council of 1139 restored

peace to the church, excommunicating Roger of Sicily; but an expedition undertaken against Roger ended in Innocent's being taken prisoner and obliged to recognize him. The pope supported Bernard of Clairvaux in his prosecution of Peter Abélard and Arnold of Brescia, whom he condemned as heretics.

The remaining years of Innocent's life were taken up by a quarrel with the Roman commune, which had set up an independent senate, and by one with King Louis VII of France, about an appointment. France was threatened with the interdict, but before matters came to a head Innocent died on Sept. 24, 1143.

(T. Cr.; C. H. Le.)

Innocent III (Lothair of Segni) (d. 1216), pope from 1198 to 1216, was born in 1160 or 1161 in Gavignano, a castle belonging to his father, Trasimund of Segni, in the Roman Campagna. Through his mother, Claricia Scotti, he was related to many noble Roman families. As a young man Lothair studied theology in Paris and canon law in Bologna under the great canonist Huguccio of Pisa, whose relatively moderate doctrines on the relationship between the spiritual and the temporal authorities lastingly influenced the future pope. In 1189 Pope Clement III, possibly a relative of Lothair, raised the young subdeacon to the dignity of cardinal deacon of St. Sergius and St. Bacchus. During the pontificate of Celestine III, Lothair did not take any prominent part in the government of the church and had time to write several theological works; two of them, "On the Miserable Condition of Man" and "On the Mysteries of the Mass," are significant expressions of the ascetic-liturgical inspiration by which this pope who was so active politically was animated.

On the very day of Celestine III's death, Jan. 8, 1198, Lothair was unanimously elected pope after only two ballots; he was ordained priest on Feb. 21, and on the next day was consecrated as bishop of Rome.

During Innocent's pontificate, in 1215, occurred the fourth Lateran council, which constituted the culmination not only of his pontificate but of the whole medieval papacy, with regard to brilliant attendance and representation of the whole church and, above all, as regards the importance of its decrees. It promulgated, for instance, the dogma of transubstantiation, bound every Catholic to confession at least once a year and communion at Easter time, forbade clerical participation in ordeals and other "judgments of God," and enacted important reforms of clergy and laity without which the medieval church would hardly have withstood internal and external dangers for another 300 years.

Innocent III's very exalted conception of the role of the papacy in the Christian world and his success in making this conception a reality would have been unthinkable without the preparations of the Hildebrandian age (*see* Gregory: *St. Gregory VII*) and without the intellectual and political developments of the 12th century. Innocent III was the fortunate heir and fulfiller where Gregory VII had been the embattled prophet and pioneer. Innocent's sermons on the day and on the anniversaries of his coronation, as well as the vast corpus of his official letters, blended the legal and philosophical-theological thought of the scholastic age with new expressions of mystical fervour and created a language and ideology of unprecedented splendour and majesty for the glorification of the papal office. At the same time the political constellations within Christendom during his pontificate allowed the pope to exercise his spiritual authority not only in the inner precincts of the church but also in all vital political questions of the day. Yet he explicitly disclaimed the right and the intention to intervene in temporal affairs as such, with the exception of course of the Papal States and of those kingdoms which had voluntarily recognized the feudal suzerainty of the papacy. As far as Germany was concerned, Innocent felt that he had very special rights, since the king of Germany was also the emperor of the Holy Roman empire and, as such, was meant to be the protector of the Roman and universal church. Because the special position of the German king-emperor *ipso facto* affected the pope's spiritual realm, Innocent believed he had the right to approve or reject dubious elections to the German throne and acted accordingly in the contest over the succession to Henry VI. Otherwise he was careful to limit his intervention in temporal matters (outside the Papal States and the vassal kingdoms) to cases in which political actions had either infringed upon spiritual rights or raised serious moral questions. Nevertheless, the combined authority claimed by the pope on these various grounds was very great indeed, and he himself often spoke of the pope's *plenitudo potestatis* (a term which goes back to Leo the Great), though he considered this always as rooted in a *spiritual* power, the power given to Peter by Christ of binding and loosing souls. Papal plenitude of power was for him essentially spiritual sovereignty, however much it could branch out into the temporal sphere for spiritual reasons. It is this claim, not a claim to temporal world rulership, which stands behind some of Innocent's most striking assertions of papal supremacy. They are properly understood, in the whole context of his reign, only as assertions of the ultimate competency of the supreme spiritual authority in any matter whatsoever by which the spiritual concerns of the church (that is to say, faith and morals) are affected.

At the beginning of his reign Innocent III was confronted with three problems: the insecurity of papal sovereignty in the Papal States; the double election in Germany; and the French-English or, to be more exact, the Capetian-Angevin war. At the time of his accession, Rome was practically independent of papal government, but Innocent soon succeeded in reasserting papal rights there. Within a few years, though not without a struggle, he had pacified the rival aristocratic factions and won over most of the people. Moreover, he had been very successful in his policy of recuperation of the Papal States with regard not only to the re-establishment of effective papal government in the so-called patrimony of St. Peter, but also with regard to the acquisition of the duchy of Spoleto, the march of Ancona, etc., which he claimed on the strength of the heretofore never fulfilled promises of Pepin and Charlemagne. For Innocent, as for the popes of the 12th century, the existence of strong Papal States in the centre of Italy was a vital prerequisite for the independence of the papacy from secular power, and doubly so after the experiences of the last decade, when the union of the Holy Roman empire with the Sicilian kingdom under Henry VI had nearly paralyzed the papacy's freedom of action.

The problem of Italy also governed Innocent's policy in the German crisis, when the princes of the Holy Roman empire, ignoring the claims of Henry VI's son Frederick II (*q.v.*), had split over the election of a new German king. One party elected the brother of the deceased emperor, Philip of Hohenstaufen, duke of Swabia; the other elected the duke of Brunswick (son of the great Guelph Henry the Lion and nephew of the English kings Richard the Lion Hearted and John), who was to be known as Otto IV. Innocent, fearing the Hohenstaufen tradition, favoured Otto, and the initial actions of Philip and his followers were not calculated to allay his fears; Frederick he hoped to restrict to his Sicilian inheritance and thus to avoid a reunion of the empire with Sicily. Philip, however, was so successful against Otto that Innocent after a few years found it necessary to resume negotiations with him, which might have led to his recognition and to the resignation of Otto or even to the pope's rejection of the latter, since he already had misgivings about him. Yet Philip unexpectedly disappeared from the scene: he was murdered in 1208 by Otto of Wittelsbach, who had a private grievance against him. Otto IV was then crowned emperor by Innocent III.

In a surprisingly short time Otto managed to alienate the pope by his blatant pursuit of plans and actions hostile to papal sovereignty in the Papal States and aiming at the reunion of the empire and Sicily. Innocent excommunicated him after he had embarked, in a flagrant breach of his promises, on the conquest of the Sicilian kingdom, and turned to the only other possible candidate for the German and imperial crowns, the young Frederick of Sicily. The pope had in fact no other choice; he also could hope that he would be able to prevail upon Frederick to keep Germany and Sicily permanently separate. A promise to that effect was no doubt a condition of his support in the German election of 1212, and in 1216 Frederick II, as king of Germany, solemnly promised to transfer full rule over Sicily to his infant son Henry. Meanwhile, Frederick, with the help of King Philip II Augustus of France, had triumphed over Otto IV and over Otto's uncle and ally, King John of England, at the battle of Bouvines (1214). Innocent, who previ-

ously had tried to end the war between France and England and had temporarily succeeded in doing so, had at this crucial moment been unable to prevent the fusion of the German throne contest with the French-English (Capetian-Angevin) dynastic conflict. (*See* also FREDERICK II [Holy Roman emperor]; OTTO IV; PHILIP [German king].)

His relationship to both western kings was very complex also in other respects. Philip Augustus, who had at all times opposed Otto IV, the relative of his Angevin enemies, had only after a resistance of 12 years obeyed the pope's demand for reinstatement of his rightful queen, whom he had repudiated. John of England had been excommunicated by Innocent because of his refusal to recognize as archbishop of Canterbury Cardinal Stephen Langton, who had been elected by the monks of the cathedral in accordance with the pope's wishes. Not until the last moment had John submitted to the pope and, in order to forestall French invasion of England, declared England a fief of the Holy See (1213). While Innocent did in fact protect John from this latest French design, he could neither deprive his own protégé, Frederick II, of Philip Augustus' military help nor could he expect John to abandon his ally and nephew, Otto. However, when John was forced to sign Magna Carta and then complained to the pope as to his feudal overlord, Innocent annulled the charter as having been extorted without his consent. Innocent did not and could not see in Magna Carta what later ages were to see in it, an assertion of law against tyranny; he considered it, not altogether without justification, as an attempt at feudal insurrection against royal authority, which he as King John's feudal overlord could not ignore.

Of the two so-called crusades which took place during the pontificate of Innocent III, one—the fourth crusade of 1202–04—was diverted to Constantinople, chiefly to suit Venetian interests and against the will of the pope. Innocent nevertheless accepted the *fait accompli* because he mistakenly believed that the establishment of the Latin empire and patriarchate of Constantinople would bring about a lasting reunion between the Eastern and Western churches (*see* CRUSADES). The other crusade was launched against the Albigensian heretics, with Innocent's approval. The pope's decision opened an unhappy chapter in the history of the church by placing under supreme ecclesiastical leadership the repression of heresy by force. It is true that the Albigensian crusade achieved what two generations of missionaries had been unable to do: it led to the extirpation of heresy in southern France (*see* CATHARI). But the price was much bloodshed, devastation and injustice, which the pope, who never demanded the death sentence against heretics, did his best to reduce to smaller proportions, though without much success.

Innocent recognized that the successes of the Albigensian heretics had been due in part to the fact that not a few of them tried to live in evangelic and apostolic poverty. This spirit Innocent, who in his personal life was frugal, encouraged wherever he found it among the Catholic clergy and laity. In granting lay and clerical communities—such as those of the northern Italian Humiliati, the Catholic Poor of Durandus of Huesca, the Dominicans, and above all the first community of St. Francis of Assisi—permission to preach and teach, Innocent went far beyond what the popes of the 12th century had thought possible and inaugurated the Mendicant orders.

In awareness of the importance of Innocent's legislation in all fields of the church's life, the canonists began to collect and publish his decretals during his pontificate; one of these collections, the so-called *Compilatio Tertia* by Petrus Collivaccinus, received the pope's official approval. A great number of Innocent III's decretals were later to enter the second part of the *Corpus Juris Canonici*, Gregory IX's *Liber Decretalium*, or *Liber Extra* (*see* CANON LAW). The far-reaching centralization of church government is reflected by Innocent's legislation in general and also by his unlimited claim to fill all vacancies of ecclesiastical offices. The great majority of these provisions, however, were used by Innocent III to support the numerous poor clerics who had been ordained by the bishops but were not adequately or not at all supported by them, the rather unhappy stratum of *clerici vagantes* well known from the history of literature. Innocent was not successful in his attempt to induce the prelates assembled at the fourth Lateran council to secure once and for all the support of the Roman Curia by the reservation of a part of their revenues; the plan, if successful, might have prevented the piecemeal fiscalism of his successors which was to do so much harm to the papacy's reputation.

In the midst of vast preparations for a new crusade which he hoped would liberate the holy land, Innocent III died suddenly, in Perugia, on July 16, 1216, from one of his frequent attacks of fever, almost certainly malaria. It is hardly possible to refrain from surmising that, had he lived longer, the fifth crusade would have had a less unfortunate end (*see* CRUSADES); also that the all-out struggle between Frederick II and the papacy might have been prevented. No other pope of the 13th century possessed the exceptional blend of strength and profound humaneness that the contemporary sources show Innocent III to have had. For portrait *see* article PAPACY.

INNOCENT III (Lando of Sezza), antipope from 1179 to 1180. The election of this schismatic cardinal on Sept. 29, 1179, constituted a purely local last flare-up of the opposition against Pope Alexander III (*q.v.*). After his protector, a member of the family of the counts of Palombara, had given him up, in Jan. 1180, he was relegated to the south Italian monastery of La Cava.

INNOCENT IV (Sinibaldo Fieschi) (*c.* 1190–1254), pope from 1243 to 1254, was born in Genoa. His family, the house of the counts of Lavagna, played a great role both in Parma and in Genoa, and not a few of them had been imperial rather than papal partisans. Sinibald studied canon law at Bologna and was himself one of the most notable canonists of the age. He came to the Roman Curia under Honorius III in 1226, and by Gregory IX was made vice-chancellor of the Roman church and cardinal priest of St. Lawrence in Lucina (1227) and rector of the march of Ancona (1235). After a vacancy which had lasted almost two years, largely because the emperor Frederick II held two cardinals as prisoners, Sinibald was elected pope, succeeding Celestine IV, on June 25, 1243. He chose the name Innocent, thus no doubt indicating his intention to follow the lead of the great Innocent III. If Frederick had hoped that he would find the new pope more amenable than Gregory IX, he was soon to be disenchanted. (For the origins of and reasons for the papacy's struggle with Frederick II *see* GREGORY: *Gregory IX.*) Even those members of the pope's family who belonged to the imperial party were to change sides. After a year of fruitless negotiations and unfulfilled agreements the pope decided to secure his full freedom of action by leaving Italy, which was under imperial control. He fled to Lyons, which, though still belonging to imperial Burgundy, was so close to the border of France that for all practical purposes Innocent was under the protection of the French king St. Louis IX, as was to become apparent later, when a French army was ready to check whatever moves against Lyons Frederick II intended. On June 28, 1245, Innocent opened the first general council of Lyons, the 13th general council of the church. In it he renewed Gregory IX's sentence of excommunication against the emperor and declared him deposed. The four principal reasons given were: perjury, disturbance of peace, sacrilege and suspicion of heresy. The first two points referred to all differences between Frederick and the popes, accumulated since Honorius III and especially since Gregory IX; the third to Frederick's capture of cardinals and other prelates; the fourth to contempt of ecclesiastical sanctions and favour shown to Muslims and Muslim customs. During the remainder of his pontificate Innocent carried on relentless war against Frederick. The struggle was conducted on both sides with all means at their disposal. Circumstantial and therefore inconclusive evidence would even seem to implicate the pope in the Italian plot to assassinate Frederick (1246); if Innocent really knew and approved, his attitude may have been influenced by medieval ideas on tyrant murder and the outlawry of the excommunicated and heretics; he did consider Frederick II both a tyrant and a heretic. In Germany Innocent succeeded in bringing about the election of two successive antikings, Henry Raspe of Thuringia and William of Holland; at least in south Germany they were unable to dislodge Frederick's son Conrad IV. The real decision in the great struggle between empire and papacy was to fall in Italy and Sicily, but neither Fred-

erick II nor Conrad IV nor Innocent IV himself lived long enough to witness it. Charles of Anjou, brother of Louis IX, who was finally to replace the Hohenstaufen in the south Italian-Sicilian kingdom, was chosen to rule there by Innocent, but he did not at that time accept; neither did Richard of Cornwall, the brother of Henry III of England, whereas Henry himself accepted for his son Edmund, who, however, was never to see Sicily. Only for a short while Innocent succeeded in obtaining the submission of Manfred, Frederick II's brilliant illegitimate son, the emperor's *de facto* heir in Sicily and the regent for the *de iure* heir, Conrad IV's infant son Conradin. While Innocent was taking possession of parts of the Sicilian kingdom, a new conflict with Manfred arose. At Naples the pope received the news that the latter had refused to follow his summons, had rebelled and beaten the papal army. Innocent, already ill, died soon thereafter, to be succeeded by Alexander IV; Manfred's star remained in the ascendancy until extinguished by Charles of Anjou 12 years later.

Innocent IV had inherited large debts from Gregory IX and needed great amounts of money for his own struggle with the emperor. He thus was driven further to increase papal fiscal exactions, contributing to the growth of anticlerical nationalism. In particular, Innocent's exploitation of the system of papal provisions to benefices aroused strong complaints. He also was the first pope who practised nepotism on a large scale, thus setting a fateful precedent.

Innocent IV granted the cardinals the red hat which is still the principal symbol of their office. In the great struggle between the Mendicants and the secular clerics at the University of Paris this pope favoured the latter; in the conflict between the Conventual and the Spiritual Franciscans he favoured the former. In 1254 he issued the bull *Ordinem veterem* through which the Franciscan friars were allowed the use of money not only in case of necessity but also in cases of manifest utility, while the pope assumed the ownership of all their possessions except where the donors had reserved it. Innocent IV (as Louis IX a little later) sent missions to the Mongols, hoping to convert them, to win their support against the Muslims, and thus to save what was left of the kingdom of Jerusalem. The Franciscan John of Pian Carpini visited the court of the great khan at Karakorum in 1246, but only received the standard order of the Mongol rulers, requiring all Christian leaders to do homage to the Mongol suzerain of the world.

Innocent IV died on Dec. 7, 1254. Among all popes he is perhaps the one who formulated the most extreme claims concerning papal authority in the political order, claims which did not in their full extent become a generally accepted part of the teaching of the Catholic Church. While in many ways Innocent continued the view on church-state relations held by his predecessors and by earlier theologians and canonists, he went beyond them at least in two important matters: negatively, when he declared that power outside the church is not truly ordained by God and therefore is merely a tyranny; positively, when he asserted that the papacy is the culmination not only of sacerdotal-pontifical, but also of royal-imperial government—in other words that, by virtue of his vicarship for Christ the king, the pope "naturally and potentially" is the monarch and leader of the political (temporal) as well as of the ecclesiastical (spiritual) order. Innocent IV pronounced such views both in his commentary to Gregory IX's so-called *Liber Extra* and in his letters, including, perhaps, the encyclical *Aeger cui levia* (the authenticity of which has been doubted, not without reason).

Blessed Innocent V (Peter of Tarentaise) (*c.* 1224–1276), pope during 1276, the first Dominican pope, was born around 1224 in the village of Tarentaise in Forez, belonging to the archdiocese of Lyons. He entered the Dominican order about 1240 and in 1255 began his studies at the University of Paris, where in 1259 he obtained the degree of master in theology. The most important among his writings is his commentary to the *Sentences* of Peter Lombard. He collaborated with St. Albert the Great, St. Thomas Aquinas and other Dominicans in drawing up a rule of studies for the order. He was provincial of the French province of the Dominicans at least from 1264 to 1267 and again from 1269 to 1272, when he was made archbishop of Lyons by Gregory X, who about a year later raised him to the dignity of cardinal bishop of Ostia. He was elected pope on Jan. 21, 1276. During his short pontificate Innocent V continued the efforts of his predecessor to bring about a crusade, to strengthen the union with the Greeks and to pacify Italy. It seems, however, that like the other French popes of the second half of the 13th century he was willing to make far-reaching concessions to Charles of Anjou. He died on June 22, 1276, and his feast is kept on the anniversary. (G. B. L.)

Innocent VI (Étienne Aubert) (d. 1362), pope from 1352 to 1362, was born at Monts in Limousin. He became professor of civil law at Toulouse and subsequently chief judge of the city. Having taken orders, he was raised in 1338 to the see of Noyon and translated in 1340 to Clermont. He was made cardinal priest of SS. Giovanni e Paolo in 1342 and cardinal bishop of Ostia and Velletri, grand penitentiary and administrator of the bishopric of Avignon ten years later. He was elected pope on Dec. 18, 1352.

As pope, Innocent revoked the reservations and commendations of his predecessor Clement VI and prohibited pluralities, urged upon the higher clergy the duty of residence in their sees, and diminished the luxury of the papal court. Largely through the influence of Petrarch, whom he called to Avignon, he released Cola di Rienzo, who had been sent a prisoner in Aug. 1352 from Prague to Avignon, and used the latter to assist Cardinal Albornoz, vicar-general of the States of the Church, in tranquilizing Italy and restoring the papal power at Rome.

Innocent established good relations with the German king Charles IV, whom he caused to be crowned emperor at Rome in 1355. The following year Charles published the famous Golden Bull (*q.v.*), which prescribed a method for the election of the German kings and passed over in silence the claims of the papacy to approve the election. Contrary to statements sometimes made, Innocent raised no objection to the bull. He had other matters in hand. In 1360 he arranged the treaty of Brétigny between France and England, a success which redounded on his head, for the peace released roving armies of mercenaries. One of these "free companies" occupied Pont-Saint-Esprit and threatened Avignon. In the end Innocent was constrained to buy them off. In the last years of his pontificate he was busied with preparations for a crusade and with negotiations for the reunion of Christendom. He died Sept. 12, 1362.

Innocent VII (Cosimo Gentile de' Migliorati) (1336–1406), pope from 1404 to 1406, was born at Sulmona. He was made papal vice-chamberlain and archbishop of Ravenna by Urban VI and cardinal priest of Sta. Croce in Gerusalemme, bishop of Bologna and papal legate to England by Boniface IX. He was unanimously chosen to succeed Boniface on Oct. 17, 1404. The election was opposed at Rome by a considerable party but peace was maintained by the aid of Ladislas of Naples, in return for which Innocent agreed not to come to terms with the antipope Benedict XIII, except on condition that he should recognize the claims of Ladislas to Naples. Innocent issued at the close of 1404 a summons for a general council to heal the schism, but the council never assembled, as the Romans rose in arms to secure an extension of their liberties and finally, maddened by the murder of some of their leaders by the pope's nephew Ludovico de' Migliorati, compelled Innocent to take refuge at Viterbo (Aug. 6, 1405). Later, recognizing the pope's innocence of the outrage, they made their submission to him in Jan. 1406. He returned to Rome in March, and, by a bull of Sept. 1, restored the city's decayed university. He died on Nov. 6, 1406.

Innocent VIII (Giovanni Battista Cibò) (1432–1492), pope from 1484 to 1492, successor of Sixtus IV, was born at Genoa, the son of Arano Cibò, who under Calixtus III had been a senator of Rome. Through the favour of Cardinal Calandrini, half-brother of Nicholas V, he obtained from Paul II the bishopric of Savona. Sixtus IV translated him to the see of Molfetta and created him cardinal priest of Sta. Balbina in 1473 and of Sta. Cecilia subsequently.

Innocent VIII was not a successful pope. His summons to a crusade against Islam went unheard, and he ended by making a treaty with the sultan Bayezid II (1489), agreeing, in return for an annual payment of 40,000 ducats and the gift of the Holy Lance,

to detain the sultan's fugitive brother Jem in confinement in the Vatican. Innocent's maneuvers in Italian politics were equally unscrupulous and unsuccessful. He deposed Ferdinand (Ferrante) king of Naples in 1489 for failure to pay arrears of tribute. But the papal arms were worsted, and Innocent had to abandon his project of incorporating Naples into the ecclesiastical state. He is remembered as the persecutor of Pico della Mirandola. The capture of Granada from the Moors (Jan. 2, 1492) gave a borrowed lustre to his pontificate. Innocent died on July 25–26, 1492. A man of lax private morals, he was a weak and unworthy pope. He left the papal camera empty and States of the Church in anarchy. (T. Cr.; C. H. Le.)

Innocent IX (Giovanni Antonio Facchinetti) (1519–1591), pope for two months during 1591, was born July 20, 1519. After taking part in the council of Trent, he became nuncio at Venice and was employed on important duties at Rome by Gregory XIII, who made him a cardinal in 1583. Under the invalid Gregory XIV he assumed almost the entire direction of affairs. He was a supporter of the Catholic League in France and of the policy of Philip II of Spain, and it was with the latter's support that he succeeded Gregory on Oct. 29, 1591. He died on Dec. 30 of the same year.

Innocent X (Gian Battista Pamphili) (1574–1655), pope from 1644 to 1655, was born in Rome on May 7, 1574. He was made auditor of the Rota by Clement VIII, nuncio at Naples by Gregory XV and legate apostolic to Spain and cardinal by Urban VIII. He was elected pope on Sept. 15, 1644, through the support of those cardinals who had opposed his predecessor Urban VIII's domestic administration and diplomatic policy, both of which he proceeded to reverse. The most emphatic and significant demonstration of this change is to be seen in Innocent's condemnation of the peace of Westphalia (1648), for which papal mediators had worked under Urban; and in the fact that practically no notice was taken of his protest by either side. In support of a pro-Habsburg policy, cardinals favoured by Spain were promoted and recognition of the independence of Portugal, then at war with Spain, was refused. In Rome, the Barberini (relatives of Urban and protégés of Cardinal Mazarin) were attacked and their property confiscated. Much of the initiative in these events was taken not by Innocent but by his sister-in-law, the notorious Olimpia Maidalchini, by whose advice he was almost completely dominated. While her diplomatic policy had the praiseworthy aim of keeping the papacy aloof from international entanglements, her greed for money led her to adopt devices which destroyed the very prestige upon which such a policy depended for its success.

In doctrine, Innocent intervened in the quarrel between the Jesuits and the Jansenists and, in the bull *Cum occasione* (1653), condemned five propositions concerning the nature of divine grace said to be in Cornelius Jansen's *Augustinus*. The quarrel thereupon entered a new phase, in which it was contended that papal infallibility did not extend to matters of fact and that the propositions were not in fact implicit in the *Augustinus*, so that the teaching of Jansen had not been condemned by the bull. On all scores, therefore, papal prestige had seriously declined by the time that Innocent died, on Jan. 7, 1655.

Blessed Innocent XI (Benedetto Odelscalchi) (1611–1689), pope from 1676 to 1689, was born on May 19, 1611, at Como, where he was educated by the Jesuits. He studied law in Rome and Naples, entered the Curia under Urban VIII and became successively protonotary, president of the apostolic chamber, governor of Macerata and commissary of Ancona. Innocent X made him a cardinal (1645), legate to Ferrara and, in 1650, bishop of Novara. He was elected pope on Sept. 21, 1676, against the opposition of Louis XIV of France. On grounds of moral character he was the outstanding pope of the 17th century, being entirely free from nepotism and invariably refusing to diverge for reasons of expediency from the policy that he considered right. He averted bankruptcy by abolishing sinecures and introducing economies. As a result he was able to finance the war against the Turks and, in particular, to subsidize John Sobieski (King John III of Poland) and the emperor in the campaign which led to the relief of Vienna in 1683.

Innocent XI had to face, in Louis XIV, a man with entirely opposite principles. Their quarrel began when two French bishops resisted an edict of 1673 which extended the *régale* (*i.e.*, the king's right to administer both the temporalities and the spiritualities of vacant sees). Innocent upheld their objection, refused the offer of a compromise and, when Louis replied by having a French synod issue the famous declaration of Gallican liberties (*see* Gallicanism) in 1682, refused to confirm the promotion of any of the clergy who had taken part in it.

The deadlock that resulted was made worse in 1687, when Innocent took action against the abuse of ambassadorial privileges by the French representative in Rome. Something approaching a schism threatened, and the deadlock was still unresolved when Innocent died. In addition, Innocent opposed Louis's candidate for the archbishopric and electorate of Cologne (1688) and would not help his plans for James II of England.

In doctrinal matters, Innocent had some sympathy with the Jansenists. On the occasion of an appeal to him by the Jesuit Thyrsus González, whose rigorist theories were being suppressed by his superiors, Innocent showed his disapproval of the lax probabilism taught by many Jesuit casuists (1680); and in 1687 he had González made general of the Jesuits. On the other hand, he was personally favourable to the Quietist Miguel de Molinos, most of whose propositions he condemned in 1687.

Any general appreciation of Innocent XI's pontificate must take into account the problems created by the ambitions of Louis XIV at a time when the church was passing through a period of doctrinal discord. Innocent's greatest contribution was perhaps his domestic reform, both moral and administrative. His integrity was unquestioned. He died on Aug. 12, 1689, and was beatified by Pius XII on Oct. 7, 1956. For portrait *see* article Papacy.

Innocent XII (Antonio Pignatelli) (1615–1700), pope from 1691 to 1700, was born in Neapolitan territory on March 13, 1615. He was educated at the Jesuit college in Rome, entered upon his official career at the age of 20, and became successively vice-legate of Urbino, governor of Viterbo and nuncio to Tuscany, to Poland and to Austria. He was made cardinal in 1681 by Innocent XI, whose pontificate he took as a model for his own, which began on July 12, 1691. Nepotism was officially condemned in a bull of 1692 and justice was administered in the papal states without regard for the status of the persons involved. The deadlock with France was broken in 1693 when both the French bishops of the synod of 1682 and Louis himself wrote letters disavowing the declaration of Gallican liberties of 1682, and Innocent agreed to the extension of the *régale* enacted in 1673 (*see* above, *Innocent XI*). Typically, Louis first assured himself that his repudiation was invalid, since a letter could not annul an edict registered by the *parlement*. In doctrinal matters, Innocent allowed the uneasy peace between Jansenists and Jesuits to continue; condemned the archbishop Fénelon's *Maximes des saints* at Louis XIV's instigation in 1699; but refused to condemn Celestino Sfondrati's book on predestination, which J. B. Bossuet had denounced as Quietistic in 1697 but which was still "under consideration" when Innocent died, on Sept. 27, 1700.

Innocent XIII (Michelangiolo Conti) (1655–1724), pope from 1721 to 1724, the son of the duke of Poli, and a member of a family that had produced several popes, among them Innocent III, was born at Poli on May 13, 1655. He served as nuncio in Switzerland and Portugal and was made cardinal and bishop of Osimo and Viterbo by Clement XI. He was elected pope, after a long conclave, on May 8, 1721, as a result of the exclusion by the emperor of the candidature of Cardinal Fabrizio Paolucci. One of his first acts was to invest the emperor Charles VI with Naples (1722); he protested in vain against the imperial investiture of Don Carlos with Parma and Piacenza. He recognized the Stewart pretender "James III" and promised him subsidies conditional upon the re-establishment of Roman Catholicism in England. Moved by deep-seated distrust of the Jesuits and by their continued practice of "accommodation" (whereby missionaries might modify Christian usage to attract converts) despite Clement XI's express prohibition, Innocent forbade their society to receive new members in China and was said to have meditated its suppression. This encouraged the French Jansenist bishops to press for the revoca-

tion of the bull *Unigenitus;* but the pope commanded its unreserved acceptance. Innocent died on March 7, 1724.

(I. F. B.)

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INNOCENTS' DAY (CHILDERMAS, or FEAST OF THE HOLY INNOCENTS), a festival celebrated in the Latin Church on Dec. 28 and in the Greek Church on Dec. 29 (O.S.) in memory of the massacre of the children by Herod in his attempt to destroy the infant Jesus (Matt. ii, 16–18). The church early regarded these little ones as the first martyrs. It is uncertain when the day was first kept as a saint's day. At first it seems to have been absorbed into the celebration of the Epiphany, but by the 5th century it was kept as a separate festival. In Rome it was a day of fasting and mourning.

The boy bishop (*q.v.*), whose tenure of office lasted till Childermas, had his last exercise of authority then, the day being one of the series of days which were known as the Feast of Fools (*q.v.*). Parents temporarily abdicated authority, and in convents and monasteries the youngest nun and monk were for the 24 hours allowed to masquerade as abbess and abbot. These mockeries of religion were condemned by the Council of Basel (1431). In medieval England the children were reminded of the mournfulness of the day by being whipped in bed on Innocents' morning; this custom survived to the 17th century. The day is still observed as a feast day and day of merrymaking for children in Roman Catholic countries, and particularly as an occasion for practical joking.

IN NOMINE, an English instrumental form of the 16th and 17th centuries which used the plainsong of the antiphon *Gloria tibi trinitas* (Vespers of Trinity Sunday) as a *cantus firmus* (*q.v.*) or basic melody. The *In nomine* owes its name to an instrumental arrangement of the section *in nomine Domini* of the Benedictus of the Mass *Gloria tibi trinitas* by John Taverner (*c.* 1495–1548?) which, in the mid-16th century, began to serve as a model for numerous new compositions. Although the instrumental styles changed, the title and *cantus firmus* remained the same through the Elizabethan and Jacobean periods and continued in use until the time of Henry Purcell.

(B. Tr.)

INNS AND INNKEEPERS: *see* HOTELS AND RESTAURANTS, LAWS CONCERNING.

INNSBRUCK, the capital of the Austrian province of Tirol, lies at a height of 1,880 ft. in a wide valley of the Inn river. It is built on and around the triangle formed by the mouth of the Inn's right-bank tributary, the Sill, which comes from the Brennersee. Its population ([1961] 100,695) is German-speaking and mostly Roman Catholic.

Surrounded by lofty mountains, it occupies a strategically and commercially important site at the junction of the road and railway from Germany to Italy over the Brenner pass with the thoroughfare from western Europe (Switzerland) to eastern Europe, via Vienna, over the Arlberg pass. The bridge (*bruck*) over the Inn which originally served this traffic gave the town its name and its coat of arms. The streets of this picturesque old town are narrow and there are many houses with bay windows and frescoes, some of which date from the 14th century. The main street of the old town, the Herzog-Friedrich-Strasse, is lined with 15th-century arcades; one of its most famous buildings is the old Fürstenburg adorned by the Goldenes Dachl, a balcony with a "Golden Roof," claimed to have been built by the duke Frederick "of the empty pocket" (d. 1439), which was refashioned by the emperor Maximilian I in about 1500. The emperor (d. 1519) is buried at Wiener Neustadt, but his monumental tomb is in the Franciscan or Court church (Hofkirche) which was built (1553–63) for that purpose. The church also contains the tombs of the Tirolean hero Andreas Hofer (*q.v.*) and of other heroes of the war of liberation of 1809.

The university was founded by the emperor Leopold I in 1672 and has four faculties—divinity, law, medicine and philosophy. Its great library dates from 1745, a gift of the empress Maria Theresa. Innsbruck has four museums: the Ferdinandeum, with prehistoric, industrial art and natural history collections and a picture gallery; the museum of Tirolean folk art; the Regimental museum of the Imperial rifles, on the Berg Isel, with exhibits of historical military interest; and in the castle of Ambras, where are parts of the collections of Archduke Ferdinand II of Tirol. Innsbruck is one of the most popular tourist and health centres in central Europe. It is easily accessible by road, rail and plane (alpine airport).

Originally a small market centre belonging to the Bavarian counts of Andechs, it developed into a prosperous town because of its strategic position. It was surrounded by walls and was given a mint, and in 1239 it received its own rights and privileges. The duke Frederick, who is supposed to have built the original "Golden Roof" onto the front of his residence in about 1420, made Innsbruck the new capital of Tirol in place of Merano. In 1460 his son, the duke Sigmund, transferred his residence to Innsbruck.

From 1363 to 1918 Innsbruck and the Tirol belonged to the house of Habsburg. The town became a battlefield in the war of liberation when four battles were fought on Berg Isel under the leadership of Hofer after Napoleon had given Innsbruck to the kingdom of Bavaria in 1806. With the rest of Austria it was annexed to Germany in 1938 and was damaged in air raids during World War II; in 1945 it was first occupied by U.S. troops and became later the headquarters of the French zone of occupation.

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INNS OF COURT AND CHANCERY. The four inns of court seated in London—Lincoln's inn, Gray's inn, the Inner Temple and the Middle Temple—have frequently been referred to as "colleges in a university of law," and in their general structure, system of government and functions this analogy holds good. In Coke's *Reports* they are described as "the most famous Universitie for profession of law only," and they are referred to by Fortescue, Coke and Selden as universities for the study of the law on the same footing as the universities of Oxford and Cambridge. Just as the universities are responsible for the preparation of students for a degree and for their discipline, so the inns of court are responsible for the education and discipline of their students; and their respective governing bodies, the benches, exercise the exclusive right of admitting persons to practise by a formal call to the bar.

They are voluntary societies, unchartered, unincorporated and unendowed. Hence their early history is very obscure and the date of their respective foundations cannot be precisely determined, for they did not own land but only leased it, and records of such transactions are much more difficult to trace than dealings with a fee simple. Since the inns were not endowed by any benefactor, there was no foundation charter, and no statutes, to be preciously preserved.

Since the inns were primarily concerned in the middle ages with legal education, attempts have been made to connect them with the early educational establishments of London. No doubt the city was well furnished with schools where the rudiments of Latin, grammar, logic, etc., were taught, possibly with those odd tags of law which often appeared as illustrative material in the course of rhetoric. But this is not sufficient to account for the rise of the inns of court, which were devoted to the technical study of English, not Roman, law and which seem to have been concerned from the first with students well beyond the schoolboy stage.

There is nothing to suggest that while the common law was still young, its administrators had any systematic education in English law; it was learned in the course of service, the first rudiments possibly as private clerk to some official. These conditions persisted well into the 13th century. By about 1256 Henry de Bracton's massive book on the laws and customs of England and the bulk of the plea rolls both show that the common law was extensive and intricate, conducted by numerous skilled men in courts which had considerable establishments.

This law had little in common with Roman and canon law; whence it followed that there was no question of the universities teaching English law. Moreover, there arose a class of men, literate but lay, who took an interest in law. They dominated, and created, the legal profession, and faced and solved the problem of English legal education. The inns of court were the answer they supplied.

This emergence of the literate layman is clear from the appearance (contemporary with Bracton's last years) of treatises on English law in French instead of Latin. From them and other sources it seems clear that already English law was being taught. Many were studying—the surviving manuscripts of these manuals are numerous—and the teachers were able enough to write quite good little books.

The students listened to arguments in court, and discussed law among themselves. That does not mean that there was any permanent inn; the students may well have made their own private arrangements both for teaching and lodging.

The general educational history of the city of London does not seem to show any genuine relevance to all this. It is usual to mention the writ of 1234 whereby Henry III ordered that "no regent of law schools in the said city shall teach laws (*leges*) there henceforth." This language suggests teaching of academic standards, and *leges* without further qualification must mean Roman law. F. W. Maitland's suggestion that the schools in question were perhaps the schools of St. Paul's cathedral is attractive, were it not for the fact that one would not expect the civic authorities to exercise jurisdiction over them.

Whatever its meaning, the writ of 1234 cannot be taken as having anything to do with the teaching of English law, whether at inns of court or elsewhere.

By about 1260 laymen were taking up law studies, and didactic manuals were written in the vernacular French for them; law students attended arguments in court and discussed points of law among themselves, from which it is a fair inference that the students not only met in court but almost certainly congregated out of court.

It could be assumed that the students were well-to-do—in 1305 the chief justice suspected that a knotty case before him had been manufactured by some apprentice who bought the land in order to see how it would fare in court. Finally, by about 1300, lawyers of various sorts were numerous and needed regulation. The city made orders for practitioners before the London courts in 1280, and in 1292 the king commanded his judges to select from different counties 140 apprentices and attorneys and to allow no other to meddle with legal business.

Bearing all this in mind, it is a natural inference that law students should have acted like university students elsewhere, hiring hostels or inns where they could live together. It might even be an established practitioner who leased a house, taking in students and guiding their studies. This system was common in English and foreign universities among such men as could afford to live on such a scale. To assist the poor university student, benefactors often founded colleges (or conferred endowments upon some existing inn or hall) to enable poor scholars to stay. This did not happen in London; law students had the means (sometimes borrowed) to keep themselves at an inn without the aid of collegiate endowments. It is not surprising that the inns were at first liable to move as leases expired or more suitable premises were found, and in time leases would be given (or renewed) for long terms; in the Tudor period the growth of the trust enabled the inns to acquire the ownership of their quarters.

Aspirants to practice in the superior courts were only a small proportion of all those needing a legal education. There was a keen demand for stewards and legal advisers to landowners everywhere, conducting general business and keeping manorial courts. These men needed the rudiments, but not the refinements, of the common law, and they too came from the class of literate laymen. There was likewise the large class of attorneys, and a growing class of bookkeepers and correspondence clerks. Some part of their knowledge could be got from *dictatores*, professional teachers of letter writing; more still by joining an inn of chancery.

Chancery clerks (being then clergy in at least minor orders) had long lived as part of the household of the chancellor, but in the 14th century they had become too numerous, and the household broke up as groups of clerks either combined to take inns or married. Many seem to have taken in students for training and, since the penning of writs and other legal documents was a prominent part of their work, a good grounding in law could be obtained in an inn of chancery. By the end of the 14th century these inns were in danger of being submerged by a flood of attorneys-to-be and of students who used a stage at an inn of chancery as a preparation for entering an inn of court. Eventually each inn of court secured control of one or more inns of chancery and supervised its affairs, appointed readers to teach in it and later often bought its premises, thus becoming its landlord.

By the beginning of the 15th century the four inns of court were established bodies with tradition behind them. They were governed by their benchers, who had previously given at least two courses of lectures (readings), and who presided over mock arguments (moots) in which students argued before them difficult

points of law. The standard was high and the teaching thorough. A number of manuscript reports of readings and moots survive.

Since the law was highly technical, proficiency could only be acquired by following the severe studies of the inns, so that in practice the inns had a *de facto* monopoly. This soon became recognized, and when benchers called certain students to the bar of their inn, those students were regarded as qualified apprentices or barristers. The inns steadily remained organizations of students. When the crown conferred the degree of serjeant-at-law upon a few outstanding barristers, they at last ceased to be apprentices and withdrew from their inn to the Serjeants' inn. The judges were always serjeants and so remained in Serjeants' inn. In spite of the severity of their studies, there were in the 15th and 16th centuries many students of the inns who had no legal ambitions but joined them for the purpose of general education (which was by no means neglected there). Since the universities were still strongly ecclesiastical, the inns were much frequented by the sons of wealthy families who had no intention of becoming lawyers.

By the end of the 16th century the inns of court began to exclude attorneys and solicitors and refused to call them to the bar, with the result that attorneys especially fell back upon the inns of chancery, and were finally in a profession distinct from that of the barristers.

The golden age of the inns of court may well have been from the middle of the 15th century (as Sir John Fortescue described it) to the early years of the 16th century. The inns (by the end of that period) had acquired the freehold of their sites and began the building of splendid halls which continued through the reign of Elizabeth I. Their material prosperity was also shown by their magnificent feasts and the entertainment offered to the sovereigns. If a man left an inn to become a serjeant, feasting on the scale of a coronation was expected. The system of legal education was at its best and most vigorous during that period.

Various causes brought about its decline. The great activity of the printing press led students to suppose that they could learn more quickly and more easily from printed books, and so they neglected attendance at readings and moots. Indeed, students performed moots by deputy. If students were reluctant, so were the readers, who were unpaid and lost much time from their practices in preparing and delivering readings, and latterly had to provide very costly feasts; many paid heavy fines to escape the office. The judges, who had assumed vague powers of giving directions to the inns, often tried to compel observance of the old system, but it was clearly on the decline. It broke down completely during the Civil War, and the desperate efforts at the Restoration to revive it were abandoned. Readings ceased in 1677. Only the fees survived, and having paid them, the student was deemed to have fulfilled all his duties.

During the 18th century the cessation of the old system left a void which was slowly filled by new arrangements. There had been no readers to recommend students for call to the bar since 1677, so the four inns finally agreed (in 1762) to call students who had kept a stated number of terms; later it was settled that eating three dinners was equivalent to keeping the whole term. The benchers kept their position as the sole governing body of each inn and stoutly resisted the claim that king's counsel should become benchers as of right. It was also settled that the head of the inn was the bencher holding the office of treasurer, which passed by rotation in order of seniority. Since the Judicature acts of 1873, 1874 and 1875 the grade of serjeant-at-law has been extinct, with the result that judges, no longer being serjeants, can remain members of their inns and in fact are benchers.

The inns of chancery were not fitted to become the professional organ of so large a body as the attorneys and solicitors, if only because these practitioners were not congregated in London. They therefore created their own society, and the inns of chancery one by one were sold.

The common law commissioners of 1854 investigated the inns of court, and, thus stimulated, the inns took steps to resume their educational functions. Readerships were established and eminent lawyers engaged in teaching with a view to examinations conducted by the Council of Legal Education, representing all four inns.

Lincoln's Inn.—The legends connecting this inn with Henry de Lacy, earl of Lincoln (d. 1311), and with John Thavie the armourer (d. 1348) have no historical foundation and rest on misunderstandings. It is certain that Lincoln's inn was lessee of the bishops of Chichester on land west of Chancery lane by 1422. It was also shown by G. J. Turner and E. Williams that it once occupied land on the east side of the same lane which had been accumulated between 1331 and 1348 by Thomas de Lincoln, king's serjeant. It is presumably there that Lincoln's inn first came into existence, being known, as often, by the name of the landlord whose "inn" the lawyers rented.

By 1369 Thomas de Lincoln had conveyed the whole of the freehold to the abbey of Malmesbury. It does not follow that the lawyers were already in possession by 1369, for the house may still have been called by Lincoln's name even after he had disposed of it. But it is quite certain that in 1399 the abbey was receiving rent for "the new inn at London called Lincoln's inn." The bishops of Chichester ceased to reside at their house on the other side of Chancery lane in 1412, and evidently the inn moved across the street between 1412 and 1422 to the present site.

The earliest records of Lincoln's inn, the *Black Books*, commence in 1422. The control of the society was vested in the council, which consisted of the masters of the bench. Next in rank came the utter-barristers, those who had been called to the bar, and the inner-barristers or students, so called because at the moots held in the hall of the inn the former sat on the outermost part of the form which represented the bar of the court and the latter sat inside and between them. Formerly attorneys and solicitors also might be members of the inn. It is interesting to note that Sir Thomas More's grandfather was chief butler prior to his call in 1470. The chief butler at this period acted rather as clerk to the council than as butler in the modern sense. He was clearly an educated man. The bishop of Chichester's palace and the chapels of Our Lady and of St. Richard sufficed for the needs of the society for nearly a century. The Bishop's hall was pulled down in 1491 and the present Old hall erected in its place in 1506. When this proved insufficient for the growing membership the present New hall was built in 1843. The present chapel, constructed by Inigo Jones, was completed in 1623. Thavie's inn (which had no connection with the armourer) has existed since 1376 as an inn of chancery, and its site was acquired by Lincoln's inn in 1550. It was sold by the benchers in 1769 and thus erased as a legal institution. The other inn of chancery attached to Lincoln's inn, Furnival's inn, dates from about 1406. Its ancient hall, in Holborn, still exists.

Gray's Inn.—The site of Gray's inn formed part of the manor of Portpoole, which passed in 1294 to the dean and chapter of St. Paul's, who let it to Reginald de Grey, chief justice of Chester and first Lord Grey of Wilton. There is little doubt that the judge lived there with his clerks and other officers of his court and law students. The Greys had for a century been connected as officials with both the court of exchequer and the chancery. Gray's inn continued in the de Grey family till the conveyance of the manor of Portpoole in 1503 to the prior and convent of the charterhouse at Sheen, from whom the benchers held the inn until the dissolution of the monasteries in 1539 when the rent became due to the crown. In 1733 the benchers acquired the freehold. The existing records of the inn only commence with the year 1569, but Chief Justice Sir Thomas Billing told William Paston in 1454 that he had been a fellow in Gray's inn; that would imply that the inn was in existence about 30 years earlier. The constitution and officers of the inn are similar to those of the other inns. When the records open, governors had ceased to be elected. The control of the inn was vested in the masters of the bench. The office of pensioner was abolished in 1630, but the name survives in the *Pension Book of Gray's Inn* and in the old and new pension chambers, where the masters of the bench meet for the discussion and transaction of the business of the society and for relaxation. Of the servants of the inn the chief were in 1570 the steward, the master butler, the priest and the master cook. Whether anything of the old hall of the de Greys remains cannot be determined. It was rebuilt or re-edified under the supervision of Nicholas Bacon and Gilbert

Gerard in 1556. It was a particularly fine specimen of Tudor architecture and may be compared with the Middle Temple hall, which it much resembled, although on a smaller scale. In 1941 the hall and much else perished in an air raid, but the screen and heraldic glass had been removed to safety. The oak screen is said to have been presented by Elizabeth I. The chapel was reconstructed or re-edified in 1615 and finally restored in 1893. The library is first mentioned in 1555.

The inns of chancery affiliated to Gray's inn were Staple inn and Barnard's inn. The former was an inn of chancery in the reign of Henry V and later became the property of the Actuaries society. Barnard's inn, named after Lionel Barnard who leased it from the dean of Lincoln, became an inn of chancery at least before 1451. The inn was later the property of the Mercer's company.

The Inner and Middle Temples.—As far as the history of the Inner and Outer Temples can be traced, they have always been separate societies. Writing about 1387, Geoffrey Chaucer describes the "Manciple of a Temple" who had 30 lawyers as his masters, which suggests something like an inn, perhaps more than one, as already existing. The Temple had been the seat in England of the Knights Templars, on whose suppression in 1312 it passed after an interval of some years to the Knights Hospitallers of St. John of Jerusalem. The first mention of the Middle Temple as a distinct society occurs in a will dated 1404, and of the Temple as an inn of court in the *Paston Letters,* where, under date Nov. 1440, the Inner Temple is spoken of as a college, as is also subsequently the Middle Temple. The two societies continued as tenants to the Knights Hospitallers of St. John until the dissolution of the order in 1539; they then became the lessees of the crown and so remained until 1609, when James I made a grant by letters patent of the premises in perpetuity to the benchers of the respective societies on a yearly payment by each of £10, a payment bought up in the reign of Charles II. In this grant the two inns are described as "the Inner and the Middle Temple or New Temple." Excepting the church and the priests' hall at the west end of the hall, nothing remained in modern times of the edifices belonging to the Knights Templars, the present buildings having been almost wholly erected since the reign of Queen Elizabeth I or since the Great Fire (1666), in which the major part of the Inner Temple perished. The Temple suffered heavy destruction by air raids during World War II. The church has been in the joint occupation of the Inner and Middle Temple from time immemorial—the former taking the southern and the latter the northern half. The round portion of the church was consecrated in 1185, the nave or choir in 1240. The largest and most complete of the four remaining round churches in England, it is built on the plan of the church of the Holy Sepulchre at Jerusalem. Narrowly escaping the ravages of the fire of 1666, this beautiful building is a perfect specimen of early Gothic architecture in England. The constitution of both societies is similar to those of the other inns, but the meetings of the benchers are in both styled a "parliament," which is further evidence of their antiquity.

The Inner Temple comprehends a hall, parliament chamber, library and other buildings often rebuilt and extended, the present buildings being completed in 1870. The library owes its existence to William Petyt, keeper of the Tower records in the time of Queen Anne, who was also a benefactor to the library of the Middle Temple. Belonging to the Inner Temple, Clifford's inn was the most important of the inns of chancery and numbered among its members Sir Edward Coke and John Selden. Clement's inn was an inn of chancery before the reign of Edward IV, taking its name from the parish church of St. Clement Danes; it was the inn of William Shakespeare's Master Shallow, and the Shepherd's inn of William Makepeace Thackeray's *Pendennis.*

The Middle Temple possesses in its hall one of the most stately of existing Elizabethan buildings. It was completed in 1572, the richly carved screen at the east end in the style of the Renaissance being erected in 1575. The hall, which was preserved unaltered and survived the air raids of World War II, has been the scene of numerous historic incidents, from the time of Queen Elizabeth I. The library, which contains about 70,000 volumes, dates from 1641. In civil, canon and international law, as also in divinity and ecclesiastical history, the library is rich; it contains also some curious works on witchcraft and demonology. There was only one inn of chancery connected with the Middle Temple, New inn, the buildings of which were razed. *See* also Doctors' Commons; Legal Profession: *England and Wales.*

The King's Inns, Dublin.—The legal school in Ireland, the King's inns, corresponds closely to the English inns of court and is in many respects in unison with them in its regulations with regard to the admission of students into the society and to the degree of barrister-at-law, as also in the scope of the examinations enforced. Formerly it was necessary to keep a number of terms at one of the inns in London—the stipulation dating as far back as 1542 (33 Henry VIII, c. 3). Down to 1866 the course of education pursued at the King's inns differed from the English inns of court in that candidates for admission to the legal profession as attorneys and solicitors carried on their studies with those studying for the higher grade of the bar in the same building under a professor specially appointed for this purpose—herein following the usage anciently prevailing in the inns of chancery in London. This arrangement was ended by the Attorneys and Solicitors act (Ireland) of 1866. The origin of the King's inns may be traced to the reign of Edward I. when a legal society designated Collett's inn was established outside the walls of the city; it was destroyed by an insurrectionary band. In the reign of Edward III, Sir Robert Preston, chief baron of the exchequer, gave up his residence in the city to the legal body, which then took the name of Preston's inn. In 1542 the land and buildings known as Preston's inn were restored to the family of the original donor, and in the same year Henry VIII granted the monastery of Friars Preachers for the use of the professors of the law in Ireland. Thenceforward the legal body was known as the King's inns.

In discipline and professional etiquette the members of the bar in Ireland differ little from their English brethren. The same style of costume is enforced, and the same gradations of rank are observed. The King's inns does not provide chambers for business purposes; there is consequently no aggregation of counsel in certain localities, as is the case in London around the inns of court.

Scotland.—The corporation known as the Faculty of Advocates in Edinburgh corresponds with the inns of court in London and the King's inns in Dublin and, like them, regulates the admission of barristers. *See* Advocates, Faculty of.

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INONU, ISMET (1884–), Turkish army officer and statesman, a close colleague of Mustafa Kemal in the critical years of the Turkish republic and subsequently three times president of it, was born at Izmir (Smyrna) on Sept. 24, 1884, the son of Rashid, an eminent lawyer. Educated at the Artillery school and at the General Staff college in Istanbul, he served on the general staff of the 3rd army at Edirne. During the First Balkan

War he became major and chief of staff of the Yemen army. Promoted lieutenant colonel in World War I, he commanded the IV army corps in Syria in 1916. At the time of the Turkish surrender (Oct. 1918) he was in Istanbul, but later he joined Mustafa Kemal's National Liberation movement in central Anatolia.

When the grand national assembly was elected in Jan. 1920, Ismet became deputy for Edirne, but later he sat for Malatya. After the Greek occupation of western Anatolia (*see* GRECO-TURKISH WAR), he was appointed chief of the general staff in June 1920. Thus began a close co-operation between the cautious and stubborn Ismet and the shrewd and long-sighted Mustafa Kemal. When the Greeks advanced deep into Anatolia in July 1921, Ismet, by then a pasha, succeeded in turning the tide at the battle of Inonu, near Ankara. This was followed by the defeat of the Greeks on the Sakarya river and their expulsion from Anatolia.

Appointed foreign minister in Oct. 1922, Ismet represented Turkey at the Lausanne conference, where he strongly opposed Lord Curzon, the British foreign minister. Supported by Mustafa Kemal, he gained most of the Turkish demands in the treaty of Lausanne (July 24, 1923), though the question of the Straits was settled only by the Montreux convention in 1936. When Mustafa Kemal became president of the republic (Oct. 1923), Ismet became prime minister. He resigned on Nov. 21, 1924, but returned on March 4, 1925, and remained in power until Sept. 23, 1937. It was in 1934 that he took the surname of Inonu (commemorating his victory in 1921), while Mustafa Kemal took that of Ataturk.

When Ataturk died on Nov. 10, 1938, Inonu was elected president the following day; and he was re-elected in 1943 and 1946. All his abilities were needed during World War II to keep Turkey neutral and to maintain treaty obligations to both sides. After World War II, however, he encouraged the creation of a parliamentary opposition, and the Democratic party defeated his Republican People's party on May 14, 1950. He ceased to be president on May 22, and led the opposition. As a result of the general election of Oct. 1961, Inonu became in November prime minister for the third time. (M. P. P.)

INOUE (INOUYE) **KAORU** (1835–1915), one of the five elder Japanese statesmen of the Meiji period, was born in 1835, a samurai of the Choshu fief. He was a close friend of Itō Hirobumi, who later became Japan's first prime minister. They grew up together, studied in Choshu and in 1862 went to Edo (Tokyo) intending to help drive the foreigners out of Japan. They soon found this objective quite impractical and, wishing to study the foreigners' awesome power, they secretly left Japan in 1863 and worked their way to England as common sailors. The following year, when news reached them of the crisis over the bombardment of foreign ships by their own clan at Shimonoseki, they hurried home to urge their clansmen and the Tokugawa to seek peace. They failed in this effort and Inoue was severely beaten by reactionary samurai. Like Itō, Inoue became an ardent member of the party seeking to overthrow the shogunate, for he believed that only under the personal government of the emperor could Japan be unified and modernized. With the overthrow of the Tokugawa in 1867, Inoue became a leading member of the government, and held important positions in the ministries of finance, industry and foreign affairs during the first decade the new government was in power. After Itō became prime minister in 1885, Inoue served in succession as foreign minister, minister of the interior and minister of finance.

He retired from active politics in the late years of the century and turned his attention to business. He was closely associated in business with Shibusawa Eiichi; he became one of the pillars of the financial world and had close connections with the Mitsui bank. During the Russo-Japanese War he was named special adviser to the minister of finance and at the request of the emperor attended all important state councils. He became a marquess in 1907. Despite his retirement from active politics in 1898, he continued to have an important influence on the state of affairs behind the scenes and was until his death one of those elder statesmen (genro) to whose advice the emperor had recourse in reaching decisions on the most difficult political questions. (T. C. SH.)

INOWROCLAW, a town of Poland in the Bydgoszcz *wojewodztwo* (province), is situated in the centre of Kujavia, and is a road and rail junction. Pop. (1960) 47,000. As the former capital of Kujavia, Inowroclaw had the character of an industrial and trade town as early as the 15th century (mills, distilleries, breweries). Discovery of rich salt deposits in the mid-19th century intensified its industrial importance. The salt deposits provide one-sixth of Poland's total supplies and have also facilitated the development of Inowroclaw as a health resort.

To the south of Inowroclaw lies a group of lakes (the Goplo and others) which, with the Notec river, constitute one of Poland's most attractive waterways. (K. M. WI.)

INQUEST, a body appointed by public authority to inquire into designated matters. In the modern period the term most frequently refers to an inquiry made by a coroner to determine the cause of death. Historically, the coroner's jury is closely related to the practices that eventually developed into the grand jury, the petit jury and the jury in condemnation proceedings. Originally persons appointed to the coroner's jury were expected to inform the crown's officers of local events with which the members were assumed to be familiar. Only later was the jury conceived as a body whose function is to make a finding on the basis of evidence submitted to it at a hearing.

See CORONER; JURY. (F. A. A.)

INQUISITION, the name of a papal judicial institution that combated heresy, alchemy, witchcraft, etc., and wielded considerable power in medieval and early modern times. The Inquisition furnishes a favourite argument to those who accuse the Roman Catholic Church of tyranny and cruelty. The name is derived from the Latin verb *inquiro*, "inquire into," which emphasizes the fact that the inquisitors did not wait on complaints but sought out heretics and other offenders. Investigating offenses rather than waiting for accusations had been practised by both church and state long before any means other than moral suasion were used to secure uniformity of belief. It was only when heresy became widespread and seemed to threaten the existing order that churchmen departed from the traditional position as stated by St. Bernard of Clairvaux: "Faith must be the result of conviction and should not be imposed by force [*Fides suadenda, non imponenda*]. Heretics are to be overcome by arguments, not by arms."

Before the 12th Century.—During Christianity's first three centuries the penalties against heretics were exclusively spiritual, usually excommunication. When, however, the emperors became Christian, Arian emperors persecuted the Catholics and Catholic emperors persecuted the Arians. After Theodosius I the Great made Christianity the established religion, late in the 4th century, heretics came to be looked upon as enemies of the state and laws were enacted against them. Penalties included confiscation of property, exile, loss of civil rights, etc.; only those whose doctrines or practices threatened society (*e.g.*, the Manichees and Donatists) were subject to the death penalty. The Fathers of the Church, as a rule, were opposed to state intervention. Optatus of Milevis, however, defended the death penalty for the fanatical Circumcellions (north African peasants, attacking Catholics in the Donatist cause). Augustine at first declared himself against the application of civil penalties but later came out in favour of moderate severity. Martin of Tours and Ambrose of Milan protested the execution of Priscillian (the first heretic to receive capital punishment) in 385. St. John Chrysostom appealed to Matt. xiii, 30, "Let both [the wheat and the weeds] grow together until the harvest," to justify his rejection of temporal punishment of heresy; still he was opposed to letting heretics spread their doctrines.

During the three centuries that preceded A.D. 1000, little is heard of the coercion of religious dissidents. About 1000, however, the doctrines of the Cathari, called in France Albigenses, began to spread in Europe (*see* CATHARI). In 1022 Robert II of France had 13 heretics burned at Orléans, and the emperor Henry III had some hanged at Goslar in 1051. Throughout the 11th and early 12th centuries dissenters were occasionally executed by the civil power, but the initiative in these cases seems to have come as a rule from the people, threatening to lynch the

dissidents, rather than from either the secular or the ecclesiastical authorities.

Origins of the Medieval Inquisition.—After about 1150 opinion in regard to the employment of force to secure ecclesiastical unity began to change. The numbers of the Cathari and, somewhat later, the Waldenses (*q.v.*) had increased to such an extent that the state as well as the church appeared to be threatened. That heresy had to be repressed by force was soon taken for granted. The revival of Roman law, in which the emperor appeared as the defender of orthodoxy, led to the same conclusion. The third Lateran council (1179) passed strict decrees against heretics. In the Synod of Verona (1184) Pope Lucius III, in agreement with the emperor Frederick I Barbarossa, decreed the excommunication of heretics and their protectors; heretics who, after proper ecclesiastical trial, refused to recant and do penance, as well as those who after repenting had relapsed, were to be handed over to the civil power for punishment. The emperor for his part declared heretics under the ban of the empire.

The ecclesiastical Inquisition was at first in the hands of the local bishops, who found it difficult to cope with heresies which naturally did not respect diocesan limits. Moreover, during the 11th and 12th centuries the centralization of the church had made considerable progress. The result was that Innocent III began to send legates to preside over the repression of heresy; about 1200 he sent two Cistercian monks against the Albigenses in southern France.

The fourth Lateran council (1215) decreed that rulers who failed to rid their territories of heresy were threatened with deposition and loss of their dominions, and this led them to decree the death penalty for heresy: Aragon in 1197, Lombardy in 1224, France in 1229, Rome in 1230, the Two Sicilies in 1231 and Germany in 1232. To prevent the Inquisition being used for political purposes, however, Gregory IX reserved the apprehension and trial of heretics to the church, and instituted the papal Inquisition. He did not abolish the right of the bishops to judge heretics in their own dioceses but urged them to support the papal inquisitors. In 1233 he wrote to the bishops and prelates of France:

> When we consider that you are distracted by the tumult of your different occupations and are scarcely able to breathe because of the distressful flood of cares which submerge you, we have decided that it is only right to give part of your burden to others and accordingly to send to the kingdom of France and neighboring provinces against the heretics some Dominican friars. We enjoin that you receive them kindly and treat them with honor by giving them such good advice, aid and support in this office and in other respects that they may be able to carry out the task entrusted to them.

When in the course of time it became clear that the Inquisition did infringe upon the rights of the bishops, the Council of Vienne in 1312 prescribed co-operation between papal and episcopal inquisitors.

Papal inquisitors in medieval times were often members of the Dominican order, though Franciscans and members of other religious orders as well as secular clergy were employed at times. As the Inquisition had no courts of its own, the convent of the order to which the inquisitor belonged was normally used as a court.

Early Inquisition.—The Inquisition was concerned with deliberate, stubborn and public denial of a doctrine of the church by baptized Christians. Jews, Muslims and heathen were subject to the Inquisition only indirectly, if they tried to lead Christians into heresy or unbelief. The medieval Inquisition was concerned with the heretics of the time—the Cathari, the Waldenses, certain Béguines and Beghards, the Apostolici—most of whom, because of their antisocial tenets, would be treated harshly even by many modern governments. Protectors of heretics were by that fact suspect of heresy, as were the excommunicated who made no effort to have the excommunication lifted. Devil worship, adultery, incest, etc., were eventually included in the purview of the Inquisition.

The power of the inquisitors was great, and the office was looked upon as a high dignity. Inquisitors could name deputies and had assistants (*socii*), notaries, police and counselors. Since they could excommunicate even princes, they usually had the support of the civil power. Before being chosen for their office the inquisitors had distinguished themselves for learning and upright life. In the course of time manuals for their guidance were composed, those of Bernard Guy and Nicholas Eymeric being the best known. In the judgment of their contemporaries, most of the inquisitors performed their duties in a spirit of mercy and understanding. Some canonized saints were numbered among them, notably St. Peter Martyr (of Verona), who has been called the saint of the Inquisition. Born of Catharist parents in 1205, Peter early turned to orthodoxy and in the course of time became a Dominican friar. He distinguished himself as a preacher in Lombardy, his faith and piety winning much influence, and about 1234 he was appointed inquisitor by Gregory IX for the Milanese territories; later his jurisdiction was extended to include most of northern Italy. Peter did not hesitate to punish heretics who would not recant, but his professed desire was to convert them. His rigour and his success in bringing about conversions won him many enemies, and on April 6, 1252, he was assassinated; Pope Innocent IV canonized him the following year.

Many inquisitors, however, won reputations for excessive cruelty. Konrad (*q.v.*) von Marburg, appointed inquisitor for Germany by Gregory IX in 1231, was assassinated in 1233 and has gone down in history as the type of the heartless heresy hunter. Konrad was apparently a member of the secular clergy and had been confessor to St. Elizabeth of Hungary, whom he treated with extreme severity. He was undoubtedly rigid (with himself as with others), but his assassination was due probably as much to German dislike for the institution of the Inquisition, which was soon suppressed in Germany, as to his cruelty.

Robert le Bougre, who escaped assassination but whose reputation rivals that of Konrad, was another early inquisitor whose name was remembered with hatred. In his youth Robert is said to have renounced Catholicism for love of a Catharist girl, and he lived for years as a member of the sect. After abjuring, he became a Dominican and in 1233 was appointed by Gregory IX one of the first papal inquisitors for France, being suspended the following year on the charge of lack of moderation. Reinstated as inquisitor in 1235, he did not change his methods, and his terrorism led to his dismissal and imprisonment in 1239.

Procedure.—When the inquisitor came to a place where heretics were known or suspected to reside, he assembled the clergy and people to listen to a solemn discourse. Those guilty of heresy were urged to present themselves to the inquisitor within a stated time, called a time of grace and lasting a fortnight or a month. On those who confessed their guilt lesser sentences were imposed. Those who knew of heretics were ordered under pain of excommunication to make them known to the inquisitor. At the expiration of the time of grace, those accused or suspected were hailed before the inquisitor. If they admitted their guilt and were ready to renounce their errors, they had to do so in a solemn gathering (*sermo generalis; see* below) in which they were sentenced. Those who pleaded not guilty were questioned by the inquisitor. If the interrogation led to no decision, witnesses were introduced, the testimony of two trustworthy men being considered sufficient to convict if the suspect could not refute the charges.

The obligation to report suspects was a kind of invitation to denounce personal enemies. The accused, moreover, found it hard to defend himself, since during most of the 13th century he was not informed of the identity of his accusers. The only safeguards lay in the fact that false witnesses were punished and that the counselors of the inquisitor had to testify to the trustworthiness of those whose testimony was accepted. It was not until the time of Boniface VIII (1294–1303) that the names of accusers were revealed to the accused. Witnesses for the defense rarely appeared, since this of course might lead to their coming under suspicion. The lawyer of the accused, when he had one, was little more than a counselor, charged more with getting a confession than with defense.

The use of torture, which had been a customary judicial procedure among the Greeks and Romans, was at first rejected by the northern peoples; ordeals and oaths took its place. But when the

church outlawed ordeals and Roman law was revived, torture also was revived. In 1252 Innocent IV, by the bull *Ad extirpanda*, authorized its use by the inquisition to obtain confessions and the names of other heretics. Later Clement V decreed that it could not be used by papal inquisitors without the consent of the local bishop. According to canon law torture could be employed only once, but some inquisitors ordered it a second time as a continuation. It is difficult to determine whether or not torture was much used.

Sentence.—On admission or conviction of guilt of lesser misdeeds, the prescribed penalties included recitation of prayers, fasting, almsgiving, flogging, pilgrimages, etc. Wearing of a yellow cross, imprisonment, confiscation of property, etc., were imposed for more serious heresy. Life imprisonment was the extreme penalty the inquisitor could impose. Condemned heretics who refused to recant, as well as those who relapsed after condemnation and repentance, were turned over to the secular arm for punishment. The inquisitor had to consult his counselors (between 9 and 50 clerics and laymen) about the sentences and could not hand a prisoner over to the civil authorities without the consent of the local bishop. Every effort was put forth to induce the heretic to recant; sometimes, to this end, his delivery to the secular power was deferred for as long as a year.

The death penalty was imposed by the civil authorities and not by the church, but the ecclesiastical authorities were in fact morally responsible, because they could excommunicate a ruler who did not carry out the sentence where it was prescribed by law. In handing the heretic over to the secular power, the inquisitor asked that punishment be carried out without shedding blood or endangering life, but this was merely an antique formula intended to influence the condemned to ask for mercy and to emphasize the fact that the church did not itself shed blood. Bodies of persons condemned after death were disinterred and burned.

Life imprisonment, a not uncommon penalty, was imposed on those who confessed under torture as well as on those who recanted after being sentenced to death. Confiscation, much dreaded, was imposed on those condemned to perpetual imprisonment, on those who escaped sentence by flight and on those turned over to the secular arm. It could also be imposed on the heirs of those who died in heresy, as well as on those who had acquired the possessions of deceased heretics by purchase. Confiscation was not rare, and its proceeds served in part to defray the expenses of the Inquisition; local civil and ecclesiastical authorities also profited from it.

The public announcement of penalties was generally made at a solemn gathering, called *sermo generalis* ("general sermon") in medieval times but more commonly known in the history of the Inquisition by the Spanish equivalent, auto-da-fé (*q.v.*). As a rule this ceremony took place on a Sunday in a church or in the open. The inquisitor preached a short sermon, civil officials vowed obedience to the inquisitor, mitigations of earlier sentences were pronounced, and then recantations and sentences of condemned persons were announced and the condemned were turned over to the secular arm.

Geographical Limitation.—The medieval Inquisition did not function in Scandinavia, and in England it was used only in the case of the Templars (though under the statute *De haeretico comburendo* of 1401 the Lollards were persecuted; *see* LOLLARDS). In Germany, after the inauspicious start under Konrad von Marburg, it was used after 1450 against witches; in Bohemia it was employed against the Hussites, and in the 14th century it was used in the Netherlands against the Beghards. But it was in northern Italy, southern France and to a lesser degree Christian Spain that the Inquisition was most employed in medieval times. By the end of the 13th century it had overcome the Catharist threat to Christianity. In the later middle ages relatively little is heard of it except in connection with the trial of witches and the Spanish Inquisition.

Since most of the records of the medieval Inquisition have perished, it is impossible to give more than fragmentary statistics in regard to the numbers who suffered the death penalty, confiscation, etc. In the early days scores, occasionally hundreds of burnings at the stake are referred to. Later the extreme penalty was rarely applied; life imprisonment and confiscation of property were commoner. Among the victims of the medieval Inquisition were St. Joan of Arc, John Huss and Girolamo Savonarola.

Spanish Inquisition.—The medieval Inquisition had played a considerable role in Christian Spain during the 13th century, but the struggle against the Muslims kept the inhabitants of the Iberian peninsula busy and served to strengthen their faith. When toward the end of the 15th century the reconquest was all but complete, the desire for religious unity became more and more pronounced. It was at first the Jews who seemed to block the way to unity.

During the centuries the Jewish community in Spain had flourished and grown in numbers and influence, though anti-Semitism had from time to time made itself felt. Henry III of Castile and León (late 14th century) seems to have brought pressure to bear on the Jews to convert them. Then and later the threat of severe penalties hung over the Jewish community in Spain.

> The only alternative before the Jews was baptism or death. Thus the number of nominal converts to the Christian faith soon became very great. The secret Jews were incomparably more dangerous than those who openly professed their religion (L. Pastor, *The History of the Popes From the Close of the Middle Ages*, Eng. trans., vol. iii, p. 398 [1894]).

These nominal converts from Judaism were called marranos (*see* MARRANO). After Aragon and Castile were united by the marriage of Ferdinand and Isabella (1469) the marranos were denounced as a danger to the existence of Christian Spain, and a bull of Sixtus IV in 1478 authorized the Catholic kings to name inquisitors in whom they might repose confidence. This did not mean that the Spanish sovereigns were turning over to the church the struggle for unity; rather, they were seeking to use the Inquisition to support their absolute and centralizing regime, and most especially to increase the royal power in Aragon.

The first Spanish inquisitors, operating in Seville, proved so severe that Sixtus IV had to interfere. But the Spanish crown now had in its possession a weapon too precious to give up, and the efforts of the pope to limit the powers of the Inquisition were without avail. In 1483 he was induced to authorize the naming by the Spanish government of a grand inquisitor (inquisitor general) for Castile, and during the same year Aragon, Valencia and Catalonia were placed under the power of the Inquisition.

The president of the Inquisition in Spain was the grand inquisitor, designated by the government but receiving his ecclesiastical jurisdiction from Rome, which empowered him to name deputies and hear appeals. In deciding appeals the grand inquisitor was assisted by a council of five members and by consultors. All these offices were filled by agreement between the government and the grand inquisitor. The council, especially after its reorganization under Philip II, put the effective control of the institution more and more into the hands of the civil power. After Clement VII (1523–34), priests and bishops were at times judged by the Inquisition. In procedure the Spanish Inquisition was much like the medieval Inquisition. The first grand inquisitor in Spain was the Dominican Tomás de Torquemada (1420–98), who has become the symbol of the inquisitor who uses torture and confiscation to terrorize his victims; his methods were the methods of a time when judicial procedure was cruel and designed to inspire terror. The number of burnings at the stake during his tenure has been exaggerated, but it is generally put, by fair estimate, at about 2,000. (*See* also TORQUEMADA, TOMÁS DE.)

By edict of March 31, 1492, the Spanish Jews were given the choice of exile or baptism. When in 1502 Islam in its turn was proscribed, the Inquisition began to devote its attention to the moriscos (*q.v.*), the Spanish Muslims who had accepted baptism. When the Protestant Reformation began to penetrate into Spain the relatively few Spanish Protestants also were eliminated by the Inquisition. Nor did Catholics escape its rigours: Ignatius Loyola was twice arrested on suspicion of heresy, and the archbishop of Toledo, the Dominican Bartolomé de Carranza (*q.v.*), was imprisoned for almost 17 years.

Under the supreme council of the Spanish Inquisition were 14 local tribunals in Spain and several in the colonies, among which

those in Mexico and Peru have been particularly attacked. The Spanish Inquisition was introduced into Sicily in 1517, but efforts to set it up in Naples and Milan failed. The emperor Charles V in 1522 introduced it into the Netherlands, where its efforts to wipe out Protestantism were unsuccessful. John III of Portugal, with the permission of the pope, introduced a tribunal like the Spanish Inquisition against the Portuguese Jews in 1536. Though his methods led the pope to revoke the grant, the Inquisition was definitely established in Portugal in 1547, at which time its scope was also widened.

The Inquisition in Spain was suppressed by Joseph Bonaparte in 1808, restored by Ferdinand VII in 1814, suppressed again in 1820, restored again in 1823 and finally suppressed in 1834. The Portuguese Inquisition was suppressed in 1820.

Roman Inquisition.—The Roman Inquisition was established in 1542 by Pope Paul III to combat Protestantism; some have seen in its institution a desire to counterbalance the Spanish Inquisition at a time when a great part of Italy was under Spanish rule. It was governed by a commission of six cardinals, the Congregation of the Inquisition, whose powers in matters of faith extended according to their mandate to the whole Catholic world. The cardinal inquisitors were authorized to delegate their powers and to receive appeals from the sentences of their delegates. The Roman Inquisition was thoroughly independent and much freer from episcopal control than the medieval Inquisition had been. Under Paul III (1534–49) and Julius III (1550–55) its action was not rigorous, and Julius ruled that although the tribunal had general authority its action should be limited especially to Italy. The moderation of Paul III and Julius III was imitated by their successors with the exception of Paul IV (1555–59) and Pius V (1566–72). Under Paul IV the Inquisition functioned in such a way that it alienated nearly all parties.

> The hasty and credulous pope lent a willing ear to every denunciation, even the most absurd. Neither rank nor dignity nor merit weighed in the balance in the case of anyone suspected of heresy; he would be treated by the Inquisition as if he were the open and declared enemy of the church. The inquisitors, constantly urged on by the pope, scented heresy in numerous cases where a calm and circumspect observer would not have discovered a trace of it. . . An actual reign of terror began which filled all Rome with fear (L. Pastor, *The History of the Popes From the Close of the Middle Ages,* Eng. trans., vol. xiv, p. 287 [1924]).

While Pius V (a Dominican and himself formerly grand inquisitor) avoided the worst excesses of Paul IV, he nevertheless declared at the beginning of his reign that questions of faith took precedence over all other business and made it clear that his first care would be to see that heresy, false doctrine and error were suppressed. He was said, in fact, to have more zeal against heretics than against the Turks. He took part in many of the activities of the Inquisition, and it was thought that nothing pleased him more than to aid it. (*See* also PAUL; PIUS.)

The aims of Paul IV and Pius V, which were pursued with more moderation by the other pontiffs of the 16th and 17th centuries, were achieved. The religious unity of Italy was maintained without resorting to the Spanish Inquisition. The best-known victims of the Roman Inquisition are Pietro Carnesecchi, Aonio Paleario and Giordano Bruno.

After Protestantism had been eliminated as a serious danger to Italian religious unity, the Roman Inquisition became more and more an ordinary organ of papal government concerned with maintaining good order and good customs as well as purity of faith among Catholics. The best-known case in the 17th century is undoubtedly the condemnation of the Copernican system and of Galileo (1616, 1632). In his reorganization of the Roman curia in 1908, St. Pius X dropped the word "Inquisition," and the congregation charged with maintaining purity of faith is now known officially as the Holy Office (*Congregatio sancti officii*).

Conclusion.—Not only non-Catholics but many Catholics have judged the Inquisition severely. These condemnations have at times been motivated by an exaggerated idea of its rigours. More frequently they may be said to be due in part to the fact that the Inquisition has been considered apart from the judicial context of the times. The principles and practices of the Inquisition were no crueler than those of the contemporary civil courts; if it is condemned on such grounds, the middle ages and the Renaissance must also be condemned. Not only Catholics but the early Protestants and many other religious groups used force to impose religious unity.

On purely religious grounds the problem is sharper. Has a church the right and duty to use more than moral suasion against erring brethren? Have the orthodox the right to inflict temporal punishment on heretics? Does charity demand discipline rather than tolerance? In the case of purely religious conflict all these questions might readily be answered in the negative, but religious conflict almost always has social and political overtones. Religious rebels often threaten the existing order, and the issue is almost never clear-cut. Theologians of the middle ages, even apart from these considerations, were in favour of eliminating pertinacious heretics, arguing that to corrupt the faith is a much more serious crime than to counterfeit money or commit many other offenses that were then punishable by death. They insisted, however, that efforts should be made to bring the heretics to recant and that the death sentence should be carried out by the civil authorities. During the Renaissance period Catholic theologians argued that death is the only efficacious deterrent in the case of heresy—excommunication, fines and exile had been tried and found useless. Catholic theologians of the present day do not subscribe to either the medieval or the Renaissance arguments.

See also references under "Inquisition" in the Index.

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(E. A. R.)

INSANITY. Although formerly a part of scientific nomenclature, the word "insanity" is today employed principally as a term of legal significance. So used, it denotes those conditions of mental disorder or defect which modify certain of the legal relations, rights and obligations of afflicted persons. For discussions of mental disorder in its medical and psychological aspects, *see* MENTAL DEFICIENCY; PSYCHIATRY; PSYCHOANALYSIS; PSYCHOLOGY; PSYCHOLOGY, ABNORMAL; PSYCHOSES.

In general, the legal rules which define the rights, privileges and obligations of persons assume the existence of a degree of mental capacity sufficient to enable the person to manage his conduct and affairs in the ordinary contingencies of life. When, by reason of mental disease or defect, such capacity is lacking, however, the law applies special regulations which deny to the insane person some of the rights and privileges enjoyed by other members of the community, and, at the same time, relieve him of certain obligations and responsibilities. These various rules are encountered both in the criminal and civil law. The degree of mental incapacity required to be found and the modes of proof vary from situation to situation. There is, thus, no single legal test of insanity. Reference must always be made to the particular purpose for which the inquiry is made. Even with respect to the same rule, legal authority is sometimes sharply divided.

INSANITY IN THE CRIMINAL LAW

The most dramatic application of the insanity concept, though not necessarily of the greatest practical importance, is that which relieves the afflicted person of criminal responsibility for his conduct. It is important to understand that the legal tests of responsibility are not, and are not intended to be, scientific definitions of mental disorder. Rather, the legal tests are expected to identify those persons whose incapacities, produced by mental disease or defect, are of such character and extent that criminal responsibility should be denied on grounds of social expediency and justice. The inutility and moral incongruity of holding seriously disordered persons to the criminal consequences of their acts have been recognized in the development of the Anglo-American law for at least seven centuries. Responsibility assumes capacity to make elementary moral discriminations and power to adjust behaviour to the commands of the law. One lacking such capacities

is conceived as ineligible for the moral condemnation inherent in a criminal conviction. Such persons, also, are not likely to be deterred from the commission of criminal offenses by the threat of penal sanctions.

Early History.—Beginning with the writings of Henry de Bracton in the 13th century, discussion of the legal consequences of mental disorder appear in the work of several early commentators. The 17th-century treatise of Lord Hale, however, contains perhaps the first systematic effort to state a legal test of criminal responsibility in the English law. Hale wrote: ". . . such a person as labouring under melancholy distempers hath yet ordinarily as great understanding, as ordinarily a child of fourteen years hath, is such a person as may be guilty of treason or felony." This observation was made the basis of the so-called child of 14 years test in later cases.

In *Arnold's Case* (16 How. St. Tr. 695), decided in 1724, Justice Tracy, relying on a suggestion of Bracton, announced a formulation sometimes referred to as the "wild beast test." Not every kind of "frantic humour," said Justice Tracy, exempts a man from punishment; "it must be a man that is totally deprived of his understanding and memory, and doth not know what he is doing, no more than an infant, than a brute, or a wild beast . . . ." In *Hadfield's Case* (27 How. St. Tr. 1282), tried in 1800, Thomas Erskine, the brilliant criminal advocate, induced the court to accept the proposition that "delusion . . . , where there is no frenzy or raving madness, is the true character of insanity."

McNaghten Rules.—But it is the rules announced in the famous case of *McNaghten* (10 Cl. and Fin. 200) which constitute unquestionably the most important pronouncement on the subject of criminal responsibility in the Anglo-American law. Though formulated in 1843, the McNaghten rules still provide the basis for the modern law in most English-speaking jurisdictions. Daniel McNaghten, acting under a delusion that he was being persecuted by Sir Robert Peel, shot and killed Peel's secretary, Edward Drummond, believing him to be Sir Robert. McNaghten was brought to trial on a charge of murder, but was acquitted by a verdict of not guilty on the ground of insanity. The public interest and outcry were of such proportions that the house of lords was induced to employ the unusual procedure of addressing a series of questions to the judges of England on the subject on insanity. The answers to these questions, announced by the chief justice, Sir Nicholas Tindal, constitute the McNaghten rules. It has been suggested that the judges' answers, since submitted in response to hypothetical questions and not in the course of adjudicating an actual case, have no binding legal effect. As a practical matter, however, the rules have been accepted as authoritative in most Anglo-American jurisdictions. A portion of the judges' answer to the second and third questions is most important for the purposes of modern law: ". . . to establish a defence of insanity, it must be clearly proved that, at the time of the committing of the act, the party accused was labouring under such a defect of reason, from disease of mind, as not to know the nature and quality of the act he was doing; or if he did know it, that he did not know he was doing what was wrong." It will be observed that it is the mental condition of the accused at the time of commission of the act which is crucial and that the incapacity must be the result of mental "disease." There have been many widely diverging interpretations of the other important terms of the formulation. Thus, in the United States, "wrong" is frequently understood in the sense of moral wrong, while in Britain mid-20th century cases have held that the accused is not entitled to exculpation if he knew his act was contrary to law.

The McNaghten rules have been the source of sharp and sometimes intemperate controversy for over a century. The range of criticism has been wide and the points made have possessed varying degrees of cogency and relevance. It is said, for example, that the McNaghten rules, by their exclusive reliance on the criterion of knowledge, emphasize unjustifiably the cognitive or intellectual elements of human personality, at the expense of the will and emotions, and, consequently, incorporate an obsolete conception of the nature of mental disorder. Since the rules are founded on conceptions foreign to modern medical science, the psychiatric witness finds it difficult or impossible to translate his learning into the terms of the legal formula, thereby depriving the court and the jury of the full benefit of his expert insight. Also, it is said that the rules require a total incapacity to distinguish wrong from right, although even grossly disordered persons may possess at least rudimentary powers of moral discrimination.

Changes From the McNaghten Rules.—Although the attack on the McNaghten rules has received much less than unanimous support, an important segment of opinion has held for many years that drastic changes in the legal tests of criminal responsibility are required. In the United States the adoption of the irresistible impulse test by the federal courts and those of about one-quarter of the states is one important consequence of this dissatisfaction. The irresistible impulse test is accepted in no jurisdiction as a total substitute for the McNaghten rules. Rather, it is intended to supplement the right and wrong test by relieving from criminal responsibility those who may have power to discriminate intellectually between right and wrong but who, because of mental disorder, are unable to act on that knowledge and to control their behaviour. As expressed by a Utah court: "Volitional ability to choose right and avoid wrong is as fundamental in the required guilty intent . . . as is the intellectual power to discern right from wrong and understand the nature and quality of his acts" (78 Utah 580, 6 P. 2d 177).

The irresistible impulse test has also received its share of criticism, and the critics have included both supporters and opponents of the McNaghten rules. Some have urged the difficulties of distinguishing between the irresistible impulse and the impulse which is merely unresisted. More fundamentally, others have complained of the emphasis on "impulse" as erroneously suggesting that volitional disorders are manifested only in sudden or momentary inclinations to commit unlawful acts. Still others have urged that a proper interpretation of the McNaghten rules renders the irresistible impulse test unnecessary, since serious volitional disorders are always accompanied by impairment in the cognitive capacities of the afflicted person.

In recent years the movement to reform the legal tests of criminal responsibility has received increased impetus in the countries of the Anglo-American legal system. In the United States one important judicial development was the 1954 decision in *Durham* v. *U.S.* (214 F. 2d 862) by the U.S. circuit court for the District of Columbia. That decision, applicable only to the District of Columbia and not to the federal courts generally, rejected the McNaghten rules as supplemented by the irresistible impulse tests, which had formerly been applied in the jurisdiction, and adopted a new formulation derived from opinions of the New Hampshire court, the only U.S. jurisdiction that had theretofore rejected the McNaghten rules. The Durham test, as it has come to be known, is "simply that an accused is not criminally responsible if his unlawful act was the product of mental disease or mental defect."

The decision was hailed by many in the medical profession and by some lawyers as an event of profound importance. It was pointed out that the formulation, by avoiding reference to any particular symptom of mental disorder, eliminates the danger of incorporating into the legal test conceptions of mental disease which are or which may shortly become obsolete. It was also urged that the test provides the psychiatric expert with greater freedom in conveying his scientific evaluation of the accused's condition to judge and jury. Despite its claimed advantages, no other U.S. court had adopted the Durham formulation by the beginning of the 1960s. Some commentators have pointed to difficulties in the notion of causation inhering in the phrase "the product of." Because the formulation states no requirements with reference to the degree of incapacity produced by the mental disorder, questions have been raised as to the breadth of the exculpation it may theoretically authorize.

Trial Practice.—The mode of trying the insanity issue in criminal trials has provoked very nearly as much criticism as the tests of responsibility. The use of the lay jury to decide the issue of responsibility, the adversary nature of the judicial proceedings, the use of partisan expert witnesses, the elaborate "hypothetical questions" which may be put to the psychiatric witness and other

procedural matters have been attacked frequently and with considerable asperity.

While some of the criticism reveals misunderstanding of the purposes and function of legal proceedings in these cases, it cannot be denied that many of the complaints point to weaknesses which can and should be remedied. In the United States, provisions of state constitutions, such as those relating to the right of jury trial, place certain limitations on innovation. Thus, statutes of Washington and Mississippi, which entirely eliminated the defense of insanity from the trial of criminal cases, were held unconstitutional. A California statute has been sustained, however, which requires the insanity issue to be tried in a separate proceeding, after it has been determined in the original trial that the accused committed the criminal acts charged.

Partial Insanity.—Mental disorder may affect criminal liability even though the incapacity of the accused is not of such degree as to relieve him entirely of criminal responsibility. The definitions of certain offenses require proof of particular mental states on the part of the accused. In some jurisdictions, the doctrine of "partial" insanity entitles the defendant to a jury instruction on the issue whether his mental disorder rendered him incapable of entertaining the particular mental state included in the definition of the crime. Thus, in a prosecution for murder in the first degree, the issue would be whether the accused was, by reason of mental disorder or deficiency, rendered incapable of premeditating or deliberating the killing, which is an essential element of the crime. If the jury determines that the accused was incapable of premeditation, it may return a verdict holding him guilty of second-degree murder or some lesser degree of criminal homicide. The U.S. supreme court has refused to reverse a criminal conviction for first-degree murder where the trial judge refused such an instruction (*Fisher* v. *U.S.*, 328 U.S. 463). But the trend of judicial authority in the United States appears to be toward the contrary result. In England, the Homicide act, 1957, introduced the doctrine of "diminished responsibility" into the law of England and Wales. It had long been part of the law of Scotland. Section 2 of this act provides in essence that an accused shall not be convicted of murder if he suffered from such abnormality of mind as substantially impaired his mental responsibility for his acts in doing or being a party to the killing. If the accused succeeds in establishing this condition he shall be found guilty of manslaughter. In *R.* v. *Byrne* (2 Q.B. 396 [1960]) the phrase "abnormality of mind" was broadly read to encompass cases in which the abnormality creates substantial difficulties for the accused in controlling his physical acts.

Continental European Tests.—Tests of responsibility are included in the criminal legislation of countries whose legal systems are not derived from the English common law. These tests typically give consideration to both cognitive and volitional incapacities. Thus, article 85 of the Italian penal code relieves a person of responsibility when he "is deprived of the capacity of understanding or volition." The factors which most significantly distinguish the continental law of insanity from that of the English-speaking jurisdictions are procedural, not the least important of which derive from the fact that in continental Europe no provision is ordinarily made for the use of lay juries to resolve the issue of criminal responsibility. In some but not all the continental codes, mental disorder, which is insufficient in degree to relieve the accused of responsibility, may be taken into account by the sentencing authority to mitigate punishment.

"Present Insanity."—The significance of mental incapacity in the criminal law is not restricted to the question of the mental condition of the accused when the criminal act was committed. At the common law a person afflicted with what is sometimes called "present insanity" cannot be required to plead to an indictment or stand trial on a criminal charge.

The legal test of "present insanity" is wholly distinct from the tests of criminal responsibility. While the test of "present insanity" has been expressed with some variations in language, "present insanity" consists in essence of that degree of mental disorder which denies the accused understanding of the nature of the proceedings against him or renders him incapable of making or assisting in his own defense. The principle which protects such persons from standing trial has been widely adopted in modern legislation. Indeed, under U.S. constitutional provisions, the principle has been recognized as part of the concept of fair trial and due process of law. The question of "present insanity" may be raised by the defense, the prosecution or the trial judge. It has been held that the judge has not only a privilege to raise the issue, but, when he reasonably suspects the mental capacity of the accused, he is under duty to do so. At common law the issue of "present insanity" was tried before the trial judge, with or without a jury at the judge's discretion. Some of the statutes in the United States preserve the common-law powers of the judge in this matter, others require the summoning of a jury and still others require the trial judge to obtain the assistance of psychiatric specialists in determining the issue. It is important to understand that a finding of "present insanity" only postpones the criminal proceedings until such time as the accused has sufficiently recovered from his incapacities.

One of the important problems in the administration of criminal justice is the detection of mentally disordered persons among those apprehended and brought to trial on criminal charges. Although the right to raise the issue of "present insanity" is clearly established, there is reason to believe that substantial numbers of persons are tried who should not be subjected to criminal proceedings. Even larger numbers of seriously disordered persons are arrested and released from custody who, in their own interests and those of the community, should be confined in mental institutions. In response to these needs, court clinics and other facilities have been established in many localities for the purpose of providing pretrial psychiatric examinations, either on a routine basis or when requested in special circumstances. Most observers agree that such facilities have made a substantial contribution to the effective administration of the criminal law. Perhaps the most interesting statute on this subject is the famous Briggs law of Massachusetts. The law, enacted in 1921, requires the routine examination of all persons charged with certain specified criminal offenses. The examinations are conducted by specialists employed in the state department of mental health. A report of the examination is forwarded to the court and may be introduced in evidence if the accused is brought to trial. The procedure not only assists in the detection of those who are presently insane, but, it is claimed, the tendency of juries to regard the reports as impartial and to give them great weight has done much to eliminate the "battle of the experts" when the issue of criminal responsibility is raised at the trial.

Insanity After Sentence.—There are other situations in which mental disorder has important consequences in the administration of criminal justice. One of these is presented by cases in which a prisoner under sentence of death is found to be incapable, by reason of mental disorder, of understanding the nature and purposes of the punishment about to be inflicted upon him. At common law, the death penalty may not be inflicted in such situations, so long as the mental disorder persists. The reason for the rule, suggested by Lord Coke, is that the execution of a disordered person "cannot be an example to others." Another reason, sometimes advanced, is that the disordered prisoner is incapable of communicating facts to his counsel which might be useful in securing executive clemency. There is a wide variety of statutes in the United States regulating the mode of determining insanity in these cases. Many require a jury trial of the issue. Others authorize the issue to be determined in the courts, with or without juries in the judges' discretion. Still others have eliminated judicial trial of the issue and place its determination, after some species of administrative hearing, in the governor or other executive personnel. Such a state statute has been upheld by the U.S. supreme court (*Solesbee* v. *Balkcom*, 339 U.S. 9). Questions may arise, also, as to whether the prisoner has sufficiently recovered his faculties to permit the execution to proceed. Although there is no definitive constitutional ruling on the point, this determination probably must be preceded by a hearing, though not necessarily by a judicial hearing.

Insanity and Acquittal.—A procedural problem of some importance relates to the disposition of defendants who are acquitted on the criminal charge by reason of insanity. If the defendant is

still suffering from mental disorder, his interests and those of the community may require that he be confined in a mental institution until his recovery. In the United States this problem has been the subject of a wide range of statutory provisions. The prevailing legislative pattern confers discretion on the trial judge to order the civil commitment of the defendant in such cases, though in many statutes the order of committal can be entered only after the judge has conducted an investigation into the defendant's present mental condition. Some of the states require the jury at the criminal trial to consider the defendant's present mental condition. If the jury finds that the accused at the time of acquittal is still afflicted with mental disorder, the trial judge must order the defendant committed to a mental institution. A few states have so-called "automatic commitment" statutes, which require the immediate confinement of defendants acquitted on grounds of insanity without any further hearing or investigation. These laws, in effect, create a presumption of continuing mental disorder, and have been upheld as constitutional in the state courts. A person who has, in fact, recovered from the mental illness may be released by the hospital authorities, or may challenge the legality of his confinement in the courts, ordinarily in a habeas corpus proceeding in which recovery from the mental disease is alleged. In England, no provision was made for civil commitment of such persons before 1800, and a defendant acquitted on grounds of insanity was permitted to go at large. After that date the trial judge had power to detain the defendant "during His [or Her] Majesty's pleasure." The Trial of Lunatics act, 1883, authorized a new form of verdict—"guilty, but insane"—in cases in which the defendant successfully maintains an insanity defense, and, in effect, directed the automatic commitment of such defendant to the custody of the home secretary. The form of verdict authorized by the 1883 act is inaccurate and illogical; it is, in fact, a verdict of acquittal on the criminal charge, from which an appeal by the prosecution may not be taken. The Royal Commission on Capital Punishment (1949–53), following the recommendations of the earlier Atkin committee, urged an amendment to the law "so that the verdict may again be one of acquittal in language as well as in substance." (F. A. A.)

INSANITY IN THE CIVIL LAW

Questions relating to the legal consequences of mental disorder are encountered throughout the civil law. These problems may be roughly classified into two broad categories: those relating to the protection and care of the disordered person in the interests of his well-being and the safety of the community, and those relating to the capacity of the insane person to perform certain legal acts and to enter and avoid certain legal relations. As in the criminal law, there is no single legal test of insanity applicable to all situations in which the mental capacity of a person may be in issue.

Protection of the Well-being of the Insane and of the Community.—The obligation to afford care and protection for seriously disordered persons has long been recognized. But involuntary commitment to a mental institution subjects the person to loss of liberty. Many of the problems relating to commitment procedures stem from the necessity of reconciling the need for protective measures and for reasonably adequate procedural safeguards.

At mid-20th century, statutes in Anglo-American jurisdictions provided a variety of procedures for the commitment of the mentally ill. These statutes had replaced common-law rules which provided for petition to the chancery court, issuance of a writ *de lunatico inquirendo* and trial of the fact of insanity by a jury. A procedure for indeterminate commitment authorized by almost all of the U.S. statutes involved a hearing before a judge or a quasi-judicial agency following petition by an interested party, notice to the allegedly insane person and examination of the person by two physicians (not necessarily psychiatrists). In appropriate cases, the court or commission issued an order of commitment. The mandatory requirement of a jury trial, which had been incorporated in the statutes of many states in the 19th century as a result of well-publicized charges of allegedly improper commitments, had been eliminated in all but two states. In several others, a jury might be demanded by the person proceeded against. Some jurisdictions furnished counsel to those requesting representation.

Indeterminate commitment without a hearing was permitted in about 15 states. In those cases the order of commitment was made by physicians or health officers, and a judicial hearing was held only if the patient appealed from the order. This simplified procedure, commonly used in continental European countries, was authorized in England by the Mental Health act of 1959.

The circumstances justifying indeterminate commitment were variously defined. The Draft Act Governing Hospitalization of the Mentally Ill, which had been adopted in whole or in part by one-fourth of the states in the U.S. since its proposal in 1950, provided that commitment could be ordered if the mentally ill person was likely to injure himself or others, or if he was in need of hospital care but had lost the power to make an intelligent decision concerning it. Many other U.S. jurisdictions used similar criteria.

Short-term commitment without a hearing was authorized by almost all of the states, where immediate hospitalization was deemed necessary, usually on the certificate of a single physician. The procedure permitted detention for only a short period, usually five days, unless a formal commitment order had been obtained in the meantime. A few states provided for "non-protested" commitment, whereby a relative or friend might commit a person summarily if he did not protest. A number of others permitted commitment without a hearing for a longer period of time for diagnostic purposes, but the requirements were more stringent. Voluntary commitment, requested by the person himself, was provided for in a number of states. Under this procedure, a person might be detained for a fixed period, typically 60 days, or for a brief period after he requested release.

Reimbursement by the patient or his close relatives of the state's expense in hospitalizing the patient was required almost universally. Sterilization of certain insane and mentally deficient persons was permitted in about half the states by laws enacted during the first half of the 20th century. The Virginia sterilization law was held not to offend the U.S. constitution in *Buck* v. *Bell* (274 U.S. 200), decided by the U.S. supreme court in 1927.

Release after indeterminate commitment ordinarily followed an administrative finding by hospital authorities that the patient had regained his sanity. A patient denied release though he had recovered from his disorder could resort to the courts, generally through habeas corpus proceedings.

Commitment to a mental hospital did not, in most instances, result in an adjudication of incompetency. The latter was more frequently decided in a separate judicial procedure for the appointment of a guardian. The guardianship might relate either to the person or to the property of the insane individual, or both. The test of mental capacity authorizing the appointment of a guardian was ordinarily said to be whether the person, by reason of mental disorder, was unable to manage his own affairs or to care for his estate. Guardianship procedures were governed by statute in all states, and the procedures resembled those for indeterminate commitment by court order.

Legal Capacity of Insane Persons.—Capacity to enter contracts or to convey property may exist though a person is mentally defective or disordered, or even, in some U.S. states, though he has been committed to an institution or judged incompetent. The laws of the Anglo-American jurisdictions on this subject represent attempts to reconcile policies favouring security of business transactions and protection of the mentally ill. It is not surprising that there are disagreements on the weight to be assigned to each. Thus it appears to be the current English view that an agreement cannot be avoided by the insane party if it was fair to him and his disorder was unknown to the sane party, whereas most U.S. jurisdictions permit avoidance by one whose mental incapacity prevented him from understanding its nature and effect, usually conditioned upon his return of any benefits received. Normally the insane person may hold the other party to the bargain.

Most jurisdictions provide by legislation that persons of unsound mind lack capacity to dispose of property by will. The relevant test is whether the testator is of sufficiently sound mind

and memory to understand the nature of his act, to comprehend the character and extent of his estate and to recollect the natural objects of his bounty.

In all U.S. jurisdictions, a marriage can be annulled at the instance of a party who was at the time of the ceremony unable to understand its nature and resulting rights and obligations, and who has not ratified the marriage after regaining sanity. In about half of the states the sane spouse also can, in these circumstances, probably obtain an annulment; sometimes the statutes require him to have been ignorant of the other's disorder at the time of the marriage. Prolonged and incurable insanity, occurring after marriage, is recognized in a majority of states as a ground for divorce. In England, the law has long permitted annulment at the instance of either spouse if one was unable to understand the ceremony and the ordinary incidents of marriage, and there had been no ratification. The Matrimonial Causes act of 1937 greatly enlarged the rights of the sane spouse by allowing, if certain requirements are met, annulment where the other was of unsound mind or a mental defective or subject to recurrent fits of insanity or epilepsy, even though he had understood the ceremony and its consequences. In addition, the act permitted for the first time in England divorce for incurable insanity occurring after marriage, if the respondent was continuously under care and treatment for at least five years immediately preceding the action.

Insane persons are generally held liable for their torts; *i.e.*, harm they inflict on others. It is apparent that the proposition results in the imposition of civil liability on those who, by reason of mental disorder, may be incapable of avoiding the torts. This rule may be explained, in part, as a historical survival from a period in which tort liability was generally imposed without regard to the fault of the actor. A number of additional reasons have been advanced, none of which appear wholly satisfactory. It is said that since insanity may be feigned, a contrary rule of law might be used improperly by a sane person to escape liability. Also, placing responsibility on the insane person may induce the guardian, or others interested in the person's welfare, to exercise closer supervision of his activities. Finally, public policy requires that, as between two innocent persons, loss should be borne by the one who occasioned it. In the adjudicated cases, insane persons have been held liable for a wide variety of torts including assault and battery, trespass on land and even alienation of affections. An insane person is liable for negligent harms, and the standard of care is apparently that which is required of a sane person. One exception to the rule of liability relates to certain wrongs requiring proof of a "specific" intent, which a disordered person may be incapable of forming. These include such torts as malicious prosecution and defamation.

Finally, mental disorder may have important consequences as it relates to the capacity of insane persons to give testimony in judicial proceedings. The early common-law rule rendered any person of unsound mind totally incompetent as a witness. Although a literal reading of some modern statutes would require the same result, it appears that nowhere is the rule applied in its original rigour. The broad principle generally applied today would exclude a witness only where the disorder substantially impairs the trustworthiness of the particular testimony. Some of the cases suggest that a person of unsound mind is competent to testify if it is found that he understands the nature and significance of his oath and has sufficient possession of mind and memory to recollect and relate what he saw and heard.

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(C. L. KE.)

INSCRIPTIONS are documents incised on some hard or permanent material in the form of letters or other conventional signs, for the purpose of conveying some information or preserving a record. (Although inscriptions come from many parts of the world, *e.g.*, India, Mexico, Turkey, China, this article deals only with those from the ancient near east, Greece and Rome, since these have been by far the most thoroughly studied.) Inscriptions are to be distinguished on the one hand from manuscripts, or documents written on papyrus, parchment, paper or other more or less smooth surfaces by means of a brush, reed or pen and some coloured fluid (*see* PALEOGRAPHY; PAPYROLOGY), and on the other hand from pictures or reliefs intended to convey information or to record events (*see* PICTOGRAPHY), though inscriptions were often combined with such pictures or reliefs, especially in primitive times. There are also some classes of documents which are intermediate between inscriptions and manuscripts, such as writing incised with a stylus or sharp-pointed instrument upon tablets covered with a thin coating of wax or scratched upon pottery or other hard materials (*ostraka*). But as the forms of the letters and the character of the writing in both these cases approximate to what is found in manuscripts, they are usually considered to belong to that class of document; but graffiti, or casual scratching on walls, rocks or fragments of pottery, are sometimes included in the study of inscriptions because they often fill gaps and, in early times at least, did not differ in form or character from ordinary inscriptions. A good example is offered by the names and other records scratched by Greek mercenaries at the time of Psammetichus II (6th century B.C.) on the legs of the colossal statues at Abu Simbel in Egypt. As one of the earliest examples of the use of the Greek alphabet, these find their place in the history of inscriptions. On the other hand, casual notes as well as receipts, accounts, etc., are found scratched upon potsherds or *ostraka*, which were merely a cheap substitute for more expensive material such as papyrus; the study of such *ostraka* cannot be separated from that of manuscripts on papyrus, and really forms a branch of paleography rather than of epigraphy.

Inscriptions were studied and quoted by authors in ancient times, by orators and by historians—notably Thucydides and Polybius—as records of political, economic and social interest; they also contributed to the history of art, and Polemon of Ilium had the nickname of *stelokopas* ("tablet-picker") given him for his studies of such documents. His work is now lost. Some of the great scholars of the Renaissance were interested both in Greek and Roman inscriptions. But the gigantic task of collecting and editing all known ancient inscriptions has been undertaken only since the 19th century.

FORM

Materials and Technique.—Inscriptions were commonly incised on stone or marble, on metal or on wood (though this last material has hardly ever survived except in Egypt) or on terra cotta. In Egypt and Mesopotamia hard stones were frequently used for the purpose, and the inscriptions are therefore well preserved and easy to read. In Greece the favourite material, especially in Athens, was white marble, which takes an admirably clear lettering but is liable to weathering of the surface, if exposed, and to wear, if rebuilt into pavements or similar structures. Many other kinds of stone, both hard and soft, were often used, especially crystalline limestones, which do not easily take a smooth surface and which, therefore, are often difficult to decipher, because of accidental marks or roughness of the material.

The metal most commonly used for inscriptions was bronze; flat tablets of this metal were often made for affixing to the walls of temples and other buildings. Occasionally such tablets were made of silver or gold, and inscriptions were often incised on vessels made of any of these metals. Inscriptions on metal were nearly always incised, not cast. An important class of inscriptions are the legends on coins; these were struck from the die. (*See* NUMISMATICS.) Clay was very extensively used for inscriptions in the near east and in Crete. In this case the symbols were incised or impressed on specially prepared tablets when the clay was soft, and it was subsequently hardened by fire. In Greece many inscriptions on vases were painted before firing (especially when they had reference to the scenes represented), or incised after firing; potsherds were often used as a cheap writing ma-

terial. Inscriptions were also impressed from a mold upon wet clay before firing; this frequently was the case with tiles, amphora handles, etc., objects which often supply valuable information as to the buildings to which they belong or the place from which they took their origin.

The tools used for making inscriptions varied with the material; most of them were chisels of some sort, usually with a square blade; early inscriptions were sometimes made on hard rock by successive blows with a punch or pointed hammer. Sometimes a circular punch was used for *O* or a letter of which *O* formed a part.

Early inscriptions, which were often amateur work, are frequently very irregularly cut. But in almost all examples of later work the inscriptions were evidently cut by professionals and there are definite styles and methods belonging to various places and periods. In Egypt, for instance, the hieroglyphs (*q.v.*) were carefully and delicately cut in early times, but became more careless and conventional in later periods. In Greece the best work was done in the 5th and 4th centuries B.C. in Athens. The letters were all exact and regular in shape, with no adventitious ornaments, and, especially in the 5th century, were usually aligned exactly with the letters above and below as well as with those on each side. The result is a beauty and simplicity of effect that has never been surpassed. At that time all the strokes were made of equal thickness, but in the 4th century B.C. and later there arose the custom of holding the chisel obliquely to the surface, thus producing a wedge-shaped stroke. A similar custom in Mesopotamia gave rise to the cuneiform (*q.v.*) system. In Greece this effect appears earlier on metal inscriptions than on stone or marble. In the 3rd century and later it became common to introduce apices, or ornamental ends, to the strokes, a custom which prevails to the present day in ordinary capital letters. The custom of making different strokes and different parts of curves of varying thickness became common in Roman inscriptions, which developed a monumental style of their own, varying from period to period. Inscriptions can often be dated approximately by the style of the cutting as well as by the shapes of the letters; skill in doing this can only be acquired by a careful and minute study of originals and facsimiles.

Inscriptions vary greatly in size according to their intended position, their purpose and the skill of the cutter. Some inscriptions are of great length, the longest—a statement of accounts of the temple at Delos under Athenian administration—being nearly half as long as a book of Thucydides; and many other inscriptions approach this in length.

Symbols and Forms of Writing.—The origin of writing (*q.v.*) and the evolution of the alphabet (*q.v.*) need not be discussed here. For the present purpose it is sufficient to note that most of the known forms of writing originated in some system of picture writing. Such systems appear independently in different parts of the world—in Egypt, Mesopotamia, Crete, among the Hittites and in China and America. The evidence for all of these is to be found mainly in inscriptions. The development from ideograms (or direct representation of an object or idea) to symbols of phonetic value, and so to syllabaries or alphabets, took place in many different systems to various degrees. The Greeks borrowed the Phoenician system of writing, with certain modifications and improvements. From the Greek was derived the Latin; and from the two, all the later alphabets of European peoples. It is still a matter of dispute whether the Phoenician was derived from the Egyptian.

The pictographic shapes naturally tended to be conventionalized and simplified for convenience of cutting, in accordance with the materials and tools employed. In many cases they developed from a pictorial to a linear form. It is possible that some of these linear forms may not be derived from pictograms at all, but from purely conventional geometrical forms, such as were widely used at all periods and places as owners' or masons' marks. The tendency of linear forms to become wedge-shaped is most conspicuous in cuneiform, but the same tendency occurred in Greek inscriptions of the 3rd and 2nd centuries B.C., and earlier in inscriptions incised on bronze.

In the north of Europe the Ogham inscriptions are alphabetic, and are apparently an independent invention on arbitrary lines, like the Morse code; but Runes, which were extensively used in the same region, are derived from the Greek or the Latin alphabets. (*See* OGHAM WRITING; RUNE.)

Certain symbols which are not strictly alphabetic or phonetic in character are also found in inscriptions of most alphabetic systems. The commonest of these are the various systems of numerals that were used in different times and places. It is impossible to give any full description here of these different systems, but a brief account may be given of the principles underlying them. Most of them are based upon a decimal system, doubtless owing to the habit of counting on the fingers. In some cases the symbols are simple and obvious, as in the Cretan script where circles and short horizontal and vertical strokes are used for hundreds, tens and units, each being repeated as often as necessary; and a similar system for the lower denominations was used at Epidaurus in the 4th century B.C. In Athens the usual system was to indicate each denomination by its initial, M for *myrioi* (10,000), X for *chilioi* (1,000), H for *hecaton* (100), Δ for *deca* (10), Π for *pente* (5) and I for units. The other Greek system followed that derived from the Phoenicians, using the letters of the alphabet in their conventional order from 1 to 9, 10 to 90 and 100 to 900; in this arrangement obsolete letters were retained in their original places so as to give the requisite number of 27 symbols. The Roman system of numerals—M, D, C, L, X, V, I (for 1,000, 500, 100, 50, 10, 5 and 1)—is generally supposed to have arisen from the adaptation of certain symbols in the Greek alphabet.

Apart from numerals, the use of initials in the place of complete words was not common in early times. However, it became very frequent in Roman inscriptions, which sometimes are made up almost entirely of such abbreviations and can only be understood by those familiar with the formulae. Compendia or monograms also occurred in later Greek and Roman times, and became very common and difficult to interpret in early Christian and Byzantine inscriptions.

Some kind of punctuation is often found in inscriptions of all kinds. In Greek inscriptions a vertical line or a dot (or group of dots) sometimes indicates the separation between sentences or words; but words are seldom separated by spaces as in modern printing, so that the text is continuous and no division of words exists. This is particularly the case with Greek inscriptions of the best period. In Roman inscriptions it was usual to separate the words by dots. In certain inscriptions a cross (+) was used to indicate the beginning of an inscription, especially when its direction was erratic. Christian inscriptions sometimes began with a cross, which doubtless had a symbolic meaning, and a leaf or other device was often placed at the end.

The direction of the writing varies greatly in different places and times. The letters or symbols may be arranged vertically below one another, reading from top to bottom, or horizontally, reading either from right to left or left to right; they may also be arranged in a kind of pattern—in which case their order may be indeterminate, or follow a wandering or curved line, or read left to right and right to left alternately (*boustrophedon*, or as an ox in plowing). Most Semitic alphabets, including Phoenician, read from right to left; and the earliest Greek inscriptions follow the same direction. But the direction from left to right became regular in Greece after the 6th century B.C., and consequently was adopted by the Romans and in all European systems. The individual letters or symbols usually face in the same direction as the writing as a whole.

Position or Place.—When they have a direct relation to the sculptures, reliefs or paintings with which they are associated, inscriptions often form a kind of pattern to fill the background or vacant spaces between the figures. Sometimes, however, and especially in Mesopotamian statues or reliefs, they are cut right across the figures without any regard to the artistic effect. In late Greek or Roman work it was usual to cut any inscription relative to a statue or relief upon the base on which it was mounted, but short inscriptions such as dedications or artists' signatures were often placed in some inconspicuous position upon the work itself. In

the case of painted vases the inscriptions relative to the subject represented were usually painted; but dedications and other inscriptions were often incised after the vase had been fired.

In Egypt, inscriptions were often inscribed or painted upon the inner walls of tombs, whether they referred to religious belief or ritual or to the honours and possessions of the deceased. They were intended for his benefit and convenience rather than for the information of others—to perpetuate his familiar surroundings, not to make him live in the memory of his successors. The information which is derived from such inscriptions is invaluable, but such was not the intention with which they were made. On the other hand, inscriptions which were intended to be seen by the public and to perpetuate a record of events or to supply useful information usually occurred in places of common resort, above all in temples and sacred precincts. Sometimes they were cut on convenient rock faces, sometimes upon the walls of temples or other buildings. Most frequently the slabs of marble (*stelae*), stone, metal or other material upon which the inscriptions were incised were set up in convenient positions to be read in places of public resort. This was the method of publication of all laws, decrees and official notices, of treaties and contracts, of honours to officials or private citizens, of religious dedications and prescriptions of ritual. Inscribed tombstones were set up over graves, which were usually placed along the chief roads leading out of a town; the most familiar example is the sacred way from Athens to Eleusis. Inscriptions commemorative of victories or other great events were erected upon the spot only in exceptional cases; more often such memorials were set up in some great religious centre such as Delphi or Olympia. But boundary stones were necessarily placed on the line which they defined.

Chief Periods and Nationalities.—The study of inscriptions supplies an important contribution to the history of many lands and peoples. In some cases, as in Egypt and Mesopotamia, it forms almost the only source of first-hand written information; in others, as in Greece and Rome, it offers a most valuable supplement and comment to what is otherwise recorded.

Both Egyptian and Mesopotamian inscriptions go back to an extremely early date; it is uncertain which is the earlier but both show, as early as 3000 B.C., a complete, organized system of writing which implies many centuries of development behind it. The Egyptian hieroglyphic script, as used in inscriptions, continued without any essential change of character until Roman times, though various cursive hieratic and demotic types were also in use. On the famous Rosetta stone in the British museum, which first gave the clue to the interpretation of Egyptian writing, hieroglyphic, demotic and Greek versions of the same decree are given side by side. Its date is 195 B.C. The Mesopotamian linear symbols developed, mainly for technical reasons, into a wedge-shaped or cuneiform system which was adopted in modified forms and applied for millennia to different languages: Sumerian, Babylonian, Assyrian, Hurrian, Hittite and Old Persian. An independent hieroglyphic system, which also developed into various linear scripts, appeared in Crete around 2000 B.C. (*see* MINOAN LINEAR SCRIPTS). The Hittite hieroglyphs date from the period of Hittite domination in northern Syria and Asia Minor, from about 1600 to 700 B.C. (*See* also HIEROGLYPHS.)

The earliest known Phoenician inscriptions date from about the 10th century B.C., and the alphabet remained in use down to the 3rd century B.C. It was modified and adopted by the Greeks at an uncertain date; the earliest Greek inscriptions are generally dated in the 8th century B.C.

In early times each Greek state had its own alphabet; but in the year 403 B.C. (the archonship of Eucleides) the Ionian alphabet, which is the one used now for Greek capital letters, was officially adopted by Athens and soon became universal in Greece. From the various Greek alphabets were derived the different local Italian types, including the Etruscan, with sundry modifications. The Roman alphabet was among these. There are a few very early Roman inscriptions. They did not become common until the 3rd century B.C.; from that time the letters took much the same forms as they preserve to the present day.

The custom of putting inscriptions in Greek and in Latin on buildings and other monuments continued through medieval times and is still customary, classical forms being frequently imitated. The latest dated inscription in the Greek Corpus records the building of a bridge in Sicily in A.D. 1121; the series of Byzantine inscriptions continues practically without interruption to the present day; and Latin retains its use as a universal language in religious, public and private inscriptions.

Methods of Dating.—It is often possible to date an inscription approximately by the style of the lettering, or even by the alphabet used. Thus at Athens the Ionic alphabet was adopted in place of the early Attic alphabet in 403 B.C. But the change was already in process in private inscriptions, and Ionic forms are sometimes found earlier, even in official documents. Inscriptions are dated in various ways, mostly by giving the name of a king, magistrate or priest. In the case of kings, they only give an approximate date, unless the year of his reign is given also. But in the case of most independent cities the date is given by the name of an annual magistrate, and thus the year is indicated precisely. At Athens, the name used was that of the Eponymous Archon and, since an almost complete list of these has been drawn up from inscriptions and other sources, this means of dating is quite satisfactory. The custom of dating by Olympiads, which is familiar from later Greek and Roman writers, was rarely used in early Greece, except in connection with athletic victories. Many inscriptions are dated from various local eras, often based upon historical events such as the foundation of a town or festival, the organization of a province or even the visit of an emperor. The number of these eras in later times, especially in Asia Minor, becomes very bewildering. In Attic decrees, and some others, it also was usual to give the day of the month.

In Greek inscriptions of the Roman period, the year of the emperor is defined by the number of his consulate or other indications or titles, as in the corresponding Latin inscriptions. In later times, the dating is commonly by indiction, *i.e.*, in terms of the 15-year tax cycle, but as this only gives the number of the year within such a period, while leaving that period undefined, such dating is very inconvenient, except for merely temporary use. In the Eastern empire the date from the creation of the world (5509 B.C.) is sometimes given; but the date of the Christian era is hardly ever used.

CONTENT

Purpose of Inscriptions.—Inscriptions may be divided roughly into two main classes: (1) those in which the inscription was subservient to the object on which it was inscribed or, at any rate, had a direct relation to that object (*e.g.*, the name of the owner or the record of dedication to a god); and (2) those in which the inscription existed for its own sake, or for the sake of the information which it recorded, the object on which it was inscribed being either made for the purpose, as a slab of marble or plate of bronze, or made use of, as in the case of a convenient wall or the surface of a rock or even a potsherd. The walls of buildings are often covered with such inscriptions, especially if they are in a conspicuous or convenient position, and so offer an obvious means of publicity.

For those accustomed to a vast mass of books, newspapers and other printed documents, it is difficult to realize the extensive use and great convenience assigned to inscriptions in ancient times. Not only were public announcements of all sorts, such as should now be made known by advertisements or posters, thus placed before the public, but all kinds of records and enactments—codes of law and political decrees; regulations for all matters, civil and religious; accounts and contracts, public and private; treaties between states; records of public and private benefactions and dedications, and all matters of administration; honours to the living and to the memory of the dead. Many of these were intended to preserve for all time the records which they contained; but others must have been of only temporary interest. It seems, therefore, the more remarkable that they should have been incised on permanent material such as bronze, marble or stone—and incised in the first instance, with a care and perfection of technique which have led to their survival to the present day, so

as to preserve invaluable evidence as to the life and institutions of the people who made them. Temporary and permanent value are thus often combined in the same inscription. For instance, an Athenian citizen, visiting the Acropolis or the market place, could satisfy himself at first hand as to treaties or decrees of the people, public accounts or state income and expenditure. In the near east and Helladic Greece vast archives of clay tablets were kept in royal palaces and temples.

Relative Inscriptions.—Inscriptions having a direct relation to the object, or representation, on which they are inscribed vary greatly in their contents. Those relating to picture or relief chronicles of the victories or exploits of kings, as in Egypt and Mesopotamia, serve as a record of the events and help to interpret the scenes. Such inscriptions are not common in Greek or Roman work; but frequently, especially in early Greek times and on vases, the names of persons and even of objects are written beside them for the purpose of identification, and sometimes a speech issues from the mouth of a figure. On the carved wooden chest of Cypselus, of about 600 B.C., hexameter verses were written, curving about among the figures and giving a description of each scene. The bases of statues and reliefs often had inscriptions cut upon them for identification and record. This was particularly the case with honorary statues and tombstones. In other cases, where there is an evident relation between the artistic representation and the inscription, the figures are subordinate and seem merely to illustrate the text, such as a treaty between Athens and Samos with a relief at its head representing the goddesses Athena and Hera clasping hands, as representatives of their respective cities. In other cases the arms or device of a city is carved on an inscription, almost like a seal on a document. In all these cases the figures and the inscription are part of a common design, whether carried out by the same hand or not. But in the case of owners' marks, or names cut on vases or other objects, or of the dedication of such objects, the inscription is not necessarily contemporary; it may indeed be misleading, as in the case, mentioned with disapproval by Cicero, of re-using old Greek statues and placing new dedicatory inscriptions on them in Roman times; for instance, one of the statues of Athenian knights of the 5th century B.C., placed at the entrance of the Acropolis, had a later inscription cut on its base to make it serve as an equestrian statue of Germanicus, probably in 18 A.D. when he visited Athens. In Egypt and Mesopotamia also it is not unusual to find the name of a later king or official cut upon an earlier work.

Independent Inscriptions.—The majority of inscriptions are of independent value and interest, the object on which they are cut being either provided for the purpose or utilized as convenient and suitable. Such inscriptions may be classified as (1) religious and (2) political and social. The distinction between the two is not always easy to draw; for in almost all ancient civilizations religion was a part of the established service of the state and was under public control, or at least was closely bound up with political administration. It follows that many inscriptions relating to religious matters take the form of political decrees or state documents, and therefore might, especially as far as form is concerned, be included in either category; but it is usually possible to classify them according to their contents and intention.

Greek Inscriptions

Religious.—*Temples.*—A temple was often a kind of religious corporation under the control of the state, and its accounts and details of administration were made public at frequent intervals, usually annually, by means of inscriptions, exhibited to public view in its precinct. Many such inscriptions have been found and they supply a great deal of information that can be obtained from no other source. Some great temples, such as that of Apollo on the island of Delos, held great amounts of property, both real and portable, the latter taking the form either of more or less precious offerings dedicated in the temple and its surrounding buildings, or of coined money. The inscriptions accordingly record gifts and acquisitions of landed property, leases and assignments, payments of rent and fines for default, loans and interest and many other business transactions suitable to a great landed proprietor or to a bank. They therefore throw much light upon the social and economic conditions of ancient life, such as are nowhere else recorded. The lists of offerings dedicated in the temple and other buildings almost recreate their appearance. These offerings are described as being on the floor, on the walls, on shelves or in cases; they consisted of vases and other objects suitable for use in the temple service; ornaments and jewels; statuettes, mostly in gold and silver; weapons and tools; coined money; and bullion, mostly melted down from old offerings. The detailed care that was taken to ensure that the full weight of melted objects was preserved, whether made into a new vessel or not, is recorded in other inscriptions. These elaborate inventories were checked and revised by each successive board of administrators, and gave the best possible security against any robbery or peculation. In addition to such general lists, there are also innumerable records of various gifts and acquisitions, whether of land and houses, or of movable property of all sorts. Buildings and repairs, sometimes by the state, sometimes by individuals, whose piety and generosity are suitably honoured, are also recorded. In form, these are often hardly to be distinguished from public works of a secular character, which must be mentioned later.

The inscriptions on or belonging to special dedications are often of great historical interest—there need only be quoted the inscription on the famous snake column from Delphi, with the list of the Greek states which took part in the Persian War, and that relating to the Roman arms dedicated by Pyrrhus of Epirus at Dodona after his victories. Most of the great temples being of immemorial sanctity, it is hardly to be expected that any records of their foundation should be found in inscriptions. But on the other hand there are many accounts of the dedication of new temples, either by states or communities or by private individuals. In almost all such cases it was necessary to obtain sanction for the foundation from the state; thus the inscription often takes the form of a decree of the people authorizing the foundation of the temple, and often giving some privileges to the founder or founders.

Officials.—Inscriptions give much information as to priests and other religious officials. There are, in the first place, lists of priests, some of them covering long periods and even going back to mythical times; there are also lists of the treasurers and administrators, who were usually lay officials appointed for the purpose either by election or by lot. The duties and privileges of priests are recorded in many inscriptions, and vary considerably from place to place. It is recorded, for instance, what portions of a victim at any sacrifice were to be received by the priest. In any important temple this must evidently have been far more than the priest or his family could consume; accordingly, it must have been sold, and so constituted a considerable source of income. Consequently a priesthood was an office well paid and much sought after; and in later Greek times, especially in Asia Minor, priesthoods were frequently sold, under proper guarantees and with due sureties as to the duties being carried out. Sometimes a fee to the priest had to be paid in cash; in some cases a priest or priestess was allowed to take up a collection on certain days. On the other hand, the duties of a priest are often recorded; he had to see to the cleaning and care of the temple and its contents, to provide flowers and garlands for decorations and to supply the regular daily service. Sacrifices on great occasions were usually provided by the state, as also were important repairs; but in some cases a priest undertook these on his own account, and was honoured accordingly—for instance, by being allowed to inscribe his name in the restored temple.

Besides priests, many other officials of various ranks were attached to temples and recorded in inscriptions. Some of these, especially those who were concerned with buildings or constructions, or with the inventories of temple treasures and the accounts of administration, were lay officials appointed by the state, as in the case of political officers. But many others had specialized sacerdotal functions; for instance, in many places there were *manteis* or prophets, often of special families with hereditary skill in divination; at Eleusis records were found of the hierophant,

the torchbearer and others who took part in the celebration of the mysteries. At Olympia, in later Greek times, was found a remarkable list of officials, viz.: three priests, three libation pourers, two prophets, three custodians (of keys), a flute player, an interpreter, a priest for the daily sacrifice, a secretary, a wine pourer, three dancers at libations, a woodman (to supply wood for the sacrifices) and a steward and cook—the last being no sinecure, in view of the numerous sacrificial feasts.

There were also many more menial offices in the service of temples which were carried out by slaves. Such slaves were often presented to the temple or acquired in some other way. There is a whole class of inscriptions, found on many sites, in which the sale of slaves to a temple or to the god of a temple is recorded. It is often difficult to know whether such slaves were intended for the service of a temple, or, on the other hand, such service was either purely formal or was not required at all, the sale to the temple being intended as fictitious, so as to enable a slave to acquire his own freedom and at the same time to secure the protection of the god in his free status.

Ritual.—The ritual appropriate to different divinities and temples varied greatly from place to place, and it was therefore necessary or desirable to set up notices in all public places of worship for the information and guidance of worshipers. The commonest and most essential act of worship was sacrifice; an example of the simplest form of prescription is to be seen in the inscription on the relief from Thasos in the Louvre: "To the Nymphs and to Apollo the leader of the Nymphs, the worshiper may, if he so choose, sacrifice a male and a female victim. It is not permissible to offer a sheep or a pig. No paean is sung. To the Graces it is not permissible to offer a goat or a pig."

It is to be noticed that this order of service contains a prohibition as well as a prescription. Such prohibitions are frequent, and often relate to the need of ceremonial purity in all worshipers entering a sacred precinct. They must, for a certain time, have abstained from certain prescribed means of pollution, varying from place to place. The officials are sometimes ordered to erect notices giving information on this point; for instance, at the precinct of Alectrona at Ialysus, it was prescribed that "no horse, ass, mule, nor any other animal with a bushy tail should enter, and that nobody should bring such animals in or wear shoes or any article produced from pigs. There is also a fine for driving in sheep." Other precincts were protected in a more general manner from any invasion or violation. It was prohibited to cut wood or to remove earth and stones or to drive any beasts into some precincts; the right of erecting booths was either restricted or denied altogether. Sometimes more detailed prescriptions are given for the whole organization of a festival; thus at Andania, in Messenia, the arrangements for the celebration of the local Eleusinia—the dress of the participants, the officials and policing—are very fully described. Similarly, in the hall of the Iobacchi, at Athens, the order of proceedings, the officers and the characters in the sacred play and various administrative details are ordered.

When there was any doubt about a ritual or procedure, divination was often resorted to, and the results of such divination were recorded in inscriptions as a guidance for the future. It was also a common practice to consult Delphi or some other oracle in doubtful or difficult cases; in such cases the exact method of procedure was sometimes recorded, as well as the response of the oracle. Forms of worship were often prescribed or recorded, especially hymns, which were sometimes inscribed together with their musical notation. The performance of songs or hymns and dances was also a matter of constant reference, especially in connection with lyrical or musical contests; the victorious band or performer often dedicated the prize in honour of the god. A special form of contest was that in dramatic performances, of which many records have survived, both from Athens and from many other parts of the Greek world. The regulation of athletic festivals and the records of victors in their contests also form a numerous class of inscriptions. As regards mysteries, though there are numerous regulations affecting the arrangement of celebrations and the conduct of those participating, there is, as was to be expected, very little concerning the actual performances.

Another interesting phase of Greek religion known mainly from inscriptions is offered by the shrines of healing. The most notable of these was the precinct of Asclepius at Epidaurus, where lists of the cures effected by Apollo and Asclepius have been found on large slabs of inscription, compiled, in all probability, from earlier documents. The cures are of the most varied kinds, ranging from painful diseases or surgical cases to a lost boy and a broken cup. The formula is the same in almost all cases: the consultant comes to Epidaurus, sleeps in the *abaton*, has dreams or sees visions and comes out whole. In later times, when such faith healing had probably become less efficacious, elaborate prescriptions of diet and hygiene are recorded.

A special form of prayer consisted of curses, which were often buried in the ground, probably with the intent to reach the infernal gods. Such curses often give the reason for their being made, usually some injury done to the author of the curse; sometimes they devoted the offender to the infernal gods.

Private Associations.—Another element in Greek religion which is known almost exclusively by means of inscriptions is to be found in the religious associations that existed in many Greek cities, apart from the organization of state religion, though sometimes recognized by it. Each association had its own regulations, which were duly recorded in inscriptions; the associations varied greatly both in purpose and in character. Many of them had a definitely religious purpose, in the worship of certain gods; sometimes an alien community was given special permission to worship its own god or gods in its own way. Other associations were more social in character and served as clubs, or as burial societies. A remarkable feature about such associations is that the lists of members of many of them include the names of women and of slaves, thus contrasting with the civic basis of established religion in Greece and anticipating a religion in which "there is neither Jew nor Greek, there is neither bond nor free, there is neither male nor female."

Political and Social.—*Codes and Regulations.*—Ancient writers state that the earliest laws of Athens were inscribed upon tablets of wood, put together in a pyramidal shape. These, owing to their material, have perished; but there are some very early codes of law preserved on stone, notably at Gortyna in Crete. There an inscription of great length is incised on the slabs of a theatre-shaped structure in 12 columns of 50 lines each; it is mainly concerned with the law of inheritance, adoption, etc. Doubtless similar inscriptions were set up in many places in Greece. An interesting series of inscriptions deals with the conditions under which colonists were sent out from various cities, and the measures that were taken to secure their rights as citizens. A bronze tablet records in some detail the arrangements of this sort made when the Locrians established a colony in Naupactus; another inscription relates to the Athenian colonization of Salamis in the 6th century B.C.

Decrees.—A large number of inscriptions are in the form of decrees of various cities and peoples, even when their subject matter suggests that they should be classified under other headings. Almost all legislative and many administrative measures took this form; often a decree prescribed how and where the inscription should be set up. The formulae and preambles of such decrees vary considerably from place to place, and from period to period. Those of Athens are by far the most exactly known, owing to the immense number that have been discovered; and they are so strictly stereotyped that they can be classified with the precision of algebraical formulae and dated, often to within a few years, by this test alone. It was usual to record the year (by the name of the Eponymous Archon), the day of the month and of the prytany (or presiding commission according to tribes), the various secretaries, the presiding officials and the proposer of the decree. It is also stated whether the resolution was passed by the senate (Boule), by the assembly of the people (Ecclesia), or by both. The circumstances or the reason of the resolution are then given, and finally the decision itself. Some other cities followed Athens in the form of their decrees, with such local variations as were required; others were more independent in their development,

and different magistracies or forms of government had various results. In the Hellenistic age and later, the forms of independent government were kept up to a great extent, though little real power remained with the people. On the other hand, it is a common thing to find letters from kings, and later from Roman emperors, inscribed and set up in public places.

Public Accounts.—It was customary to inscribe on stone all records of the receipt, custody and expenditure of public money or treasure, so that any citizen could verify for himself the safety and due control of the state in all financial matters. As in the case of temple accounts, it was usual for each temporary board of officials to render to their successors an account of their stewardship, and of the resources and treasures which they handed over. In all cases of public works the expenditure was ordered by the state, and detailed reports were drawn up and inscribed on stone at intervals while the work was being carried out. In many cases there is a detailed specification of building work which makes it possible to realize not only all the technical details and processes employed, but also the whole plan and structure of a building. A notable instance is the arsenal of Philon, which has been completely reconstructed on paper by architects from the building specification. In the case of the Erechtheum, there is not only a detailed report on the unfinished state of the building in 409 B.C., but also accounts of expenditure and payments to the workmen employed in finishing it. Similar accounts have been preserved of the building of the Parthenon, spread over 15 years; in the case of both the Parthenon and the Erechtheum, there are included the payments made to those who made the sculptures.

Naval and military expenditure is also very fully accounted for; among other information there are records of the galley slips at the different harbours, and of the ships of the Athenian navy, with their names and condition. In short, there is no department of state economy and financial administration that is not abundantly illustrated by the record of inscriptions.

Tribute Lists.—A set of records of high historical value are the tribute lists, recording the quota paid to Athens by her subject allies during the 5th century B.C. These throw much light on her relations with them at various periods. (*See* DELIAN LEAGUE.)

Ephebic Inscriptions.—An institution about which knowledge is mainly derived from inscriptions is the ephebic system at Athens (*see* EPHEBI). There are not only records of lists of ephebi and of their guardians and instructors but also decrees in honour of their services, especially in taking their due part in religious and other ceremonies, and resolutions of the ephebi themselves in honour of their officials. It is possible to trace in the inscriptions, which range over several centuries, the gradual transformation of what was originally a system of physical and military training for Athenian youths from the age of 18 to 20, with outpost and police duties. In later times there were added to the instructors in military exercises, others who gave lectures on what should now be called arts and science subjects; thus in Hellenistic and Roman times, when youths from all parts of the civilized world flocked to Athens as an intellectual centre, the ephebic system became a kind of cosmopolitan university.

Political and Commercial Agreements.—In addition to inscriptions which are concerned with the internal affairs of various cities, there are many others recording treaties or other agreements of an international character between various cities and states. These were incised on bronze or stone and set up in places of public resort in the cities concerned, or in common religious centres such as Olympia and Delphi. The simplest form of treaty is merely an alliance for a certain term of years, usually with some penalty for any breach of the conditions. Often an oath was prescribed, to be taken by representatives on each side; it was also not unusual to appeal to the god in whose temple the treaty was exhibited. In other cases a list of gods by whom the two parties must swear was prescribed. Commercial clauses were sometimes added to treaties of alliance, and commercial treaties are also found, agreeing as to the export and import of merchandise and other things. In later days, especially in the time of the Hellenistic kings, treaties tended to become more complicated and detailed in their provisions.

Another series of records of great historical interest is concerned with arbitration between various states on various questions, mainly concerned with frontiers. In cases of dispute it was not uncommon for the two disputants to appoint a third party as arbitrator. Sometimes this third party was another state, sometimes a specified number of individuals. Thus, in a frontier dispute between Corinth and Epidaurus, 151 citizens of Megara were appointed by name to arbitrate, and when the decision was disputed, 31 from among them revised or confirmed it. In all such cases it was the custom for a full record to be preserved on stone and set up in the places concerned. In this case the initiative in referring the matter to arbitration came from the Achaean league.

Proxenia Decrees.—A very large class of inscriptions deals with the institution of *proxenia*. According to this, a citizen of any state might be appointed *proxenos* of another state; his duties would then be to offer help and hospitality to any citizen of that other state who might be visiting his city, and to assist him in any dispute or in securing his legal rights. The office has been compared to the modern appointment of consuls, with the essential difference that the *proxenos* was always a citizen of the state in which he resided, not of that whose citizens and interests he assisted. The decrees upon this matter frequently record the appointment of a *proxenos* and the conferring on him of certain benefits and privileges in return for his services; they also contain resolutions of thanks from the city served by the *proxenos* and record honours consequently conferred upon him.

Individual Honours.—This class of inscription is, in form, not unlike the last, except that the honours recorded were given for all sorts of services, private and public, to the state and to individuals. A frequent addition is an invitation to dine in the Prytaneum at Athens. Some were inscribed on the bases of statues set up to the recipient. In early times these inscriptions were usually brief and simple. The bust of Pericles on the Acropolis held nothing but the names of Pericles himself and of the sculptor Cresilas. Later it became usual to give, in some detail, the reasons for the honours awarded; in Hellenistic and Roman times these became more and more detailed and fulsomely laudatory.

Artists' Signatures.—These inscriptions are of special interest for the light they throw upon the history of art. The artist's name was usually carved upon the base or pedestal of a statue, especially in earlier times, and consequently was easily separated from it if the statue was carried off or destroyed. An instance in which both statue and pedestal are preserved is the Victory, signed on its pedestal by Paeonius at Olympia. Occasionally, and more frequently in later times, the artist's signature was carved upon some portion of the statue itself. But in later copies of well-known works it has to be considered whether the name is that of the original artist or of the copyist who reproduced his work.

A special class of artists' signatures is offered by the names signed by Attic vase painters and others upon their vases. These have been made the basis of a minute historical and stylistic study of the work of these painters and unsigned vases also have been grouped with the signed ones, so as to make an exact and detailed record of this branch of Greek artistic production.

Historical Records.—The great majority of these fall into one of the classes already referred to. But there are some instances in which an inscription was set up merely as a record, *e.g.*, a list of athletic or other contest victories. The most famous historical record is the autobiographical account of the deeds and administration of Augustus, which was reproduced and set up in many places; it is generally known as the Monumentum Ancyranum because the most complete copy of it was found at Ancyra. The Marmor Parium at Oxford, found in Paros, is a chronological record of Greek history, probably made for educational purposes and valuable for the traditional dates it gives of events from the earliest times.

Tombs.—This is by far the most numerous class of inscriptions, both Greek and Latin. In early Athens often no record was left beyond the name of the deceased, the name of his father and his deme. Sometimes a word or two of conventional praise was added, such as "a good and wise man." Occasionally the circum-

stances of death were alluded to, especially if it took place in battle or at sea. Such epitaphs were frequently in metrical form, usually either hexameters or elegiacs. Many of them have been collected and they form an interesting addition to the Greek anthology. In later times it became usual to give more elaborate praise of the deceased; but this was hardly ever so detailed as on more modern tombstones. The age and other facts about the deceased were occasionally given on Greek tombstones, but not nearly so often as on Latin ones, which offer valuable statistical information in this respect.

Latin Inscriptions

Latin inscriptions may be classified on much the same lines as Greek; but certain broad distinctions may be drawn at the outset. They are generally more standardized in form and in content, not only in Rome and Italy but also throughout the provinces of the Roman empire. One of the chief difficulties in deciphering Latin inscriptions lies in the extensive use of initials and abbreviations. These are of great number and variety, and while some of them can be easily interpreted as belonging to well-known formulae, others offer considerable difficulty, especially to the inexperienced student. A mere list of such initials and abbreviations occupies 68 pages in R. Cagnat's *Cours d'epigraphie latine*. Often the same initial may have many different meanings according to the context. Some common formulae such as V.S.L.M. (*votum solvit libens merito*, "according to justice he discharges his vow willingly"), or H.M.H.N.S. (*hoc monumentum heredem non sequetur*, "this monument is not to pass to the heir") offer little difficulty, but there are many which are not so obvious and leave room for conjecture. Often the only way to determine the meaning is to search through a list of initials, such as those given by Cagnat, until a formula is found which fits the context.

Most of what has been said about Greek inscriptions applies to Roman also. The commonest materials in this case also are stone, marble and bronze; but a more extensive use is made of stamped bricks and tiles, which are often of historical value as identifying and dating a building or other construction. The same applies to leaden water pipes which frequently bear dates and names of officials. Terra-cotta lamps also frequently have their makers' names and other information stamped upon them. Arms, and especially shields, sometimes bear the name and corps of their owners. Leaden disks were also used to serve the same purpose as modern identification disks. Inscriptions are also found on sling bullets—Roman as well as Greek; there are also numerous classes of *tesserae*, or tickets of admission to theatres or other shows.

As regards the contents of inscriptions, there must evidently be a considerable difference between the records of a number of independent city states and an empire including almost all the civilized world; but municipalities maintained many of their independent traditions in Roman times, and consequently their inscriptions often follow the old formulas.

The classification of Roman inscriptions may, therefore, follow the same lines as the Greek, except that certain categories are absent and that some others, not found in Greek, are of considerable importance.

Religious.—*Temple Dedications.*—These are very numerous; and the custom of placing the name of the dedicator in a conspicuous place on the building was prevalent, especially in the case of dedications by emperors or officials, or by public bodies. Restoration or repair was often recorded in the same manner. In the case of small objects the dedication is usually simple in form; it usually contains the name of the god or other recipient and of the donor, and a common formula is D.D. (*dedit, donavit*, "he gave," "he has given"), often with additions such as L.M. (*libens merito*, "willingly according to justice"). Such dedications are often the result of a vow, and V.S. (*votum solvit*, "he discharges his vow") is therefore often added. Bequests made under the wills of rich citizens are frequently recorded by inscriptions; these might either be for religious or for social purposes.

Officials.—A priesthood was frequently a political office and consequently is mentioned along with political honours in the list of a man's distinctions. The priesthoods that a man had held are usually mentioned first in inscriptions, before his civil offices and distinctions. Religious offices, as well as civil, were restricted to certain classes, the highest to those of senatorial rank, the next to those of equestrian status; many minor offices, both in Rome and in the provinces, are enumerated in their due order.

Regulations.—Among the most interesting of these is the ancient song and accompanying dance performed by the priests known as the Arval brothers. This is, however, not in the form of a ritual prescription, but a detailed record of the due performance of the rite. An important class of documents is the series of calendars that have been found in Rome and in various Italian towns. These gave notice of religious festivals and anniversaries, and also of the days available for various purposes. The bronze tablets from Iguvium contain extensive ritual instructions in the Umbrian dialect for a cult association known as the Atiedian brethren.

Colleges.—The various colleges for religious purposes were very numerous. Many of them, both in Rome and Italy and in provincial municipalities, were of the nature of priesthoods. Some were regarded as offices of high distinction and were open only to men of senatorial rank; among these were the Augurs, the Fetiales, the Salii and, in imperial times, the Sodales Divorum Augustorum. The records of these colleges sometimes give no information beyond the names of members, but these are often of considerable interest. Haruspices and Luperci were of equestrian rank.

Political and Social.—*Codes and Regulations.*—Information as to these is not drawn mainly from inscriptions and, therefore, they need not be considered here. On the other hand, the word *lex* (law) is usually applied to all decrees of the senate or other bodies, whether of legislative or of administrative character. It is best, therefore, to consider all together under the heading of public decrees.

Laws and Decrees.—A certain number of these dating from republican times are of considerable interest. One of the earliest relates to the prohibition of bacchanalian orgies in Italy; it takes the form of a message from the magistrates, stating the authority on which they acted. Laws all follow a fixed formula, according to the body which passed them. First there is a statement that the legislative body was consulted by the appropriate magistrate in due form; then follows the text of the law; and finally the sanction, the statement that the law was passed. In decrees of the senate the formula differs somewhat. They begin with a preamble giving the names of the consulting magistrates, the place and conditions of the meeting; then comes the subject submitted for decision, ending with the formula Q.D.E.R.F.P. (*quid de ea re fieri placeret*, "what does the senate determine to be done concerning this matter?"); then comes the decision of the senate, opening with D.E.R.I.C. (*de ea re ita censuerunt*, "concerning this matter they have resolved thus"). C is added at the end, to indicate that the decree was passed. In imperial times the emperor sometimes addressed a speech to the senate, advising them to pass certain resolutions; or, especially in later times, he would give orders or instructions directly, either on his own initiative or in response to questions or references. The number and variety of such orders is such that no classification of them can be given here.

One of the most famous is the edict of Diocletian, fixing the prices of all commodities. Copies of this in Greek as well as in Latin have been found in various parts of the Roman empire.

Building Records.—A very large number of inscriptions record the building or repair of public buildings by private individuals, by Roman or provincial magistrates and by emperors. In addition to the dedication of temples, inscriptions recording the construction of aqueducts, roads, especially on milestones, baths, basilicas, porticos and many other works of public utility are found. In early inscriptions often nothing was given but the name of the person who built or restored the edifice and a statement that he had done so. But later it was usual to give more detail as to the motive of the building, the name of the emperor or a magis-

trate giving the date, the authority for the building and the names and distinctions of the builders; then follows a description of the building, the source of the expenditure (*e.g.*, S.P.-*sua pecunia*, "his money") and finally the appropriate verb for the work done, whether building, restoring, enlarging or otherwise improving. Other details are sometimes added, such as the name of the man under whose direction the work was done.

Military Documents.—These vary greatly in content, and are among the most important documents concerning the administration of the Roman empire. "They are numerous and of all sorts—tombstones of every degree, lists of soldiers' burial clubs, certificates of discharge from service, schedules of time-expired men, dedications of altars, records of building or of engineering works accomplished. The facts directly commemorated are rarely important." But when the information from hundreds of such inscriptions is collected together, "you can trace the whole policy of the imperial Government in the matter of recruiting, to what extent and till what date legionaries were raised in Italy; what contingents for various branches of the service were drawn from the provinces, and which provinces provided most; how far provincials garrisoned their own countries, and which of them, like the British recruits, were sent as a measure of precaution to serve elsewhere; or, finally, at what epoch the empire grew weak enough to require the enlistment of barbarians from beyond its frontiers." (F. Haverfield, *Authority and Archaeology*, p. 314.)

Treaties and Agreements.—There were many treaties between Rome and other states in republican times; but as a rule, knowledge of these does not derive from inscriptions, which are very rare in this earlier period. In imperial times, to which most Latin inscriptions belong, international relations were subject to the universal domination of Rome, and consequently the documents relating to them are concerned with reference to the central authority, and often take the form of orders from the emperor.

Proxeny.—This custom belonged to Greece. What most nearly corresponded to it in Roman times was the adoption by a city or a state of some distinguished Roman as its patron. The relation was then recorded, usually on a bronze tablet placed in some conspicuous position in the town concerned. The patron probably also kept a copy in his house, or had a portable tablet which would ensure his recognition and reception.

Individual Honours.—Honorary inscriptions were extremely common in all parts of the Roman world. Sometimes they were placed on the bases of statues, sometimes in documents set up to record some particular benefaction or the construction of some public work. The offices held by and the distinctions conferred upon the person commemorated are enumerated in a regularly established order (*cursus honorum*, "order of honours"), either beginning with the lower and proceeding step by step to the higher, or in reverse order with the highest first. Religious and priestly offices are usually mentioned before civil and political ones. These might be exercised either in Rome itself, or in the various municipalities of the empire.

There was also a distinction drawn between offices that might be held only by persons of senatorial rank, those that were assigned to persons of equestrian rank and those of a less distinguished kind. It follows that when only a portion of an inscription has been found, it is often possible to restore the whole in accordance with the accepted order.

Artists' Signatures.—When these are attached to statues it is sometimes doubtful whether the name is that of the man who actually made the statue or of the master whose work it reproduces. Thus there are two well-known copies of a statue of Hercules by Lysippus, of which one is said to be the work of Lysippus and the other states that it was made by Glycon. Another kind of artist's or artificer's signature that was commoner in Roman times is to be found in the signatures of potters upon lamps and various kinds of vessels; they are usually impressed on the mold and stand out in relief on the terra cotta or other material. These are of interest for the information they give as to the commercial spread of various kinds of handicrafts and the conditions under which they were manufactured.

Historical Records.—Many of these inscriptions might well be assigned to one of the categories already considered. But there are some which were made expressly to commemorate an important event or to preserve a record. Among the most interesting is the inscription of the Columna Rostrata in Rome, which records the great naval victory of Duilius over the Carthaginians; this, however, is not the original, but a later and somewhat modified version. A document of high importance is a summary of the life and achievements of Augustus, already mentioned, known as the Monumentum Ancyranum. The various sets of Fasti constituted a record of the names of consuls and other magistrates or high officials, and also of the triumphs accorded to conquering generals.

Tombs.—These are probably the most numerous of all classes of inscriptions. Though many of them are of no great individual interest, they convey, when taken collectively, much valuable information as to the distribution and transference of population, as to trades and professions, as to health and longevity and as to many other conditions of ancient life. The most interesting early series is that on the tombs of the Scipios at Rome, recording, mostly in Saturnian metre, the exploits and distinctions of the various members of that family.

About the end of the republic and the beginning of the empire, it became customary to head a tombstone with the letters D.M. or D.M.S. (*dis manibus sacrum*, "sacred to the shades of the gods"), thus consecrating the tomb to the deceased as having become members of the body of ghosts or spirits of the dead. These are followed by the name of the deceased, usually with his father's name and his tribe, by his honours and distinctions and sometimes by a record of his age. The inscription often concludes with H.I. (*hic iacet*, "here lies") or some similar formula, and also, frequently, with a statement of boundaries and a prohibition of violation or further use—for instance, the formula mentioned above, H.M.H.N.S.

The person who erected the monument and his relation to the deceased are often stated; or if a man has prepared the tomb in his lifetime, this also may be stated, V.S.F. (*vivus sibi fecit*, "while living he made this for himself"). But it is obvious that there is an immense variety in the information that either a man himself or his friends might wish to record.

Milestones and Boundaries.—Milestones (*miliaria*) have already been referred to, and may be regarded as records of the building of roads. Boundary stones (*termini*) are frequently found, both of public and private property. A well-known instance is offered by those set up by the commissioners called "III. viri A.I.A." (*agris iudicandis adsignandis*, "for assigning boundaries of farms") in the time of the Gracchi.

See also references under "Inscriptions" in the Index.

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INSECT, any member of the class Insecta (or Hexapoda), the largest class of the largest animal phylum, Arthropoda (*q.v.*). Like all arthropods, the insects have segmented bodies, jointed legs and, when present, external skeletons (exoskeletons). However, insects are distinguished from other arthropods by having the body divided into three major regions, which appear to be deeply incised (hence the term "insect" from the Latin meaning "cut in"). These three regions are: (1) the head, which bears the mouth parts, eyes and a pair of antennae; (2) the thorax, which usually has three pairs of legs (hence "Hexapoda," the former class name) and often one or two pairs of wings; and (3) the many-segmented abdomen, which contains the digestive, excretory and reproductive organs.

Popularly "insect" brings to mind the familiar pests or disease carriers, from bedbugs, houseflies and clothes moths to Japanese beetles and aphids; the annoyers, such as mosquitoes, fleas, horseflies and hornets; and the conspicuous butterflies and moths. The pest species are actually in the minority, most insects being beneficial from man's viewpoint; they pollinate plants, produce useful substances, control pest insects, act as scavengers and serve as food for other animals (see *Importance of Insects*, below).

Insects as organisms—their origin and evolution, metamorphosis and development, anatomy and physiology, habits and behaviour, classification—and the ways in which they are useful or injurious to man are discussed below. Further information on their structure and habits is presented in articles on particular insects and on various insect orders. The science that is concerned with insects from the broad biological and applied aspects is considered under the title Entomology.

The following topics are discussed here:

I. Introduction
  1. Size Range
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    7. Trichoptera (Caddis Flies)
    8. Lepidoptera (Butterflies, Moths)
    9. Diptera (True Flies)
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    11. Hymenoptera (Ants, Bees, Wasps, Etc.)

I. INTRODUCTION

In numbers of species, in the vast numbers of individuals and in the great adaptability, wide distribution and persistence of the group as a whole, insects are perhaps the most eminently successful of all animals. They dominate the present-day land fauna; about 850,000 species have been described, representing about 80% of known animal life, yet entomologists estimate the actual number of living species as being in excess of 2,000,000. The most numerous in species are the orders Coleoptera (beetles), Lepidoptera (butterflies and moths), Hymenoptera (ants, bees, wasps, etc.) and Diptera (true flies).

1. Size Range.—The majority of insects are small, being less than $\frac{1}{4}$ in. long. The size range, however, is wide. Some are microscopic, as certain of the feather-winged beetles (family Ptiliidae), barely $\frac{1}{100}$th of an inch long; while some of the tropical forms attain considerable size, being measured in several inches, as the African goliath beetles, certain Australian stick insects and some Asian and South American moths.

2. Distribution.—Insects are adapted to every land and fresh water habitat where food is available, from deserts to lush jungles, from glacial fields and swift-running, cold mountain streams to stagnant, lowland ponds and hot springs. Many live in brackish water up to one-tenth the density of sea water, a few in sea water and some fly larvae can live in pools of crude petroleum where they eat other insects that fall in.

3. Diversity.—In many species sexual dimorphism (difference in body structure between the sexes) is pronounced, and knowledge of one sex may give little clue as to the appearance of the other sex. In some, as the twisted-wing insects (Strepsiptera), the female is a mere inactive bag of eggs, while the male is winged and one of the most active insects known. Modes of reproduction are very diverse. Parthenogenesis (reproduction without fertilization) is common in some insects (certain wasps, bees, aphids) and reproductive capacity is generally high (ants, termites, aphids, flies). Some insects, as the May flies, feed only in the larval stage and go without food as adults. Among the social insects the queen ants and queen termites live for many years (15–50), while some adult May flies live less than two hours.

Some insects advertise their presence to the other sex by flashing lights, and many imitate other insects in colour and form and thus avoid or minimize attack by predators that feed by day and find their prey visually, as birds, lizards, other insects, etc.

Behaviour is equally diverse, from the almost inanimate parasitic forms where the larva lies in the nutrient blood stream of its host and feeds by absorption, to dragonflies that pursue victims in the air, tiger beetles that outrun prey on the land and dytiscid beetles that outswim prey in the water.

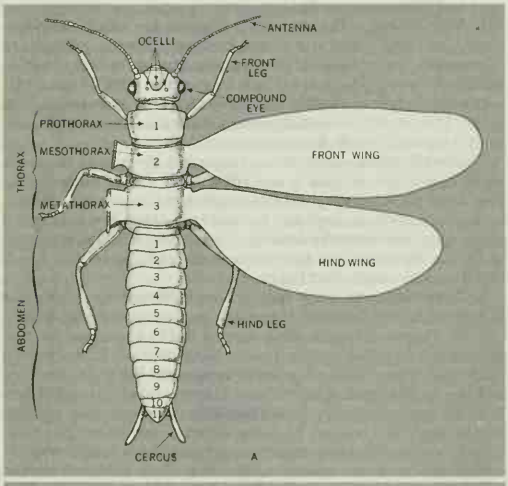
In some cases the adult insects make elaborate preparations for the young; in others the mother defends or feeds her young; and in still others there are complex insect societies, which, in the case of tropical termites and ants, may reach populations of millions of inhabitants.

4. Abundance.—No scientist familiar with insects has attempted to estimate individual numbers beyond areas of a few acres or a few square miles in extent. Figures soon become so large as to be incomprehensible. The large populations and great variety of insects are related to their small size, high rates of reproduction and abundance of suitable food supplies. Insects abound in the tropics, both in numbers of different kinds and in numbers of individuals.

A commonly used method in teaching entomology is to count the insects in and on a square yard of rich moist soil. Including the young and adults of all forms from microscopic young Collembola to all large adults, 500 are easily found and 2,000 are not unusual in samples of soil in the north temperate zone. This is roughly 4,000,000 insects on one moist acre. The untrained observer walking through such an area would probably notice only an occasional butterfly, bumblebee or large beetle, supergiants among insects. Only a few thousand species touch man's living seriously enough to require control measures—those that attack his crops, herds and products, and those that carry disease. However, when they do appear as enemies of man, they can build up populations with speed and attack in incredible numbers. In northern regions the few houseflies that winter over are rare insects, but in August their descendents occur in great numbers. Thus man moves about in a world of insects but is virtually unconscious of their vast numbers. (C. H. Ky.; X.)

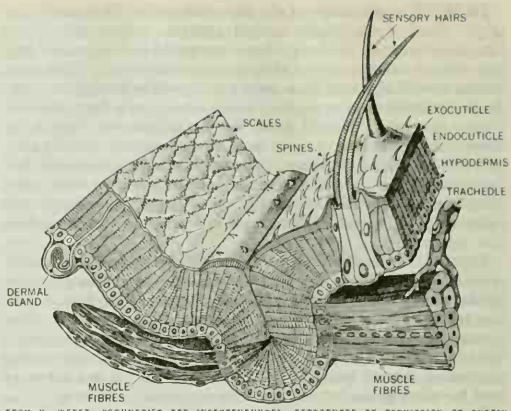
II. STRUCTURE AND FUNCTION

Insects share with other arthropods a number of structural features, including the possession of a segmented body, an external skeleton, and paired, segmented appendages, some of which are usually specialized for walking, eating, egg-laying or other particular functions.



(A) FROM H. H. ROSS, "A TEXTBOOK OF ENTYMOLOGY"; REPRODUCED BY PERMISSION OF JOHN WILEY & SONS, INC., (B) FROM H. WEBER, "GRUNDRISS DER INSEKTENKUNDE", REPRODUCED BY PERMISSION OF GUSTAV FISCHER VERLAG

FIG. 1.—MAJOR BODY PARTS OF A GENERALIZED INSECT: (A) VIEW FROM ABOVE WITH SEGMENTS NUMBERED; (B) EXTERIOR FEATURES OF MALE. WINGS NOT SHOWN; MALE ORGANS SHOWN THROUGH BODY WALL



FROM H. WEBER, "GRUNDRISS DER INSEKTENKUNDE"; REPRODUCED BY PERMISSION OF GUSTAV FISCHER VERLAG

FIG. 2.—BODY COVERING SHOWING RELATION OF CUTICLE TO OTHER FEATURES

1. External Features.—*Body Covering.*—The insect body is covered with a cuticular exoskeleton consisting chiefly of a chitin-containing substance somewhat resembling the cellulose of plants. It is secreted by a layer of epidermal cells, the hypodermis. The innermost layer (endocuticle) is colourless, tough and elastic, the outermost (exocuticle) rigid and amber-coloured. The entire cuticle is pierced by ducts of dermal glands that pour out protective secretions over the surface. Hairs and scales of various types, some of which constitute sense organs, articulate with the cuticle. The colour and pattern of an insect's body may be located either in the cuticle itself or in the hairs, scales or dust that may cover the cuticle. The colours may be produced by pigments or by optical interference of light scattered by minute striations of the surface. Black or brown colouring is generally a result of melanin pigments deposited in the exocuticle. (*See* SKELETON, INVERTEBRATE.)

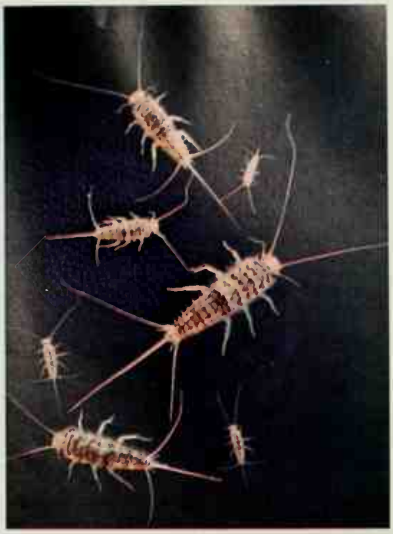
Head.—A number of fused segments form the head capsule. Attached to this capsule are the eyes and various appendages, including the antennae, which bear a variety of sense organs, and the highly modified mouth parts.

Thorax.—Three segments compose the thorax: the prothorax, mesothorax and metathorax. Usually each segment bears a pair of legs, each leg articulating with thoracic plates (sclerites), and consisting typically of a basal coxa, trochanter, femur, tibia and tarsus. In most flying insects the meso- and metathorax each bears a pair of wings, although the second pair may be reduced in size or lost, as in the true flies. The wings are traversed by veins that subdivide them into cells, the veins being stronger and more concentrated near the anterior margin. In some instances the first pair of wings is modified to form covers or sheaths (elytra) for the hind wings, as in beetles and grasshoppers. In grasshoppers the elytra fulfil a double function, as wings in flight and as covers at rest. In beetles the elytra are rigid, and in flight are held up at an angle, acting as fixed lifting surfaces.

Abdomen.—The abdomen typically consists of eleven segments, although not more than ten are visible (and in adults usually fewer) as a result of telescoping and modification into copulatory structures. In ants, bees and wasps the first abdominal segment is fused with the thorax and is termed a propodeum. Most exposed segments are typically simple, consisting of a dorsal plate (tergum), a ventral plate (sternum), and a lateral (pleural) membrane that connects them. Within the abdomen are enclosed the digestive, reproductive and excretory organs.

The complex of external structures used in copulation or egg

Dragonfly, order Odonata. Dragonflies are found throughout the world, nearly everywhere there is fresh water. This species was photographed in central Africa



Firebrats, order Thysanura. Wingless insects, in some species eyeless; firebrats are household pests

Stone fly, order Plecoptera. Medium-sized to large insect with well-developed eyes and wings. The nymphs are aquatic

May fly, order Ephemeroptera. Another flying insect found near bodies of fresh water where eggs are laid and nymphs mature

Termites, order Isoptera. Portrait of three of the castes of a *Reticulitermes* species: winged individuals are kings and queens, large yellow-headed individuals are soldiers, others are workers

REPRESENTATIVES OF INSECT ORDERS

PHOTOGRAPHS (TOP LEFT, CENTRE LEFT, BOTTOM LEFT, BOTTOM RIGHT) E. S. ROSS, (TOP RIGHT) ROMAN VISHNIAC—PUBLIX

INSECT

Brown lacewing, order Neuroptera. Soft-bodied insect with extremely elaborate venation of its large wings. Larvae are beneficial to man as aphid eaters

Earwig, order Dermaptera. A hard-bodied insect characterized by a pair of "forceps" (cerci) at the end of its abdomen

Paraphagadochir trachelia, a web spinner, order Embioptera. A social insect that lines its subterranean tunnels with silk produced from glands in its front tarsi (leg segments)

Snake fly, order Raphidiodea (considered by some a superfamily of Neuroptera). Photograph shows the long, slender ovipositor of a female as she rests on a plant stem covered with aphids

Stylops, order Strepsiptera. Twisted wing flies, a small, parasitic order. This unusual photograph shows a male in the act of fecundating a female that lives within the abdomen of a bee (note wings at top centre) that is feeding on a flower

REPRESENTATIVES OF INSECT ORDERS

PHOTOGRAPHS, E. S. ROSS

Horsefly, *Tabanus* species, order Diptera. Colour patterns of the compound eyes are used in identifying species of *Tabanus*. Houseflies and mosquitoes are also members of this order

A velvet ant, a mutillid wasp, the female of which is wingless and antlike, order Hymenoptera. This is the great order of social insects, including bees and ants. Velvet ants are parasites on other insects

Bush katydid, *Microcentrum rhombifolium*, order Orthoptera. The leaflike colour, shape and pattern of venation serve to camouflage the katydid from predators

Long-horned meadow grasshopper, *Orchelimum* species, another member of the Orthoptera, related to the katydids and crickets

Cockroach, order Blattaria (considered by some a family of Orthoptera). Flattened, quick-running scavengers, some species have become household pests. Most are tropical, such as this one from Peru

Close-up of the head of a queen bald-faced hornet (*Vespula maculata*), order Hymenoptera. This wasp is related to the common yellow jacket

REPRESENTATIVES OF INSECT ORDERS

PHOTOGRAPHS, (TOP LEFT, TOP RIGHT, CENTRE LEFT, BOTTOM LEFT) JOHN H. GERARD, (CENTRE RIGHT, BOTTOM RIGHT) E. S. ROSS

INSECT

Nymphs of the milkweed bug, a member of the chinch bug family, Lygaeidae, pests that attack many cereal crops and grains

Stink bug, family Pentatomidae, protected by its nauseous odour and taste

Triatoma species, a reduviid or assassin bug. This one is a household invader and a disease carrier that bites man

Leafhopper, a plant-sucking insect of the family Cicadellidae. Many species are destructive to the trees, shrubs and flowers upon which they feed

Cicada, *Tibicen* species, the familiar song-producing insect of the summer. The skin case left after its final molt may often be seen attached to the bark of a tree

Another reduviid bug shown emerging from its final molt to its adult stage

A shield-backed bug (family Scutellaridae) of central Africa. A plant-eating insect related to the stink bugs

HEMIPTERA: THE TRUE BUGS AND THEIR RELATIVES

PHOTOGRAPHS, (TOP LEFT) JOHN H. GERARD, (TOP CENTRE) ROMAN VISHNIAC—PUBLIX, (TOP RIGHT, CENTRE RIGHT—2, BOTTOM RIGHT) E. S. ROSS, (BOTTOM LEFT) D. DWIGHT DAVIS

Caterpillar of the cynthia moth. *See* picture and caption at right

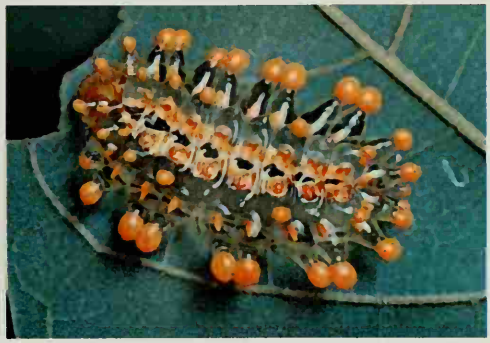
Larva of *Charaxes* species (family Nymphalidae), a large African butterfly

Cynthia moth, *Samia cynthia*, family Saturniidae, resting on a flower just after emerging from its cocoon. The wings have not yet fully opened

Red caterpillar of Peru. The hairs on this larva are poisonous

Caterpillar of the polyphemus moth (*Antheraea polyphemus*)

Measuring worm of the Congo. This is the larval stage of one of the geometrid moths, second largest family of the Lepidoptera



Exotic larva of a Peruvian lepidopteran

LEPIDOPTERA: BUTTERFLIES AND MOTHS

PHOTOGRAPHS (TOP LEFT, CENTRE RIGHT) JOHN H. GERARD; (TOP RIGHT) ROMAN VISHNIAC—PUBLIX, (OTHERS) E. S. ROSS

INSECT

The ivory-marked beetle (*Eburea quadrigeminata*), a long-horned wood-boring beetle (family Cerambycidae)

Six-spotted tiger beetle (*Cicindela sexguttata*) showing metallic coloration that is typical of many cicindelids

Tumblebugs (*Canthon laevis*) rolling a ball of dung. After a site has been selected, eggs are laid in the ball of dung and it is buried

Eyed elater (*Alaus oculatus*), a click beetle (family Elateridae)

Stag beetle (*Pseudolucanus capreolus*), a male showing the greatly enlarged mandibles that resemble the antlers of a stag

Striped blister beetle (*Epicauta vittata*) shown on a tomato, one of the crop plants on which it feeds

COLEOPTERA: BEETLES

PHOTOGRAPHS JOHN H. GERARD

Western spotted cucumber beetle (*Diabrotica undecimpunctata*), a pest which destroys cucumbers by eating and by acting as a disease carrier

White grub, the larva of the June beetle or June bug, *Phyllophaga* species

Colorado potato beetle (*Leptinotarsa decemlineata*), a serious crop pest

Fuller rose weevil (*Pantomorus godmani*), a flightless snout beetle of the western U.S., that attacks fruit trees as well as roses

The round-headed apple borer, *Saperda candida* (family Cerambycidae) shown above its emergence hole in a branch

Another cerambycid beetle, the cottonwood borer (*Plectrodera scalator*), photographed on a day lily

A Peruvian cassid or tortoise beetle, family Chrysomelidae. The brilliant metallic colours of these beetles disappear when they die

A ground beetle *Galerita bicolor*, a North American member of the large family Carabidae

COLEOPTERA: BEETLES

PHOTOGRAPHS (TOP LEFT, TOP CENTRE LOWER, TOP RIGHT, BOTTOM LEFT) E. S. ROSS, (TOP CENTRE UPPER, CENTRE LEFT, BOTTOM RIGHT) O. DWIGHT DAVIS, (CENTRE RIGHT) JOHN H. GERARD

INSECT

Aggregation of monarch butterflies (*Danaus plexippus*) resting during a migratory flight. The monarch follows a regular seasonal migration and return flight

Bee fly (family Bombyliidae) hovering as it drops its eggs into the entrance of the burrow of a ground nesting bee

Larva of a green lacewing, family Chrysopidae, carrying "trash"—the remains of victims—on its back as it forages

A rare example of nonhuman use of a "tool": a sphecid wasp tamping dirt into its burrow by means of a tiny stone held in its mandibles

A cricket singing in front of the entrance to its nest. The sound is made by raising the wings up over the back and rubbing them together

Female mantis assuming a frightening pose to ward off attack on her eggs, the white mass on which she is standing

INSECT HABITS

PHOTOGRAPHS, (TOP LEFT) D. DWIGHT DAVIS, (OTHERS) E. S. ROSS

Nest building by tailor ants (*Oecophylla species*) of Angola. Ant at left is holding a larva and squeezing it. As larva secretes silk, second ant uses it to weave leaves together. *See* below

Group of tailor ants pulling leaves together in preparation for permanent attachment by sewing with larval silk

Formica ants tending aphids. The smaller insects are "milked" by ants for a sweet "honeydew" they secrete. In return, the ants carry the aphids to choice feeding grounds and may take them into their own nests during the winter

Completed nest of the tailor ant (*see* pictures above) showing leaves gathered together and sewn around the twig of a tree. Nests may be made more than 100 ft. above the ground in tropical trees

TWO HIGHLY ORGANIZED ACTIVITIES OF THE ANTS

PHOTOGRAPHS: E. S. ROSS

INSECT

Aphids (at right) sucking the juices from a plant while an aphid lion (left), the larva of a golden-eyed lacewing, attacks an aphid

Hawk wasp stinging a large spider. The wasp carries the paralyzed spider to a burrow and deposits eggs on it

Aedes mosquito feeding on man. Note abdomen swollen with blood. Only the females are bloodsuckers

Damselfly (order Odonata) eating an insect held in its mandibles while mites (red spots) bite the damselfly. Mites are arachnids, members of the same phylum (Arthropoda) as insects

Blues (lycaenid butterflies) drinking at a mud hole. Note extended proboscises

Robber fly (family Asilidae) feeding upon a grasshopper. Prey is held by the strong legs of the fly while it uses its beak to puncture the integument of its victim

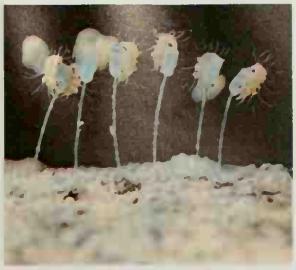
Aulicus, a checkered beetle (family Cleridae), feeding upon an insect larva

INSECTS FEEDING

PHOTOGRAPHS (TOP LEFT) ROMAN VISHNIAC—PUBLIX (TOP CENTRE) JOHN N. GERARD (OTHERS) E. S. ROSS

Cicada, *Tibicen* species, just emerged from its nymphal shell, completing a metamorphosis that lasts as long as 17 years in some species

Braconid, a parasitic wasp, laying eggs. Note long ovipositor extended from abdomen



Lacewing larva (family Chrysopidae) hatching from eggs. Each egg is borne on the end of a hairlike stalk formed of a hardened secretion

Arctiid eggs hatching on a leaf. Grown larvae are the familiar "woolly bear" caterpillars that become nocturnal moths

Newly-hatched stink bugs (family Pentatomidae) and their empty egg cases on a leaf

Aphids being born alive by parthenogenetic reproduction of wingless females. Note individual emerging from mother at right

Short-horned grasshoppers or locusts (Acrididae) mating. Eggs are laid in the soil in large masses enclosed in a capsule

Praying mantis (*Stagmomantis carolina*) with egg mass. Egg laying takes place in autumn, the eggs hatch early the following summer. Each capsule contains about 200 eggs

REPRODUCTION AND METAMORPHOSIS

PHOTOGRAPHS (TOP LEFT, BOTTOM RIGHT) JOHN H. GERARD, (OTHERS) E. S. ROSS

INSECT

Parasitic fly of central Africa with the body shape and markings of a bee, features that serve to protect it from the bees which it parasitizes

Cryptic pygmy locust (family Tetrigidae), a tiny insect that resembles the bark of a tree

Nymph of orchid mantis (*Hymenopus coronatus*). The form and coloration of the nymph serve to conceal it from its prey. The adult of this species bears little resemblance to the nymph

A mantidfly or mantispid (related to lacewings) with wings and abdomen like those of a wasp, and enlarged front legs like those of a mantis

Larva of the spicebush swallowtail butterfly (*Papilio troilus*). Large eyelike spots are merely protective coloration

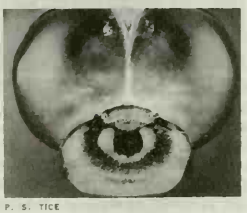
A walking stick, *Diapheroma femorata*, a phasmid, related to the mantids, coloured and shaped like a twig. These insects also assume positions that further enhance their disguise

PROTECTIVE COLORATION AND MIMICRY

PHOTOGRAPHS (TOP LEFT, TOP RIGHT, CENTRE RIGHT) E. S. ROSS, (CENTRE LEFT) J. R. HENDRICKSON FROM D. DWIGHT DAVIS, (BOTTOM RIGHT) D. DWIGHT DAVIS, (BOTTOM LEFT) JOHN H. GERARD

laying is termed the genitalia. In the female these usually serve as an ovipositor and in the Hymenoptera they are sometimes modified for sawing, boring or stinging. In the male the genitalia usually consists of clasping organs to hold the female abdomen during copulation and an intromittent organ (aedeagus) to introduce the seminal fluid.

2. Senses and Communication.—*Sight.*—The eyes are of two kinds, simple and compound. The simple eyes (ocelli) each consist of a transparent lens-shaped swelling of the cuticle and an underlying retina composed of a few dozen light-sensitive cells. In many insect larvae the ocelli occur in small groups on either side of the head and serve for the perception of objects. In adult insects the ocelli occur in addition to the compound eyes and are commonly situated in a group of three on the vertex of the head; here they seem to serve, like many other sense organs, as "stimulatory organs," which bring the insect to a state of alertness by increasing muscular tone and perhaps enhancing responses to sensory stimuli.



P. S. TICE

FIG. 3.—COMPOUND EYES OF DRAGONFLY, COMPOSED OF NUMEROUS FACETS

The compound eyes are very elaborate visual organs. They consist of large numbers of facets (some 4,000 in the housefly; 10,000 to 20,000 or more in the dragonfly), each of which has its own retinal element below. Each facet (ommatidium) receives a thin shaft of light from the object being viewed. The whole eye thus projects upon the retina a composite erect image consisting of a mosaic of points of light, each point contributed by one ommatidium. The fineness of the mosaic and thus the acuity of vision increases as the number of facets increases. It has been estimated that in the bee, under the best conditions of illumination, the resolving power of the eye (*i.e.*, the ability to perceive two closely applied lines as distinct from each other) is about one-hundredth as good as that of man.

Insects have a considerable ability to distinguish the forms of objects; bees can be trained to associate the presence of food with black figures of a particular shape on a white ground. But the chief function of the compound eyes is probably to perceive the movement of objects as the stimulating points of light pass from one ommatidium to the next.

Insects also perceive colour. The colour sense is particularly well developed in flower-visiting insects like butterflies and bees. Bees can be readily trained to come to a particular colour for food. Many insects can perceive ultra-violet light; moths, for example, will fly around a lamp that is screened by a special glass allowing passage only of ultra-violet light. (*See* VISION.)

Chemical and Mechanical Senses.—The chemical senses of taste and smell are the most remarkable of all senses in the insect. Organs of taste, which distinguish salt, sweet, sour and bitter qualities, occur chiefly around the mouth parts, and various insects (butterflies and flies) can detect sweet substances, even in very dilute solutions, in contact with the tarsi. The organs of smell are usually thin-walled hairs or minute cones situated chiefly on the antennae and palpi, often arising from the floor of a pit. The males of certain moths, which have bushy antennae covered with these organs, can smell a female a mile or more away. In bees the sense of smell seems curiously like our own, unrelated substances that smell alike to us are also confused by the bee. (*See* also SMELL AND TASTE.)

P. S. TICE

FIG. 4.—FEATHERLIKE ANTENNA OF CECROPIA MOTH

Tactile and mechanical senses are also well developed in insects. The touch receptors, consisting of hairs or bristles with movable bases, occur practically all over the body but are most abundant on the antennae. Their stimulation "informs" an insect of air currents, surface terrain and in some cases vibrations. Receptors within the body relay information as to the position of the body and its relation to the earth (senses of kinesthesis and equilibrium).

Insects can also perceive differences in temperature and humidity. The location of these senses is not always well defined, but in some insects at least they reside in the antennae. Thus the antennae, which assume such diverse forms in different insects, subserve a varied range of senses. (*See* also TOUCH, SENSE OF.)

Hearing.—Several orders of insects have evolved a special organ of hearing that consists of a diaphragm or membrane that acts much like the tympanic membrane in man. They are found in pairs, one on each side of the body, and occur chiefly in those insects that produce sound—grasshoppers, crickets, cicadas. Moths also have well-developed tympanic organs with which they apparently can hear the supersonic pulses emitted by bats, a factor that no doubt has survival value. (*See* also HEARING: *Evolution of Hearing.*)

J. M. CONRADER

FIG. 5.—AUDITORY ORGAN OF KATYDID ON UPPER END OF FORELIMB

Sound production.—The stridulations of cicadas and crickets, the humming of mosquitoes and the buzzing of bees are familiar sounds. Stridulation, usually accomplished by the male, is produced by rubbing one part of the body against another: the tips of the two forewings, the legs against the body, etc. Buzzing and humming are produced by vibrating the wings or other parts of the body. Cicadas, among the loudest insects, have resonators to amplify the sound produced by rapid vibration of a pair of membranes on the abdomen. Other noise-making insects include many beetles and termites, which make tapping sounds in wood. Although it has not been proved for all sound-making insects, sound may serve as a warning of danger and as a mating call.

3. Musculature and Locomotion.—*Walking.*—An insect walking on six legs supports itself on a tripod consisting of the anterior and posterior limb on one side and the middle limb on the other, while it carries forward the other three legs. It holds on to rough surfaces by means of claws at the extremity of its tarsi. Many insects are able to hold on to smooth surfaces by means of adhesive organs termed pulvilli. These bear numerous hairs with soft flattened extremities. It seems that when the pulvilli are drawn over a smooth surface, they become applied so closely to it that adhesion takes place and the insect is held by surface molecular forces.

The movements of insects are brought about by numerous striated muscles connecting one part of the exoskeleton with another. (In his classic work Pierre Lyonnet [1762] described 4,061 muscles in the goat moth caterpillar.) When the body wall is rigid, as in the grasshopper, the muscles run across the flexible joints from one region of firm cuticle to another. In a soft-bodied insect, such as a caterpillar or a newly molted individual, the firmness of the body wall is ensured by a general tension, or tone, in all the muscles, which sets up an even pressure upon the body fluids. Many of the movements in such an insect are brought about by the pressure of the blood acting upon points where the muscles have been relaxed.

The prodigious strength observed among insects is due in large part to the disproportionately greater amount of muscle per unit body weight. The strength of all living materials is governed by the same engineering principle that obtains in nonliving substance—as the size of any object changes (increases or decreases) its area varies as the square of linear dimensions while its volume varies

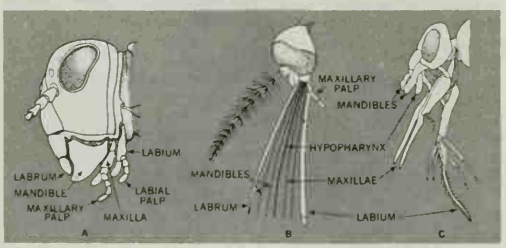
as the cube. Applied here, body weight increases as the cube of body dimensions while strength of muscle increases only as the square of muscle dimensions; it follows then that as body size decreases, the ratio of muscle strength to weight becomes progressively greater. In addition, the exoskeleton provides lightweight attachment for a marvelous fabric of tiny muscle fibres and an array of intricate pivots that afford leverage. Efficiency of insect musculature results also from the peculiar arrangement of short fibres that tend to distribute the work load evenly along certain parts of the body; *e.g.*, the chevron arrangement of muscles along the length of the femur of a grasshopper's leg.

Flight.—Some insects utilize relatively simple up and down wing movements for flight, but these movements are usually complicated by twisting and folding of the wing. The membranous area of the wing bends under air pressure while the anterior margin remains relatively rigid. As the wing moves up and down, the actual path of the wing tip is a loop or a figure eight. Among the more primitive groups, such as dragonflies and lacewings, each pair of wings moves independently. In moths and butterflies, and in bees and wasps, the wings on each side are coupled and function as one. Insects such as beetles and grasshoppers, with hardened or modified forewings, fly with the hind wings, which are usually enlarged and expanded; their flight rarely achieves the perfection, however, of moths, bees, wasps and flies.

The frequency of wing-beat varies over a wide range, from 5 per second in the butterfly *Papilio machaeon* to about 1,000 per second in the midge *Forcipomyia*. The basic movement of the wings up and down is produced by indirect muscles, which do not act on the wings themselves but distort the thoracic walls to which they are attached. These muscles have the remarkable property of being stimulated to contract whenever they are stretched. Hence two sets of muscles working in opposition can maintain a very high rate of movement, without the need for an equal number of nervous impulses per second. This indirect system governs the fundamental frequency of wing-beat, while control of flight and maneuvrability is achieved by direct muscles. These are under nervous control, and rotate the wing about a complex articulation at its base (*see* also FLIGHT [NATURAL]).

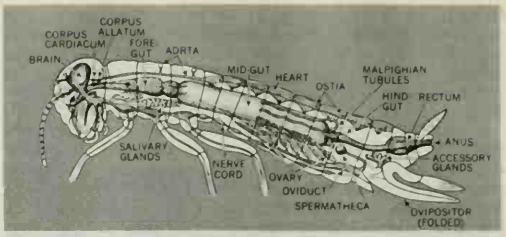
4. Feeding and Digestion.—Almost every kind of organic material can be used as food by some insect. The feeding mechanisms and the digestive processes of insects are therefore exceedingly diverse. In the more generalized forms the mouth parts (fig. 6) consist of a pair of upper and lower lips (labrum and labium), biting mandibles, and a pair of maxillae for holding and manipulating food. In more specialized insects these basic structures are modified in various ways for piercing and sucking. Cockroaches, ants, beetles and caterpillars chew their food; blood-sucking bugs and flies pierce the skin and draw out the blood; sap-sucking insects do the same thing on plants; butterflies can only imbibe fluids through the long tubelike proboscis.

The first and last segments of the gut, the fore-gut and hind-gut, are lined with thin cuticle continuous with that over the body surface. The intervening segment, the mid-gut or stomach, has the lining cells freely exposed. In insects that eat solid food the mid-gut is generally protected by a delicate detached membrane of chitin, the peritrophic membrane.



(A) FROM H. WEBER, "GRUNDRISS DER INSEKTENKUNDE"; REPRODUCED BY PERMISSION OF GUSTAV FISCHER VERLAG

FIG. 6.—TYPES OF MOUTH PARTS: (A) CHEWING; (B) SUCKING; (C) BITING AND LAPPING



FROM H. WEBER, "GRUNDRISS DER INSEKTENKUNDE"; REPRODUCED BY PERMISSION OF GUSTAV FISCHER VERLAG

FIG. 7.—INTERNAL STRUCTURE OF FEMALE. WINGS NOT SHOWN; ORGANS SHOWN THROUGH BODY WALL

Digestive enzymes are produced in the salivary glands and in the mid-gut; they vary with the nature of the food. The absorption of the products of digestion takes place in the mid-gut, the hind-gut apparently being chiefly concerned in the absorption of water. At the dilated end of the hind-gut, the rectum, are groups of enlarged epithelial cells, the so-called "rectal glands," whose function seems to be to recover as much water as possible from the feces before they are discharged. The rectal glands may play an important part in the conservation of water in terrestrial insects.

Insects that feed on substances difficult to digest, such as wood (cellulose) or hair (keratin), commonly have digestive enzymes specially adapted to deal with them. In other insects, such as termites, great numbers of protozoans or other microorganisms, occurring naturally in the gut, serve to digest the food for their hosts.

5. Nutrition and Metabolism.—Besides fats, carbohydrates and proteins, insects require much the same range of vitamins and minerals as do mammals. They find an ample quantity of these when they feed on a mixed diet. But insects that feed solely on blood, or flour, or plant juices, generally harbour symbiotic microorganisms, often within special groups of cells called mycetomes. These microorganisms provide their hosts with the elements that are lacking in their food (*see* SYMBIOSIS).

All the chemical changes that occur in the living body are included under the term metabolism. They include the breakdown of food substances and their building up into all the complex materials needed to provide energy for movement, growth, reproduction and the elaboration of all the chemical secretions by the many glands.

Energy.—From carbohydrates, fats and proteins in the food, insects produce and store the fat and glycogen used for energy production. These are mainly stored in the so-called "fat body," in the abdomen. During starvation or hibernation the glycogen stores are first consumed and then the fat. Many insects can subsist for weeks or months upon their stores of fat.

The processes of oxidation in the body that accompany the liberation of muscular energy vary enormously in insects with the intensity of their activity. Thus on going from rest to active flight a bee may increase its oxygen consumption 48-fold. During flight a bee weighing 100 milligrams may burn sugar at the rate of 35 to 40 milligrams per hour.

Chemical Secretions.—The glands in the skin and elsewhere produce an astonishing range of chemical substances. Some of these, such as silk, wax and lac, are articles of commerce. Then there are digestive enzymes; hormones regulating development, metamorphosis and molting; complex venoms, notably in the glands of the stings in bees and wasps; formic acid in certain ant venoms; cantharidin in the beetle called "Spanish fly"; urticating substances in the hairs of caterpillars; stink glands, froth glands, scent glands and many more. (*See* HORMONES, INVERTEBRATE; INSECT BITES AND STINGS.)

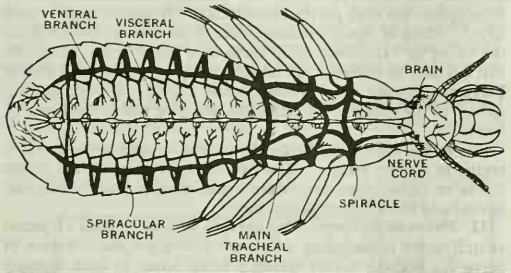
Among the most striking chemical products of insects are their pigments. Some of these, such as the yellow carotins, some anthocyanins and flavones and derivatives of chlorophyll, are derived from the plants eaten by the insects; but many of the most conspicuous pigments, such as those of pierid butterflies (pterine) appear to be by-products of metabolism. Production of such pig-

ments may be markedly affected by the surroundings; thus the chrysalids of certain butterflies adapt their coloration to that of the background on which they rest. (*See* ANIMAL COLORATION; PIGMENT, ANIMAL.)

Water Metabolism and Temperature.—The most important environmental factors that influence the physiology of insects are humidity and temperature. The retention of sufficient water in the tissues is a prime necessity of life. By having an impermeable cuticle, by keeping the spiracles closed as much as possible and by recovering water from the excreta before they are discharged, many insects, in spite of their small size, are able to exist in dry environments.

Insects are also greatly affected by temperature. They are poikilothermic (or "cold blooded") animals whose temperature is normally the same as that of their surroundings. However, if the surroundings are too cold, insects are incapable of movement. Certain butterflies at high altitudes cannot fly unless the sun is shining and their bodies are warmed by the radiant heat. During flight the contracting muscles produce enough heat to raise the body temperature far above that of the surrounding air. The large hawk moths are unable to take flight until their body temperature has been raised to 89°–97° F. (32°–36° C.) by preliminary fluttering, and during flight their temperature may rise above 105° F.

Different insects are able to resist different levels of high temperature; the largest forms can cool themselves to some extent for short periods by the evaporation of water but few can withstand temperatures much above 122° F. for a period of one hour. There are differences also in their resistance to low temperatures. Insects that pass the winter in the open in cold climates develop a condition of "cold hardiness." In this state, in which the free water content of the body is reduced, the insect can be cooled far below the true freezing point of the tissue fluids (supercooled) without the body freezing and without causing any injury. Some insects in this state can survive a temperature of −18° F. (−28° C.).



(TOP) FROM J. FOLSOM, "ENTYMOLOGY WITH SPECIAL REFERENCE TO ITS ECOLOGICAL ASPECTS"; BLAKISTON DIV., MCGRAW-HILL. (BOTTOM) A. B. KLOTS

FIG. 8.—(TOP) RESPIRATORY SYSTEM OF A GENERALIZED INSECT; (BOTTOM) MOTH CATERPILLAR WITH PROMINENT SPIRACLES

6. Respiration.—Most insects breathe by means of tracheal tubes (tracheae), which usually open at the surface of the body through a number of spiracles and which conduct oxygen to the tissues and carbon dioxide to the exterior. The tracheae are inward extensions of the cuticle in the form of tubes that branch among the internal organs. In the larger branches their walls are stiffened and prevented from collapse by a spiral thread. Their finest terminations, which are devoid of this spiral thickening, contain a variable amount of liquid and are termed tracheoles. These envelop tissues and cells and even penetrate the latter.

If the spiracles were always open, an insect would lose excessive quantities of moisture and would soon die of desiccation. Each is therefore provided with a muscular ring (or sphincter) that is held closed most of the time, being opened only at intervals as the need for exchange of gases requires. In the smaller and less active insects oxygen is conveyed from spiracles to tissues wholly by diffusion. But in larger and more active forms (grasshoppers, bees, flies, etc.) the tracheae are ventilated by alternate contraction and expansion of the body wall. These respiratory movements occur particularly during activity, and in many insects they are made more effective by the expansion of the tracheae at various points to form large thin-walled air sacs. The opening of the spiracles and the increased mechanical ventilation during activity are brought about by the accumulating carbon dioxide stimulating respiratory centres in the nervous system.

P. S. TICE

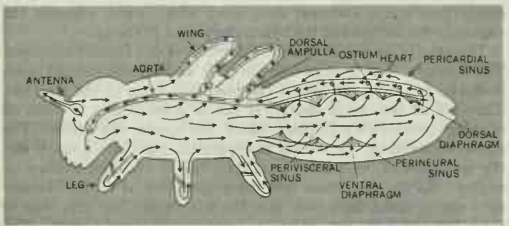
FIG. 9.—AQUATIC DOBSON FLY LARVA (HELLGRAMMITE) BEARING TUFTS OF TRACHEAL GILLS

In aquatic and in parasitic insects there are many remarkable adaptations in the respiratory system. Most of these are concerned with bringing the spiracles, often a single pair at one end of the body, into contact with the atmospheric air. But in a few larval insects the tracheal system is closed; it sends dense network of branches either to the surface layers of the body or to special outgrowths (tracheal gills), found on the body surface or, as in dragonfly larvae, within the rectum. These gills enable aquatic insects to obtain oxygen in solution in the water.

7. Blood and Associated Tissues.—Insects have an open circulation. Throughout most of the body the organs and tissues are bathed directly by the blood or hemolymph.

The fluid is kept in circulation by a dorsal vessel or heart that pumps it from the hind end of the abdomen and discharges it into the vascular space or sinus in the head (collectively, these sinuses are termed the hemocoele). The dorsal vessel is suspended by a diaphragm that separates the dorsal or pericardial sinus from the perivisceral sinus. A ventral diaphragm separates the perivisceral sinus from the ventral or perineural sinus. The blood filters back to the posterior part of the body and enters the dorsal vessel through valved openings called ostia. There are also small pumping organs or accessory hearts that ensure circulation in the wings, legs and antennae.

The blood is a clear colourless or slightly green or yellow fluid that plays little part in respiration. It contains a few white blood cells, called hemocytes, that act as phagocytes, ingesting microorganisms or debris from disintegrated cells; for the most part hemocytes do not circulate but adhere to the tissues. In a few larvae (Chironomidae or blood worms) there is hemoglobin in the



FROM H. WEBER, "GRUNDRISS DER INSEKTENKUNDE"; REPRODUCED BY PERMISSION OF GUSTAV FISCHER VERLAG

FIG. 10.—DIAGRAM OF OPEN BLOOD CIRCULATION. DIRECTION OF BLOOD FLOW INDICATED BY ARROWS

blood, and under conditions of poor oxygen supply, as when these larvae are living in mud, this pigment acts as a carrier of oxygen.

Associated with the circulatory system are other tissues that function in storage of reserves and in intermediary metabolism. Pericardial cells, which occur in little groups along the sides of the heart, remove from the blood colloidal material such as unwanted proteins derived from the breakdown of cells. The fat body is often the most conspicuous object in the insect abdomen. It serves as a store for fat, glycogen and sometimes for droplets of protein, particularly during hibernation or during the pupal stage when no food is taken. The oenocytes are large clear cells that usually occur in groups beneath the epidermis. They enlarge and become active during molting and probably secrete some of the constituents that form the cuticle.

8. Light Production.—The light-producing organs of various beetles (glowworms, fireflies, etc.) are probably derived from the fat body. They are covered by a layer of translucent cuticle. Within the cells an enzyme, luciferase, causes the oxidation of a substance, luciferin, and almost all the energy liberated appears in the form of "cold light." (*See* BIOLUMINESCENCE.)

9. Excretion.—The main excretory organs of insects are the Malpighian tubules. These are blind vessels, varying in number from 2 to 100 or more, lying freely in the body cavity and discharging into the gut at the junction of the mid-gut with the hind-gut. The urine that they produce is mixed with the residue of food from the stomach, and the mixture, after passing along the hind-gut, forms the excreta or feces. The character of the excreta depends on the type of food eaten. In the plant-sucking insects, such as aphids and leafhoppers, the feces are wholly fluid. Many insects that feed on dry foods discharge a dry powdery excrement from which every trace of water has been removed. In certain insects, notably caterpillars and the larvae of such beetles as the mealworm, which dry their excrement before discharge, the blind extremities of the Malpighian tubules are closely applied and bound to the outer wall of the rectum; the significance of this "cryptonephridial" arrangement is not fully understood.

The chief waste product in the urine is uric acid, which usually appears in solid form as granules or crystalline spheres that become more and more concentrated as the water is resorbed. In many insects uric acid, besides being discharged in the urine, accumulates in cells in other parts of the body (storage excretion). The stored granules may collect in special urate cells scattered through the fat body or in the epidermis, where they account for the chalky colouring of many caterpillars. In other insects, particularly larvae that feed inside the tissues of plants, granules of calcium carbonate may accumulate in quantity in the Malpighian tubules and as "calcospherites" in the cells of the fat body.

The excretions from the Malpighian tubules are sometimes made use of by the insect to strengthen or to colour the silken cocoon spun by the larva before pupation, and in a few insects (the ant lion larva and its allies are the best known) a part of the Malpighian tubule is actually modified to secrete silk.

10. Reproduction.—In most insects reproduction is bisexual, the egg cell produced by the female developing only after fusion with the sperm cell set free by the male. The reproductive system consists of paired sexual glands, the ovaries of the female and testes of the male, paired gonoducts into which the sexual products are discharged, and a common duct lined with cuticle, forming the vagina in the female and the ejaculatory duct in the male.

The ovaries consist of chains of developing ova termed ovarioles. The ripe egg, with a large store of yolk and a fully formed shell, is discharged from the lowest chamber or follicle of the ovariole. The shell of the egg is pierced at one or more points to form an opening (micropyle) through which the sperm can enter. The sperm received by the female at copulation pass into a small sac, the spermatheca, connected by a duct to the common oviduct or vagina. As the egg passes into the vagina several of the filamentous sperm make their way into the micropyle, but only one of these fuses with the egg nucleus and initiates its development. The sperm cells received during a single act of copulation will commonly suffice for fertilizing the eggs throughout the life of the female. In the queen bee the store of sperm received during the short nuptial flight lasts for several years.

In both sexes there are accessory glands connected with the reproductive system that may provide nourishment or a protective covering for the sex cells. In the males of some insects (Lepidoptera, many Orthoptera and Coleoptera) the sperm are not conveyed to the female in a free fluid but are enclosed in a membranous sac or spermatophore formed by the secretion of the male accessory glands. Likewise in the female, the eggs of cockroaches, locusts and some other insects are not laid singly but are cemented together in an egg capsule or oötheca.

The egg production of insects is influenced by much the same factors as is their growth. It is delayed or prevented by low temperatures or by the lack of sufficient protein. Furthermore, a hormone secreted by the corpus allatum (an endocrine gland behind the brain) is necessary. In some insects the presence of sperm in the spermatheca provides a necessary stimulus for egg production; in others a full quota of sterile eggs may be laid by the unimpregnated female. As in growth or egg development, periods of dormancy (diapause) may supervene, notably during hibernation, when no production of eggs takes place even under favourable conditions of temperature.

There are many special modes of reproduction among insects, some of them very curious. Parthenogenesis (reproduction from unfertilized eggs) occurs sporadically in many insects; in some it is constant, and males are unknown. During their summer generations aphids are both parthenogenetic and viviparous (bear young alive). Birth of newly hatched larvae is common in certain flies; the tsetse fly (*Glossina*) gives birth to a single full-grown larva that has been nourished in the uterine cavity by special milk glands. Polyembryony occurs in various parasitic insects; a single egg will spit up in the course of development and give rise to hundreds of larvae.

One of the most remarkable phenomena is paedogenesis, which occurs in certain midges. The ova in the young ovaries of the larvae or pupae ripen prematurely and develop into larvae that devour and disrupt their parent host.

11. Nervous System.—The nervous system consists of paired ventral nerve cords, along which are strung ganglia (clusters of nerve cell bodies), a pair typically being found in each segment of the thorax and abdomen. The nerve cords, which are closely applied during most of their course, separate in the head to loop around the digestive tract, forming the circumesophageal commissure. This commissure unites the supraesophageal ganglion (or brain), which receives the nerves from the great sense organs on the head and co-ordinates behaviour, and the subesophageal ganglion, which innervates the feeding parts. The series of segmental ganglia throughout the thorax and abdomen supply nerves to muscles and sense organs of their own segments.

FROM R. SNODGRASS, "PRINCIPLES OF INSECT MORPHOLOGY", REPRODUCED BY PERMISSION OF MCGRAW HILL BOOK CO.

FIG. 11.—NERVOUS SYSTEM, DISSECTION OF A GRASSHOPPER

To an extent that varies in the different groups of insects, the ganglia become partially fused with one another. None of the ganglia contains centres absolutely vital to the insect: an insect deprived of the brain and subesophageal ganglion can still live and walk; the isolated abdomen can still lay eggs. The individual ganglia can in fact serve as the centres for the simpler reflex actions, such as the withdrawal of the leg on pressure. They can even effect the degree of co-ordination necessary for walking. But for the co-ordination of all the complex reactions the brain is necessary. (*See* also NEUROLOGY, COMPARATIVE.)

12. Behaviour.—Some insect behaviour consists in fixed responses to stimuli such as light, temperature, water, chemicals, gravity, air currents, etc. Since reception of and response to stimuli are mediated by the nervous system, which is genetically determined, behaviour in such cases is largely automatic. Other kinds of insects can learn by experience, the best known instances being found among the ants, bees and wasps. The study of insect behaviour is still in its infancy and offers a promising field for investigation. (*See* ANIMAL BEHAVIOUR; SOCIOLOGY, ANIMAL; PSYCHOLOGY, COMPARATIVE; SOCIAL INSECTS.)

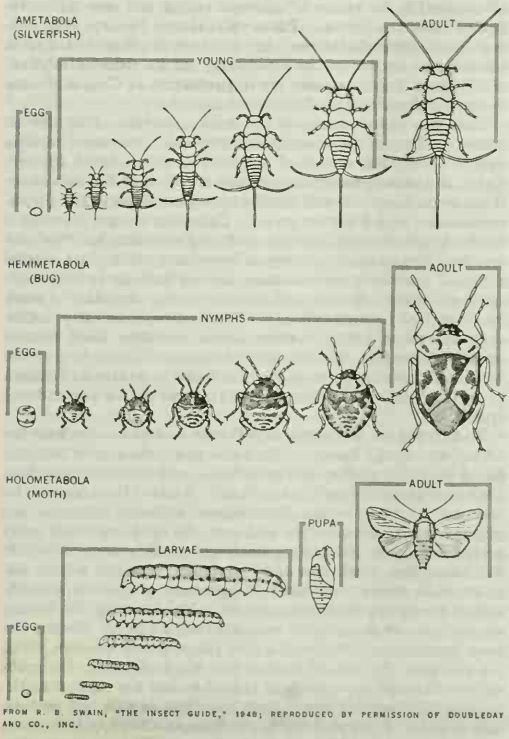
Migratory behaviour, well known among the locusts (certain grasshoppers of the family Acrididae) and some butterflies, is found in many other winged insects as well. (*See* MIGRATION, ANIMAL.)

III. LIFE HISTORY

1. Development.—Most insects start to develop within an egg that is covered by a hard shell, the chorion. Some eggs are completely watertight and can withstand exposure in the open for months without drying. Eggs laid in the earth or inserted into plant stems, etc., are able to absorb moisture from their surroundings. Many insects pass the winter in the egg stage. In these, embryonic development is arrested and the organism goes into a state of dormancy or diapause, until conditions are more favourable.

When the young insect is fully developed, it may chew its way out of the egg, if it has biting mouth parts, or force off an egg cap or cut an opening in the shell by means of "hatching spines" of varying types. The young insect aids itself in this process by swallowing air, and when it is free from the shell, it distends itself with still more air so that the newly hatched insect is always much larger than the egg from which it has come.

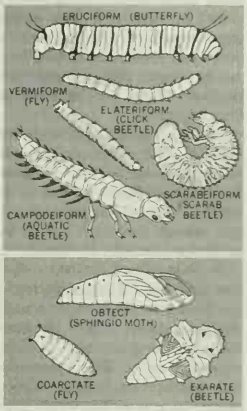
2. Growth and Moulting.—The newly hatched insect is covered by a cuticle that is flexible enough to allow movement of the parts but rigid enough to serve as a skeleton to which the muscles are attached. The rigid parts are incapable of stretching or of growth. To permit growth, the old cuticle is shed from time to time, a new and larger cuticle first having been formed beneath, folded and compressed, and thereby exerting a pressure that helps to force off the old cuticle. This process is initiated by a hormone and is termed moulting or ecdysis, the periods between successive moults being called stadia and the insect forms being called instars. The epidermis separates from the old skin and the cells divide and arrange themselves in proper form and then lay down the new cuticle. Meanwhile the old endocuticle is digested and the products are absorbed through the new cuticle. In the young stages of insects there are always certain lines of weakness, usually in the middle of the thorax, where the exocuticle is lacking. When the new cuticle is formed and digestion of the old is complete, the old skin splits along these lines and the insect can escape from its old skin. At this critical stage, when the new cuticle is colourless and soft, the insect is most vulnerable. It proceeds immediately to swallow air and distend itself to its full size. It contracts its muscles and so forces the body fluid into the wings, when present, causing them to expand. It then sets in motion the oxidative processes within the cuticle that lead to the hardening and darkening of the skin.



FROM R. B. SWAIN, "THE INSECT GUIDE," 1948; REPRODUCED BY PERMISSION OF DOUBLEDAY AND CO., INC.

FIG. 12.—TYPES OF DEVELOPMENT

3. Metamorphosis.—As growth proceeds through successive molts, the more primitive, wingless insects change little, each succeeding instar merely increasing in size. However, most insects pass through striking changes of form, or metamorphosis, at the last molt, when the adult stage is reached, and in certain groups the final stage is preceded by an inactive pupa. Metamorphosis, like the molting process that permits it, is controlled by hormones. The various types of metamorphosis (or lack of it) exhibited by insects after leaving the egg express fundamental evolutionary relationships. These are commonly classified as follows:



SECOND FROM TOP FROM E. L. PALMER, "FIELD-BOOK OF NATURAL HISTORY", REPRODUCED BY PERMISSION OF MCGRAW HILL BOOK CO.; ALL OTHERS FROM KLOTS AND KLOTS, "1001 QUESTIONS ANSWERED ABOUT INSECTS," DODD, MEAD AND CO.

FIG. 13.—TYPES OF LARVAE AND PUPAE

Ametabola.—Insects that develop directly without change in form from newly hatched nymph to adult, the adults being primitively wingless. Examples are springtails, silverfish, etc.

Prometabola.—Insects that pass through two distinct immature stages, an aquatic nymph and a winged young adult (subimago), before transforming to a sexually mature adult (imago). Only the May flies have this type of development.

Hemimetabola.—Insects in which metamorphosis occurs between the last nymphal stage and the imago. There is no subimago and no pupal stage. Examples are the dragonflies, stone flies, cockroaches, grasshoppers, lice, aphids, etc. (Secondarily wingless groups in this series are assigned here on other grounds, since their metamorphosis is less pronounced than in winged forms.)

Holometabola.—Insects that develop through a resting stage (prepupa and pupa) between the larva (rather than nymph) and the adult. The wings develop internally in the last larval stage (prepupa) and evert from sacs to an external position on the pupa. The larvae have no external wing pads and may be campodeiform (*i.e.*, like the larvae of *Campodea*, a genus of diplurans or twintails), eruciform (caterpillarlike), scarabaeiform (grublike), elateriform (wirewormlike) or vermiform (maggotlike). Three principal types of pupae occur: obtect, with the appendages stuck to the body; exarate, with the appendages free from the body; and coarctate, like exarate, but having a hard, smooth covering (puparium). Examples are lacewings, butterflies and moths, true flies,

fleas, beetles, ants, bees and wasps, etc.

Hypermetamorphosis, in which the different larval instars vary in form, often changing from an active campodeiform stage to more sedentary vermiform or scarabaeiform larva, occurs in some beetles and neuropterans, in twisted-wing insects and in a few true flies and hymenopterans.

IV. IMPORTANCE OF INSECTS

A. Beneficial Insects

Most of the species of insects now known are beneficial or useful to man and are important in the balance of nature.

1. Pollination.—The evolution of some insects is closely associated with the evolution of flowers, a relationship of interdependence that exists today notably among the hymenopterans and a few other groups. As a result, most of the higher plants are insect pollinated, although a number have their pollen carried by other agencies, including bats, birds and wind. Insect-pollinated plants include most fruit and seed crops, which depend entirely upon insects or require them for maximum production. A great variety of insects contribute to pollination, but the most important are bees and wasps, butterflies and moths, flies and gnats and beetles. Moths are the major pollinators of the nighttime, bees of the daytime.

In some cases, rather complex methods are used to achieve pollination. For example, the yucca moth, sole pollinator of the yucca Spanish bayonet, inserts her eggs into the ovary of the flower, then forces a wad of pollen into the long funnel-shaped stigma. The developing larvae eat some of the developing seeds but enough seeds are left to insure survival of the yucca—a remarkable example of interdependence of an insect and a plant.

2. Balance of Nature.—*Regulation of Density Among Plants and Animals.*—The populations of plants and animals that make up the living world exist in a natural balance that is regulated and maintained very largely by parasitic and predaceous organisms. In this system, plant- and animal-feeding insects play an extremely important role. This becomes clear immediately when man alters this balance by various agricultural practices. Garden plants moved to new regions where their natural enemies do not occur may become serious weeds, as happened when opuntia cactus was introduced to Australia, lantana to Hawaii, and St.-John's-wort to California. Likewise, insects carried about the world by commerce, without their natural enemies, have become serious pests, and the restoration of the natural balance in such cases is a principal objective of biological control (*see* Entomology).

Improvement of Soil and Disposal of Waste.—The large numbers of insects that live in the soil, including some that are injurious to the roots of plants, improve the quality of the soil by bringing earth to the surface from deeper layers, contributing to the humus and increasing air penetration. Others, by their scavenging, hasten the decay of dead organisms and thus contribute to the cycle that involves all life and improves the environment of man.

Provision of Food for Other Useful Animals.—Insects provide the principal food for trout and other fresh-water game fish, for many game birds and songbirds and for some of the fur-bearing and game animals of tropical regions.

3. Useful Products.—Throughout recorded history man has made use of insect products. Some of these, like the silk of commerce, shellac and beeswax are body secretions of insects. Others, as cochineal and crimson-lake dyes and medicinal substances such as cantharidin and bee venom, are extracts. Whole insects and their larvae have long been familiar food in certain parts of the world and are exotic specialty or gourmet items in some western countries. However, the food most consistently derived from insects has been honey, collected from flowers in the form of nectar and elaborated and concentrated by the honeybee.

4. Scientific and Aesthetic Value.—Their small size, great diversity and special adaptations have made insects popular subjects of study. They have yielded some of the most convincing data in support of the theory of evolution. These include protective coloration and mimicry, polymorphism, geographical variation, host specificity and other phenomena. The vinegar or pomace fly (*Drosophila*), because of its ease of handling, its reproductive capacity and short life cycle and its giant chromosomes of the salivary gland, has been a major tool of the geneticist; other insects also are yielding data fundamental to an understanding of animal physiology and animal ecology. (*See* Entomology.)

Finally, insects yield much of aesthetic value to mankind. They have been used directly in ornaments and jewelry, and their shapes and patterns have been widely copied in the decorative arts. They have inspired numerous songs, poems and stories and have provided enjoyment for thousands of amateur collectors and hobbyists. Their own songs and chirps and the colour and flash of their wings add much to the enjoyment of human life.

B. Harmful Insects

Although by far the majority of insects benefit man directly or indirectly, the best known species are those that he considers injurious. These fall into two major categories—those that attack and annoy man and other living animals, and those that attack man's crops and plant products. The control of these pests constitutes the major objective of the applied fields of medical and veterinary entomology and of agricultural and forest entomology, respectively.

1. Effects on Man's Health.—Insects that annoy man include flies, mosquitoes, ants, bees and wasps, which are encountered largely in the out-of-doors but which frequently may invade his dwelling places (*see* Insect Bites and Stings). Others, such as lice and fleas, are more intimately associated with man, living on his body as parasites. By far the most important, however, are the insects that carry other parasites on or in their bodies or that serve as hosts for causal organisms of certain human diseases that could not exist without the insect.

Among the more important diseases carried by insects, the following may be mentioned. The cockroach (*q.v.*) can carry agents of typhoid, cholera and possibly leprosy (*qq.v.*). The body louse (*Pediculus*) is the vector of epidemic typhus and also carries relapsing fever (*see* Typhus Fever; Relapsing Fever). The bedbug (*q.v.; Cimex lectularius*) has not been implicated in disease transmission outside of the laboratory, but its reduviid relatives of the genus *Triatoma* carry the trypanosomes of Chagas' disease in tropical America (*see* Trypanosomiasis).

True flies include some of the most important of all disease vectors. Among the mosquitoes, *Anopheles* transmits malaria (*q.v.*); *Aedes*, the viruses of dengue and yellow fever (*qq.v.*); *Culex*, and other genera, the causative organism of filariasis (*q.v.; Wuchereria bancrofti*) and various viral illnesses including the encephalitides (*see* Encephalitis). *Culicoides* midges transmit a relatively unimportant filariasis-producing organism, but *Phlebotomus* sand flies transmit *Leishmania* organisms, which cause oriental sore and espundia; trypanosomes causing kala azar; *Bartonella* causing Carrión's disease; and viruses causing pappataci or sandfly fever (*see* Leishmaniasis). Finally, *Simuliam* carry onchocerciasis; tabanid flies, various worms including those causing loaiasis; tsetse flies, trypanosomes of sleeping sickness (*q.v.*); and house flies, which may spread typhoid fever, dysentery and cholera (*see* Housefly). Fleas are able to transmit plague and endemic typhus.

2. Attacks on Domestic and Game Animals.—Sucking lice (Anoplura) attack horses, cattle, swine and various game animals; biting lice infest poultry and game birds; and fleas feed upon both birds and mammals (*see* Louse; Flea). Some of these insects also transmit avian and mammalian diseases, including tularemia and plague (*qq.v.*). However, as with man, the most important insect pests of domestic and game animals are the flies, some of which, like tsetse flies, black flies and mosquitoes, transmit serious diseases, while others cause localized irritations of the eyes, nostrils, ears or alimentary canal, or cause loss of blood through the feeding of adults or of parasitic or wound-infesting larvae. Among the most important are the warble flies (*Hypoderma* species), which are prevalent throughout Europe and North America; the grubs migrate through the body and lodge beneath the skin of cattle, causing irritation and loss of flesh, reduction of milk and perforation of hides. In Central and South America *Dermatobia hominis*, sometimes called the human botfly because it attacks man, also

infests cattle and other domestic animals. Horse botflies (*Gasterophilus* species) attach their eggs to the hairs of the animal; when swallowed, the eggs hatch into larvae that develop in the stomach and intestine of the host. The larvae of the sheep botfly (*Oestrus ovis*) infest the sinuses of the heads of sheep, and the sheep ked (*Melophagus ovinus*), a ticklike blood-sucking fly, is especially harmful to lambs; both are species of world-wide distribution. (*See* BOTFLY.) The sheep blowflies (Calliphoridae) infest the wool and skin of the animals, causing septic wounds that may result in the death of the hosts; serious losses from these insects are suffered in Australia (*see* BLOWFLY). Another fly, *Wohlfahrtia magnifica*, similarly infests sheep in the U.S.S.R. Screwworms, larvae of flies of the genus *Callitroga*, infest the decaying flesh of the wounds of cattle and goats, sometimes invading the living tissues and producing lesions that often lead to death (*see* SCREWWORM). The horn flies, or buffalo flies (*Siphona* species), are responsible for severe losses to cattle, notably in the United States and Australia. Other biting flies that annoy animals include the stable fly (*Stomoxys calcitrans*), black flies (Simuliidae) and horse flies (Tabanidae) (*see* BLACK FLY; HORSE FLY). (*See* also FLY; BACTERIAL AND INFECTIOUS DISEASES; PARASITOLOGY.)

3. Injury to Plants.—*Cultivated Crops.*—Practically all of the crops grown by man have important insect pests. The stems and shoots of cereals are infested by the frit fly (*q.v.; Oscinella frit*) and gout fly (*Chlorops pumilionis*) in Europe, and the Hessian fly (*q.v.; Mayetiola destructor*), in Europe but more destructive as introduced in North America. The European corn borer (*q.v.; Pyrausta nubilalis*) has also become a serious pest of corn (maize) in North America. Several noctuid moths of the genera *Busseola* and *Sesamia*, and pyralid moths, especially *Chilo*, have larvae that are stem borers of maize and of sorghum, millet and rice in different parts of Africa and Asia. The chinch bug (*q.v.; Blissus leucopterus*) seriously affects all cereal crops in the central United States, and the grain pest (*Eurygaster integriceps*) sucks the young grains of cereals in the middle east and southern U.S.S.R. Wireworms (*q.v.;* larvae of elaterid beetles) are widespread root-feeding pests of cereals. Outbreaks of army worms (*q.v.*) and cutworms (larvae of noctuid moths) destroy crops of all kinds, including pasture plants, as do locusts and grasshoppers (*qq.v.*). Clovers and alfalfa (lucerne) are injured by leaf-feeding caterpillars (*Colias*) and root-feeding larvae of weevils (*Sitona*); in the western United States the spotted alfalfa aphid (*Therioaphis maculata*) is a very important pest (*see* WEEVIL; APHID). Vegetable pests in both Europe and North America include the onion maggot (*Hylemyia antiqua*), cabbage maggot (*H. brassicae*) and the carrot rust fly (*Psila rosae*). The cabbage butterfly (*Pieris rapae*), a migratory species of European origin, has spread to North America and also to New Zealand and Australia. The Colorado potato beetle (*q.v.; Leptinotarsa decemlineata*), originally associated with wild *Solanum* in the Rocky Mountains, has spread eastward in North America and has also become established in western Europe. Also in Europe, beans, mangels and sugar beets are infested by the bean aphid (*Aphis fabae*), while flea beetles (*Phyllotreta* species) riddle the foliage and destroy the seedlings of cruciferous crops. The most serious enemy of beans in North America is the Mexican bean beetle (*Epilachna varivestis*), which has spread from the western states.

In many parts of the world the developing flower buds and bolls of cotton are attacked by the pink bollworm (*Pectinophora gossypiella*) and by larvae of several genera of Noctuidae, one of which (*Heliothis*) similarly affects maize, tobacco and many vegetable and pulse crops. The boll weevil (*q.v.; Anthonomus grandis*) is the most important native pest of cotton in North America. Plant injury is caused by the cotton fleahopper (*Psallus seriatus*) and related mirid bugs (*Lygus*) in the United States; cotton foliage is eaten by larvae of the migratory moth *Alabama argillacea* in many parts of the new world and "scorched" by the feeding of cicadellids (*Empoasca* species) in the old.

Sugar cane is attacked by moth borers, notably *Diatraea saccharalis* and related species in the western hemisphere and other genera of the Pyralidae in the old world. Other important sugar-cane pests include white grubs (larvae of scarab beetles), a froghopper (*Aeneolamia varia*) in Trinidad and a leafhopper (*Perkinsiella saccharicida*) that has become established in many sugar-growing countries. Tobacco is injured in the new world by tobacco flea beetles (*Epitrix* species), the budworm (*Heliothis virescens*) and several species of hornworms (Sphingidae), while cutworms are troublesome everywhere. Tea has many pests, of which the shot-hole beetle (*Xyleborus fornicatus*) in Ceylon and the tea mosquito bug (*Helopeltis*) in Asia and Africa are important examples. The young shoots of cacao are attacked in West Africa by cacao mirids (*Sahlbergella* and *Distantiella*), causing "dieback." The numerous pests of coffee include moth and beetle larvae that bore in the wood and leaf miners and scale insects that damage leaves and stems. The coffee berry borer (*Stephanoderes hampei*) is particularly destructive in Africa, Java and Brazil, while in eastern Africa a pentatomid bug (*Antestiopsis*) causes serious damage to *arabica* coffee. Among tropical crops, coconut palms are attacked by rhinoceros beetles, one of which (*Oryctes rhinoceros*) is spreading among the Pacific islands, and by species of coreid bugs that cause premature falling of the nuts. Bananas are attacked by the widespread banana weevil (*Cosmopolites sordidus*) and sweet potatoes by the sweet potato weevil (*Cylas formicarius*). The sisal weevil (*Scyphophorus interstitialis*), a new-world species, has become established in eastern Africa.

Some of the important insect enemies of fruit and fruit trees are very widely distributed, such as the codling moth (*q.v.; Carpocapsa pomonella*) on apple, stone fruits and walnuts; the oriental fruit moth (*Laspeyresia molesta*) on stone fruit; the woolly aphid (*Eriosoma lanigerum*) on apple; and the San José scale (*Aspidiotus perniciosus*) on most deciduous fruit trees and bushes (*see* SCALE INSECT). European insect pests include the apple blossom weevil (*Anthonomus pomorum*) and several species of sawfly (*q.v.; Hoplocampa*) on top fruit. The European currant clearwing moth (*Aegeria tipuliformis*) has spread to other temperate regions; a related species, the peach-tree borer (*A. exitiosa*) is confined to North America, as are two other important pests, the plum curculio (*Conotrachelus nenuphar*) and the apple maggot (*Rhagoletis pomonella*). The root-attacking grape phylloxera (*Phylloxera vitifoliae*), of American origin, once destroyed thousands of acres of vineyard in Europe and California but is now controlled by the use of resistant root-stocks (*see* PHYLLOXERA); the fruits are attacked in America by the larvae of the grape berry moth (*Paralobesia viteana*) and in Europe by the related *Lobesia botrana*. Citrus insects are legion, some species being distributed over the entire tropical and subtropical world. Most important are the scale insects and mealy bugs (Coccidae), including the black scale (*Saissetia oleae*), Florida red scale (*Chrysomphalus ficus*), California red scale (*Aonidiella aurantii*) and purple scale (*Lepidosaphes beckii*). The citrus white fly (*Dialeurodes citri*) and the citrus black fly (*Aleurocanthus woglumi*) are important pests not only of citrus fruits but also of many other plants. The Mediterranean fruit fly (*Ceratitis capitata*) is perhaps the greatest of all fruit pests, affecting deciduous fruits as well as citrus; it has twice been eradicated from Florida. Other important fruit flies (Trypetidae) are the Mexican fruit fly (*Anastrepha ludens*), which annually invades southern Texas; the oriental fruit fly (*Dacus dorsalis*), now established in Hawaii, and related species in Australia; and the olive fly (*Dacus oleae*), a major pest in the Mediterranean region.

Transmission of Plant Diseases.—Just as insects transmit diseases of man and animals, they also play an important role in the dissemination of the bacteria, fungi and viruses that cause plant diseases. Transmission may involve simply the transport of the disease agent on the body appendages; more complex relationships occur where the disease organism passes through or multiplies within the insect tissues. The bacterium *Erwinia amylovora*, which causes fire blight, a serious disease of pears, apples and other orchard fruits in North America, is associated with many species and several orders of insects. Several related bacteria cause diseases in other plants and are believed to be insect-transmitted. The fungus *Ceratostomella ulmi*, responsible for Dutch elm disease (*see* ELM) in Europe and (since 1930) North America, and other species of *Ceratostomella* that cause blue stain

of coniferous timbers, are transmitted mechanically by bark beetles (Scolytidae). Cotton throughout the tropics is seriously affected by yeastlike fungi (*Nematospora* species) that cause internal boll disease and are transmitted via the mouth parts of stainer bugs, notably *Dysdercus* species; pentatomid bugs (*Antestiopsis* species) transmit a related fungus that seriously affects coffee berries in East Africa.

Many important plant diseases are caused by viruses, the majority of which are insect-transmitted, mainly by sucking bugs, though in a few cases chewing insects such as beetles or grasshoppers have been implicated. Transmission by the latter is purely mechanical, resulting from contamination of the mouth parts. The viruses that cause sugar-cane mosaic and potato mosaic (Y-type) can be transmitted by several kinds of aphids for a short time after these have fed, their effectiveness being increased by previous fasting. The transmission of such nonpersistent viruses seems essentially mechanical, though affected by compatibility of the virus, the aphid saliva and plant tissues inoculated. The persistent viruses, on the other hand, are characterized by a latent period following acquisition by the vector. This may last several weeks, during which the virus is not transmitted, but afterward transmissibility is extended, often throughout the vector's life. The latent period is occupied by the passage of the virus through the insect, from the intestine to the salivary glands; in some cases the virus multiplies within the vector, and in at least one (stunt disease of rice in the far east, carried by the rice leafhopper, *Nephotettix apicalis*) it is passed on to the next generation of the vector via the egg. Persistent viruses tend to be highly specific and many are transmitted by leafhoppers, including curly top of sugar beet (spread by *Circulifer tenellus*) and aster yellows (transmitted to many crop plants by *Macrosteles fascifrons*) in North America; maize streak in southern Africa (by *Cicadulina mbila*); and yellow dwarf of tobacco in Australia (by *Orosius argentatus*). The cosmopolitan green peach aphid (*Myzus persicae*) transmits potato leaf roll in North America and Europe, sugar-beet yellows in Europe and a score of other virus diseases; and *Aphis craccivora* spreads rosette disease of peanuts in Africa. Leaf curl of cotton in the Sudan is carried by the white fly *Bemisia tabaci*, and swollen-shoot disease of cacao in West Africa by the mealy bug *Pseudococcus njalensis*. (*See* PLANT DISEASES.)

Forest and Shade Trees and Timbers.—Forest trees are defoliated by numerous caterpillars; in Europe notably those of the nun moth (*Lymantria monacha*) on spruce, winter moth (*Operophtera brumata*) and mottled umber moth (*Erannis defoliaria*) on broad-leaved trees and pine looper (*Bupalus piniarius*) and pine shoot moth (*Evetria buoliana*); in North America those of the gypsy moth (*Lymantria dispar*), brown-tail moth (*Euproctis chrysorrhoea*), spruce budworm (*Choristoneura fumiferana*), larch case-bearer (*Coleophora laricella*) and various tent caterpillars (*Malacosoma* species). The gypsy and brown-tail moths were introduced into Massachusetts from Europe and have spread over New England in spite of vigorous efforts to eradicate them. The North American fall webworm (*Hyphantria cunea*) was accidentally introduced into central Europe, where it has become a pest of shade trees. The Japanese beetle (*Popillia japonica*), of only local importance in Japan, has infested a large area in the United States, defoliating shade and fruit trees. Weevils (*Hylobius abietis* and *Pissodes pini*) attack the growing shoots of pines. Bark beetles (*Ips* and *Dendroctonus* species) are responsible for much damage to northern forests, especially in North America. Other wood-boring beetles, especially Cerambycidae, attack a great variety of park and woodland trees. Indian forests suffer extensive damage from the sal borer (*Hoplocerambyx spinicornis*), while the eastern African long-horned beetle (*Oemida gahani*) is a dead-wood feeder that particularly attacks *Podocarpus* timber. In many parts of the world, the old house borer (*Hylotrupes bajulus*) seriously infests seasoned softwood roof timbers. Wood wasps (Siricidae) and wood-boring caterpillars (Cossidae) are injurious in many parts of the world, but the particular enemies of structural timbers and furniture are anobiid and lyctid beetles, notably the furniture beetle (*Anobium punctatum*), the notorious deathwatch beetle (*Xestobium rufovillosum*) and the powder-post beetles (*Lyctus* species). The majority of termites are earth-dwelling species that attack any wood in contact with the ground or accessible via the earth-covered runways they build across the surface of intervening materials; the dry-wood termites, which are independent of the ground, include several dangerous and widely transported species (*see* TERMITE).

4. Damage to Stored and Manufactured Goods.—Many insects, mostly beetles and moths, subsist on stored or manufactured products of vegetable or animal origin. Most have been widely distributed through commerce. The granary and rice weevils (*Calandra granaria* and *C. oryzae*), lesser grain borer (*Rhizopertha dominica*) and Angoumois grain moth (*Sitotroga cerealella*) prefer whole grains; the saw-toothed grain beetle (*Oryzaephilus surinamensis*), flour beetles (*Tribolium* species), mealworms (*Tenebrio* species), Mediterranean flour moth (*Ephestia kuehniella*) and Indian meal moth (*Plodia interpunctella*) prefer flour or coarsely ground cereals. Beans are attacked by bruchid beetles, peanuts and grains by the khapra beetle (*Trogoderma granaria*) and nuts and dried fruits by the almond moth (*Ephestia cautella*) and cacao moth (*E. elutella*). The drugstore beetle (*Stegobium paniceum*) and the cigarette beetle (*Lasioderma sericorne*) infest tobacco, drugs and spices, while the larder beetle (*Dermestes lardarius*) and cheese skipper (*Piophila casei*) are important pests of bacon, cheese and similar products. Woolen clothing, rugs, hair and feathers are damaged by clothes moth larvae (*Tineola bisselliella* and *Tinea pellionella*) and by carpet beetles (Dermestidae).

V. ORIGIN AND EVOLUTION OF INSECTS

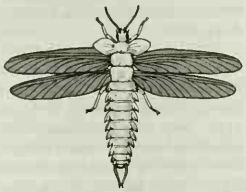
The fossil record indicates that insects existed at least 250,000,000 years before man; that they learned to fly at least 50,000,000 years before reptiles and birds; that some groups of insects have evolved rapidly and become extinct while others have persisted with relatively little change from the Carboniferous period into modern times. However, there are extensive gaps in the fossil record. Most insects are of small size, with delicate structures, and their skeletal parts are not preserved as readily as those of many other groups of animals. Special materials such as shale-forming volcanic ash and mud, concretions, coal-forming plant humus and amber-forming plant resins, have yielded the best fossil insects. Although the fossil record is the major direct source of data on the origin of insects and their early evolution, much can be inferred from the comparative morphology, zoogeography and comparative ecology of living forms.

1. Insect Ancestors.—If the facts of insect origin are preserved in the fossil record, they, no doubt, remain to be discovered among the rocks of the Palaeozoic era. It is known that many groups of invertebrates existed in the early Palaeozoic that might have given rise to the insect line. Included were other arthropods, such as trilobites, eurypterids, scorpions, crustaceans, millipedes and centipedes, and polychaete worms. Each of these has been regarded as ancestral to, or sharing common ancestry with, insects. Modern opinion seems to favour common ancestry with a group of arthropods that were already adapted to air-breathing and that resembled modern millipedes.

2. The First Insects.—Most students of insect evolution agree that the first insects were wingless, terrestrial forms, represented among living groups by the orders Thysanura (bristletails) and Diplura (twintails). This conclusion, however, is based upon a study of modern types, since these creatures are extremely fragile, with little chance of fossil preservation. Although the earliest records of insects accepted by most authorities extend back only so far as the Triassic period, it is generally postulated that they must have existed in the Devonian period, perhaps 325,000,000 years ago.

3. Evolution of Wings.—The first major departure in the evolution of insects, if the above views are correct, was the development of wings. Again, the fossil record does not date this event precisely but it must have occurred in the Lower Carboniferous period, perhaps 275,000,000 years ago, since the fossil winged forms of the earliest of the Upper Carboniferous strata are diverse, representing several orders. The evolutionary process that provided the insect wing is not clearly understood, but fossil evidence sug-

gests that wings were derived from the second and third pairs of a set of membranous expansions (paranota) on the dorsum of each of the three thoracic segments. These paranota were present on many kinds of early winged insects, and contained veins and minute hairs like those characteristic of wings. In any event, the first winged insects had a simple articulation and were unable to fold the wings back over the body. These creatures, the Palaeoptera, some of which had wing spans of 30 in., are represented today by the Odonata (dragonflies) and Ephemeroptera (May flies). Wing-flexing insects (Neoptera) do not appear in the fossil record until somewhat later, suggesting that they may have been derived from the Palaeoptera. However, some students support the view that wings arose more than once among the insects.



FROM A. D. IMMS, "INSECT NATURAL HISTORY," WILLIAM COLLINS & CO. LTD., LONDON

FIG. 14.—RESTORATION OF A FOSSIL INSECT SHOWING WINGLIKE EXPANSIONS (PARANOTA) ON THE PROTHORAX AND TWO PAIRS OF WINGS

Wings offered great advantages to the insects by providing a ready means of avoiding terrestrial predators and greatly increased their means for dispersal. The wing-flexing neopteran types were the more successful. They could protect their wings when not in flight, reduce their conspicuousness, and gain access to cracks and crevices in which to seek further protection. Also, a more complicated articulation allows much greater control of the wing during flight. Most orders of living insects are of the neopteran line.

Concurrent with the evolution of the insect wing was the requirement that the developing insect pass through distinct growth phases or metamorphosis. The early neopterous insects developed through a series of nymphal stages and gradually approached the adult form, exhibiting incomplete metamorphosis. Presumably the nymphs had food habits similar to the adults and resembled them in most aspects except that they lacked the ability to fly. Modern representatives of this line (Hemimetabola) include such groups as the Orthoptera (grasshoppers, crickets, katydids), Hemiptera (true bugs, cicadas, aphids, etc.) and various smaller orders of biting and sucking insects.

4. Evolution of Complete Metamorphosis.—The second major step in the evolution of the insects came with the advent of complete metamorphosis, a type of development in which the larval stages (grubs, maggots, caterpillars) are very different from the adult and capable of living in quite different ecological niches. The transformation to the adult is made during a transitional stage (pupa), which often has the additional advantage of carrying the insect through unfavourable periods for adult or larval activity. Since complete metamorphosis appears to have been evolved during the climatic extremes of the Permian period, it may have principally served this function originally. The ability of insect larvae to live in a different environment from the adult and to utilize different kinds of food permitted them to invade plant and animal tissue, as internal parasites, while the adult remained free-living. The great versatility inherent in this system and the large number of new environments made available for exploitation proved extremely advantageous to the holometabolous groups. Although the Holometabola do not appear in the fossil record until the Lower Permian period, nearly 90% of living species have this type of metamorphosis, including the members of the largest orders, the Coleoptera (beetles, weevils), Hymenoptera (ants, bees, wasps), Lepidoptera (butterflies, moths) and Diptera (true flies).

See also ANIMALS, PHYLOGENY OF; METAMORPHOSIS.

VI. CLASSIFICATION

The classification of insects, like that of other animals, is divided into a hierarchy of categories designed to represent various degrees of relationship. In view of the size and diversity of the class Insecta, it is not surprising to find many differences of opinion among entomologists as to the arrangement and limits of the subgroups. Subclass names are here based on the primitive presence or absence of wings. Forms that are primitively wingless are placed in the Apterygota; winged insects, even though secondarily wingless, are of the Pterygota. In some classifications the type of metamorphosis is used for the subclass name. The following classification, recognizing 31 orders, may differ in some respects with the arrangements given in related articles elsewhere in the encyclopaedia; these differences reflect the viewpoints of the various authors concerned.

Subclass Apterygota
(Ametabola)
Order Collembola, springtails
" Protura, proturans or telsontails
" Diplura, diplurans or twintails
" Thysanura, bristletails, silverfish, firebrats
Subclass Pterygota
(Prometabola)
Order Ephemeroptera, May flies
(Hemimetabola)
Order Odonata, dragonflies, damsel flies
" Blattaria, cockroaches
" Mantodea, mantids
" Phasmida, stick and leaf insects
" Isoptera, termites
" Dermaptera, earwigs
" Orthoptera, grasshoppers, crickets, katydids, etc.
" Embioptera, embiids or web-spinners
" Plecoptera, stone flies
" Zoraptera, zoraperans
" Corrodentia (Psocoptera), book lice, bark lice
" Mallophaga, biting lice, bird lice
" Anoplura, sucking lice
" Thysanoptera, thrips
" Hemiptera, true bugs and allies
(Holometabola)
Order Coleoptera, beetles, weevils
" Strepsiptera, stylopids or twisted-wing insects
" Megaloptera, dobson flies, alder flies, etc.
" Neuroptera, ant lions, lacewings, mantispids, etc.
" Raphidioidea, snake flies
" Mecoptera, scorpion flies
" Trichoptera, caddis flies
" Lepidoptera, butterflies, moths
" Diptera, true flies
" Siphonaptera, fleas
" Hymenoptera, ants, bees, wasps, etc.

The relationships and taxonomic rank within the Apterygota are still uncertainly known and therefore matters of dispute among authorities (*see* APTERYGOTA; ARTHROPODA). Cockroaches and mantids are considered by some as being suborders (Blattodea and Mantodea, respectively) of the order Dictyoptera, and by others as being superfamilies (Blattoidea and Mantoidea) of the suborder Dictyoptera, in the order Orthoptera. The stick insects and their relatives are sometimes included in the Orthoptera as the suborder Cheleutoptera, and grasshoppers, crickets and katydids (Orthoptera proper, here) as the suborder Saltatoria (*see* ORTHOPTERA). Hemiptera is often split, the suborders Heteroptera and Homoptera being made orders (*see* HEMIPTERA). Megaloptera, Neuroptera and Raphidioidea are sometimes grouped together as the order Neuroptera, with two suborders Megaloptera and Planipennia (*see* NEUROPTERA).

A. Apterygota (Ametabola)

Apterygota (fig. 15) undergo no true metamorphosis; that is, they are ametabolous. The young (nymphs) closely resemble the adults except that they are smaller and sexually immature.

1. Collembola (Springtails).—Very small (usually less than $\frac{1}{8}$ in.) wingless insects with primitive chewing mouth parts, four-segmented antennae, a six-segmented abdomen with a ventral tube-like sucker on the first segment and usually a forked, springlike structure on segment four or five. They occur abundantly in moist situations, as in soil, leaf mold, rotten wood and stream banks. (*See* SPRINGTAIL.)

2. Protura (Proturans or Telsontails).—Minute (less than $\frac{1}{16}$ in.) wingless insects with sucking mouth parts and without antennae, eyes or tail filaments. The abdomen is nine-segmented in the young, twelve-segmented in the adult. Like the springtails, they prefer moist habitats and are generally found in soil and humus.

3. Diplura (Diplurans or Twintails).—Small insects (about

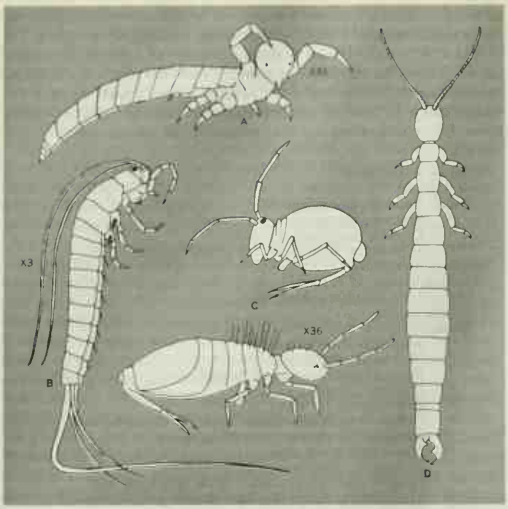


FIG. 15.—APTERYGOTA: (A) PROTURA, ACERENTOMON DODEROI. (B) THYSANURA, NESOMACHILIS MAORICUS; (C) COLLEMBOLA, (TOP) PAPIRIUS UNICOLOR, (BOTTOM) ENTOMOBRYA LAGUNA; (D) DIPLURA, EVALLJAPYX PROPINQUUS

$\frac{3}{8}$ in.) with chewing mouth parts; reduced, nonfunctional eyes (or none); and a flattened, tapering abdomen with lateral, paired tail filaments (cerci) either as long as the antennae or formed into small pincers. They are commonly found beneath the soil or among leaves and stones in moist situations. Diplurans are sometimes called two-pronged bristletails.

4. Thysanura (Bristletails, Silverfish, Etc.).—Small to medium-sized (up to $\frac{1}{2}$ in.) insects with chewing mouth parts; large eyes; long, slender, many-segmented antennae; and three long tail filaments, a median and two cerci. They are fast runners found in the soil, but some species (silverfish, firebrats) are common indoors in northern climates. *See* APTERYGOTA; SILVERFISH.

B. PTERYGOTA (PROMETABOLA)

All pterygotans undergo metamorphosis, either slight and incomplete (Prometabola and Hemimetabola) or pronounced and complete (Holometabola).

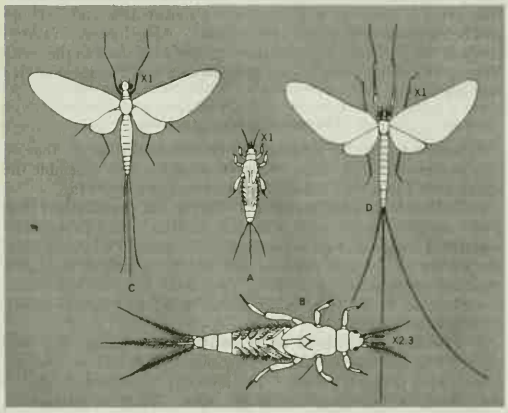


FIG. 16.—EPHEMEROPTERA, MAY FLIES. EPHEMERA. (A,B) NYMPHS SHOWING EXTERNAL WING-PADS AND LATERAL ABDOMINAL GILLS; (C) SUBIMAGO, THE WINGED LARVAL STAGE; (D) IMAGO OR ADULT

Ephemeroptera (May Flies) (Fig. 16).—Small to medium-sized (up to $1\frac{1}{2}$ in.), soft-bodied, winged insects with large eyes, vestigial mouth parts, inconspicuous bristlelike antennae, slender legs, long, segmented cerci and usually a median caudal filament; the wings are many-veined and fanlike, the second pair reduced or lacking; the nymphs are aquatic, with biting mouth parts, external wing pads and lateral abdominal gills (in some cases on the head or thorax also). A sexually immature, nonfeeding, subimago stage, with functional wings, is followed by a short-lived adult stage. *See* MAY FLY.

C. PTERYGOTA (HEMIMETABOLA)

1. Odonata (Dragonflies, Damsel Flies) (Fig. 17).—Large insects (wingspread up to $4\frac{1}{2}$ in.) with a long, slender body; large eyes; very short antennae; biting mouth parts; and two pairs of membranous, net-veined wings. Males have a secondary copulatory organ on second (or second and third) abdominal segments. The nymphs are aquatic, with a long, hinged prey-grasping labium (the "mask"); rectal respiration is replaced in later nymphal stages of damsel flies by three caudal gills. (*See* DRAGONFLY.)

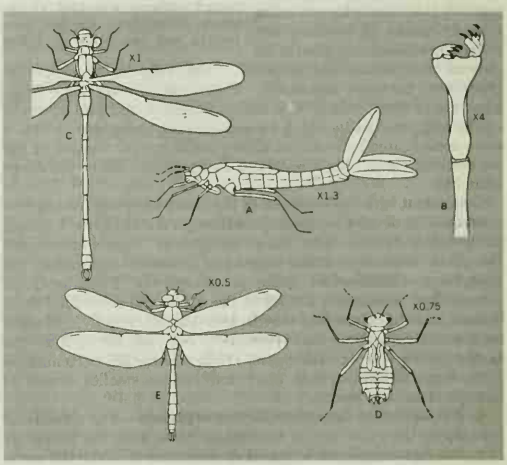


FIG. 17.—ODONATA, SUBORDER ZYGOPTERA. ARCHILESTES CALIFORNICA: (A) NYMPH WITH THREE CAUDAL GILLS; (B) PREHENSILE LIP OF NYMPH SHOWING LABIAL PALPS EVOLVED INTO RAPTORIAL JAWS; (C) IMAGO. ODONATA, SUBORDER ANISOPTERA. SOMATOCHLORA METALLICA: (D) NYMPH; (E) IMAGO

2. Blattaria (Cockroaches) (Fig. 18).—Medium-sized to large ($\frac{3}{8}$–$2\frac{3}{8}$ in.), ovoid, flattened insects with well-developed eyes; long slender antennae; chewing mouth parts; a large pronotum; and abdominal cerci. The wings, when present and fully developed, are many-veined, the fore pair narrower and thicker than the hind pair. The nymphs are terrestrial, resembling the adults in general form. (*See* COCKROACH.)

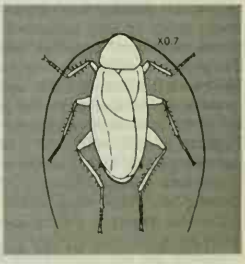


FIG. 18.—BLATTARIA. PERIPLANETA AMERICANA, COCKROACH

3. Mantodea (Mantids).—Medium-sized to large (up to and exceeding 4 in.) predaceous insects with a large head; well-developed eyes; an elongated prothorax; and very large, spined, grasping front legs held in a prayerlike attitude when at rest. The wings, when present and fully developed, are four, the first pair narrow, the second large and fanlike. The nymphs are terrestrial and similar to the adults. (*See* MANTIS.)

4. Phasmida (Stick Insects) (Fig. 19).—Large (up to 13 in.),

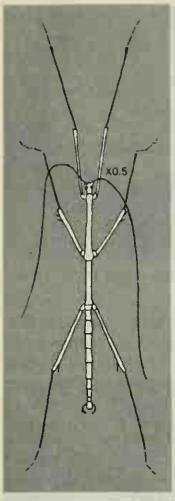


FIG. 19.—PHASMIDA. DIAPHEROMERA FEMORATA, WALKING STICK

sticklike or leaflike, plant-eating insects with small eyes; long, slender antennae; and chewing mouth parts. The nymphs are terrestrial and similar to the adults in habits and general form. (*See* STICK INSECT; LEAF INSECT.)

5. Isoptera (Termites) (Fig. 20).—Small to medium-sized (queens up to 3½ in.) social insects, living in large colonies made up mostly of pale, soft-bodied, immature workers of both sexes. Reproductive forms usually pigmented, with two pairs of similar-shaped wings that are shed after mating and dispersal flights. (*See* TERMITE; SOCIAL INSECTS.)

6. Dermaptera (Earwigs) (Fig. 21).—Medium-sized (up to and exceeding 1½ in.), elongate, tough-bodied, omnivorous insects with chewing mouth parts; large eyes; long antennae; and a pair of forcepslike cerci at the tip of the abdomen. The wings, when present and fully developed, consist of a fanlike second pair that fold up under short, padlike wing covers modified from the first pair. The nymphs are similar to adults in habits and general form. (*See* EARWIG.)

7. Orthoptera (Grasshoppers, Crickets, Katydids) (Fig. 22).—Medium-sized to large (up to and exceeding 4 in.) plant-eating insects with a large head; chewing mouth parts; and the pronotum and hind legs usually enlarged for jumping. The wings, when present and fully developed, consist of a large, fanlike second pair that fold under a narrow, elongate, leathery first pair (tegmina). The

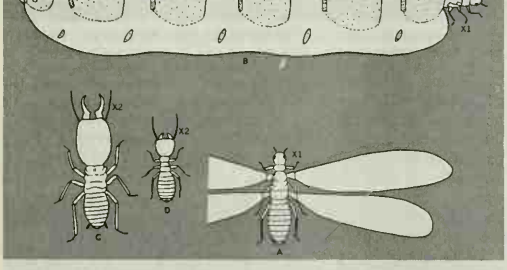


FIG. 20.—ISOPTERA, TERMITES OR WHITE ANTS. TERMES NATALENSIS: (A) WINGED VIRGIN QUEEN (MALE SIMILAR IN APPEARANCE AND SIZE); (B) AGED QUEEN (MINUS WINGS) WITH ABDOMEN DISTENDED WITH EGGS; (C) SOLDIER; (D) WORKER

nymphs are similar to the adults in habits and general form. (*See* ORTHOPTERA; CRICKET; KATYDID; GRASSHOPPER; LOCUST.)

8. Embioptera (Embiids or Web Spinners) (Fig. 23).—Small (usually less than ½ in.), elongate, flattened, semisocial plant-eating insects with chewing mouth parts; well-developed eyes; elongate and many-segmented antennae; and enlarged front tarsi modified into glands that spin the silk used in lining the tunnels in which they live. The two pairs of wings are narrow, similar and present in the male only. The nymphs are terrestrial, occurring with the adults and resembling them in habits and general body form. (*See* EMBIOPTERA.)

9. Plecoptera (Stone Flies) (Fig. 24).—Medium-sized to large (½–2½ in.), elongate insects with chewing mouth parts (often reduced); well-developed eyes; long, many-segmented antennae; abdominal cerci; and usually two pairs of well-developed, similarly textured wings, the fore pair narrower than the hind pair. The

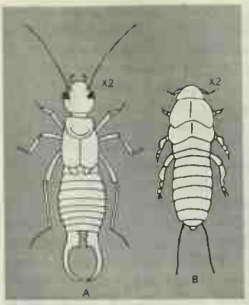


FIG. 21.—DERMAPTERA, EARWIGS: (A) FORFICULA AURICULARIS, EUROPEAN EARWIG; (B) HEMIMERUS TALPOIDES, LOUSELIKE EXTERNAL PARASITE OF AFRICAN RATS

nymphs are aquatic, with body proportions as in the adult. (*See* STONE FLY.)

10. Zoraptera (Zorapterans) (Fig. 25).—Minute (less than ⅛ in.), rare, semisocial insects with chewing mouth parts; long antennae of nine segments; and single, segmented cerci. Adults may be winged or wingless. In the latter case they are also eyeless. The wings are delicate, membranous, with only one or two veins, and are shed after mating and dispersal. The nymphs are terrestrial and similar to the adults.

11. Psocoptera or Corrodentia (Book and Bark Lice) (Fig. 26).—Minute to small (up to and exceeding ¼ in.), compact insects with a large head; chewing mouth parts; many-segmented antennae; a very narrow prothorax; and no cerci. The wings, when present and fully developed, are similar in texture, with simple, reduced venation, the front pair being larger than the hind pair. The nymphs resemble the adults. (*See* PSOCOPTERA.)

12. Mallophaga (Biting Lice) (Fig. 27).—Minute to small (up to ¼ in.), secondarily wingless ectoparasites, living largely on birds, with chewing mouth parts; and reduced eyes and antennae. The nymphs resemble the adults and because there are no wings, undergo no evident metamorphosis. (*See* LOUSE; MALLOPHAGA.)

13. Anoplura (Sucking Lice) (Fig. 28).—Minute to small (up to ¼ in.), secondarily wingless, blood-sucking ectoparasites, living largely on mammals. They are similar in form to biting lice but have piercing rather than chewing mouth parts. There is no evident metamorphosis. (*See* ANOPLURA.)

14. Thysanoptera (Thrips) (Fig. 29).—Minute (less than $\frac{1}{16}$ in.), slender insects with conelike piercing and lacerating mouth parts; large eyes; one- or two-segmented tarsi with a bladderlike tip; and no cerci. Wings, when present and fully developed, are long, narrow and fringed with hair. The nymphs are plant-eating or predaceous and resemble the adults. Unlike most other insects with incomplete metamorphosis, they have a pupalike stage.

15. Hemiptera (True Bugs, Etc.).—Minute to large (up to 4½ in.) insects of very diverse form but having beaklike, plant-piercing or blood-sucking mouth parts and incomplete metamorphosis. Wings are usually present and the compound eyes are usually large. The group divides into two major sections here treated as suborders but regarded by some as orders.

Suborder Homoptera (Cicadas, Treehoppers, Leafhoppers, Aphids, Scale Insects, Etc.) (Fig. 30).—Sap-sucking insects. Wings, if present, are membranous, with fore and hind pair similar and held sloping and rooflike over the body. When feeding they discharge a sweet fluid, honeydew, utilized as food by ants, bees and wasps. The more primitive forms are the larger (cicadas, treehoppers) and have short, bristlelike antennae and sawlike ovipositors; the more specialized are the smaller (aphids, mealy bugs, scale insects) and have either stout or long threadlike antennae at some stage in development. The aphids in particular have complex lifecycles that may involve alternation of host plants and alternation of generations with extreme polymorphism.

FIG. 22.—ORTHOPTERA: (A) OECANTHUS NIGRICORNIS, TREE CRICKET; (B) TRIDACTYLUS APICAL PYGMY CRICKET

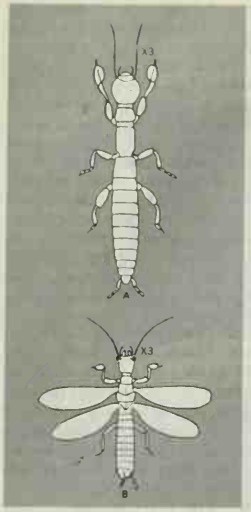


FIG. 23.—EMBIOPTERA, WEB SPINNERS, SMALL SEMISOCIAL TROPICAL GROUP. EMBIA MAJOR: (A) FEMALE; (B) MALE

Suborder Heteroptera (*True Bugs*) (*Fig. 31*).—Insects with antennae four- or five-segmented. Wings, if present, are held flat over the body with the tips overlapping, the fore pair thickened at the base. The nymphs and adults are usually similar in form and have similar food habits, many being predaceous or bloodsucking, others imbibing plant juices. Some live in the water (backswimmers, water boatmen, giant water bugs) or on the surface of the water (water striders); a few are semiaquatic (shore bugs); the remainder, terrestrial. Bloodsuckers include the assassin bugs and bedbugs; plant juice feeders include the stink bugs, plant bugs, squash bugs, lace bugs, etc. *See* HEMIPTERA; CICADA; APHID; BEDBUG; WATER BOATMAN; etc.

D. PTERYGOTA (HOLOMETABOLA)

1. Coleoptera (Beetles, Weevils) (Fig. 32).—Minute to very large (up to and exceeding 6 in.) insects, usually hard-shelled and winged. The fore pair of wings (elytra), thickened and horny, meet in a straight line down the back; the hind pair, if present, larger, membranous and folded beneath the fore wings; chewing mouth parts well developed.

The suborder Adephaga, with terrestrial, aquatic or shore-loving groups, contains the most generalized beetles, with campodeiform larvae, *i.e.*, active and predaceous. Most remaining beetles are grouped in the suborder Polyphaga, which contains several radiating lines of evolution. These lines arise with forms generally having campodeiform larvae and end with forms having cylindrical or even legless grublike larvae. In some higher families, the first stage larva is active and campodeiform, but the fullgrown larva is cylindrical and nearly legless. This ontogeny suggests a recapitulation of ancestral forms.

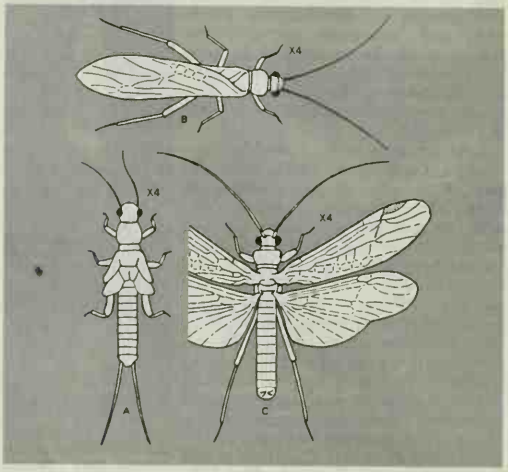


FIG. 24.—PLECOPTERA, STONE FLIES. NEMOURA VALLICULARIA: (A) NYMPH; (B,C) IMAGOES

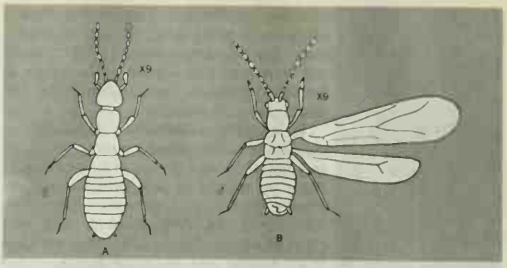


FIG. 25.—ZORAPTERA, RARE, SEMISOCIAL TERMITELIKE INSECTS. ZOROTYPUS HUBBARDI: (A) FEMALE; (B) MALE

Larvae of many of the higher groups are able to dispense with legs because (1) they live in the interior of plants; (2) are parasitic on other insects; or (3) have evolved toward a social life, like the

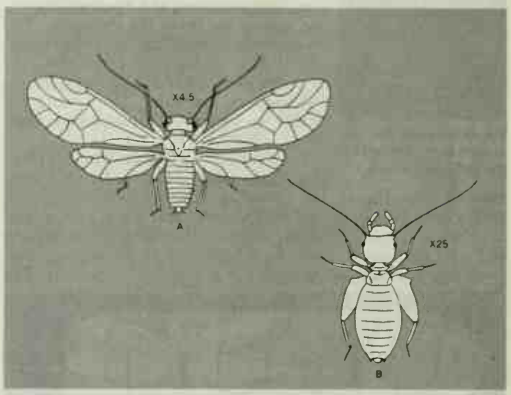


FIG. 26.—CORRODENTIA: (A) PSOCUS FASCIATUS, PSOCID; (B) LIPOCELIS DIVINITORIA, BOOK LOUSE

tumblebugs of the Scarabaeoidea and the ambrosia beetles of the Scolytidae. Metamorphosis is complete; hypermetamorphosis occurs in the Meloidae, as, for example, *Epicauta vittata* and *E. cinerea*, which are predators on clusters of grasshopper eggs. Plant parasitism occurs throughout the higher families of the Coleoptera, especially in long-horned beetles, leaf beetles, bark beetles and weevils. In these groups, many species are obligate parasites and are limited to feeding on one species of plant. As a result, many are serious pests of forest or agricultural crops.

In the family Platypodidae and in some genera of the Scolytidae, food habits have shifted from that of eating general plant tissues in which tunnels lie, to the cultivation and eating of fungi grown on the wood walls of the tunnels. The fungal food is tended by the mother, as it needs special care in planting and harvesting to prevent fast growth, which sometimes chokes the tunnels and smothers the family. The mother carries live fungus from her home burrow to that which she makes for her eggs and young. After establishing fungus beds in the burrow, she gathers the crop and places it before the larvae. (*See* BEETLE.)

2. Strepsiptera (Twisted-Wing Insects) (Fig. 33).—Uncommon minute to small (less than $\frac{3}{16}$ in.) insects showing extreme sexual dimorphism, the male being winged and active, the

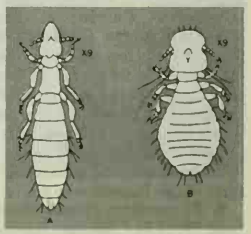


FIG. 27.—MALLOPHAGA, BITING OR BIRD LICE: (A) LIPEURUS SQUALIDUS, DUCK LOUSE; (B) GONIOCOTES COMPAR, PIGEON LOUSE

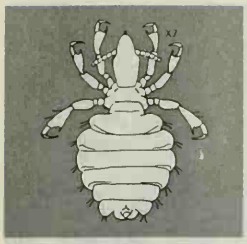


FIG. 28.—ANOPLURA, SUCKING OR MAMMALIAN LICE. HEMATOPINUS SUIS, HOG LOUSE

female usually being a degenerate endoparasite. As primary larvae both males and females are free, active, spiny and long-legged; however, after boring into the abdomen of a host (mostly Homoptera and Hymenoptera) the males develop in the usual manner but the females become literally egg-producing sacs without eyes, antennae or legs. Males have eyes wide apart, in some species stalked; forewings reduced to short flaps (pseudohalteres); thorax large; and abdomen short.

The male pupates in the last larval skin within the host. The female larva changes into a pupa with head and thorax fused, from which form she develops no further; at maturity she is enclosed in the larval skin, at the anterior end of which is a brood-passage opening, which is also used by the male in coitus. In the most primitive family, Mengeidae, the female has small eyes, antennae, mouth parts and short legs, and has been found living free under stones. In all higher families, however, she is an endoparasite, feeding off her host by osmosis.

There is much evidence to support the view that the Strepsiptera are actually a highly specialized family (Stylopidae) of parasitic Coleoptera. The forewings of the male appear to be rudimentary elytra. The life history, habits and structure of the larvae somewhat parallel those in the Rhipiphoridae (Coleoptera). In both, the primary larva is active and the later larva becomes an endoparasite.

3. Megaloptera (Dobson Flies, Alder Flies).—Large (up to about 5 in.) terrestrial insects with aquatic larvae and complete metamorphosis. The adults are similar, having two pairs of large membranous wings with numerous veins and cross-veins; large eyes; long antennae; and chewing mouth parts. The larvae also have chewing mouth parts and are predaceous on small aquatic animals in lakes and streams. When ready to pupate, they leave the water and transform into adults in cells constructed in moist soil or decomposing wood. (*See* ALDER FLY; DOBSON FLY.)

4. Neuroptera (Ant Lions, Lacewings, Mantispids, Etc.) (Fig. 34).—Small to large (wingspread up to $2\frac{3}{4}$ in.) soft-bodied insects with long, subequal, net-veined wings, which are folded rooflike over the body (venation is dense and elaborate in the higher forms); five-jointed tarsi; mouth parts with raptorial jaws, usually modified into tubular blood-sucking organs; and no cerci.

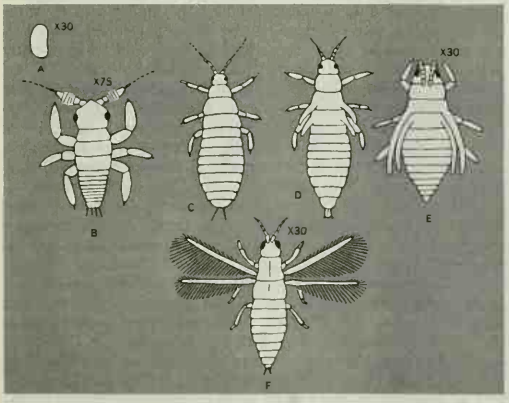


FIG. 29.—THYSANOPTERA, THRIPS. HERCOTHRIPS FASCIATUS: (A) EGG; (B,C) FIRST AND SECOND LARVAL STAGES; (D) THIRD LARVAL OR PREPUPAL STAGE, WHICH DOES NOT FEED; (E) FOURTH IMMATURE OR "PUPAL STAGE"; (F) IMAGO

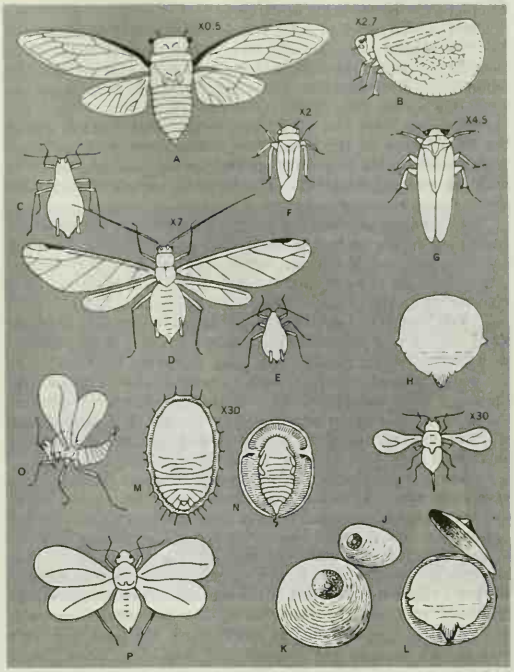


FIG. 3D.—HEMIPTERA, SUBORDER HOMOPTERA. (A) CICADA MARGINATA, CICADO; (B) ACANTHOLOMIA BIVITTATA, FULGORID; (C–E) MYZUS PERSICAE, APHID, THREE FORMS OF FEMALE; (F) EXITIANUS OBSCURINERVIS, CICCADELLID; (G) PERKINSIELLA SACCHARICIDA, LEAFHOPPER. (H–L) LINDINGASPIS ROSSI, AURICARIA SCALE: (H) MATURE FEMALE FREED FROM WAX SCALE; (I) MALE; (J) MALE SCALE; (K) FEMALE SCALE; (L) FEMALE WITH WAX SCALE LIFTED. (M,N,O,P) ALEYRODES CITRI, CITRUS WHITE FLY: (M) "PREPUPA"; (N) MALE "PUPA"; (O) MALE; (P) FEMALE

Metamorphosis is complete, hypermetamorphosis occurring in the Mantispidae. Larvae various, being campodeiform or eruciform, and gilled in the aquatic Sisyridae. A cocoon is spun from silk produced by the Malpighian tubules. Structure and habits are very different from family to family. They show evolution from a fairly simple venation, as in the Sialidae and Coniopterygidae, to some of the most elaborately veined wings known, in such families as the Myrmeleonidae, Ascalaphidae and Dilaridae.

The majority are voracious wandering predators that stalk their prey, but the larva of the ant lion, Myrmeleonidae, digs a circular pit in sand or dust in which it lies in wait for any insect that slides to the pit bottom. The larva of the spongilla fly (Sisyridae) is parasitic in fresh-water sponges, while that of the Mantispidae is parasitic in egg sacs of spiders where it undergoes a hypermetamorphosis. The lacewings of the Hemerobiidae and Chrysopidae eat aphids and scale insects, making themselves very beneficial insects. (*See* NEUROPTERA; ANT LION; LACEWING FLY.)

5. Raphidioidea (Snake Flies).—Medium-sized to large (up to and exceeding 1 in.) insects with two pairs of similar, net-veined wings; long antennae; chewing mouth parts; a long, serpentlike neck and large eyes. The female has a long, slender, curved ovipositor. Metamorphosis is complete. The larvae are terrestrial and predaceous, with a well-developed head, strong thoracic legs and segmented antennae. Two families are known, the Raphidiidae, which have simple eyes (ocelli) in addition to the compound eyes, and the Inocelliidae, which lack ocelli.

6. Mecoptera (Scorpion Flies) (Fig. 35).—Small to medium-sized (usually $\frac{1}{2}$–1 in.), slender, predaceous insects with chewing mouth parts; large eyes; long antennae; long, slender legs. Wings, when present, are four and long and slender. Metamorphosis is

complete, the larvae being eruciform.

The common forms of damp woods, *Panorpa* and *Bittacus*, look like four-winged crane flies (Diptera). The venation of the wings is similar to that of the crane flies, but with more cross veins. The name comes from the great bulb of male genitalia in some genera, appearing as the stinging organ on the tail of a scorpion. The caterpillarlike larva is a voracious predator that wanders among the dead leaves of the forest floor. The adult *Bittacus* hangs from bushes by the long fore legs and catches passing gnats, etc., with the grasping hind feet. This requires remarkable binocular vision to the rear, very unusual in animals.

Mecoptera are of special interest to students of insect evolution since they appear to be close to the ancestral group from which evolved the panorpid or mecopteroid complex: the orders Mecoptera, Trichoptera, Lepidoptera, Diptera and Siphonaptera. The Neuroptera are also close relatives. (*See* SCORPION FLY.)

7. Trichoptera (Caddis Flies) (Fig. 36).—Small to medium-sized (less than 1 in.) mothlike insects, nocturnal or crepuscular, with feeble chewing mouth parts; long antennae; large eyes; and the wings covered with hairs and scales and folded rooflike over the body. Metamorphosis is complete. The larvae are aquatic, living in a silk case to which usually are attached sand grains, sticks or pebbles; eruciform; and in most species have filamentous abdominal gills.

Caddis flies are general feeders, though some are restricted to a vegetarian diet. The tubes or cases may be free so the larvae can crawl about by extending head and legs or may be attached solidly to a rock or log in the stream bed. They pupate in a silk or gelatinous cocoon within the case. The pupa has no gills but breathes the air dissolved in the water. When ready to emerge, the pupa chews its way out by means of its special free jaws, the pupal skin splits and the adult flies up from the water. Incapable of feeding because of defective mouth parts, the adult lives only long enough to mate and oviposit, and then dies. (*See* CADDIS FLY.)

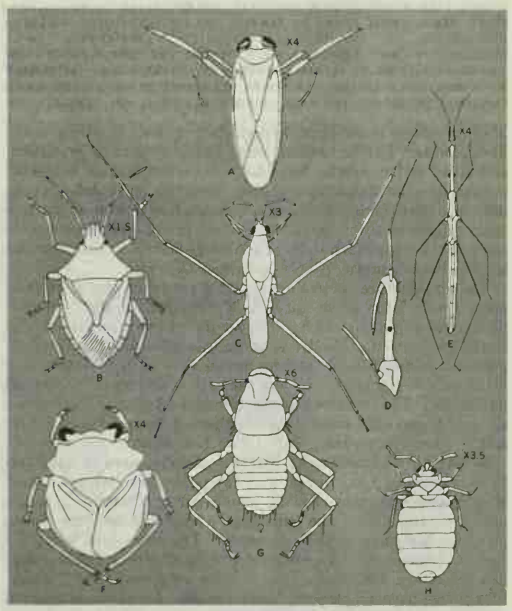


FIG. 31.—HEMIPTERA, SUBORDER HETEROPTERA, TRUE BUGS: (A) ARCTOCORIXA ALTERNATA, WATER BOATMAN; (B) APATETICUS CYNICUS, STINK BUG; (C) GERRIS BUENOI, WATER STRIDER; (D,E) HYDROMETRA MARTINI; (D) SIDE VIEW OF HEAD SHOWING PIERCING BEAK; (F) GELASTOCORIS BARBERI, TOAD BUG; (G) HESPEROCTENES IMPRESSUS, PARASITIC ON BATS; (H) CIMEX LECTULARIUS, BEDBUG

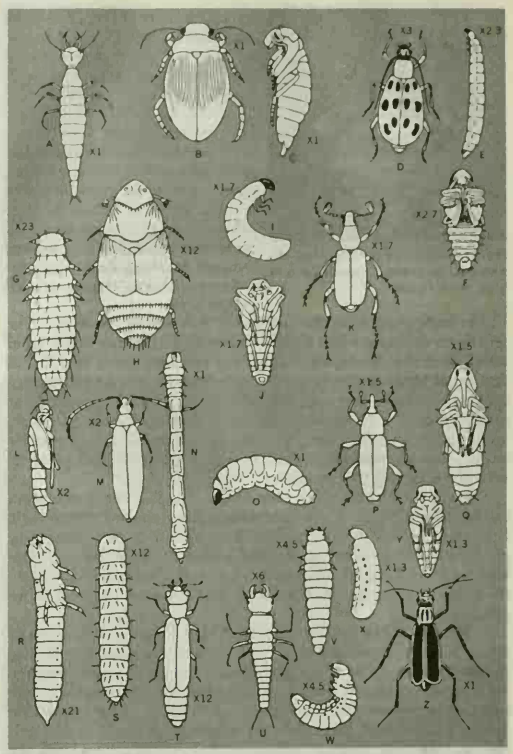


FIG. 32.—COLEOPTERA, BEETLES—LARVAL, PUPAL AND ADULT STAGES: (A–C) DYTISCUS MARGINALIS, DYTISCID, DIVING BEETLE; (D–F) DIABROTICA 12-PUNCTATA, CHRISOMELID, CORN ROOTWORM; (G,H) PLATYPSYLLUS CASTORIS, PLATYPSYLLID, PARASITIC ON THE BEAVER; (I–K) MACRODACTYLUS SUBSPINOSUS, SCARABAEID, ROSE CHAFER; (L–N) CUPES CONOCOLOR, CUPESCID, PRIMITIVE WOOD BORER; (O–Q) SPHENOPHORUS OBSCURUS, WEEVIL, SUGAR CANE BORER; (R–T) MICROMALTHUS DEBILIS, MICROMALTHID, LEGGED AND LEGLESS LARVAE, PRIMITIVE BORER; (U–Z) EPICAUTA, BLISTER BEETLES, PARASITIC ON GRASSHOPPER EGGS

8. Lepidoptera (Butterflies, Moths) (Fig. 37).—Small to large (wingspread up to and exceeding 6 in.) insects usually without mandibles; with two maxillae and galeae developed into a hollow nectar-sucking proboscis, coiled at rest; and wings usually prominent, fanlike and covered with overlapping scales. Metamorphosis is complete. The larvae are caterpillars with up to four pairs of abdominal prolegs; compound eyes reduced to a semicircle of 4–12 ocelli on each side of the head; vestigial antennae; and chewing mouth parts. The butterflies have thickened antennae, usually clubbed at the tip but sometimes hooked (skippers, Hesperoidea); they are active during the day. The moths have many-jointed antennae, often featherlike but never clubbed. Moths are usually drab and crepuscular or nocturnal, though there are some brightly-coloured forms that are diurnal and have the appearance and habits of large butterflies.

The caterpillars are herbivorous, except in a few butterflies (Lycaenidae) that feed on aphids and other small insects, and some carnivorous moth larvae. A few are borers in plant stems and wood; others are aquatic, with filamentous gills. The adults usually feed on nectar, injured fruits, etc., imbibing the juices.

Except in the very primitive Micropterigidae, the pupa is obtect, with all appendages glued to its surface, one of the highest forms of pupa known. The last instar of moth caterpillars usually spins a silk cocoon that serves as a protective case during pupation. The butterfly caterpillars have no silk cocoon, but the pupa (chrys-

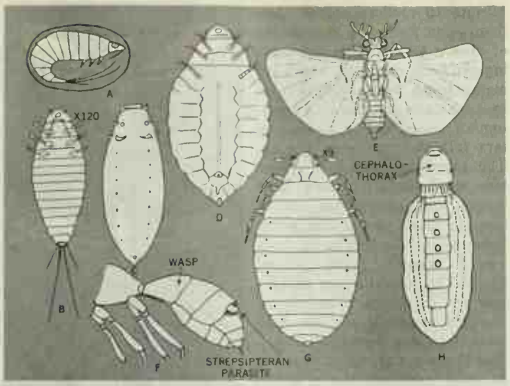


FIG. 33.—STREPSIPTERA, TWISTED-WINGED INSECTS, INTERNAL PARASITES OF OTHER INSECTS. (A-E,G) EOXENOS LABOULBENIA, MENGEIDAE, MOST PRIMITIVE FAMILY WITH ACTIVE ADULT FEMALE (G); (A) FIRST STAGE LARVA IN EGG DISSECTED FROM MOTHER; (B) FIRST STAGE LARVA OR ACTIVE TRIUNGULIN; (C) LAST STAGE MALE LARVA; (D) LAST STAGE FEMALE LARVA; (E) ADULT MALE, FOREWINGS RUDIMENTARY. (F,H) XENOS PALLIDUS FEMALE: (F) WITH CEPHALOTHORAX OF THE PARASITE PROJECTING FROM ABDOMEN OF THE WASP POLISTES; (H) PARASITE DISSECTED OUT, SHOWING THE FUSED, PUPALIKE CEPHALOTHORAX

alis) hangs with a silken loop about its middle. The oriental silkworm or silk moth (*Bombyx mori*) is the only insect fully domesticated by man. It cannot live without his care in daily feeding and is not known in a wild form (*see* SILK).

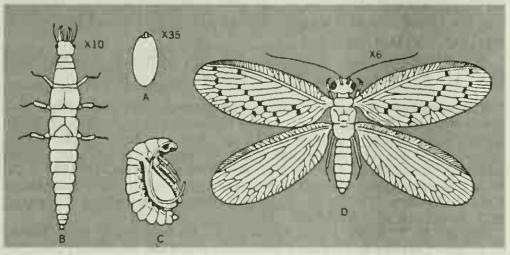


FIG. 34.—NEUROPTERA, NETTED-WINGED FLIES. HEMEROBIUS STIGMATERUS, LACEWING: (A) EGG; (B) LARVA; (C) PUPA; (D) ADULT

Adaptive coloration and mimicry are highly developed in these large and conspicuous insects. Many caterpillars also exhibit protective coloration. (*See* BUTTERFLY AND MOTH; MIMICRY.)

9. Diptera (True Flies) (Fig. 38).—Minute to large (less than $\frac{1}{16}$ in. up to 2 in.) insects with large antennae and eyes; mouth parts modified for sucking and lapping; the first pair of wings, on mesothorax, well developed, the second pair being reduced to knobs (halteres) and present even when fore wings are absent.

Flies divide into Nematocera, with whiplike antennae, and Brachycera, with short antennae, though each group has some exceptions. Nematocera include many primitive families like crane flies (Tipulidae), which are elongate and slow-flying. Larvae of Nematocera usually have a well-developed head, with mandibles that can be opposed to each other; pupae are obtect, with the adult

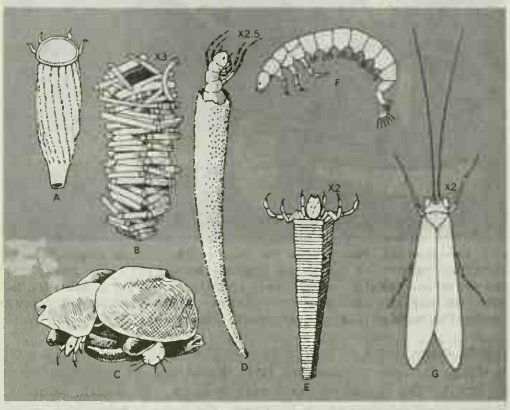


FIG. 36.—TRICHOPTERA, CADDIS FLIES AND CASEWORMS. (A) SILK CASE OF MAYATRICHIA AYAMA; (B) "LOG-CABIN" CASE OF OECETIS CINERASCENS; (C) PEBBLE CASE OF PROTOPTILA MACULATA; (D) SAND CORNUCOPIA OF LEPTOCELLA ALBIDA. (E) CHIMNEY CASE OF BRACHYCENTRUS NUMEROSUS. (F,G) HYDROPSYCHE SIMULANS: (F) WEB-SPINNING LARVA; (G) IMAGO

appendages visible, but stuck down. Brachycera divide again into Orthorrhapha, which have many features in common with Nematocera; and Cyclorrhapha, which are the shorter, stumpier flies, often bristly, like bluebottles, fruit flies and hover flies. Larvae of Cyclorrhapha are maggots or grubs, with no distinct head; mouth-hooks working vertically, and usually two spiracles posteriorly; pupae are formed within the hardened skin of the previous larval stage, called a puparium. In the Orthorrhapha (straight seam) the adult escapes from a straight, longitudinal dorsal slit. In the Cyclorrhapha (circular seam) the anterior end of the pupal case opens by a circular seam.

Larvae of flies have adapted themselves to an extraordinary range of food-materials, perhaps greater than those of any other order of insects. A great many feed in decaying vegetable materials, leaf-mold, rotting wood or fungi. Some attack healthy

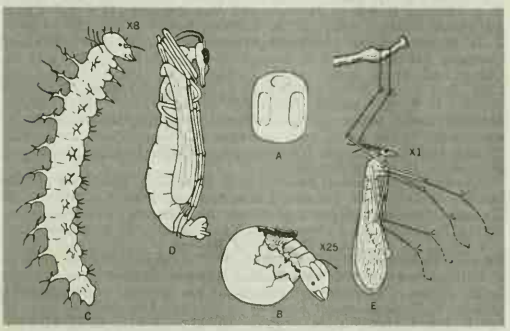


FIG. 35.—MECOPTERA, SCORPION OR HANGING FLIES. BITTACUS PILICORNIS. (A) FRESHLY LAID EGG; (B) SWOLLEN EGG, HATCHING; (C) LARVA; (D) PUPA; (E) IMAGO, IN USUAL HANGING POSITION READY TO CAPTURE PREY WITH MIDDLE AND HIND FEET

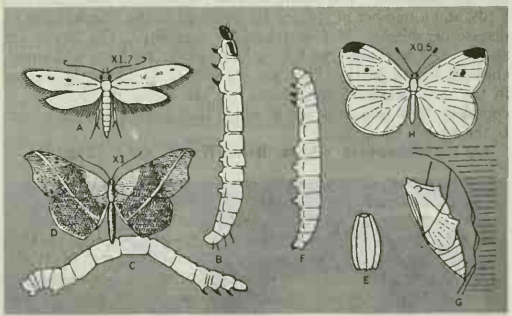


FIG. 37.—LEPIDOPTERA, MOTHS AND BUTTERFLIES. (A,B) TINEA PELLIONELLA, CLOTHES MOTH LARVA (CATERPILLAR) AND IMAGO; (C,D) DREPANODES MURIFERATA, MEASURING WORM LARVA AND IMAGO. (E-H) PIERIS RAPAE, COMMON CABBAGE BUTTERFLY: (E) EGG; (F) LARVA; (G) PUPA; (H) IMAGO

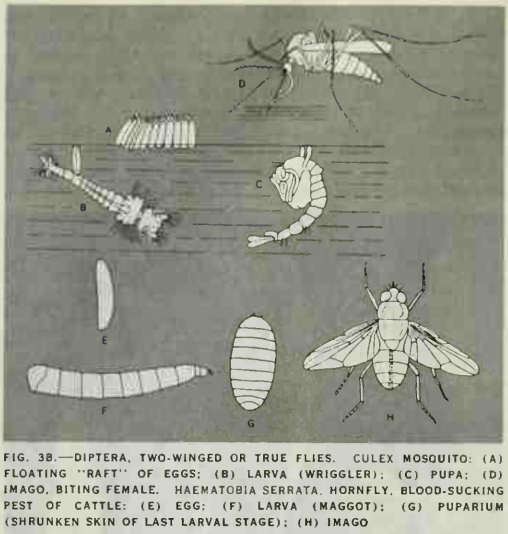


FIG. 38.—DIPTERA, TWO-WINGED OR TRUE FLIES. CULEX MOSQUITO: (A) FLOATING "RAFT" OF EGGS; (B) LARVA (WRIGGLER); (C) PUPA; (D) IMAGO, BITING FEMALE. HAEMATOBIA SERRATA, HORNFLY, BLOOD-SUCKING PEST OF CATTLE: (E) EGG; (F) LARVA (MAGGOT); (G) PUPARIUM (SHRUNKEN SKIN OF LAST LARVAL STAGE); (H) IMAGO

plants, mine stems of leaves or provoke plant galls; others feed in dung, carrion, wounds and fetid discharges, or suck the blood or destroy the tissues of vertebrate animals. In several families, loosely grouped together as Pupipara, the larva is nourished on internal secretions by the mother until it is ready to pupate.

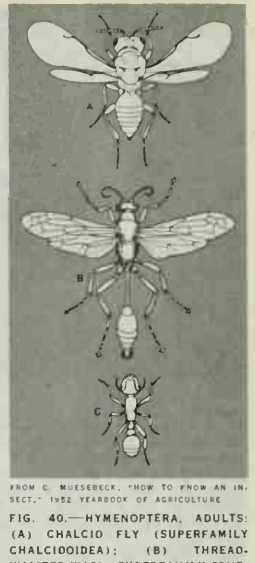
Many families of flies are parasitic, as larvae, on other insects. The Tachinidae are one of the most beneficial groups of insects. In some cases the egg is laid on caterpillars, back of the head. The maggot bores in but leaves its posterior end, which has the spiracles for breathing, projecting from the host's body, or it may attach the spiracular end to a large trachea or spiracle of the host while it devours the viscera. The maggots of other flies help to reduce the carcasses of birds, mammals and dead fish to soil.

The housefly (*q.v.*), whose maggot is reared in filth and excrement, may spread disease organisms when it walks on human food. The many blood-sucking flies, from the mosquito (*q.v.*) to the horse- and tsetse fly (*q.v.*), add to the discomfort of man and his domestic animals. The mosquitoes that transmit malaria, yellow fever and other diseases create serious health problems over large areas. (*See* FLY.)

10. Siphonaptera (Fleas) (Fig. 39).—Small (less than $\frac{1}{4}$ in.) insects, secondarily wingless, with laterally compressed bodies; piercing and sucking mouth parts; long, spiny legs and short, clubbed antennae. The adults feed on the blood of mammals and birds, and a number of species are involved in the transmission of disease organisms. Metamorphosis is complete. The larvae are slender and wormlike, with long body hairs; no legs; and small, chewing mouth parts. They are scavengers, living in the soil or in the nest debris of their hosts. When larval development is complete, they spin a cocoon in which they pupate and transform to the adult. (*See* FLEA.)

11. Hymenoptera (Ants, Bees, Wasps, etc.) (Fig. 40).—Minute to moderate-sized (less than $\frac{1}{32}$ in. up to $4\frac{1}{2}$ in.) insects of diverse form but usually having two pairs of wings, which are membranous and often divided by a network of veins into a system of closed cells. Hymenoptera fall into two great groups. The primitive Symphyta (sawflies, wood wasps, horntails) have larvae like caterpillars, which damage many plants, and sometimes bore into trunks of trees (wood wasps). The second group, the Apocrita, are divided into the Parasitica (ichneumons, chalcids, cynipids) and the Aculeata (stinging hymenopterans). The Parasitica are usually minute to small, and their larvae live as internal parasites (or parasitoids) in the eggs, larvae and pupae of other insects. The gall wasps, Cynipoidea, either provoke plant galls or live in the galls made by other insects. The Aculeata comprise the bees, wasps and ants. Their larvae are helpless, soft-bodied grubs that receive varying degrees of maternal care, from being supplied with a store of food to being given continuous attention in the well-organized nests of the ants and the social bees and wasps. For an account of social Hymenoptera, *see* SOCIAL INSECTS.

FIG. 39.—SIPHONAPTERA, FLEAS. CTENOCEPHALUS FELIS, CAT FLEA: (A) EGG; (B) LARVA; (C) DISK-SHAPED COCOON; (D) PUPA; (E) IMAGO, WHICH LIVES ON MAMMAL



FROM C. MUESEBECK, "HOW TO KNOW AN INSECT," 1952 YEARBOOK OF AGRICULTURE

FIG. 40.—HYMENOPTERA, ADULTS: (A) CHALCID FLY (SUPERFAMILY CHALCIDOIDEA); (B) THREAD-WAISTED WASP (SUPERFAMILY SPHECOIDEA); (C) ANT (FAMILY FORMICIDAE)

See HYMENOPTERA; ANT; BEE; WASP; SAWFLY; ICHNEUMON FLY; *see* also references under "Insect" in the Index.

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(E. G. L.)

INSECT, SOCIAL: *see* SOCIAL INSECTS.

INSECT BITES AND STINGS. Malaria, yellow fever, typhus, encephalitis, tularemia, bubonic plague, typhoid fever, anthrax and many other diseases are carried and transmitted by insects. This article, however, concerns itself primarily with host reactions resulting from toxins peculiar to the insect itself and with measures for repelling these insects and treating the diseases that their bites provoke.

Fortunately, few of the billions of insect bites and stings that the population of the world suffers each year result in serious disease. Most insect bites, such as those of the fly, mosquito and flea, cause an almost immediate reaction in humans consisting of itching, redness and local swelling of the skin. This usually subsides within 2 to 24 hours without leaving any permanent mark. It is believed that this result is an allergic reaction dependent upon salivary components to which the host has developed a sensitivity via previous exposure. Infants receiving their first mosquito bite show no reaction (sensitivity) to the bite, and individuals who receive bites continually over long periods of time may develop an immunity (desensitization) and consequently develop no reaction to the insect bite. Thus, natives frequently hold the erroneous belief that parasites indigenous to the region do not bite them.

Stinging insects such as the bee, hornet or wasp give rise to intensely painful, elevated skin lesions that are transitory and believed to be due to the irritant action of formic acid and an alkaline neurotoxic substance present in the venom. Multiple stings may give rise to alarming systemic illness with fainting, collapse of the circulatory system, difficult breathing and, in rare instances, death. The honeybee leaves its stinger in the skin whereas the wasp does not. Beekeepers eventually develop an immunity to the sting of the bee and they may receive many stings without experiencing any subjective or objective response. Such an immunity can be developed experimentally by repeated injections of bee venom.

Bloodsucking lice (Anoplura) live on or close to the skin and occur in three varieties: the head louse, body louse and pubic louse. They fix their eggs to hair or clothing and periodically feed on their host. Their bites result in severely itchy skin lesions, which when scratched frequently become infected and may thus result in widespread complications.

Bedbugs, which live in mattresses, walls and furniture, attack their host only in the dark. Though they are usually thought of as denizens of poverty and filth, they not infrequently find their way into the environs of affluence.

In way of treatment, local applications for any bite or sting are of little value other than the removal of insect parts left in the wound or local applications of antiseptic agents to prevent infection. Anti-itch medicines such as menthol or phenol compounds may be applied. For those insects such as lice that reside on the skin, local applications of Cuprex, DDT powder or lindane will destroy the insects. However, some insecticides such as DDT are not lethal for the eggs of these insects so that repeated applications over two weeks are necessary to eradicate the colony. Spraying the environs with DDT, chlordan or lindane is usually effective in destroying resident bedbugs, fleas and most other insects.

Much more fiction than fact surrounds the question of effective insect repellents. So-called oral repellents (compounds believed to repel insects after being taken orally by an individual) have not been proved of value for the human. However, local applications to the skin of such compounds as dimethyl phthalate, dimethyl carbate, butopyronoxyl and 2-ethyl-1,3-hexane-diol either alone or in combination have been shown to be very effective for general use. A good, all-purpose, clothing repellent for mosquitoes, ticks, fleas and chiggers is the following mixture: *n*-butyl acetanilide, 30%; benzyl benzoate, 30%; 2-butyl-2-ethyl-1,3-propanediol, 30%; and polysorbate 80, 10%. This mixture is diluted in one to two parts of water.

See also ENTOMOLOGY: *Applied Entomology: Medical and Veterinary Entomology.* (RD. B. S.)

INSECTICIDES, chemicals used for destroying insect pests. When employed to protect plants, they may be applied in the form of sprays, aerosols or as dusts. Insects indoors may be killed by fumigation (*q.v.*). *See* PEST CONTROL; ENTOMOLOGY: *Applied Entomology: Principles of Insect Control*; SPRAYS AND DUSTS IN AGRICULTURE; and also references under "Insecticides" in the Index.

INSECTIVORE, a name loosely applied to any insect-eating animal or plant, but more specifically given to any of the mammals of the order Insectivora, which includes shrews, moles, hedgehogs, tenrecs, solenodons and extinct forms that date from the very beginnings of placental mammalian history. Insectivores are common throughout the temperate and tropical zones of Europe, Asia, Africa and North America. Only one genus occurs in South America, and none in Australia or the polar regions. The greatest diversity is seen among the African forms. Insectivores include the smallest and most active of mammals. They are chiefly insect eaters, but some also feed on other small animals, including mice, snakes and birds, and even on plants. Most are small mouselike forms that are burrowers or tree dwellers; a few are adapted for swimming. Except for the tree shrews, all are at least partly nocturnal.

GENERAL

Living insectivores fall into four well-defined groups: (1) the jumping or elephant shrews (Macroscelididae) and tree shrews (Tupaiidae); (2) spiny and hairy hedgehogs (Erinaceidae); (3) true shrews (Soricidae); and (4) tenrecs, potamogales (Tenrecidae) and golden moles (Chrysochloridae). The first group is the most primitive in structure and is generally treated as a suborder, the Menotyphla. Some authorities regard the Menotyphla as a distinct order, while others classify the tree shrews as a suborder of Primates (*q.v.*) and the jumping shrews as a suborder of Insectivora.

The remaining three groups of living insectivores are fairly homogenous in basic characters and are classified as the suborder Lipotyphla. The hedgehog group appears to be the most primitive of the Lipotyphla and the ancestral stock of the rest of the suborder.

Characteristic Features.—Insectivores range in size from the pygmy shrew (*Suncus etruscus*) of southern Europe, which weighs as little as two grams and measures one and one-half inches in combined head and body length, to the comparative giant, the *bulau* or moonrat (*Echinosorex gymnurus*), a hairy hedgehog of Borneo, which attains a length of 15 in. or more. The snout of insectivores is typically elongate and pointed, or provided with tentacles as in some moles; the tail is well developed except in most burrowing forms; fore and hind feet are provided with four or five toes, the first toe never being opposable. Most insectivores possess the primitive number of teeth for placental mammals, which may be expressed by the following formula showing the number of each kind of tooth in each upper and lower jaw of one side: incisors $\frac{3}{3}$; canines $\frac{1}{1}$; premolars $\frac{4}{4}$; molars $\frac{3}{3} = 22$, or a total of 44 teeth. Sometimes a fourth pair of molars is present, while the incisors may be reduced to two in each upper jaw and one in each lower jaw. Canines are usually weak and, in many insectivores, not clearly differentiated from incisors and first premolars. Molar crowns may have (1) three main tubercles in the shape of a V (zalambdodont), (2) five tubercles in the shape of a W (dilambdodont), or (3) four tubercles intermediate in shape.

The skull is generally elongate, with the tympanic bone ringlike and free, enclosed in the tympanic cavity or included in the formation of the tympanic bullae. The clavicle is usually present, except in the otterlike *Potomogale*, and the entepicondylar foramen and central wrist bone are generally present. The cerebral hemispheres of the brain are smooth and do not extend backward over the cerebellum.

Jumping shrews and tree shrews (Menotyphla) are distinguished from all other insectivores (Lipotyphla) by the presence of a pouch (caecum) off the digestive tract. The uterus is two-horned,

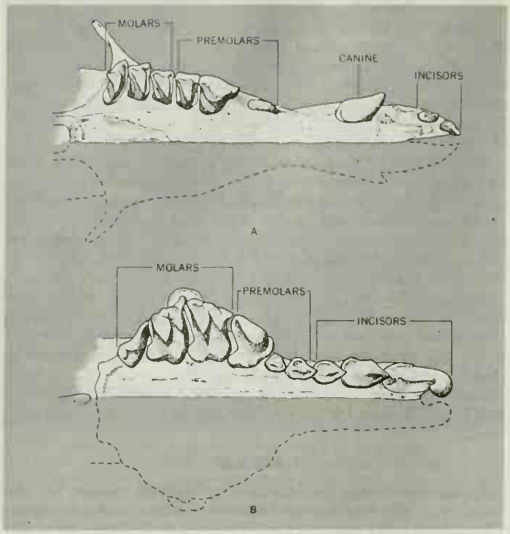
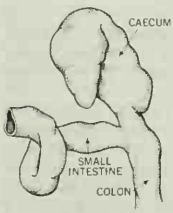


FIG. 1.—DENTITION OF INSECTIVORES ILLUSTRATING THE TWO PRINCIPAL TYPES OF MOLAR TEETH: (A) ZALAMBDODONT OR V-SHAPED MOLARS IN A TENREC (TENREC EDAUDATUS); (B) DILAMBDODONT OR W-SHAPED MOLARS IN A THICK-TAILED SHREW (SUNCUS MURINUS)

and the placenta deciduate. The testes are usually abdominal or inguinal but may be scrotal in a few species. Some insectivores produce one offspring at a birth, but most average at least five to a litter, and there may be two or more litters per year. Tenrecs are the most prolific, 16 or more being born at one time.



FROM O. O. DAVIS, "ANATOMY OF THE TREE SHREW," FIELD MUSEUM OF NATURAL HISTORY, ZOOLOGICAL SERIES, VOL. 20, NO. 30, 1938

FIG. 2.—WELL-DEVELOPED CAECUM IN THE TREE SHREW DENDROGALE

Relationships.—Ancestral Menotyphla may well have given rise to the Primates (lemurs, monkeys, apes and man), Chiroptera (bats) and Dermoptera (flying lemurs or colugos). The oldest known insectivore lived in Asia during the Upper Cretaceous, roughly 70,000,000–80,000,000 years ago. The ancestry, descendants and even the interrelationship of these early insectivores cannot be satisfactorily determined from the fragmentary fossil evidence, but several primitive genera are known, all included in the family Deltatheridiidae. This group may have given rise to the North American branch of the insectivores, which appeared more than 10,000,000 years later, during the Lower Paleocene. One of the most interesting of early North American insectivores is *Palaeoryctes* of the Middle Paleocene. It was formerly regarded as ancestral to living zalambdodont insectivores and was placed at the base of the tenrec stock.

It now appears, however, that the classification of insectivores on the basis of the structure of the molars, whether V shaped or W shaped, is tenuous if not artificial. The cranial characters of *Palaeoryctes*, however, point to its menotyphlic affinities. Many other little-known Upper Cretaceous and Early Tertiary insectivores are included in the Menotyphla on purely negative evidence.

CLASSIFICATION AND SURVEY

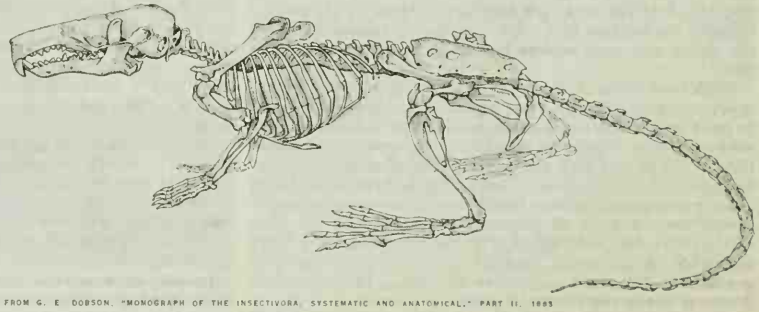
The following classification of insectivores includes the fossil (*) and living families.

Suborder Menotyphla
- Superfamily Deltatheridioidea
  - *Family Deltatheridiidae (Upper Cretaceous, Asia; Paleocene-Eocene, Nnrth America)
  - * " Palaeoryctidae (Paleocene, North America)
  - * " Leptictidae (Cretaceous-Oligocene, North America; Paleocene-Eocene, Europe)
  - * " Zalambdalestidae (Cretaceous, Asia)
  - * " Apternodontidae (Oligocene, North America)
  - Families of uncertain position:
    - *Nyctitheriidae (Paleocene-Eocene, North America; Eocene, Europe)
    - *Pantolestidae (Paleocene-Eocene, North America; Eocene, Europe)
    - *Mixodectidae (Paleocene-Eocene, North America)
    - *Aphelsicidae (Paleocene-Eocene, North America)
- Superfamily Tupaioidea
  - *Family Anagalidae (Oligocene, Asia)
  - " Tupaiidae, tree shrews (Recent, Asia)
- Superfamily Macroscelidoidea
  - Family Macroscelididae, jumping or elephant shrews (Recent, Africa)

Suborder Lipotyphla
- Superfamily Erinaceoidea
  - Family Erinaceidae, spiny and hairy hedgehogs (Eocene-Pliocene, North America; Eocene-Recent, Europe; Oligocene-Recent, Asia; Miocene-Recent, Africa; Recent, Philippines)
  - * " Dimylidae (Oligocene-Miocene, Europe)
  - " Talpidae, moles (Eocene-Recent, Europe; Oligocene-Recent, North America; Recent, Asia)
- Superfamily Soricoidea
  - Family Tenrecidae, tenrecs, potamogales (Recent, Africa, Madagascar)
  - " Chrysochloridae, golden moles (Miocene-Recent, Africa)
  - " Solenodontidae, solenodons, alamiquis (sub-Recent-Recent, Cuba, Isle of Pines, Hispaniola, La Gonave, Puerto Rico)
  - " Soricidae, true shrews (Oligocene-Recent, North America, Europe; Miocene-Recent, Africa; Pliocene-Recent, Asia; Recent, Madagascar, Philippines, Celebes, Moluccas, South America)

Only the living families are discussed in the following survey. Skull characters and dentition, important in identification, are emphasized.

Jumping Shrews (Macroscelididae).—African jumping shrews are the size of a mouse or rat, with the hind limbs considerably larger than the forelimbs and the tail long. The snout is well produced (hence the name "elephant shrew" for some genera), and the skull triangular in shape, with the brain case comparatively well expanded, postorbital processes little developed or absent, zygomatic arches never perforated, tympanic bullae well developed, the bony palate perforated (except in *Rhynchocyon*), and the mandible with the upper border of coronoid process and condyle on the same level. The female has three pairs of mammae but



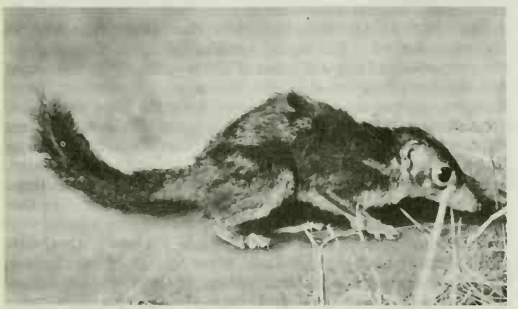
FROM G. E. DOBSON, "MONOGRAPH OF THE INSECTIVORA, SYSTEMATIC AND ANATOMICAL," PART II, 1883

FIG. 3.—SKELETON OF THE RUSSIAN DESMAN (DESMANA MOSCHATA)

produces only one or two young in a litter. Jumping shrews are diurnal as well as nocturnal and are common in arid or semiarid regions.

Typical jumping shrews, or elephant shrews, have five toes on each front foot, comparatively long nasal bones, short frontals. Postorbital processes are absent, and there are three upper incisors on each side of the jaw and small canines. The genus *Elephantulus* has a narrow snout, large ears, five toes on each hind foot and 40 teeth. The dengoli (*Nasilio*) has 42 teeth and a shorter snout; the common elephant shrew (*Macroscelides*), with the same dental formula, has a long snout and a pair of occipital protuberances formed by the greatly enlarged auditory bullae. *Petrodromus*, which has four toes on each hind foot, includes one species (*Petrodromus tetradactylus*) with the bristles on the underside of the tail being normal and not rough to the touch, and two others (*P. sultan* and *P. rovumae*) with the bristles terminating in rough knobs. *Rhynchocyon*, with a checkerboard pattern on its back, has four toes on each fore and hind foot, small postorbital processes, relatively short nasals and large frontals, one upper incisor and an elongated canine.

Tree Shrews (Tupaiidae).—The squirrellike tree shrews and the pen-tailed tree shrew are forest dwellers, diurnal and much more terrestrial than arboreal. They are characterized by a pointed snout with a naked tip, well-developed ears and a long tail, with at least the terminal half well covered with hair. The fore and hind limbs are approximately equal in length, and each has five toes with recurved claws. The skull is somewhat pear-shaped, with



ZOOLOGICAL SOCIETY OF LONDON

MALAY TREE SHREW (TUPAIA)

the rostrum well defined, orbits large and ringed with bone, zygomatic arches perforate, auditory bullae moderately developed, palate slightly fenestrated and coronoid process of mandible high. The dental formula is: I $\frac{2}{3}$, C $\frac{1}{1}$, P $\frac{3}{3}$, M $\frac{3}{3}$ = 38; the molar crowns are W shaped, upper incisors large and caniniform and the upper canine small and like the first premolar. A caecum is present, though sometimes small, and there is a permanent scrotum, a condition unique in insectivores. The cerebral hemispheres are extremely well developed, and the olfactory lobes are relatively smaller than in other insectivores.

True tree shrews are distinguished from pentails by the squirrellike tail, pointed snout and zygomatic arch with a large perforation. The genus of common tree shrews, *Tupaia*, has the lower canine larger than the adjacent incisor. The numerous species of *Tupaia* are distributed throughout the tropical forests of the Philippines and the Indo-Malaysian region. The genus *Anathana*, of India, resembles *Tupaia* externally but the zygomatic perforation is smaller and the lower canines are similar in size and appearance to the adjacent incisor. *Dendrogale*, of Indochina and Borneo, comprises the smallest of tree shrews, with the tail rounded and close-haired and the second incisor as large as the first. *Urogale*, of Mindanao in the Philippines, is similar but somewhat larger, and with the second incisor larger than the first and third.

The pen-tailed tree shrew, *Ptilocercus*, the typical genus of the subfamily Ptilocercinae, lives in Borneo, Sumatra and the Malayan peninsula. The basal two-thirds of the very long tail is naked, the terminal third being furnished with a featherlike brush of hair. (*See* TREE SHREW.)

Hedgehogs and Allies (Erinaceidae).—The hedgehog family is divided into the subfamily Erinaceinae, the true or spiny hedgehogs of Europe, Asia and Africa, and the subfamily Echinosoricinae, the hairy hedgehogs or gymnures, chiefly Indo-Malayan in distribution. The Erinaceinae are characterized by a dense covering of spines on the back, a vestigial tail and 36 teeth. The typical genus, *Erinaceus*, includes the common European and Asiatic hedgehog, *E. europaeus*. Its young are born blind and with soft spines that are soon replaced with rigid ones. The common hedgehog is a hibernator and is known to have a high immunity to poisons. Other species of *Erinaceus* (*E. algirus*, *E. frontalis*, *E. albiventris*) range from the western Mediterranean region southward into the northern half of Africa. *Hemiechinus* is a genus of Asiatic large-eared hedgehogs. *Paraechinus*, of north Africa and Asia, has peculiarly inflated pterygoid bones.

The Echinosoricinae are distinguished by a hairy, not spiny, coat, well-developed tail and 40 or 44 teeth. The typical genus, *Echinosorex*, of Borneo, Malaya, Indochina and Burma, is opossumlike with a long, coarse pelage, black and white or whitish; a long scaly tail, pale at the tip; and 44 teeth. *E. gymnurus* is the largest insectivore. *Hylomys*, of Java, Sumatra, Borneo and Yunnan, is volelike, with a soft coat and a very short hairy-tail, about one-fifth the length of the head and body combined. *Neotetracus*, of southern China and Tonkin, with a tail more than one-half the length of the head and body, has 10 teeth in each half jaw for a total of 40. The upper canine is larger than the adjacent incisor. *Podogymnura*, of the Philippines, is about the same size as *Neotetracus* but its tail is one-third the length of the head and body, and its upper canine is smaller than the adjacent incisor. (*See* HEDGEHOG.)

Moles (Talpidae).—Moles, with few exceptions, are well adapted for burrowing or swimming. They are common throughout the temperate zones of Europe and Asia. The common old-world mole, *Talpa europaea*, perhaps extends into the Arctic region in Siberia. Moles are small to moderate in size, with cylindrical bodies and fur. The tail and limbs are short; each foot has five toes adapted for burrowing or swimming except in the shrew mole (*Uropsilus*). The snout is conical and produced into a proboscis. The small eyes are sometimes covered by skin and the ears generally have auricles. The crowns of the molars are W shaped and upper and lower canines are present. The skull is flattened and narrow, with cranial bones fused at an early age, auditory bullae not well developed; the tympanic bone is joined to the cerebral capsule; zygomatic arches are present, though often weakly developed, and the postorbital processes are absent; the articular process of the mandible has two facets. The pectoral muscles are enormously developed in the burrowing forms. As a rule a female produces a single litter of one to six young during the year.

Moles are grouped in five subfamilies. Uropsilinae, with *Uropsilus*, is the most primitive. This genus is shrewlike in form without specializations for digging or swimming. It occurs in western China and northern Burma. Several other genera of shrew moles have been described on the basis of dental characters, but all appear to belong to a single, dentally variable species, *Uropsilus soricipes*. The usual number of teeth is 38.

The subfamily Desmaninae includes two kinds of aquatic moles with front feet normal, hind feet enlarged and webbed. One, *Galemys pyrenaicus*, the Pyrenean desman of France, Spain and Portugal, has a combined head and body length of five inches, the tail being somewhat longer and with the tip flattened from side to side. The other, the Russian desman (*Desmana moschata*), is about eight inches long, the tail being about as long and flattened throughout its length.

True moles of the subfamily Talpinae are all closely related species of the genus *Talpa*. The common mole (*Talpa europaea*) occurs throughout most of Europe, Siberia and Mongolia; the other species are found elsewhere in Asia. True moles are short-tailed, with the eyes generally covered by skin and the front feet extraordinarily expanded into shovellike digging tools. The dental formula is: I $\frac{3}{3}$, C $\frac{1}{0-1}$, P $\frac{3-4}{3-4}$, M $\frac{3}{3}$ = 40–44.

The subfamily Scalopinae comprises eight genera of extremely small Asiatic and North American burrowing moles with external ears absent, forefeet enlarged for digging and canine and first upper premolars very small. *Scaptonyx fusicaudus*, of western China and northern Burma, is about three and one-half inches long, its tail being more than half as long and well haired. *Scapanulus oweni*, of China, is four inches long, with an enlarged front upper incisor. *Urotrichus*, with two species confined to Japan, is slightly smaller. The American shrew mole (*Neurotrichus gibbsi*), of the northwestern United States, with a length of about three inches is the smallest of American moles. The three species of *Scapanus* are restricted to western United States and bordering parts of Canada and Mexico. They are four or more inches long, robust, with short naked tails and three lower incisors. *Scalopus*, of the eastern half of the United States, is similar but larger with thinly haired tail, webbing between the front toes, and two lower incisors. The hairy-tailed mole (*Parascalops breweri*) of northeastern United States and bordering parts of Canada is much smaller with a densely haired tail and laterally placed nostrils.

The subfamily Condylurinae contains only the unusual star-nosed mole (*Condylura cristata*) of northeastern United States and eastern Canada. This species is five to six inches long, the tail being more than one-third as long, and the tip of the snout is adorned with a characteristic ring of 22 fleshy appendages. (*See* Mole.)

Tenrecs and Potamogales (Tenrecidae).—The tenrecs and potamogales live in Madagascar and western Africa, respectively. The skull is elongate, lacks the malar and zygomatic arches, but has the tympanic bone ringlike, the auditory bullae variable in development, postorbital process absent and molars V shaped or W shaped. The penis is retractile and the testes abdominal. The subfamily Tenrecinae comprises the tenrecs. The common tenrec (*Tenrec* or *Centetes*) is a pale brown animal about the size of a small rabbit with long harsh or spiny hair and virtually no tail. The dental formula is: I $\frac{2}{3}$, C $\frac{1}{1}$, P $\frac{3}{3}$, M $\frac{3}{3}$ = 40. The female has 12 pairs of mammae and produces 16 or more young at a birth. Tenrecs spend the dry season hibernating in their burrows. *Setifer* is a hedgehoglike tenrec with 36 teeth. *Echinops* and *Dasogale* are similar but smaller and have 32 teeth each. The streaked tenrec (*Hemicentetes*), with 40 teeth, is less spiny and characterized by the broad black and white bands running the length of its body. The burrowing rice tenrec (*Oryzorictes*) is shrew- or molelike in appearance, with fine fur, short but well-developed tail, small eyes, small external ears and 40 teeth. *Microgale* and *Limnogale* are closely related ratlike tenrecs with long tails and aquatic habits. *Geogale* (including *Cryptogale*) is a shrewlike tenrec with large ears, 34 teeth and unknown habits.

The subfamily Potamogalinae comprises two genera of aquatic insectivores confined to western equatorial Africa. The otterlike *Potamogale* has a combined head and body length of about 12 in.; a thick, laterally flattened tail equally long; nostrils protected by valves; toes unwebbed, but the second and third hind toes united by skin for two-thirds their length; tympanic bullae well developed; and molars weakly W shaped. *Micropotamogale* is similar but smaller and shrewlike, with the tail cylindrical as in tenrecs, narial valves absent and molars more nearly V shaped. *Potamogale* depends entirely on the action of its tail for propulsion through water. The habits of *Micropotamogale* are little known. (*See* Tenrec.)

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TAILLESS TENREC (TENREC ECUADATUS)

Golden Moles (Chrysochloridae).—Golden moles are blind, burrowing insectivores ranging from the Cameroons to southern Africa. The small body, robust and nearly cylindrical in form, is carried on short legs and has a rudimentary tail. The pelage is silky with a metallic luster; the neck is short and thick and the muzzle bluntly conical, with the tip naked. The external ears are hidden in fur, and the eyes are small or covered with skin. Each forefoot has four toes, of which two or three are armed with large thick claws adapted for burrowing, and each hind foot has five toes. The skull is conical in outline, with sutures prematurely obliterated, postorbital constriction not defined, postorbital processes absent, zygomatic arches and auditory bullae well developed. The teeth number 36 to usually 40. (*See* Golden Mole.)

Solenodons (Solenodontidae).—The West Indian solenodons, or alamiquis, are large shrewlike insectivores with a combined head and body length of about ten inches and a nearly naked tail almost as long. The nostrils open to the side, the eyes are small and the external ears well developed. Scent glands are present in the axillary and inguinal regions. Solenodons have 40 teeth; the molar crowns are V shaped. One species, *Solenodon cubanus*, lives in Cuba; another, *Solenodon paradoxus*, in Haiti. A second genus, also from the Greater Antilles, is the smaller and recently extinct *Nesophontes*.

True Shrews (Soricidae).—More than 100 species of true shrews are known. The typical kinds are distributed throughout the temperate and tropical zones of Europe, Asia, North America and the temperate zone of the Andes of northwestern South America. Shrews are absent in Australia and the polar regions but are present in many oceanic islands, in some of which they were introduced by man. Shrews are small, the largest is no bigger than a common rat. The pelage is soft, the snout long and pointed, eyes small, external ears more or less developed and sometimes provided with valves for closing the auditory meatus. Five toes are present on each foot. The tail is variable in length but always well developed. The teeth number from 26 to 32; the molar crowns are W shaped; the single lower incisor of each side is strongly developed and forward projecting; the first upper incisor is large, with a well-developed cuspule on its posterior base; second and third incisors and anterior premolars are unicuspidate and undifferentiated from each other; canines are absent; and milk dentition evidently missing. The skull is long and narrow, with bones fused at an early age, zygomatic arches absent, tympanic bullae absent, tympanic bone ringlike and free, articular process of mandible with two articular facets.

All shrews are nocturnal and terrestrial. Some climb on occasion, a few are well adapted for aquatic life and one species is a burrower. The metabolic rate of shrews is extremely high, few being capable of surviving half a day without food. The saliva is highly toxic and aids the shrews in subduing and killing prey, which varies from slugs, worms, insects and spiders to mice and small birds. Most shrews produce three to ten young in a litter, the young being born blind and naked.

Shrews are arranged in three subfamilies: Soricinae, with the tips of the teeth red or brown; Crocidurinae, with white teeth; and Scutisoricinae, with a peculiar vertebral column unlike that of any other mammal.

The genus of common shrews, *Sorex*, typical of the subfamily Soricinae, contains about 38 species in North America and 9 species in Europe and Asia. It is the only insectivore genus common to both hemispheres. Species of *Sorex* have small, slender bodies, ranging in colour from brown to black. The tail is less than one-half the combined head and body length, hairy in young individuals and naked in the old. The snout has well-developed vibrissae; the eyes are minute; three pairs of inguinal mammae are present in the female. The dental formula is: I $\frac{3}{1}$, P $\frac{4}{2}$, M $\frac{3}{3}$ = 32. The American pygmy shrew (*Microsorex*), represented by a single species (*M.*

hoyi), measures less than two inches in combined head and body length; it is the smallest American shrew. The largest American shrews are the short-tailed shrews of the genus *Blarina*, with one, possibly two, species; they average about three and one-half inches in head and body length. Their dental formula, as well as that of *Microsorex*, is the same as in *Sorex*. *Cryptolis*, another genus of small American shrews, comprises about 28 species, of which one lives in the high Andes of Venezuela, Colombia and Ecuador, the others in Central America, Mexico and the eastern part of the U.S. The dental formula of *Cryptotis* is: $I\frac{3}{1}$, $P\frac{3}{3}$, $M\frac{3}{3} = 30$. The remaining North American genus, *Notiosorex*, has the dental formula $I\frac{3}{2}$, $P\frac{2}{1}$, $M\frac{3}{3} = 28$. The Asiatic *Soriculus*, with six species, resembles *Sorex* but is larger and has only 30 teeth. *Chodsigoa*, with three species, also Asiatic, is very similar but has 28 teeth. *Blarinella*, with a single species in western China and northern Burma, is also like *Sorex* but has a shorter tail, smaller ears and somewhat specialized claws. *Neomys*, of Asia, comprises two species of aquatic shrews with broad fringed hind feet and tails with a keel of stiff hairs.

All white-toothed shrews (Crocidurinae) are native to the old world. The typical genus, *Crocidura*, comprises about 20 species (though more than 200 have been described). Crociduras are characterized by the long bristles of the tail. The dental formula is: $I\frac{3}{1}$, $P\frac{2}{2}$, $M\frac{3}{3} = 28$. Species occur in Europe, Africa, Asia, Indonesia and the Philippines. The thick-tailed shrews of the genus *Suncus* are native to the warm parts of Europe, Africa, Asia, Indonesia and the Philippines. There are ten species. The largest, *S. murinus*, about the size of a house rat, has been introduced by man into many parts of the world. The smallest species, *S. etruscus*, with the head and body length less than two inches, is perhaps the smallest mammal in the world; it occurs throughout most of the range of the genus. The tail of *Suncus* is characterized by long bristles, as in *Crocidura*. The dental formula is: $I\frac{3}{1}$, $P\frac{3}{2}$, $M\frac{3}{3} = 30$. *Myosorex*, with three African species called "mouse" shrews, is similar to *Suncus* but lacks caudal bristles and has three premolars in both upper and lower jaws. *Surdisorex*, another African genus, with two species, is densely furred, with ears greatly reduced and claws well developed. The dental formula is: $I\frac{3}{1}$, $P\frac{2-2}{2-3}$, $M\frac{3}{3} = 28$ or 30. *Solisorex*, of Ceylon, is a burrower; it has enlarged claws on each forefoot, a tail without bristles, simple lower incisors and 28 teeth. *Feroculus*, another Ceylonese burrower, has the digging claws of each forefoot even larger, the tail with bristles, the cutting edge of lower incisor lobed, and 30 teeth. *Anourosorex*, with two species in southeastern China, Tibet and northern Burma, is also adapted to underground life. The tail and ears are vestigial. The dental formula is: $I\frac{2}{1}$, $P\frac{2}{2}$, $M\frac{3}{3} = 26$. The aquatic *Nectogale*, with one species in Tibet, has the long, thick tail fringed above and below; external ears absent; hind feet fringed; toes fully webbed; and soles with adhesive pads for clinging to slippery rocks in mountain streams. The less specialized *Chimarrogale*, with one species ranging from the Himalayas to Japan and another in Borneo and Sumatra, has external ears, toes not webbed and tail fringed below only. *Nectogale* and *Chimarrogale* eat arthropods, including crustaceans, and small fish. *Diplomesodon* of eastern Russia is piebald, with the tail covered with white hair and tufted at the tip.

The subfamily Scutisoricinae, with a single genus and species, is known only from the upper Congo river basin in Africa. The genus *Scutisorex*, the armored shrew, measures nearly five inches in length, the tail somewhat less. The fur is long and thick and the skull is heavily ridged, with the brain case strongly roughened. The spinal column has almost twice the number of vertebrae found in other insectivores. The transverse processes of each vertebra are hypertrophied and interlocked with the adjacent processes in a manner which gives the spine the appearance of a long narrow canoe. This odd-shaped structure can resist the pressure exerted by a man standing on it and the stomp of any ungulate traveling over the littered forest floor where *Scutisorex* lives. (*See* SHREW.)

See also MAMMAL; ZOOGEOGRAPHY.

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(PH. H.)

INSECTIVOROUS PLANTS: *see* CARNIVOROUS PLANTS.

INSEIN, a town and district in the Pegu division of the Union of Burma, lies immediately north of Rangoon. Area of district 1,903 sq.mi.; pop. (1962 est.) 537,291. The district includes a large tract of the Irrawaddy delta on either side of the Hlaing or Rangoon river and on the east of the Irrawaddy itself. In the east of the district is a portion of the southern end of the Pegu Yomas clothed with dense evergreen forest which, in spite of its nearness to Rangoon, was still the haunt of wild elephants in modern times. The Rangoon-Prome line of the Burma railways runs through the district.

INSEIN, the chief town, lies 10 mi. N.W. of Rangoon, of which it has become almost a suburb, especially since the independence of Burma in 1948 and the subsequent rapid growth of Rangoon. The town has railway workshops, a government engineering school and veterinary college, and a large jail. (L. D. S.)

INSELBERG. An isolated hill standing above well-developed plains, in appearance not unlike an island above the sea (hence the name). Although the term is sometimes applied generally, most geologists restrict its use to such hills formed under tropical and subtropical conditions, as in Nigeria (*q.v.*), usually formed of plutonic rocks such as granite and gneiss, and characterized by steep curved sides of smooth bare rock. These bare rock domes, which may stand 1,500 ft. above the plains, are more specifically called bornhardts and display an onionlike "peeling" (exfoliation) of concentric rock shells, in thickness from a few inches to 20 ft., from the surface. A pediment, or low-angle slope slightly concave upward, is usually present at the base of the inselberg. In its later stages an inselberg may develop into a *kopje; i.e.*, a residual hill composed of a pile of large boulders, in form similar to the granite tors of Devon and Cornwall. Isolated hills similar to inselbergs but formed under nontropical conditions are known as monadnocks. (J. C. PH.)

INSHTATHEAMBA (BRIGHT EYES) (1854–1903), American Indian writer and lecturer who promoted public interest in reform of the U.S. government's Indian policies, was born in Nebraska on the Omaha reservation. She was the daughter of a former Omaha chief, Inshtamaza or Iron Eye. His father, Joseph La Flesche, who married an Omaha woman, was a French trader, and Iron Eye also bore his father's name. Bright Eyes was originally named Susette La Flesche but later adopted her Indian name. She studied at a mission school on the reservation and later was educated at a private school in Elizabeth, N.J. She thereafter was a teacher in a government school on the reservation.

Bright Eyes won wide public interest in 1879 as an outspoken advocate of Indian rights. In that year she toured the eastern states to call attention to the government's arbitrary action against the Ponca tribe. In 1877 the Poncas, related to the Omahas, had been forced to leave their reservation on the Niobrara river in South Dakota and to emigrate to the southern Indian territory. The tribe found living conditions there intolerable, however, and led by chief Standing Bear traveled north on foot for about 600 mi., arriving at the Omaha reservation in March 1879. The Indians were arrested and ordered to be returned to their new home. On April 30, 1879, the federal district court held, however, that they should be freed under a writ of habeas corpus.

Bright Eyes, noted for her eloquence as a speaker, edited *Ploughed Under, the Story of an Indian Chief* (1881). She died on the Omaha reservation, near Bancroft, May 26, 1903.

INSIDE PASSAGE or INLAND PASSAGE is a sheltered sea route extending from Seattle, Wash., approximately 1,000 mi. to Skagway, Alaska. Protection from winds and storms is provided

by Vancouver Island, by a series of islands lying eastward of Hecate strait and, in Alaska, by the Alexander archipelago. Vacationers have favoured this waterway, both for its great natural beauty and its customary smoothness.

The greatest width of the chain of islands is about 80 mi. Their rugged topography is concealed beneath heavy forests and dense undergrowth. Several small glaciers may be seen from the channel. Rainfall is heavy, and may be expected at any season.

Navigation.—The shores of the channel drop off sharply, and in most places there is ample depth for all vessels. Anchorages are numerous. Tidal currents attain considerable velocity in places. Extensive surveys have practically eliminated unmarked pinnacle rocks which have caused several notable marine disasters. Pilotage is not required, but is desirable.

Principal towns along the passage include Victoria, Vancouver and Prince Rupert in British Columbia and Ketchikan, Wrangell, Petersburg, Juneau and Skagway in Alaska. (J. E. Cl.)

INSIGNIA, MILITARY. Ever since men first organized themselves into large groups for fighting they have employed certain signs or insignia to indicate their rank, branch of service and special duties or qualifications. Except for commanders of high rank, insignia were usually rather simple in ancient and medieval forces, but since the 18th century insignia for all ranks have developed along rather complicated and rigid lines. Many different devices have been used, including cockades, epaulets, hat cords, ribbons, buttons, badges, ornaments, bars, clasps, chevrons, stripes, braids and shoulder patches. In some instances there has been an evolvement of these devices. An example of this process of evolution is the epaulet (*q.v.*) which once was a major means of indicating both rank and function. Remnants of the epaulet today are the shoulder board and the shoulder strap to which are attached insignia of rank.

Although the following article deals primarily with various insignia devices which are attached to the uniform it must be remembered that the uniform is itself a form of insignia, indicating by its colour and cut the particular branch of service to which its wearer belongs. In a general way it may also indicate the rank of the wearer, particularly whether he is an officer or an enlisted man. (*See* Uniforms.)

Insignia, particularly the flags, of military organizations are discussed in the article Colours, Military.

UNITED STATES

In spite of many interesting stories about origins, the early development of rank insignia in the United States was a haphazard affair. At the start of the American Revolution it was difficult to distinguish between officers and enlisted men of the Continental army. Some "badges of distinction" were deemed necessary. Gen. George Washington wore "a light blue ribband across his breast between his coat and waistcoat." A brigadier general was assigned a pink ribbon; a major general a purple ribbon; and aides, green. Field officers were distinguished by hat cockades, red or pink. Captains wore yellow or buff cockades while lieutenants wore green. An epaulet on the shoulder with a silver star to denote the rank of general came into use near the end of the war. The colonel's eagle did not appear until about 50 years later.

Army.—The insignia of the arms and services of the U.S. army in the 20th century have followed a fairly consistent pattern and have borne an understandable relationship to the functions of the arm or service to which they apply. The crossed flags and torch of the signal corps and the flaming bomb of the ordnance corps are examples. (*See* fig. 2.) The latter is said to be the oldest of U.S. insignia, having been adopted in 1832. Originally the flaming bomb represented both artillery and ordnance and was embroidered in gold on officers' long-skirted coats. In addition to such devices, each branch of the army has its own distinctive colour; for example, infantry, light blue; armour, yellow; artillery, scarlet.

Insignia of grade are normally worn on shoulder loops by commissioned and warrant officers. (*See* fig. 1.) Noncommissioned officers wear gold-coloured chevrons (point up) on both sleeves. Enlisted specialists wear an eagle device with varying numbers of arcs above on both sleeves. On some uniforms, commissioned officers wear rank insignia on their right shirt collar and on their garrison caps; enlisted men wear unit insignia or regimental crest on the garrison cap. All personnel wear grade insignia on combat helmets. Combat leaders wear a green cloth loop around the middle of both shoulder loops of the outer garment. Branch insignia are worn on the left collar or, by officers, on both coat lapels.

In 1959 and again in 1965 the insignia worn by enlisted men and women in the U.S. army were changed. The result was the authorization in 1965 of ten distinct titles, each with its own insignia, ranging from private first class to sergeant major, plus four specialist ratings. Included was a new grade, lance corporal, placed between private first class and corporal. At the same time the two top grades (both in the same pay bracket, E-9) became sergeant major and chief master sergeant. The next two grades (both in the same pay bracket, E-8) were first sergeant and master sergeant. Two specialist grades (8 and 9) were eliminated.

Members of colour-bearing units such as regiments, separate battalions and service schools wear small enameled shields bearing the regimental, unit or school coat of arms in the middle of both shoulder loops on the outer garment. Members of major commands, armies, corps, divisions and independent commands often wear distinctive shoulder patches on the upper part of the left sleeve of their outer uniform. Many of these patches were designed for units serving in World Wars I and II and the Korean War. Both officers and enlisted men may wear the shoulder patch of the overseas unit they served with during World War II or the Korean War. This is worn at the top of the right sleeve of the uniform.

Officers on duty with the general staff of the department of the army in Washington, D.C., wear a green, black and gold medallion (general staff identification badge) on the right breast pocket. After one year's service on the army general staff, the officer is permitted to wear this insignia permanently. A similar device, the department of defense identification badge, is awarded to U.S. armed forces personnel who serve on the staff of the department of defense and is worn on the left breast pocket.

The letters "U.S." in a circle are worn by all army and air force enlisted personnel on the right coat collar and on both collars by basic trainees. Officers wear the "U.S.," without background, on both coat collars when branch insignia are worn on the lapels. On certain working uniforms the words "U.S. Army" in gold on a black background are worn on the upper left breast.

Air Force.—Insignia of rank for officers of the air force are the same as the army's except for warrant officers whose bars have sky blue rather than brown stripes. (*See* fig. 1.)

Enlisted ranks are designated by silver-coloured chevrons on a dark blue background, rounded point downward, and a silver-coloured star with a centre of dark blue.

As in the other services, air force aides and attachés are distinguished by aiguillettes. These are worn on the left shoulder except for presidential aides who wear them on the right. Aides are further identified by collar insignia designating the office or commander to whom they are assigned. Air force aviation badges are spread wings of silver colour bearing identifying centre designs and worn above the left breast pocket.

Marine Corps.—Marine officer insignia are similar to those for the army except that warrant officers' bars are broken by scarlet, rather than brown, stripes. (*See* fig. 1.) Officers wear their rank on both shirt collars and on shoulder loops of coats. Naval medical officers, chaplains and others serving with fleet marine forces and wearing marine uniforms wear their rank device on the right shirt collar and their staff corps device on the left. A bursting bomb device worn by certain warrant officers who were designated marine gunners was declared obsolete in 1965. Enlisted men wear cloth chevrons of rank on both sleeves of most uniforms and metal chevrons on the collars of certain working uniforms. All officers and all enlisted men of the rank of corporal or above wear a scarlet stripe along the outer seam of each trouser leg with the blue uniform. The marine corps emblem is worn on most headgear, coats and jackets. Rank insignia are also worn on

ARMY OFFICERS' INSIGNIA OF RANK

ARMY

GENERAL OF THE ARMY

GENERAL

LIEUTENANT GENERAL

MAJOR GENERAL

BRIGADIER GENERAL

COLONEL

LIEUTENANT COLONEL

MAJOR

CAPTAIN

FIRST LIEUTENANT

SECOND LIEUTENANT

CHIEF WARRANT OFFICER W-4

CHIEF WARRANT OFFICER W-3

CHIEF WARRANT OFFICER W-2

WARRANT OFFICER W-1

INSIGNIA OF OFFICER GRADES ARE SIMILAR IN ARMY, AIR FORCE AND MARINES EXCEPT THAT THERE IS NO FIVE-STAR RANK IN THE MARINE CORPS

WARRANT OFFICERS NAVY

WARRANT OFFICERS MARINES

WARRANT OFFICERS AIR FORCE

ENLISTED MEN

SERGEANT MAJOR

CHIEF MASTER SERGEANT

FIRST SERGEANT

MASTER SERGEANT

SERGEANT FIRST CLASS

STAFF SERGEANT

SERGEANT

CORPORAL

LANCE CORPORAL

PRIVATE FIRST CLASS

SPECIALIST 7

SPECIALIST 6

SPECIALIST 5

SPECIALIST 4

ENLISTED MEN

AIR FORCE

CHIEF MASTER SERGEANT

SENIOR MASTER SERGEANT

MASTER SERGEANT

TECHNICAL SERGEANT

STAFF SERGEANT

AIRMAN FIRST CLASS

AIRMAN SECOND CLASS

AIRMAN THIRD CLASS

NAVY OFFICERS' INSIGNIA OF RANK

NAVY

FLEET ADMIRAL

ADMIRAL

VICE ADMIRAL

REAR ADMIRAL

COMMODORE

CAPTAIN

COMMANDER

LIEUTENANT COMMANDER

LIEUTENANT

OTHER NAVY RANKS AND GRADES

LIEUTENANT JUNIOR GRADE

ENSIGN

MASTER CHIEF PETTY OFFICER

SENIOR CHIEF PETTY OFFICER

CHIEF PETTY OFFICER

PETTY OFFICER 1ST CLASS

PETTY OFFICER 2ND CLASS

PETTY OFFICER 3RD CLASS

SEAMAN

SEAMAN APPRENTICE

SEAMAN RECRUIT

ENLISTED MEN

MARINES

SERGEANT MAJOR

MASTER GUNNERY SERGEANT

FIRST SERGEANT

MASTER SERGEANT

GUNNERY SERGEANT

STAFF SERGEANT

SERGEANT

CORPORAL

LANCE CORPORAL

PRIVATE FIRST CLASS

FIG. 1.—RANK INSIGNIA OF THE U.S. ARMED FORCES

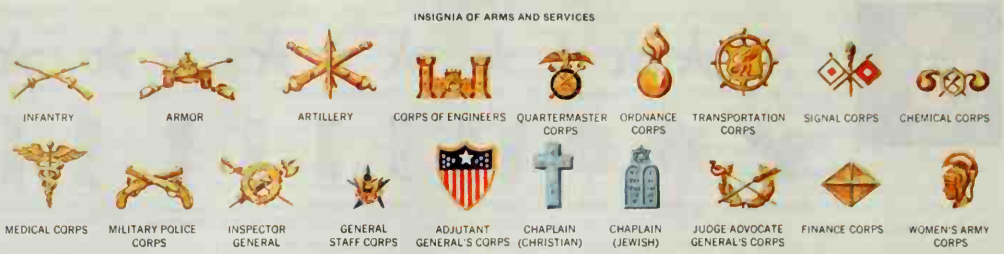


FIG. 2.—INSIGNIA OF THE U.S. ARMY ARMS AND SERVICES

garrison (fore-and-aft) caps. Shoulder patches, worn by marines during World War II, are no longer authorized. There are no branch insignia.

Navy.—Commissioned and warrant officers of the navy wear stripes indicating rank on coat sleeves or shoulder boards, the colour of the stripes depending on the colour of the uniform. (*See* fig. 1.) Devices above the stripes distinguish between line and staff corps officers. Flag officers also wear on their shoulder boards a foul anchor and one or more stars according to rank (five stars in a circle for a fleet admiral). Rank may also be designated by metal insignia of the army type except that warrant officers wear single bars broken by blue instead of brown. Such insignia are worn on both shoulder loops of the raincoat and on both shirt collars by line officers. Staff corps officers and warrant officers wear the rank device on the right shirt collar and the staff corps or specialty insignia on the left. As in the other services, higher ranks (commander and above) are distinguished by braid ornamentation on cap visors.

Navy enlisted personnel of the three lowest pay grades are designated by diagonal stripes worn on the left sleeve. Petty officers wear chevrons (point down) surmounted by an eagle and, in the case of the top two pay grades, by one or two stars. Between the chevrons and the eagle is a device indicating the petty officer's specialty. The device, as a whole, is known as a rating badge. Until after World War II seven specialty ratings (signalman, boatswain's mate–coxswain, fire controlman, gunner's mate, torpedoman, quartermaster and turret captain) were worn on the right sleeve, all others on the left. Thereafter, all rating badges were worn on the left sleeve. Depending on the uniform, enlisted rank insignia are of silver, blue, white, khaki, silver-khaki or green. Petty officers with 12 years' good conduct may wear gold rating badges.

Naval aviation badges for navy, marine corps and coast guard personnel are spread wings of gold colour worn above the left breast pocket. Submarine, parachutist and aircrew badges are worn in the same manner. The name of his ship, aircraft squadron or other special unit may be worn by an enlisted man below the rank of chief petty officer. Before World War II these unit identifying marks were worn on the hatband of the winter "flat" hat. During the war they were ordered removed and the words "U.S. Navy" substituted. In the mid-1950s identifying marks were again authorized, but were to be worn on the right sleeve just below the shoulder seam.

Coast Guard.—Coast guard officers and enlisted men wear insignia identical to those of the navy except for the officers' and chief petty officers' cap devices and the shield worn by officers in place of the navy's line or staff corps devices. Enlisted men wear the shield on the right sleeve, just above the cuff.

Service Stripes.—Enlisted men of all services wear diagonal service stripes denoting length of active service on the lower part of the left sleeve. The World War I overseas and wound chevrons and the World War II and Korean War horizontal overseas bars may be worn on the left sleeve by personnel of the army and air force.

BRITISH COMMONWEALTH

Great Britain.—*Army.*—Insignia of rank are worn by commissioned officers on epaulets and by warrant officers and noncommissioned officers on sleeves. Commissioned rank is distinguished by diamond-shaped stars ("pips") up to captain, a crown for a major and a combination of crown and stars up to a brigadier; general-rank officers wear a badge consisting of baton and sword crossed with either a star or crown, or with both star and crown for full generals. Field marshals of the British army wear crossed batons in a wreath with a crown above. Officers of the rank of colonel and above are distinguished by red bands around their caps. (*See* fig. 3.)

Warrant officers (referred to as sergeant majors) wear on their lower sleeves a badge incorporating the royal coat of arms (class I) or a crown within a laurel wreath or a crown alone (class II). Noncommissioned officers wear chevrons, point downward, on both upper sleeves: three chevrons surmounted by a crown for a quartermaster sergeant, three chevrons for a sergeant, two chevrons for a corporal and one chevron for a lance corporal. The different corps, regiments and brigades of infantry wear distinguishing badges and buttons.

Royal Navy.—Badges of rank are mainly worn on the sleeve. With blue uniform, officer rank is shown by rings of gold lace on the cuff incorporating a curl in the uppermost ring. A sublieutenant wears one ring, a captain four rings, a commodore one broad ring and an admiral of the fleet one broad and four ordinary rings. In white uniform, equivalent stripes are worn on the shoulder straps. Midshipmen wear white patches on the lapel; cadets a length of white twist. (*See* fig. 3.)

Badges indicating rating, *e.g.*, petty officer or leading seaman, are worn on the left arm and below them the good conduct badges. The various branches, gunnery, artisan, etc., are shown on the right arm, except in the case of chief petty officers, where they appear on the lapel, accompanied by three gilt buttons on the cuff. Ratings wear red badges on blue uniforms except with ceremonial uniforms which have gold badges; and blue badges on white uniforms.

Royal Air Force.—Except in the case of home and tropical mess dresses, R.A.F. officers wear rings of pale blue ranking lace bordered with black on all home and tropical uniforms. (*See* fig. 3.) A pilot officer wears one narrow ring, a flying officer one ordinary ring, a group captain four rings, an air commodore a broad ring and a marshal of the R.A.F. one broad and four ordinary rings. With home and tropical mess dresses, all officers wear gilt ranking lace.

On greatcoats, raincoats, working dress, all tropical uniforms, and flying overalls, ranking badges are worn on shoulder straps; on all other dresses, the ranking badges are worn on the sleeves. With ceremonial home dress, officers of the rank of air vice-marshal and above also wear distinctive shoulder straps.

Master aircrew and warrant officers wear rank badges on the lower sleeve in all uniforms; master aircrew wear an eagle within laurel wreaths surmounted by the royal arms and warrant officers wear the royal arms. Other airmen wear rank badges on the sleeves above the elbow; corporals and sergeants wear two and three chevrons respectively. Airmen aircrew also wear a gilt eagle above the rank badge. Flying badges are worn on the left breast above the pocket. Officers and airmen of certain specified branches wear distinguishing collar badges.

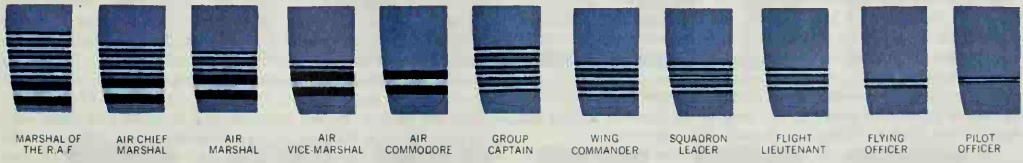
ARMY OFFICERS' INSIGNIA OF RANK

WARRANT OFFICERS

NON-COMMISSIONED OFFICERS

ROYAL NAVY: OFFICERS' INSIGNIA OF RANK

ROYAL AIR FORCE: OFFICERS' INSIGNIA OF RANK



BADGES OF RANK FOR AIRMEN

BADGES OF RANK FOR AIRMEN (AIRCREW)

FLYING BADGES

FIG. 3.—RANK INSIGNIA OF THE BRITISH ARMED FORCES

FIG. 4.—EXAMPLES OF INSIGNIA IN BRITISH COMMONWEALTH COUNTRIES: (A) OFFICER'S CAP BADGE FOR AUSTRALIAN AIR FORCE; (B) CANADIAN ARMY SHOULDER FLASH WITH SLEEVE BADGE OF WARRANT OFFICER CLASS 1

Canada.—*Army.*—Ranks and insignia for commissioned officers are the same as those of the British army. For noncommissioned officers, the Canadian coat of arms is incorporated in the sleeve badge of the warrant officer first class, while the warrant officer second class wears a wreath partially encircling a crown.

Navy.—Rank insignia are the same as that of the R.N., but unlike the R.N. the rank of commodore (one broad ring) is a full rank in the R.C.N. and promotion goes from captain to commodore to rear admiral. Among noncommissioned ranks the R.C.N. has no warrant officers and divides its chief petty officers into first class, wearing a crown over three sleeve buttons, and second class, wearing no crown. Petty officers are also divided, the first class wearing the "round rig" with crossed anchors surmounted by a crown on the sleeve, the second class wearing the sailor's or "square rig" with anchors but no crown. The R.C.N. makes no distinction in rank insignia for technical skill.

Air Force.—Commissioned ranks and insignia follow the R.A.F. However the R.C.A.F. divides warrant officers into first class, wearing on the sleeve the Canadian coat of arms, and second class wearing a crown and half wreath. The R.C.A.F. has no senior aircraftman but has a leading aircraftman below corporal, wearing a horizontal two-bladed propeller. Flight engineers wear a wing somewhat similar to that of pilots, navigators, etc., on the chest.

Australia.—Insignia in the Australian army and navy follow the British pattern. Insignia in the Australian air force follow the British pattern except that in mess dress miniature gold braid is worn on the shoulder straps.

New Zealand.—*Army.*—Insignia of rank follow the British pattern. New Zealand has, however, no distinguishing badges or buttons for brigades of infantry. The different corps and regiments wear distinguishing badges, buttons and shoulder flashes. Corps shoulder flashes worn by officers up to the rank of full colonel embody the words "New Zealand" in their title. Officers of colonel's rank and above do not wear corps shoulder flashes but wear "New Zealand" shoulder flashes when overseas.

Navy.—Rank insignia in the R.N.Z.N. follow the British navy. "New Zealand" shoulder flashes are worn by all ratings when serving with U.N. forces and when overseas, except when on loan or exchange services with other commonwealth navies.

Air Force.—Insignia of the air force follow the British model. Personnel serving overseas can be identified by "New Zealand" shoulder flashes.

India.—*Army.*—Rank insignia follow the British pattern, the crown on the shoulder strap of a general, lieutenant-general, brigadier, colonel, lieutenant-colonel and major being replaced by the three lions of Asoka. The Indian army, however, includes three ranks of junior commissioned officers above the NCO; on the shoulder strap a subedar-major wears the three lions of Asoka above a narrow stripe of gold lace bordered in red, the subedar wears two pips with a red and gold stripe and the jemadar one pip and a red and gold stripe.

Navy.—Gold ranking lace on the sleeves of commissioned officers follows the British pattern. All other badges of rank are identical to those of the R.N. with the exception of the crown which is replaced by the three lions of Asoka.

Air Force.—Ranking lace on the sleeves of commissioned officers follows the R.A.F. pattern except that the pale blue rings are bordered with navy rather than black. The highest rank is the air marshal with one broad and two other rings.

Pakistan.—*Army.*—Insignia of rank on winter dress, summer khaki and mess dress is similar to the British pattern, the *hilal* (crescent) in all cases having replaced the crown and the Mogul sword in the crossed swords and baton having replaced the crusader's sword. In addition there are three ranks of junior commissioned officers above the NCO: on the shoulder strap the subedar-major wears the *hilal* above a scarlet, Pakistan green, scarlet stripe; the subedar wears two *sitaras* (stars) above a scarlet, Pakistan green, scarlet stripe; the jemadar wears one *sitara* above a scarlet and green stripe. In the cavalry/armoured corps the subedar and subedar-major are known as risaldar and risaldar-major, with the same insignia.

Warrant officers, first class, wear on the lower sleeve a coat of arms in wreath with the Pakistan motto "Faith, unity and discipline." Distinguishing badges and buttons are worn by different regiments.

Navy.—Rank insignia in blue home dress is similar to the British pattern. In white summer uniforms, however, shoulder straps are worn as follows: a rear-admiral the crescent above the crossed Mogul sword and baton above one *sitara*, a vice-admiral with two *sitaras* worn vertically, an admiral with three *sitaras* and an admiral-of-the-fleet a crescent above crossed batons within a wreath. Officers from sublieutenant to captain wear equivalent stripes on the shoulder strap. Officers of certain specified branches wear distinction cloths between ranking lace on the sleeves in blue uniform.

Air Force.—In gray/blue winter dress and mess dress, rank insignia is similar to the British pattern; in summer khaki dress and mess dress equivalent stripes are worn on shoulder straps, the crescent replacing the crown on cap badges. All pilots and navigators are commissioned officers, wearing flying wings on the left breast with the initials PAF surmounted by the *hilal*. (X.)

OTHER COUNTRIES

Federal Republic of Germany (West Germany).—*Army* (*Heer*).—General officers of the army wear gray shoulder loops edged in gold except at the outer end. Gold diamond-shaped "stars" indicate rank; a gold wreath encircles the star at the outer end of the shoulder loop for all general officers. A general wears four stars; lieutenant general, three stars; major general, two stars; and brigadier general, one star. Field grade officers have gray, silver-edged shoulder loops ornamented with silver stars and a silver wreath at the outer end of the shoulder loop: colonel, three stars; lieutenant colonel, two stars; major, one star. The silver wreath is omitted for company grades: captain, three stars; first lieutenant, two stars; second lieutenant, one star. (*See* fig. 5.)

Warrant officers, master sergeant, and sergeant first class wear gold chevron type insignia on gray shoulder loops. Warrant officer I, one gold chevron with diamond; warrant officer II, two chevrons with diamond; chief warrant officer III, three chevrons with diamond. Master sergeant, two gold chevrons; sergeant first class, one gold chevron. The following enlisted men wear their gold rank insignia on the upper sleeves: sergeant senior grade, two chevrons; sergeant, one chevron; corporal technician, three oblique stripes; corporal, two oblique stripes; private first class, one oblique stripe; recruit, no rank insignia.

All commissioned and noncommissioned ranks wear coloured collar tabs to designate branch of service. General officers wear red collar tabs and general staff officers wear reddish-purple tabs.

Navy (*Marine*).—Commissioned rank is shown by gold stripes on sleeve cuffs and on shoulder boards. An admiral wears one board and three medium stripes; a commodore, one narrow and one wide stripe; a captain, four medium stripes; other ranks have lesser numbers of stripes.

The following ranks wear gold chevrons on both sleeve cuffs: chief warrant officer III, three chevrons with diamond at their

peak; chief warrant officer II, two chevrons and diamond; warrant officer I, one diamond and chevron; chief petty officer senior, two chevrons; chief petty officer junior, one chevron. The next lower ranks wear their gold insignia on both sleeves between the elbow and shoulder: petty officer, 1st class, two chevrons; petty officer, 2d class, one chevron; petty officer, 3d class, three oblique marks; seaman, two oblique marks; seaman apprentice, one oblique mark; seaman recruit is without insignia or rank. (*See* fig. 5.)

Air Force (*Luftwaffe*).—Insignia are identical with those of the army except that the collar tabs are yellow for ranks other than general officer.

German Democratic Republic (East Germany).—In uniforms and insignia the armed forces of East Germany retain most of the characteristics common to the German military forces of World War II.

Army.—Officers' rank is shown on the shoulder loops. An army general wears a plaited knot made up of five loops of sets of three cords, outer cords gold, central one silver, with four five-sided silver ornaments, arbitrarily called stars. A colonel general wears three stars, a lieutenant general two stars, and a major general one star. Shoulder loops for all general officers are superimposed on a red background while those of field grade officers are superimposed on a solid background coloured to indicate the branch of service. A colonel wears a knot made of four silver cords and designed in six loops, with three square-shaped pips of gilt; a lieutenant colonel wears two pips and a major wears one pip. A captain wears a shoulder loop covered with eight parallel rows of silver cord, the colour of the outside piping indicating arm or service; superimposed on the cord are four pips. A senior lieutenant wears the same shoulder loop with three pips; a lieutenant wears two pips and a junior lieutenant one pip.

Noncommissioned officers of the first three grades wear plain shoulder loops with two parallel rows of piping, the outer row

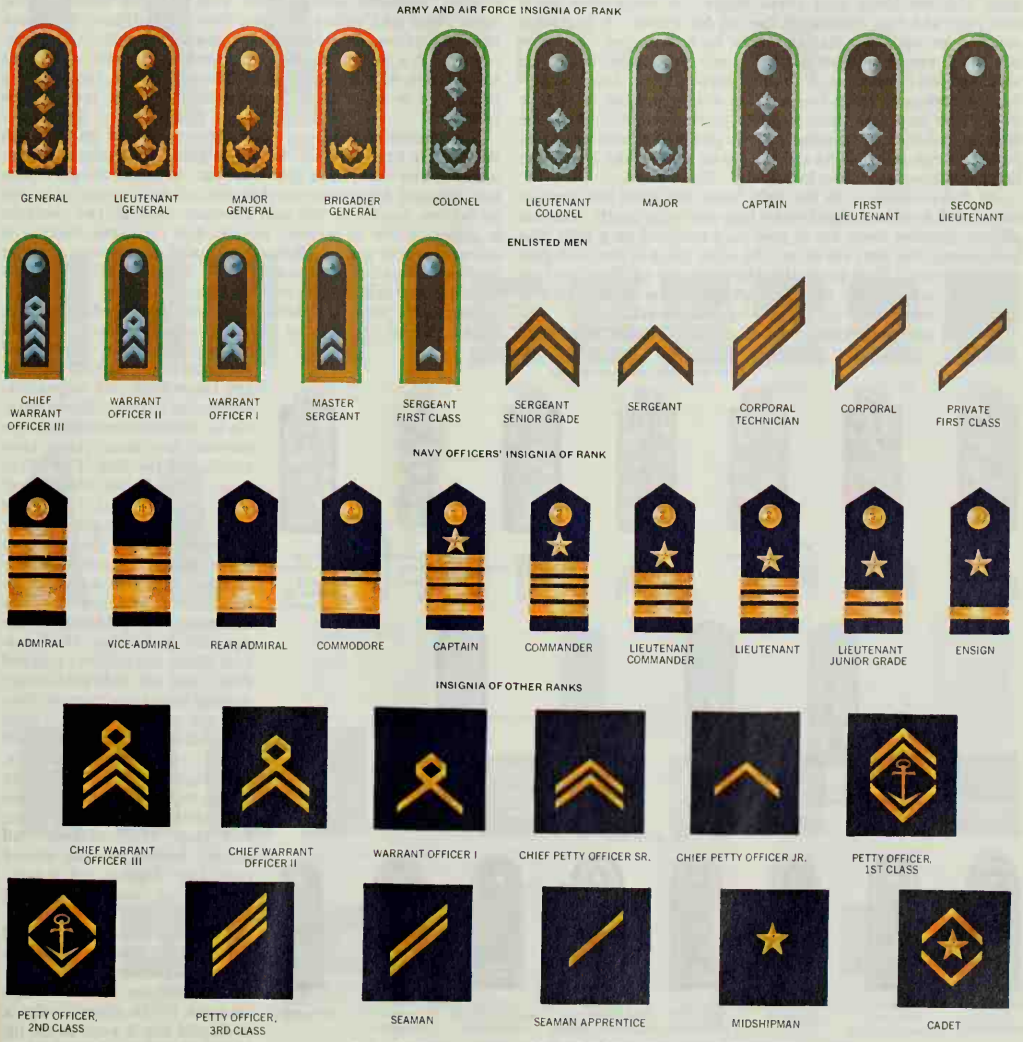


FIG. 5.—MILITARY INSIGNIA OF THE WEST GERMAN ARMED FORCES

coloured to indicate branch of arm or service. A sergeant major wears three silver pips and a junior sergeant wears no pips. Other enlisted ranks have shoulder loops ornamented with a single strip of piping coloured to show branch or service. A senior lance corporal wears two white cross stripes at the end of the shoulder loop; a lance corporal wears one white stripe; and a private wears a plain shoulder loop. (*See* fig. 6.)

Navy.—Commissioned rank is designated by sleeve braid and, for lieutenant commander and above, by gold shoulder boards similar to those of the army, but mounted on turquoise-blue background. An admiral wears three silver stars on gold shoulder board cord; on his sleeve, one broad stripe and three medium gold stripes. A vice-admiral wears two stars on his shoulder board and one broad and two medium gold stripes on his sleeve. A rear admiral wears one star on the shoulder board and one broad and one medium gold sleeve stripe.

A captain wears a silver cord shoulder board with three gold stars and one broad gold sleeve stripe. A commander wears two stars and four medium stripes on his sleeve. A lieutenant commander wears one star and three medium stripes. A senior lieutenant wears two medium stripes and one narrow stripe; his shoulder loop is the same as an army captain's, but with blue piping. A lieutenant wears two medium stripes and the same type of shoulder loop with three pips. A junior lieutenant wears one medium and one narrow stripe and two pips. An ensign wears one medium stripe on his sleeve and one pip on his shoulder loop. The lower ranks wear shoulder loops only. (*See* fig. 6.)

Air Force.—Insignia in the main follow the army but commissioned rank is on both the shoulder loop and collar patch. General officers' shoulder loops are of gold cord mounted on a light blue background; the stars are silver; the collar patch is blue with gold ornamentation. Field grade shoulder loops are of silver cord on light-blue background; the stars are gold; the collar patch is light blue ornamented by silver wing and wreath.

Enlisted men wear plain, light-blue collar patches with white wing centred, and shoulder loops similar to those of the army but of blue piping.

France.—*Army.*—Commissioned officers up to brigadier general wear rank insignia on the kepi, the beret and shoulder loops; marshals and generals wear stars indicating grade on sleeve cuffs instead of on shoulder loops. General officers wear a khaki field kepi bearing stars; dress kepi is ornamented with gold oak leaves. Silver stars indicating ranks of combatant arms and gold stars denoting ranks in the services are superimposed on black shoulder loops: marshal of France, seven stars on sleeve cuff and three rows of gold oak leaves on kepi; general of the army, five stars; lieutenant general, four stars; major general, three stars; brigadier general, two stars. Officers of the rank of colonel and below wear a kepi with gold, silver or gold and silver stripes around the top to indicate rank; the cap is coloured to indicate branch of service; shoulder loops have similar stripes superimposed on them, the stripes coloured according to arm or service: colonel, five gold stripes; lieutenant colonel, three gold and two silver stripes; major, four gold stripes; captain, three gold stripes; lieutenant, two gold stripes, second lieutenant, one gold stripe. Chief warrant officer, a gold stripe with a red thread. Warrant officer, one silver stripe with a red thread. Warrant officer kepis have a single gold or silver band around which a narrow red stripe is twisted.

Noncommissioned officers wear chevrons (point up) on both sleeves; the kepi is plain. Master sergeant, four gold chevrons; sergeant, first class, three gold chevrons; sergeant, one gold chevron; corporal, first class, two chevrons in colour of arm or service on bottom, topped by one gold chevron; corporal, two chevrons in colour of arm or service; private, first class, one chevron in colour of arm or service. Noncommissioned officers wear a similar number of bars on their garrison caps. Officer candidates wear a broken gold stripe on their shoulder loops. (*See* fig. 7.)

Navy.—No shoulder boards are worn, but an officer's badge (small gold tab) is worn on the tip of each shoulder. Flag officer cap bands are ornamented with gold braid; caps of captains and below bear gold stripes corresponding to rank. Sleeve insignia for commissioned officers are: admiral, five silver stars; vice-admiral of the fleet, four silver stars; vice-admiral, three silver stars; rear admiral, two silver stars; captain, five gold stripes; commander, three gold and two silver stripes; lieutenant commander, four gold stripes; lieutenant, three gold stripes; junior lieutenant, two gold stripes; ensign, one gold stripe; chief warrant officer, two narrow (gold and silver) and one wide gold stripe; warrant officer, one narrow silver and one wide gold stripe; chief petty officer, three diagonal gold stripes; petty officer, first class, two diagonal gold stripes; petty officer, second class, one diagonal gold stripe. Leading seaman, first class, three diagonal red stripes; leading seaman, second class, two diagonal red stripes; able seaman, one diagonal red stripe. (*See* fig. 7.)

Air Force.—Commissioned rank is designated by gold stars or gold and silver stripes on the sleeve cuffs; no shoulder loops are worn, but an officer's badge, a small gold tab, is worn on the tip of each shoulder. General officer

FIG. 6.—MILITARY INSIGNIA OF THE EAST GERMAN ARMED FORCES

FIG. 7.—RANK INSIGNIA OF THE FRENCH ARMED FORCES

cap bands are ornamented with gold braid; caps and sleeve cuffs of colonel and below bear gold stripes corresponding to rank: general, five stars; lieutenant general, four stars; major general, three stars; brigadier general, two stars; colonel, five gold stripes with a separation between the third and fourth; lieutenant colonel, same as colonel but the second and fourth stripes are silver; major, four gold stripes, the fourth one separated; captain, three gold stripes; lieutenant, two gold stripes; second lieutenant, one gold stripe.

Noncommissioned officers wear chevrons on their sleeves that are essentially the same as those for the army. (*See* fig. 7.)

U.S.S.R.—*Army.*—Following the Russian Revolution the Red army attempted to abolish distinctions of rank in both uniforms and insignia. However, by World War II, this policy had given way to one of specific styles for various grades, with insignia worn on collar patches and on sleeves. In 1943 new uniform regulations were promulgated by which the Red army restored the once hated shoulder-board type epaulets (*pogoni*) of the Imperial Russian army and reintroduced the tsarist-type standing collar and related insignia. In 1956 the Soviet ministry of defense published new uniform and insignia regulations modifying slightly and refining the system of insignia established in 1943.

Soviet army personnel wear a variety of insignia to indicate rank or grade, arm or service, and in some cases employment. (*See* fig. 8.) Rank or grade is shown by the ornamentation on the coat collar, sleeve cuffs and service cap; by the width and number of stripes on outer trouser seams; and by the arrangement of braid. Rank and grade are also indicated by the number, size and arrangement of stars (for officers) or stripes (for enlisted men) on the shoulder boards. Arm or service is shown by the coloured piping on uniform components, colour of service cap band, stripes and piping on shoulder boards, colour of collar tabs and by emblems on the shoulder boards, collar lapels and collar taps. Variations in the width of shoulder boards, colour of braid, stars and rank stripes distinguish between combatant and noncombatant officers. Further, some emblems indicate the wearer's job within his arm or service.

Dress shoulder boards for all officers except those belonging to the services have silver stars on a gold background. Service branch officers wear dress shoulder boards with gold stars on a silver background. Dress shoulder boards for all army marshals and line generals have a crisscross, gold pattern and red piping; generals of technical troops wear crimson piping. Generals of the medical, veterinary, legal and administrative services wear shoulder boards which are slightly narrower in width than those of other branches.

Shoulder-board insignia denoting rank consist of the following: marshal of the Soviet Union, one large silver star plus national emblem; chief marshal of the arm, one large silver star surrounded by a silver wreath; marshal of the arm, one large silver star; general (*general armii*), four stars; lieutenant general (*general polkovnik*), three stars; major general (*general leitenant*), two stars; brigadier general (*general maior*), one star.

Field grade officers are distinguished by two stripes (coloured according to arm or service) down their shoulder boards with medium-size stars on them as follows: colonel, three stars; lieutenant colonel, two stars; major, one star. Company grade officers have one stripe down the centre of their shoulder boards; rank is indicated by small stars as follows: captain, four stars; senior first lieutenant, three stars; first lieutenant, two stars; second lieutenant, one star.

Enlisted ranks wear both dress and field shoulder boards. On the latter, the branch colour is designated by the piping, the background colour of the shoulder board being olive drab. Some field

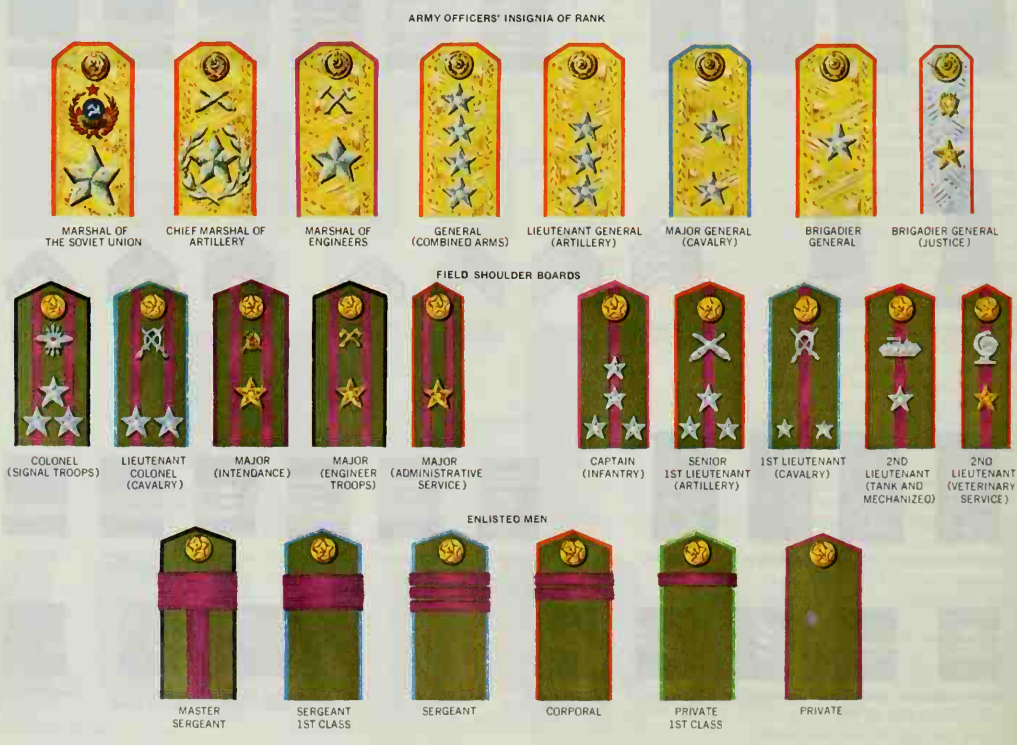


FIG. 8.—RANK INSIGNIA OF THE SOVIET ARMY

shoulder boards have claret-coloured rank stripes; others have gold or silver stripes. Emblems denoting branch of service are not worn by enlisted men on field shoulder boards. The branch colour covers the surface of the dress shoulder board and a gold metallic device (except veterinary soldiers who wear silver) denotes the branch. Black piping is worn on the dress shoulder board with the exception of artillery, armour, motor transport, medical and veterinary personnel, who display crimson piping. The number and position of the stripes used to indicate enlisted rank are: master sergeant (*starshina*), a broad transverse stripe placed on the portion of the shoulder board nearest the neck, with a medium stripe running lengthwise down the centre of the shoulder board; senior sergeant (*starshi serzhant*), one broad cross stripe placed nearest the neck; sergeant (*serzhant*), three narrow cross stripes; junior sergeant (*mladshi serzhant*), two narrow cross stripes; private, first class (*yefreitor*), one narrow cross stripe; private (*ryadovoi*), no stripes.

The colour of the arm or service is displayed on the collar tabs, on the upper edges of collars, on sleeve cuffs, on headdress and on trouser seams. In addition, the colour is also used to form the stripes and piping on dress shoulder boards.

Soviet army paratroopers and antitank personnel are regarded as specialists. A paratrooper wears an outline of a white parachute with a red star above the canopy on a blue diamond-shaped field; the antitank soldier wears crossed cannons on the left arm. Other specialist insignia are worn on the right breast of the uniform.

Air Force.—Soviet air force insignia follow the army pattern, with sky blue as the branch colour.

Navy.—Insignia of commissioned officers generally follow those of the United States. For example, a star is above the top stripe for all commissioned ranks. Sleeve insignia of line officers and those of the naval engineer service are: admiral of the fleet, one broad and four medium-width gold stripes on the sleeve; admiral, vice-admiral and rear admiral each has one less medium stripe; captain, one broad stripe; commander, four medium stripes only; subcommander, three medium stripes; lieutenant commander, two medium stripes and one narrow stripe; senior lieutenant, two medium stripes; lieutenant, one medium and one narrow stripe; junior lieutenant, one medium stripe. Commissioned naval officers also wear shoulder boards patterned after those of the army.

Japan.—*Army.*— General officers of the ground self-defense force are identified by polished silver stars (with rounded points) worn on the collar of shirt or blouse. All other officer grades wear metallic insignia with a dull silver finish. A lieutenant general wears three large stars; a major general wears two. Field and company grade officers wear their rank insignia on the uniform collars; the stars are of medium size and are mounted on a metal plate. A colonel wears three stars; a lieutenant colonel, two; a major, one.

Company officers have small silver stars on one end of the metal plate and embossed gold bands on the other end. A captain wears one star and three gold bands; first lieutenant wears one star and two gold bands; second lieutenant, one star and one gold band. Noncommissioned officers' insignia are on the same type of silver metal plate with black stripes grooved in it as follows: master sergeant, three stripes; sergeant, first class, two stripes; sergeant, one stripe. Privates wear gold chevrons (on green background) on both sleeves between the elbow and shoulder as follows: leading private, three chevrons; private, first class, two chevrons; private, one chevron; recruit, one gold bar.

Navy.—Rank and insignia of the Japanese maritime self-defense force follow the U.S. navy pattern. Commissioned officers wear gold stripes on sleeve cuffs or shoulder boards; the device above the stripes is a gold-lace cherry blossom. The chief of the maritime staff wears a special, more ornately designed blossom. A vice-admiral wears one broad and two medium stripes; rear admiral, one broad and one medium stripe; captain, four medium stripes; commander, three medium stripes; lieutenant commander, two broad stripes with one narrow stripe centred; lieutenant, two medium stripes; junior lieutenant, one medium and one narrow stripe; ensign, one medium stripe. Chief petty officer wears three gold chevrons with cherry blossom above rounded top of insignia; petty officer, first class, blossom, with two chevrons; petty officer, second class, blossom, one chevron; petty officer, third class, three red chevrons topped by pink cherry blossom; seaman, three red chevrons without blossom; seaman apprentice, two red chevrons; seaman recruit, one red chevron.

On less formal uniforms, silver metallic rank insignia are worn on both shirt collars by all ranks down to and including petty officer, second class: vice-admiral, three large blossoms; rear admiral, two large blossoms; captain, three small blossoms on an oblong plate; commander, two small blossoms on an oblong plate; lieutenant commander, one small blossom on an oblong plate; lieutenant, one blossom and three pink stripes on metal plate; junior lieutenant, one blossom, two pink stripes; ensign, one blossom, one stripe. Chief petty officer wears silver plate with three black stripes; petty officer, first class, silver plate, two stripes; petty officer, second class, one stripe. All other ranks wear red chevrons on sleeves, the cherry blossoms being blue for petty officer, third class.

Air Force.—Insignia of the air self-defense force are the same as those of the army except that privates wear silver-thread chevrons instead of gold.

Italy.—*Army.*—Commissioned rank is shown on shoulder loops which are of silver braid for general officers. A lieutenant general wears three gold stars on silver braid; a major general, two gold stars; a brigadier general, one gold star. For prestige purposes, generals holding certain key assignments are permitted to wear four stars set on red underlining. Shoulder loops of other grades are of the same material and colour as the uniform, field grades having gold piping: a colonel wears three gold stars; lieutenant colonel, two gold stars; major, one gold star. Shoulder loops of company grade officers are plain khaki: captain, three gold stars; first lieutenant, two gold stars; second lieutenant, one gold star. Warrant officer rank is designated by longitudinal stripes displayed on the shoulder loop; the highest grade is *Aiutante di Battaglia*, three gold stripes on red background; warrant officer, grade I, three gold stripes; warrant officer, grade II, two gold stripes; warrant officer grade III, one gold stripe.

Enlisted ranks wear sleeve chevrons, point downward, as follows: first sergeant, one wide gold chevron above two narrow gold chevrons; sergeant, one wide gold chevron above one narrow gold chevron; first corporal, one wide black chevron above two narrow black chevrons; corporal, one wide black chevron above narrow black chevron; private, first class, one wide black chevron. Specialist (armourer, parachutist, tank driver, etc.) insignia are worn just above the chevron. Lapel patches are worn by all ranks. The colour of three-pointed lapel insignia indicates the regiment or other assignment in cavalry; the colour and combination of colours of two-pointed insignia shows the regiment or other assignment in infantry or tank corps; the colour or combination of colours of one-pointed lapel insignia indicates arm, service or regiment of any other branch.

All ranks wear metal cap insignia designating arm or service and general officers wear the same distinctive cap insignia: lieutenant general, gold; other general officers, silver.

Navy.—Commissioned rank is indicated by gold braid on cuffs and by gold stars on shoulder boards. A vice-admiral wears five gold stripes, the upper one with curl, the lower one waved; a rear admiral wears the same with one less stripe; commodore, same as rear admiral with one less stripe; captain, one broad stripe surmounted by three narrow, the upper one with curl; commander, same as captain, with one less narrow stripe; lieutenant commander, same as for commander, with one less narrow stripe; lieutenant, three narrow stripes, upper one with curl; lieutenant junior grade, same as for lieutenant, with one less stripe; ensign, one narrow stripe with curl. Chief petty officers wear the following on their shoulder straps: class I, three gold stripes; class II, two gold stripes; class III, one gold stripe. Seamen are identified by chevrons, point downward, on their sleeves: sergeant, one broad on top and two narrow chevrons below; petty officer, one broad and one narrow gold chevron; first corporal, one broad red and two narrow stripes; seaman, first class, one narrow red stripe.

Air Force.—Commissioned rank is shown by gold patches on the

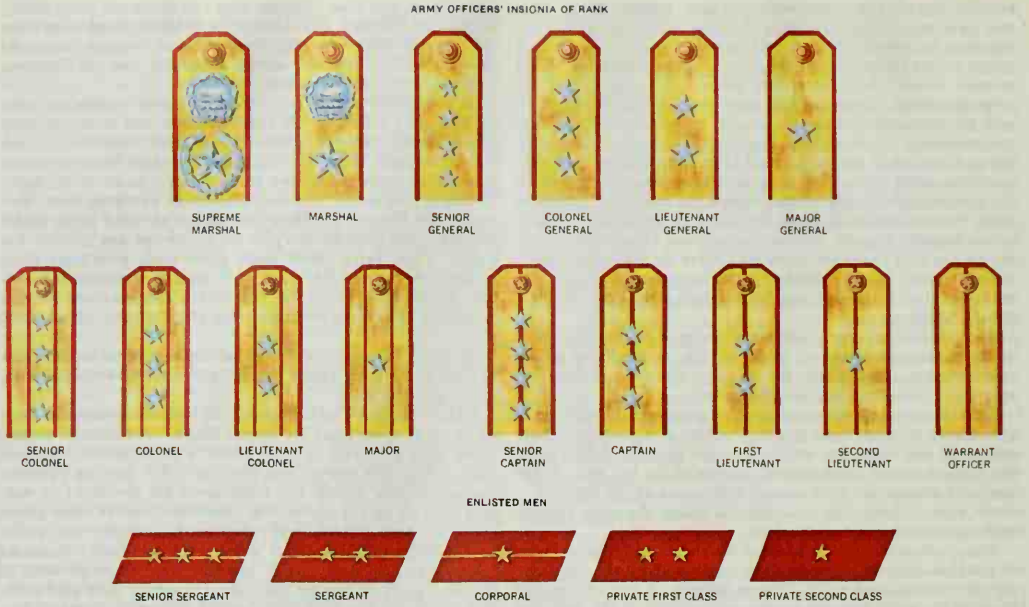


FIG. 9.—RANK INSIGNIA OF THE CHINESE COMMUNIST ARMY

cuffs; the patches are similar in design to those of the navy except that the curl is diamond-shaped. A lieutenant general wears five gold stripes of medium width, the upper one curled in a diamond shape, the lower one waved; major general, same with one less stripe; brigadier general, same as major general with one less stripe. Commissioned officers wear a shoulder strap with gold spread wings inside gold piping. Enlisted men wear rank insignia on shoulder loops.

Warrant officers are distinguished by stripes; other ranks by chevrons. *Aiutante di Battaglia,* three gold stripes with gold star superimposed; warrant officer, class I, three gold stripes; class II, two gold stripes; class III, one gold stripe. First sergeant, one broad and two narrow gold chevrons; sergeant, one broad and one narrow gold chevron; first corporal, two broad and one narrow red chevron; corporal, one broad and one narrow chevron.

Republic of China.—*Army.*—General officer grades are indicated by five-pointed gold stars worn on both the right and left collar of the shirt or on both shoulder loops of the coat. Stars for generalissimo and general, first grade, are linked in a circle; the three stars of general, second grade, in a triangle—for the collar insignia. However, when worn on shoulder loops the stars are in line: generalissimo, five stars; general, first grade, four stars; general, second grade, three stars; lieutenant general, two stars; major general, one star.

Field grade officers' rank insignia consist of various sizes and numbers of gold plum blossoms worn on the right collar of the shirt or on both shoulder loops of the coat. A colonel wears three plum blossoms; they are linked in triangular fashion if on the collar, in line if on the shoulder loop. A lieutenant colonel wears two plum blossoms, a major, one. Company grade officers wear a varying number of parallel gold bars in the same fashion as field grade insignia; captain, three bars; first lieutenant, two bars; second lieutenant, one bar. There is no rank identification for junior lieutenants and warrant officers. When rank insignia are worn on the shirt, field and company grade officers wear branch of service insignia on the left collar.

Noncommissioned officers wear metal chevron plate badges on the left sleeve just below the uniform shoulder seam. No rank identification is worn by enlisted men below corporal. A master sergeant wears a red metal badge edged in gold, with three gold chevrons above a gold plum blossom, below which are from two to four gold horizontal bars, depending on the pay grade; sergeant, first class, two green metal badges edged in gold, with three gold chevrons and three gold horizontal bars below the plum blossom; sergeant, green badge with three chevrons and two bars; corporal, same as sergeant but with only one gold bar.

Metallic branch of service insignia is generally patterned after that of the U.S. army. General officers wear plum blossom insignia in lieu of specific branch insignia.

Navy.—The system of rank identification generally adheres to that of the U.S. navy. For line officers a small circular wreath of rice stalks is worn above the sleeve cuff stripes in lieu of the star of the U.S. navy. On the shoulder boards the Chinese National sun insigne is worn between the button and the rank insignia for all line officers. Flag officer shoulder boards are gold with silver stars and insignia, and black piping on sides.

Air Force.—Rank insignia worn on the shoulder loop of the blouse consist of a varying number of wide and narrow gold bars, a spread-winged eagle being near the button end of the epaulet: general, two wide and three narrow bars; lieutenant general, two wide and two narrow bars; major general, one narrow and two wide bars; colonel, one wide and three narrow bars; lieutenant colonel, one wide and two narrow bars; major, one narrow and one wide bar; captain, three narrow bars; first lieutenant, two narrow bars; second lieutenant, one narrow bar; warrant officer, no rank insignia.

In lieu of shoulder loops the same rank insignia is worn on the right collar of summer uniform shirt with specialist identification on the left collar; warrant officer wears specialist identification on both collars. Specialist insignia: for general officer, a five-pointed gold star with plum blossom, centred; pilots, spread wings with a three-bladed propeller, centred; mechanic, aircraft engine and two-bladed propeller; other specialist insignia follow U.S. army patterns.

While insignia is prescribed for enlisted airmen it is seldom

worn. Instead airmen wear their name and rank written in Chinese characters on a cloth tab worn on top of the left breast pocket.

Communist China.—Up to and after its conquest of the China mainland in 1949 the Communist or People's Liberation army used no metallic badges or other insignia indicating military rank or branch of service. Commissioned officers could be recognized at times by the type of weapons carried, by coloured arm bands either worn on the right arm or wrapped around the butt of their pistols. The higher ranking officers could often be recognized by the presence of armed guards accompanying them. This largest Asiatic army at the turn of the mid-20th century exerted great efforts to conceal the identity of its commissioned and noncommissioned leaders. However, in 1956 the armed forces of Communist China adopted a new uniform system incorporating shoulder boards and insignia designating ranks and branches of service. This system was generally patterned after that of the Soviet armed forces. (*See* fig. 9.) In May 1965 the Chinese government announced that all insignia of rank in the Chinese army would be abolished and that henceforth generals would be indistinguishable from privates. The announcement said that all army uniforms would be alike and that soldiers would wear no insignia except a red star on their caps and a red flag on their collars.

Army.—All commissioned officers of the army wore shoulder boards of Soviet style except that branches of service were not indicated by coloured piping; both the stripes and piping were red. Shoulder boards had solid interwoven gold surfaces with rank insignia superimposed. For general officers, combat arms and political officers the shoulder boards were gold with silver stars superimposed; for administrative and technical staff officers they consisted of a gold background with gold stars. The designs were as follows: supreme marshal, one large star wreathed by silver pine sprays, and the national seal; marshal, same as supreme marshal less the wreath around the star; senior general, four small stars aligned down the centre of the shoulder board; colonel general, three medium stars; lieutenant general, two medium stars; major general, one medium star.

All field grade ranks had shoulder boards bearing two centre red stripes between which stars were placed as follows: senior colonel, four small stars; colonel, three stars; lieutenant colonel, two stars; major, one star.

Company grade shoulder boards had one centre stripe of red. Rank was distinguished by stars ranging from four stars for senior captain to one star for second lieutenant. Enlisted men wore their rank insignia on red collar tabs in the shape of parallelograms. A single, gold horizontal centre stripe on the tab identified the three top grades: senior sergeant, three stars; sergeant, two stars; corporal, one star.

Navy.—Shoulder boards and rank insignia were the same as those of the army except that the stripes and piping were black. The collar tabs were black with white or silver piping; an anchor was in the centre.

Air Force.—Insignia were the same as army insignia except that collar tabs and shoulder-board stripes and piping were sky blue. The collar tabs bore a set of wings in the centre.

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INSOLATION, the amount of solar radiant energy received in a given time on a unit horizontal area at any specified place on the surface of the earth or in the atmosphere. It is usually expressed in totals for periods of a day, a week, a month or a year.

Insolation generally denotes the actual amount of energy received after depletion by the atmospheric gases, dust and clouds, although it can express a hypothetical condition, such as the energy received through a perfectly transparent atmosphere.

(H. R. B.)

INSOMNIA, or the inability to sleep adequately, is a common symptom in modern life and varies greatly in degree. Every individual case must be investigated carefully on its own merits; the responsible causes may have a bodily basis or may exist in the mind. *See* SLEEP.

INSPIRATION, in religion, the experience of a possession by the divine that enables the inspired person to see and communicate supernatural truth. The Delphic oracle among the Greeks and the inspired shamans among various peoples have been thought to have an insight into the future and into other divine mysteries (*see* ORACLE; SHAMANISM; SIBYL). For Judaism, Christianity and Islam, the idea of inspiration has been largely (though not exclusively) connected with the sacred books of these religions. Differ though they would about the subject of the sentence, all would concur in the statement of the New Testament, "All scripture is inspired by God." Outside the language of organized religion, the concept of inspiration today is largely aesthetic; this is a secular reflection of the invocation of the Muses in the Greek and Latin epics. When theologians have taken inspiration to mean that the prophet completely loses his individuality, the infallibility of God has been attributed to the scripture as well—a position that has occasioned much controversy among both Jews and Christians since the 18th century. *See* also PROPHET.

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INSTALLMENT CREDIT. Installment credit, or hire purchase, as it is known in Great Britain, is the means by which a large part of the durable consumer goods of industrial nations is paid for. Wherever automobiles, refrigerators, laundry equipment and other such products play an important role in the lives of the people, installment credit is a large item in the financial structure of the country. In all the wealthy countries of the world, the greatest single use of installment credit is for the purchase of passenger automobiles. In the United States, for example, beginning in the 1920s, and with the exception of the period immediately after World War II, from 60% to 70% of automobiles have been bought on the installment plan and automobile credit constitutes about 40% of total consumer installment credit outstanding. Installment credit may also be used for other exceptionally large expenditures, such as tax payments, insurance premiums, travel, Christmas expenses and unpaid bills. Business credit may also be repaid by installments. In the 20th century, banks and other financial institutions have made a large number of business loans repayable in installments over several years. In some countries a limited amount of small loans to businesses has been included in the installment credit statistics. In the United States every attempt has been made to confine the concept and statistics of installment credit to the consumer segment of the economy.

Installment loans are repayable at regular intervals over a specified period of time. In the extension of such credit, the contract sometimes provides that the goods purchased will not become the legal property of the purchaser until every installment has been paid, hence the concept of hire purchase. As a rule, in case of default, all previous payments are forfeited to the lender and he may also take possession of the goods. The British Hire Purchase acts of 1938 and 1954 provided that the seller could not take back the goods without a court order if the purchaser had paid one-third or more of the hire-purchase price.

Installment credit constitutes the great bulk of all short and intermediate household credit in most countries, but households also have other debts that do not provide for regular periodic payments. The total of household debts (exclusive of house mortgages) is commonly referred to as consumer credit. Installment credit may be best understood as a major part of all consumer credit.

A large volume of installment credit depends on the employment

and income conditions of the public and on the types of goods which are produced and sold. A population which makes great use of installment credit is one which receives its income in regular periodic amounts, generally in the form of wages and salaries. At the same time, these incomes must be large enough for the population to be able to afford rather expensive durable consumer goods.

Accordingly, installment credit has grown in importance as larger portions of the public became periodic wage and salary earners; as these incomes became large enough to provide for luxury durable goods; as technology provided durable consumer goods; and as the public developed a taste for these goods.

History.—Household or consumer debt is a very old human institution. So long as consumer goods have been articles of commerce, whenever they have been produced by someone other than the consumer and then bought by the consumer, there has probably been consumer credit. But in most cases and throughout most of the world's history, the extension of credit was a personal matter between the seller and the buyer; the debt was not highly institutionalized; and provision for regular periodic repayment was not set forth in a written contract.

Installment loans for the purchase of durable consumer goods, such as furniture, appeared in the 19th century, but first received serious public attention and became of great economic importance shortly after the end of World War I. The rapid increase in sales of passenger automobiles during the 1920s was made possible in large measure by installment credit. Some retailers were able to supply the money necessary to finance credit extensions. In the 1920s, however, there was a rapid growth of a new type of institution known as the finance company.

This type of firm bought instruments of indebtedness from the retailers and collected from the debtors the sums due periodically. Some of these finance companies were from their very inception owned by or closely associated with manufacturers. The most notable example was the General Motors Acceptance corporation (G.M.A.C.), which was organized in 1918. Devoted to financing the sale of General Motors products, it became the world's largest consumer finance organization. Most finance companies, such as the Commercial Credit company of Baltimore, Md., have been independent of both manufacturers and retailers. Some operate on a large scale over an entire country, or even in several countries, while others limit their operations to small areas. In Great Britain and Australia during the late 1950s many finance companies came to be closely affiliated with commercial banks, but such connections did not develop in the United States.

Even before the dramatic increase in installment financing of durable goods in the 1920s another aspect of consumer financing had become a matter of social concern, particularly in the United States. In the 19th century, as an increasing proportion of the population moved into the urban centres and became employed on a wage or salary basis, cash borrowing for consumer purposes grew rapidly in importance. It came to be widely believed that social evils were related to this borrowing and that it should be publicly controlled. Such borrowing by individuals and households was not new, of course, but it was of increasing magnitude and social concern.

The commonest historical form of consumer lending has been pawnbroking; *i.e.*, the lending of money upon the security of household goods or personal effects. As pawnbroking developed in the late middle ages, it soon was subjected to legal controls. Special charters regulated the lenders' responsibility for the safety of the pledged property, the conditions of its forfeiture, the ratio of loans to value of the property, maximum loans to certain classes of people and maximum interest rates. The most frequent maximum interest rate permitted in the late middle ages was 43⅓%, or two pence on the pound per week. Higher rates, however, were not uncommon. (*See* PAWNBROKING.)

Alongside the pawnshops, other moneylenders have operated, advancing funds to wage and salary workers in violation of the usury laws. As a result of increasing concern about social abuses related to this type of lending, various controls have been instituted. In the United States beginning about the second decade of the 20th century, various states undertook to provide for supervised businesses to make small loans. (*See* MONEYLENDING.)

These supervised lenders, known as small loan companies or consumer finance companies, were authorized to make loans in limited amounts, charging rates in excess of those permitted under the usury laws. For example, charges might be at a rate of 3½ cents per dollar per month on amounts up to $300. This charge was supposed to be all-inclusive, providing for investigation, collection, bookkeeping and losses as well as full interest. Such credit has sometimes been criticized on the grounds that borrowers tend to keep themselves perpetually in debt or that lenders encourage them to borrow continuously and unnecessarily. Total loans of the licensed lenders increased from about $20,000,000 in 1917 to about $400,000,000 in 1937. Control of the operations of moneylenders in Britain was provided by acts of parliament in 1900 and 1927. These acts did not provide a legal escape from the usury laws, as was the case in the United States, but provided for controls and limitations in a field that was otherwise not subject to legal limitation.

In the United States, at the same time that escape from the usury laws governing cash loans was being provided by the small loan laws, escape was also provided in the form of durable goods sale credit by the legal doctrine of the time sales contract. Under this doctrine, if a price were placed upon a product to be sold on a credit basis, the difference between this price and the price prevailing if the commodity were sold for cash was judged not to constitute interest and not to be subject to the usury laws. The great expansion of sales of automobiles and other consumer durable goods in the 1920s in the United States was financed in large measure by installment credit without reference to the usury laws of the states.

The rapid growth of consumer credit in the 1920s aroused great public interest and discussion. The development was widely regarded by publicists as unsound from the standpoint of the general economy, somewhat immoral, and unwise from the standpoint of the financial advancement of the borrowers. Despite these widespread attitudes, the desires of the consumer and the salesmanship of retailers and manufacturers resulted in an extremely rapid growth of installment debt. It is estimated that installment debt in the United States rose from $1,000,000,000 in 1920 to $3,000,000,000 in 1929. In response to the widely expressed disapprobation of consumer credit and fears of adverse economic reaction to its growth, some economists and many representatives of finance companies developed theories that consumer credit was necessary for prosperity. They maintained that installment sales credit was necessary for the distribution of the new durable goods among broad groups of the population, and thereby to permit the development of industry on an efficient and highly productive basis.

When the 1929 depression overtook the world, consumer credit proved on the whole a very sound asset. Finance companies survived better than commercial banks, and their assets proved better than the commercial bank assets. Accordingly, the consumer credit business in the 1930s was not the subject of reform legislation, such as that enacted to deal with farm finance, home finance, corporate securities and the stock exchanges. Indeed, the record of consumer credit appeared relatively so good that the commercial banks of the United States, as they rose from the depression, rapidly entered the consumer credit business themselves. By the beginning of World War II they held $1,500,000,000 of installment paper, compared with $1,600,000,000 held by the sales finance companies and $700,000,000 held by other lenders, chiefly the personal finance companies.

But while the depression brought relatively few losses to the holders of consumer credit, it did lead to some critical examination of the subject. Some observers continued to feel that installment credit would contribute substantially to economic instability. Some thought that the collection of funds from the income stream by holders of installment paper during economic depression contributed substantially to a decline in consumer expenditures and to the furtherance of economic collapse. They thought that this might have been a factor in the 1929–33 depression and again in the 1937–38 recession. The completion of some major studies of consumer credit about the end of the 1930s in the United States

helped to form a basis for adoption of special government wartime controls of consumer credit. The lack of confidence in general monetary controls (*see* CENTRAL BANK) that developed during the 1930s created a favourable climate for the consideration of special credit controls when excessive credit expansion threatened upon the outbreak of war.

In the United States special regulation of consumer installment credit was adopted by the federal government for the first time in Aug. 1941. These controls were premised on the lack of effective general credit controls, the desire to channel materials into avenues most necessary for the prosecution of the war and possibly a widespread feeling that consumer credit is unwise from either a personal or social standpoint. Consumer credit controls generally took the form of a down payment requirement or limits on the amount that could be borrowed in relation to the value of the object to be purchased, and limits on the period over which repayment could be extended. In Great Britain the wartime control of consumer credit was a part of price control. It was primarily a control of the rate of finance charge and was chiefly a means of preventing the use of finance charges to circumvent the control of other prices. From 1943 to 1947 an outright prohibition of installment buying or hire purchase trading of most commodities was enforced.

Control After World War II.—The significance of consumer credit control was small during the war because the production of most goods customarily financed with installment credit was brought to a halt. At the end of the war, consumer credit controls took on a new role. As production of consumer goods was resumed, the supply was far less than the demand. Continuation of consumer credit controls helped to limit demand, and this in turn contributed to solution of the problem of allocating the limited supply among consumers.

The British government after the war placed restrictions from time to time on capital issues of hire purchase companies. Such limitations were in operation from 1945 to mid-1954 and again from Feb. 1955 to Feb. 1959. In the United States the government had difficulty deciding when to relinquish control over consumer credit terms. Restrictions were first dropped on Nov. 1, 1947, but in the face of continued inflation, excessive demand for consumer durable goods, and limited general monetary controls, special consumer credit limitations were again put into effect from Aug. 16, 1948, to June 30, 1949.

With the outbreak of hostilities in Korea, regulation of consumer credit was reinstituted in the United States in Sept. 1950 and continued until May 1952. The lack of such controls after that date may be explained in part by the availability of general credit controls, such as the purchase and sale of securities by the central bank, the adequate supply of consumer goods, the difficulties of enforcing such controls and the lack of public agreement that the special control of consumer credit is socially desirable. During the three periods when consumer credit has been under control by the federal government in the United States, administration of the control has been in the hands of the federal reserve system (*q.v.*), implemented by its regulation W.

Just as the United States was abandoning consumer credit controls in 1952, Great Britain was adopting such controls. After 1952 the United States made no use of such regulations, but they played an important role among the economic stabilization instruments exercised by the British government. Credit limitations related to British price control disappeared with the abolition of price control on April 30, 1953. In the meantime, on Feb. 1, 1952, England had entered upon a full-scale control of hire purchase as a means of general economic policy implementation. This type of control was in use the greater part of the time during the following decade, Feb. 1952–July 1954, Feb. 1955–Oct. 1958, and again beginning in April 1960. During the periods when controls were in effect the prescribed time for repayment was usually 24 months, while the initial deposit requirement for automobiles, as an example, varied from time to time from 15% to 50%.

Adoption of consumer credit control in Great Britain after it was abandoned in the United States may have been due to several factors. Other means of general credit control may have been more effective in the United States, where the cash reserve requirements on the commercial banks are very effective. Central bank influence on bank cash reserves in the United States exercises a greater influence on total demand than do the general controls of the Bank of England. Furthermore, the balance-of-trade problem of Great Britain, the extent of economic planning, and controls in other fields have created a greater predilection for specific controls of consumer credit.

The nature and timing of consumer credit controls in Canada for purposes of economic stabilization have been similar to developments in the United States. Indeed, it may be said that the 1950s saw the United States and Canada move away from consumer credit controls as an instrument for procuring economic stability, while many other countries were making substantial use of the device. In Australia hire purchase debt has been largely uncontrolled.

Consumer Spending Decisions.—Installment credit is used for two chief purposes: the purchase of durable goods that are acquired only occasionally, and other large expenditures that cannot readily be paid out of current income. Installment credit enables consumers to spend within a limited time period more than their current income. Purchases made in one month can be paid for out of the income of several months. Tax and insurance payments, annual vacation costs and school tuition payments may be expenditures of such a character.

Consumers may obtain the use of durable goods by a variety of methods: (1) Other assets may be liquidated. (2) Previously accumulated savings may be used, or funds may be saved out of current income until enough is saved to buy the commodity or service. (3) Monthly payments may be made over a period of time. (4) Goods may be obtained by lease or rental. (5) Relatively cheap goods may be bought at the outset and later be discarded or exchanged and better goods acquired as current income permits, the process being repeated indefinitely. If, for example, the $300 that might be required as down payment on a $3,000 car is devoted to purchase of a used car and the amount that would be required to make the monthly payments on the new car are accumulated, a better used car costing $1,500 can be bought after about a year, or a new $3,000 car can be bought after something over two years.

These methods are obviously not altogether distinct or mutually exclusive, but their enumeration is of some value in thinking about the subject of consumer credit. It is scarcely possible to demonstrate that one method of acquiring consumer goods is better than another. Each of them is used, and each best meets the needs of some consumers. It may be argued that the saving up and working up (items 2 and 5 above) methods are best or cheapest, but this suggestion is rather pointless for people who cannot bring themselves to follow the necessary procedures. It may be that for the great bulk of the population it is psychologically impossible either to save up money for major expenditures or to improve methodically the quality or quantity of its durable goods. Yet the consumer may genuinely desire, in spite of costly finance charges, to use installment credit for the high quality durable goods and major expenses, such as vacations, in preference to goods and services which may be simultaneously financed out of current income.

The quantity of consumer credit has depended and will depend on the pattern of goods and services bought by consumers. On the other hand, the availability of consumer credit has determined, to some extent, the pattern of goods and services bought. To the extent that increased levels of consumption take the form of using durable goods, such as automobiles, or engaging in concentrated expenditures, such as vacations or Christmas gifts, consumer credit increases in volume. When expenditures of these types are increasing relative to others, consumer credit will tend to grow more rapidly than income. Consumer tastes, however, may turn toward the leasing of durable goods, recreation, the utilization of services, such as commercial laundries, or the purchase of expendable goods. Such expenditures, which do not involve long-term installment credit, can drop the growth rate of installment credit until it is even with or lower than the growth rate of income.

The length of installment credit used to buy goods such as automobiles bears some relation to the probable length of efficient life of the purchase. A periodic reduction of the debt by a certain amount may correspond roughly to the rate of depreciation. The most common period for paying for a new automobile in the United States in the early 1960s was three years. The longer the average useful life of a product, the greater may soundly be the maturity of the indebtedness.

Many consumers see fit to borrow at interest rates ranging from 8% to possibly 30% while holding liquid assets which yield from 3% to 5%. While such a practice may seem irrational and undesirable, this may not be the practical fact. The consumer may feel that if he borrows, he will be under the discipline of repaying, while if he uses his liquid assets, he will not replace them, and later he will be in a worse financial position than if he had borrowed.

Accumulation of savings and simultaneous borrowing at much higher rates of interest, even from the same institution, may be in a sense costly or wasteful, but this may be the only way in which many households can regulate their spending and contribute to personal peace of mind and maximum satisfaction. The millions of consumers who borrow year after year, even though they have liquid assets, belie the belief that consumer installment credit is a great swindle. In the main, the users like such credit because it enables them to make the best adjustment to the need for financial planning.

Installment credit has sometimes been thought of as a means whereby the individual or family can early enjoy a level of living which is justified only by the anticipation that income will be higher at a later stage of life. However, the major consumer uses of installment credit do not offer much to this end of evening out consumption over an individual's or family's life span. An automobile buyer, 22 years of age, may reasonably expect a higher income at age 35, but the payments on the car must be made within the next two or three years.

Consumer credit does not on the whole provide a means for maintaining a family's level of living in the case of temporary decline of income. Debt is incurred primarily at times of increased employment, increased overtime and rising wage rates. It may be argued that since the monthly payments must on the whole continue to be paid at a time of declining income, spendable funds are made more uneven by installment credit. Some consumer installment debt is incurred at times of reduced income, but such credit plays a small role compared with credit associated with prior or simultaneous increases of incomes. Automobile loans and other types of consumer credit rise in times of increased employment and income; the cash loans of the consumer finance companies, the credit unions (*q.v.*) and the commercial banks also increase most in times of prosperity.

Cost of Consumer Credit.—Consumer installment credit outstanding in the United States by 1963 amounted to about $50,000,000,000, and total finance charges each year were from 15% to 18%. It thus appears that consumers paid about $8,000,000,000 per year for the use of the installment credit method of acquiring their purchases.

The reason for this high cost is that the extension of credit to consumers generally involves cost to the seller or lender. In a few instances, such as the sale of electricity and gas to consumers, either prepayment or credit is technically necessary. In this and some other cases the extension of credit may be less costly to the seller than would collection of cash simultaneously with supplying the goods or service. But, generally speaking, the seller incurs extra costs by virtue of not collecting cash at the time of the sale. In the case of the simple charge account, which is technically payable soon after the receipt of a monthly bill, the costs are generally borne by the seller or, in a sense, by the customers (both those paying cash and those buying on credit). A specific charge is almost always made for all types of installment credit. Compared with other types of credit, the charges for this kind are quite high. While governments and businesses with good credit standing have commonly been able to borrow for 4, 5 or 6 cents per dollar per year, consumers borrowing relatively small amounts, and having a less reliable or undetermined credit status, have commonly paid from 8 to 42 and more cents per dollar per year.

Provision of consumer credit requires large and complicated organizations for investigation of the borrower, keeping records and collecting delinquent accounts. The services of specialized investigation, rating and collection agencies are frequently employed. Provision must also be made for losses. Insurance on the lives of borrowers is frequently provided. Costs vary greatly, depending upon the size of the credit and the character of the borrower. The cost of investigating borrowers and making collections is much less per dollar in the case of large loans than in the case of small loans. Accordingly, the rate of interest charged must be higher on small borrowings than on large. Lenders who confine their business to persons of a relatively high degree of financial responsibility can lend at lower rates than can those who lend to the financially less reliable. This may be one reason why rates charged by the commercial banks are generally less than the rates charged by some other classes of lenders. Credit unions are also able to make small charges on loans because they have lower costs for investigation, collection and loss. Needless to say, it behooves the wise borrower to patronize the lowest-priced lender who will recognize his eligibility for credit. The level of rates paid by consumers for loans has sometimes reflected their unwillingness or inability to bargain or shop around, and some lenders have made very high and, in a sense, unjustified profits. But, in the main, the level of charges has been necessitated by the costs involved.

Consumer Protection.—Historically, consumer credit in the United States has had either to operate illegally or to find some way to avoid the usury laws of most states. Many states have prohibited lending at a charge of more than about 8 cents per dollar per year. Many states have also provided that under government supervision loans can be made by special institutions up to limited amounts at rates above the usury rate. They have generally provided these limits by law rather than by making provision for their determination by administrative action as is generally the case with public utility and other governmental price control.

The other chief way in which consumer credit charges higher than those permitted by the usury laws have been practical has been for the price of goods sold on installments to be higher than the cash price. After World War II, this means of circumventing the usury laws was questioned. Some influential observers came to regard the charges as extortionate; some court decisions indicated that the time price doctrine should not be regarded as a legitimate means of circumventing the usury laws, but as a violation of them. As a result, many states provided by law for interest on sales credit beyond the basic usury limit.

The cost of consumer credit has long been a matter of public and social concern. By way of reform it has been suggested that lenders be required to give better information to borrowers (buyers) regarding credit costs. Information requirements may be of several kinds. The law might require, for example, the quotation of both the credit sales price and the cash sales price. Such is the basic nature of the British acts of 1938 and 1954, while the Advertisements (Hire Purchase) act of 1957 went a step further in controlling publicity. A similar goal is achieved by the laws enacted in about half the states of the United States after World War II. An alternative information requirement may be for the credit cost to be stated in the form of a rate per annum on the unpaid balance. This was the nature of proposed legislation introduced into the U.S. congress in the early 1960s. *See* also MONEYLENDING; PAWNBROKING.

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(H. Jo.)

INSTINCT (Latin *instinctus*, "impulse," "instigation"). Popular and literary use of this word is loose: it has been applied to behaviour driven from within ("the mating instinct asserts itself in spring"), to nonlearned behaviour ("the kitten knows instinctively where to find the mother's nipple") and to unconscious or unpremeditated behaviour ("I put my foot on the brake instinctively"). In studies of animal behaviour it has often been applied to relatively complex behaviour which serves a vital end, is at least partly caused by an internal urge and need not be learned. However, it is being realized that the dichotomy instinctive-noninstinctive based on this complex of criteria, or even on any one of them, is not helpful, and modern students of animal behaviour prefer to classify behaviour in a very different way. Yet the aspects mentioned—of adaptedness, of causal organization and of development of behaviour in the individual—remain central themes of investigation.

Adaptedness.—A great many aspects of animal behaviour contribute to survival, and the functional significance of even the most trivial details is the object of research. Most behaviour involves processes in the sense organs, in the nervous system, in the muscles and in hormone-secreting glands, and each of these processes is adapted to contributing toward survival. This is demonstrated in such diverse phenomena as the simple prey-catching movement of the praying mantis, the more complicated action chains such as the "dance" of the honeybee scouts; such complexly adjusted movements as bird flight; the sensory refinements employed in species and individual recognition; symbiotic relationships such as those between flowers and their pollinators; the employment of learning when the situation demands it; the cooperation between individuals in social behaviour; and many other phenomena. In short, the correct functioning of behaviour is recognized as being subject to ruthless pressure of natural selection just as any other life process.

Yet it is obvious from the many things an animal does not do that animal behaviour is remarkably restricted in many respects. Many ground-breeding birds can roll an egg back into the nest, but they invariably use the clumsy method of balancing it against the bill, although a foot or a wing would be better tools and possess the required muscular equipment; gulls, although capable of learning, rarely learn to select a hard substrate when smashing shells by dropping them from the air. Further, unusual circumstances often lead to miscarriage of behaviour and so reveal the limitations of adaptedness.

Thus animal behaviour, while highly complex, variable and adapted, is yet restricted in scope and seems on the whole to be limited by the machinery evolved in adaptation to the demands of survival under natural conditions.

Even the criterion of learned or nonlearned does not allow a simple dichotomous distinction between two types of behaviour. Learning probably applies to more than one type of adaptive change in behaviour machinery during the life of the individual. Learning by imitation is extremely rare in animals; examples from apes have been reported, as they have from some birds which learn their full song by hearing fellow members of their own species, but most animals develop the behaviour typical of their species even when reared in isolation. Isolated canaries, for instance, build typical canary's nests when mature. However, many animals learn by practice. While birds develop the basic pattern of flight without practice, subsequent perfection of skill does depend on it; this may happen extremely rapidly as in cormorants, where one abortive landing attempt may suffice to cause striking improvement with the second attempt. Yet many skills develop without practice; thrushes smash snails expertly when encountering them for the first time.

Even behaviour which is neither imitated nor learned by practice may be subject to learning in another way: it can be conditioned; *i.e.*, change its responsiveness to outside stimuli. Thus pigeons learn to respond to water by drinking, and many songbirds learn to avoid obnoxious insects after one or a few penalized responses. Yet many animals react selectively to appropriate situations the first time they meet them: gull chicks hatched in an incubator respond by crouching to the alarm call of their own species and peck selectively at the parent's bill tip when soliciting food; some butterflies respond selectively to blue and yellow flowers or paper substitutes the first time they feed. In other instances such changes in responsiveness are independent of experience; *e.g.*, the appearance of reproductive responses of many animals upon reaching maturity. Even animals which learn a great deal may fail to apply their ability to learn as widely as human beings would do, and this would seem to indicate in the latter a nonlearned "predisposition to learn"; gulls which learn very readily where their nest is located have no predisposition to learn where to smash their shells.

Thus many behaviour patterns are at the same time learned and nonlearned, the growth of their machinery being the result of complicated interactions between internal and environmental agents. To make a sharp distinction between learned and nonlearned leads to a false dichotomy when applied to behaviour; rather it should be applied to influences governing the development of behaviour machinery, and modern studies try to unravel the interaction of a great variety of inherent and external growth-controlling factors.

Complexity.—Instinctive behaviour has often been considered to be more complicated than simple motor patterns such as reflexes, which have been said to involve "the whole animal." However, this difference is no longer regarded as important, for there seem to be all gradations from simple to complex movements; a frog wipes its side or back with a hind leg when the skin is irritated, and this, although a very simple movement, shows relatively good orientation and is thus more complex than the simplest possible reflex. On the other hand the newly born chicks of many birds crouch at the parents' alarm, and although this is usually called instinctive it is simpler than a frog's wiping reflex.

While it is useful to analyze behaviour into its components, it is not useful to prejudice such analysis by the application of a dichotomy between complex and simple movements and to draw an arbitrary line between instinctive and noninstinctive movements on this criterion.

Causal Organization.—The distinction between behaviour caused by an internal urge and purely reactive behaviour is also considered false, partly because most behaviour is neither purely reactive nor purely spontaneous. Modern research tends to avoid the catchword "instinct" as applied to behaviour patterns, and instead tries to unravel the causal organization of behaviour without prejudice.

Although there is only fragmentary knowledge on the subject, it is already clear that behaviour is organized in hierarchical systems with excitatory and inhibitory relationships of many kinds, and with complex interrelationships between causal chains. These systems are never completely at rest and their excitatory state is subject to continuous change.

The initiation of movements (*i.e.*, the change from one type of activity to another) can be caused by external stimuli or by internal changes or by both combined. Thus many animals of the temperate zones respond to increasing day length (received by light-sensitive organs) by changes in the activity of hormone-secreting glands, which make the animals migrate, select a suitable habitat and proceed with nest building, courting a mate, etc. In all these activities an animal responds in a variety of ways to sensory stimulation, yet a reduction of the sex hormone level (for instance, by castration) abolishes the readiness to respond to many of these very stimuli.

There are many indications that the central nervous system in the intact animal is continually stimulated both by internal agents (humoral, sensory, nervous) and by the "rest output" of peripheral sense organs, and that the machinery of each major behaviour system is never completely at rest. Apart from this, there seem to be humoral and nervous agents which control the general excitatory state. Which behaviour pattern is performed at any one moment seems to depend on the particular unbalance of the conditions facilitating or inhibiting the various systems. On the other hand the external stimuli which, given a certain state, initiate a response are specific. Their effectiveness depends first of all on the sensory equipment of the animal, which is often very different

from human equipment and from that of other species.

Thus bats are sensitive to ultrasonic vibrations; many insects can see ultraviolet radiation; on the other hand, the majority of animals cannot hear properly. Second, the stimulus situation eliciting or inhibiting a particular response is often very restricted: the males of some butterflies, for instance, pursue any moving object when they are in sexual condition, irrespective of its shape and colour.

Which of the available sensory information is responded to is often controlled by the internal condition or "mood," and it is known that this condition can centrifugally affect the responsiveness of sensory systems.

Most behaviour patterns are sequences or chains of simpler movements. Such action chains often begin with searching behaviour which may be spontaneous, and this is continued until the next link in the chain appears. The switch from one link to the next is sometimes caused by internal changes, as has been demonstrated for the mating chain of the male fruit fly, but in other instances it is mainly caused by external stimuli, as for instance in the hunting behaviour of the digger wasp *Philanthus triangulum*. Probably both internal and external control of switching are involved in most instances. Each link itself is a complex movement of variously integrated muscle movements.

Many behaviour chains terminate in an end act such as swallowing food, or in the perception of an end situation such as a shelter out of reach of a predator; the end of a chain is usually marked by an internal change indicated by a reduced readiness to perform the same chain again. This "drive reduction" is often caused by "negative feedback," *i.e.*, information reaching the system as a consequence of the activities performed or of the situation reached, which counteracts the stimuli evoking these activities. Thus reduction of the feeding drive in rats partly results from food stimulating the stomach after ingestion; the readiness to fly in the saturniid moth *Automeris* is reduced by the activity of the central nervous flight mechanism itself.

The part played by feedback systems in behaviour is certainly highly varied and complex, but whether central nervous fatigue or other depletion phenomena can contribute to drive reduction is uncertain.

There is interaction between the major behaviour systems as well as between the various parts of each system, but on the whole major systems inhibit each other mutually, so that at any particular moment the movements of the most strongly aroused system appear to the exclusion of all others. When two systems are simultaneously aroused, various "conflict movements" may occur. These may consist of components of the two patterns combined in a "mosaic"; they may be intermediate or "compromise" movements; the full movement of one pattern may appear with a different orientation; components of both patterns may appear in quick alternation; or a completely irrelevant movement may be performed ("displacement activity"). Interaction on lower levels is responsible for the co-ordination of limbs in locomotion, or even of parts of limbs such as fin rays. Such interaction is partly controlled by the central nervous system, partly by reflex loops, and it may affect both the temporal order and the amplitude of contractions.

Instincts.—Neither innateness, nor spontaneity, nor complexity, therefore, is useful as a criterion for the separation of instinct from other behaviour categories. The term "an instinct," however, has been used as a name for the machinery responsible for the organization of major, functionally unitary behaviour systems, such as feeding, mating, antipredator behaviour, etc., and when used in this way, it is a term comparable to digestive system and merely indicates a phenomenon to be studied. However, in view of the conceptual confusion which the use of such different criteria has created even this usage of the word is increasingly avoided.

Evolutionary Aspects.—Since the growth of the machinery underlying many elements of behaviour, whether affected by the environment or not, is often very stable in successive generations, many motor patterns are relatively constant during evolution, and this is why closely related species are usually similar in their behaviour. Yet evolutionary change does occur and as a consequence no two species behave exactly alike.

Simple mutations have been shown to effect behaviour changes. Much indirect evidence has been collected showing that natural selection can account for adaptive evolutionary change. Conversely, behaviour also affects evolution; such activities as habitat selection, food selection and mate selection seem to have been instrumental in the splitting-up of species.

Animals and Man.—It is too early for an assessment of the ways in which human behaviour has evolved from the ancestral animals' roots. There is, on the one hand, no doubt about the large differences between man and all animals, exemplified by such capacities as foreseeing the future outcome of a planned course of behaviour; man's extremely complicated learning abilities which in turn allow him to pass on acquired knowledge from generation to generation; his tendency to use moral criteria; the retardation of certain aspects of ontogeny which, for instance, prolongs the infantile curiosity or tendency to explore; his ability to utilize specific experience for general purposes; etc.

On the other hand it is becoming increasingly clear that these could well be differences of degree. Man's freedom of action is undoubtedly limited by his evolutionary past. The best way to gain insight in this problem is through comparative studies, particularly of those species most closely allied to man. A major obstacle hampering such work is the fact that man has two sources of knowledge about his own behaviour of which only one can be used for the purpose of comparison. Every human being can observe his own behaviour as if he were an outsider, and record his observations in the same way as behaviour of animals.

Subjective experiences however are not directly observable in animals and cannot therefore be used for comparison. Because our everyday language deals with both types of observables it is not suited as a tool of behaviour research. This is perhaps the main reason why a strictly scientific comparison of the behaviour of animals and man has not yet proceeded very far.

See ANIMAL BEHAVIOUR: *Animal Behaviour Patterns;* PSYCHOLOGY, COMPARATIVE; *see* also references under "Instinct" in the Index.

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(N. TS.)

INSTRUMENTATION, in music, is the art of writing parts in the character of instruments forming an ensemble or orchestra and of combining or contrasting the parts so that different textures are produced. The term was first used in French and English in the first half of the 19th century, but it later tended to be replaced by the term orchestration, with which it is synonymous. *See* ORCHESTRATION.

INSTRUMENT OF GOVERNMENT, the name given to the written constitution under which Great Britain was governed from Dec. 1653 to May 1657. It was an attempt to provide a legal basis for government. After the execution of Charles I in 1649 and the suppression of the house of lords, theoretical power was vested in the Rump parliament, effective power in the army, of which Oliver Cromwell was lord general. When the Rump was expelled and the council of state dissolved (April 1653) a second experiment, the parliament of Saints (Nominated, or Barebones, parliament) was equally unsuccessful. On its expulsion in Dec. 1653 Maj. Gen. John Lambert drew up the Instrument of Government under which Cromwell became "lord protector of the Commonwealth."

The Instrument was accepted by Cromwell on Dec. 16, 1653, after certain emendations. Consisting of 42 articles, the Instrument placed the legislative power in the hands of "one person, and the people assembled in parliament"; the executive power was left to the lord protector, whose office was to be elective, and a council of state numbering from 13 to 21 members. Article 33 named Cromwell as lord protector for life but the title was not hereditary. The councilors were appointed for life; 15 were named in the Instrument itself, and Cromwell and the council

were empowered to add six. To fill vacancies parliament was to name six persons, of whom the council would select two, the choice between these two being left to the protector. A parliament was to meet on Sept. 3, 1654, and until that date the protector, with the consent of the council, could make ordinances that would have the force of law. After the meeting of parliament, however, he had no power of legislation, nor had he any veto upon its acts, the utmost he could do being to delay new legislation for 20 days. A new parliament must be called "once in every third year," elaborate arrangements being made to prevent any failure in this respect, and for five months it could not be dissolved save with its own consent. The parliament, composed of a single chamber, was to consist of 460 members—400 for England and Wales, and 30 each for Scotland and Ireland—and the representative system was entirely remodeled. A large majority of the English members (265 out of 400) were to be elected by the counties, where voters must possess land or personal property of the value of £200, while in the boroughs the franchise remained unaltered. In Scotland and Ireland the arrangement of the representation was left to the protector and the council. Roman Catholics and all concerned in the Irish rebellion were permanently disfranchised and declared incapable of sitting in parliament, and those who had taken part in the war against the parliament were condemned to a similar disability during the first four parliaments. The protector was empowered to raise a revenue of £200,000 in addition to a sum sufficient to maintain the navy and an army of 30,000 men, and religious liberty was granted "provided this liberty be not extended to Popery or Prelacy." The chief officers of state were to be chosen with the consent of parliament, and a parliament was to be summoned at once in case of war. The practical effect of the Instrument was to entrust the government of the three countries to the parliament for five months out of every three years, and to the protector and the council for the remainder of the time. Although the Instrument bristled with possibilities of difference between parliament and protector, "it is impossible," as S. R. Gardiner said, "not to be struck with the ability of its framers."

Cromwell governed according to the Instrument until the meeting of parliament on Sept. 3, when he endeavoured to obtain parliamentary sanction for the Instrument. Prolonged disputes followed and he dissolved the parliament on Jan. 22, 1655, without obtaining his object. Regarding the Instrument as still in force, the protector sought for a time to rule in accordance with its provisions; but new difficulties and growing discontent forced him to govern in a more arbitrary fashion. A second parliament met in Sept. 1656, and in the following May Cromwell assented to the Humble Petition and Advice (*q.v.*) which supplanted the Instrument of Government.

See also ENGLISH HISTORY.

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INSTRUMENTS, ELECTRICAL MEASURING. Although the electrical power and communication industries are the largest users of electrical measuring instruments, most branches of science and technology depend on electrical measurements for information and for the control of processes and machines. Indeed, it would be difficult to find a research laboratory or a modern factory in which electrical measuring instruments do not, in one way or another, play a vital role.

The varied uses of electrical instruments make it desirable first to consider broadly the principles on which they operate, before undertaking a detailed examination of representative types. This article, therefore, is divided into the following sections and subsections:

I. Electrical Units
II. Absolute Measurements
  1. Lorenz Apparatus
  2. Current Balance
III. Primary Electrical Standards
  1. Standard Ohm
  2. Standard Cell
IV. Indicating Instruments
  A. Current and Voltage Measurements
    1. Potentiometer
    2. Galvanometer
    3. Permanent Magnet Moving-Coil Instruments
    4. Iron-Vane Instruments
    5. Electrodynamic Instruments
    6. Electrostatic Voltmeters
    7. Instrument Transformers
  B. Power Measurements
    1. Electrodynamic Wattmeter
    2. Electrostatic Wattmeter
    3. Bolometer
  C. Energy Measurements
    1. Commutator Watt-Hour Meter
    2. Induction Watt-Hour Meter
  D. Resistance Measurements
    1. Ohmmeter
    2. Wheatstone Bridge
  E. Capacitance and Inductance Measurements
V. Recording Instruments

In most instruments with which electrical current, voltage or power are measured some property of the electrical quantity to be measured is used to evoke a mechanical force, and it is this mechanical force which gives a measure of the electrical quantity. The reaction between a magnetic field and a current-carrying conductor, the attraction or repulsion of electrically charged bodies, are effects that are commonly used to produce such a force. More elaborate means are frequently employed—the heating effect of electrical current in a conductor may be used to raise the temperature of a thermocouple junction, generating an electromagnetic force (e.m.f.) and producing a current in an auxiliary measuring circuit.

Photoelectric and photovoltaic cells are also employed as the sensing elements of electrical measuring instruments. In the measurement of such electrical quantities as resistance, inductance and capacitance, an instrument which utilizes a mechanical force is commonly employed to detect or measure the current or voltage produced in some element of a bridge, potentiometer or other network in which the unknown quantity is being measured by comparison with other similar quantities of known magnitudes. Thus at the heart of most electrical measuring instruments is an element which converts an electrical into a mechanical effect for detection or measurement.

I. ELECTRICAL UNITS

In any measurement, the value describing the quantity must necessarily be assigned in terms of some unit. The units in which electrical quantities are measured have been defined in such a way that they are simply related to the internationally accepted units of length, mass and time (metre, kilogram and second) which form the basis of mechanical measurements. Carl Friedrich Gauss showed in 1833 that magnetic quantities could be measured in terms of mechanical units, and he proposed units (which he called absolute, abbreviation abs.) that were based on mechanical units of length, mass and time.

This concept was amplified by Wilhelm Weber, who showed in 1851 that a complete system of electrical units could be defined in terms of mechanical units. The work of Gauss and Weber formed the basis of a decision by the British Association for the Advancement of Science to define and establish a system of electrical units based on the metric system of mechanical units. Experimental determinations, sponsored by the association, led to the issuance in 1864 of the British association ohm, which was intended to embody the unit of resistance so defined. This unit was found later (1878) to differ by more than 1% from its intended absolute value, but the principles on which the British association units were based gained international acceptance at the Paris Electrical congress of 1881. This congress also described "reproducible" standards which should embody as closely as possible the absolute units of resistance and of current. The ohm was to be represented by the resistance at 0° C. of a column of mercury 106.3 cm. in length, having a uniform cross section (very nearly 1 sq.mm.) and a total mass of 14.4521 g. The ampere

was to be represented by the unvarying current that would deposit 0.001118 g. of silver per second from a silver nitrate solution. Public bill 105, passed by the United States congress on July 12, 1894, made these units, embodied in the reproducible standards and defined in terms of the metric units, the legal units of electrical measure in the United States.

It was recognized that the units embodied in the reproducible standards did not correspond exactly to the absolute units defined in terms of the mechanical units and, to avoid confusion, the former were designated as "international" units. In 1910 representatives of the national laboratories of France, Germany, Great Britain and the United States carried out measurements at the national bureau of standards in Washington, D.C., and assigned values to standard resistors and standard cells from each of the collaborating countries, in terms of international units. From that time until 1948, the 1910 determinations and the international units served the world as the basis for electrical measurements.

A series of determinations of the units of resistance and of current directly in terms of mechanical units, performed in the national laboratories of several countries, culminated in 1948 in the adoption of a new set of absolute units which differed by a few hundredths of a per cent from the previously accepted international units. At the same time the International Committee on Weights and Measures recommended that the metre be used as the unit of length and the kilogram as the unit of mass in defining the electrical units. Thus all electrical measurements derive ultimately from the prototype metre and kilogram preserved at the International Bureau of Weights and Measures in Sèvres, France, and also from the second, defined in terms of the motion of the earth.

While the differences are small between the international units used in measurements before Jan. 1, 1948, and the absolute units employed since that date, these differences are by no means negligible in accurate measurements. The differences in these units are given in the accompanying table.

Conversion Table for Electrical Quantities
International Units to Absolute Units

Resistance	1 int. ohm	= 1.000495 abs. ohms
Electromotive force	1 int. volt	= 1.000330 abs. volts
Current	1 int. ampere	= 0.999835 abs. ampere
Charge	1 int. coulomb	= 0.999835 abs. coulomb
Inductance	1 int. henry	= 1.000495 abs. henrys
Capacitance	1 int. farad	= 0.999505 abs. farad
Power	1 int. watt	= 1.000165 abs. watts
Energy	1 int. joule	= 1.000165 abs. joules.

II. ABSOLUTE MEASUREMENTS

The basic measurements which must be performed to establish the electrical units in terms of mechanical units require the utmost care in the design and construction of the required instruments and a very high degree of skill in their operation in order to assign sufficiently accurate values to the primary electrical standards. These considerations have effectively limited absolute electrical measurements to the national laboratories which, in the various countries, are legally charged with the duty of establishing and maintaining standards.

The national bureau of standards (Washington, D.C.), the National Physical laboratory (Teddington, Eng.), the Physikalisch-Technische Reichsanstalt (Berlin), and more recently the Physikalisch-Technische Bundesanstalt (Brunswick, Ger.) have all carried out such determinations, as have the national laboratories of Japan, the U.S.S.R., Canada and Australia. Their results have been intercompared by means of the standards maintained at the international bureau in Sèvres; and there is no doubt that the electrical units are closely the same throughout the world.

The absolute determination of two of the electrical units, the ohm and the ampere, permits the assignment of values to all the others through simple relationships, such as Ohm's law. Hence, all of the important absolute measurements have been either ohm or ampere determinations. There are various ways in which the ohm and ampere can be determined in terms of length, mass and time; a single example of each will serve to illustrate the principles involved.

1. Lorenz Apparatus.—This device, sometimes used in the ohm determination, is one of the simplest to describe. It consists of a metal disk which rotates in the magnetic field of a coaxial cylindrical coil that carries a current I. If M is the mutual inductance between the coil and disk (the magnetic flux through the disk for unit current in the coil) and n is the number of revolutions per second of the disk, any radius of the disk cuts across the whole flux MI each revolution or MnI lines of force per second. This, by definition, is the e.m.f. $E = MnI$ developed between the centre and edge of the disk. If the current in the coil also passes through a resistance R it develops a potential difference $V = RI$ between the terminals of the resistor. The e.m.f. E is compared to the potential difference V by opposing them to each other with a galvanometer as the detector of their difference. When the speed of the disk is varied, a speed can be found at which $E = V$ or $MnI = RI$, so that $R = Mn$. The mutual inductance M is a constant of the apparatus and can be computed from the dimensions and number of turns in the coil and the diameter of the disk. It will be observed that resistance has been determined as the product of a calculable mutual inductance and a frequency (revolutions per second).

Other ohm determinations have employed different forms of calculable mutual inductors or calculable self inductors, but in each instance resistance is determined as the product of an inductance that can be calculated from measured coil dimensions (length) and a frequency (time). It should be noted that the combination of a calculable capacitance and a frequency may equally serve to determine resistance as a function of length and time.

2. Current Balance.—The current balance, used in absolute ampere determinations, is an instrument in which the force between current-carrying conductors is measured. In one form the balance has a coil of wire suspended from one arm of an accurate equal-arm beam balance. This coil carries the current I to be measured. It is free to move in the field of a coaxial fixed coil which carries the same current.

The force between the fixed and movable coils is $F = I^2 \partial M/\partial X$, where $\partial M/\partial X$ is the rate of change of their mutual inductance with displacement along the line of motion. The weight of the movable coil (in the absence of current) is counterweighted at the opposite end of the balance beam, and the force, upward or downward between the coils when carrying current, is balanced by an added mass m on the appropriate balance arm. This force is mg, where g is the acceleration of gravity at the place where the experiment is performed. The two forces being equal, we may write

$$I\partial M/\partial X = mg \text{ or } I^2 = \frac{mg}{\partial M/\partial X}$$

The coils are so constructed that the value of $\partial M/\partial X$ can be computed from measurements on the coils. It should be noted that the current is measured in terms of mass, length and time.

Because the measured current exists only at the time of measurement, the experiment is used in practice to assign a value of e.m.f. to a standard cell by opposing this e.m.f. by an equal potential difference IR, developed by passing the measured current I through a resistance R of known value.

Thus, both an absolute ohm and an absolute ampere determination are required to assign an e.m.f. value to the cell; but the combined determinations yield two physical standards (a standard resistor and a standard cell) in terms of which the electrical units are always available in the intervals between absolute determinations.

III. PRIMARY ELECTRICAL STANDARDS

Although the values of the electrical units are initially assigned through absolute ohm and ampere determinations, they are preserved and made continuously available in the various national laboratories in terms of groups of 1-ohm resistance standards and of standard cells of known e.m.f. These groups of resistors and cells are designed to be as stable as possible and are compared at intervals with each other and with similar standards from other national laboratories to insure that their values remain constant.

1. Standard Ohm.—Manganin is the resistance alloy used in

all standard resistors and in most precision resistors of high quality. It consists of about 84% copper, 12% manganese and 4% nickel; it is characterized by its low temperature coefficient of resistance and its low thermal e.m.f. against copper. Its resistivity is about 25 times that of copper.

The Thomas standard, designed by James Thomas in 1930, has become generally recognized as the most stable of 1-ohm standards. In its construction, bare manganin wire is wound on a mandrel and annealed at 550° C. in an inert atmosphere. It is then slipped on a silk-insulated metal coil form, fixed in place without introducing mechanical strains, and hermetically sealed in a dry double-walled container. After the wire has attained equilibrium with the small amount of air sealed in with it between the double walls of the container, no further change of resistance occurs. A group of 1-ohm Thomas-type standards is used to maintain the value of the ohm at the U.S. national bureau of standards. No member of this group has changed by as much as 1 part in 1,000,000 over a 10-year interval.

2. Standard Cell.—Early attempts to establish a stable reference standard of voltage were not entirely successful. The Daniell cell (1836) had electrodes of copper and zinc with zinc sulfate as electrolyte, and produced an e.m.f. of 1.08 v. However, such cells lasted only a few weeks and were reproducible only to about 1% accuracy.

The Clark cell (1872) used electrodes of mercury and zinc amalgam in a saturated solution of zinc sulfate to produce an e.m.f. of about 1.43 v. These cells were also rather short lived and had a relatively large temperature coefficient of e.m.f. The Weston cell (1892), with electrodes of mercury and cadmium amalgam in a saturated solution of cadmium sulfate, has an e.m.f. of about 1.0186 v. at 20° C. and represents a great improvement over the earlier standards. When properly made from suitably purified materials, Weston cells can be constructed to have the same e.m.f. within a few microvolts, and may be expected to maintain a constant value over many years.

Some of the cells which were constructed in 1906 as part of the primary standard of e.m.f. for the United States are still in use at the national bureau of standards after more than half a century. The e.m.f. of the cadmium normal cell at any temperature t° C. is given by the formula

$$E_t = E_{20} - 0.0000406(t - 20) - 0.00000095(t - 20)^2 + 0.00000001(t - 20)^3$$

When kept in a controlled temperature environment and properly used, the cadmium normal cell is the most accurate standard of voltage known. The average e.m.f. of a group of such cells in a constant-temperature bath is used at each of the national laboratories as the standard of e.m.f.

A second form of cadmium cell having the same electrodes but with an unsaturated solution of cadmium sulfate as electrolyte (becoming saturated at 4° C.) is much used as a standard of e.m.f. for general laboratory and measurement work. It has a useful life of only about ten years, but its temperature coefficient of e.m.f. is much smaller than that of the saturated cell (about $\frac{1}{8}$ as large) and it will tolerate much rougher usage.

IV. INDICATING INSTRUMENTS

In a quite general way, instruments which indicate the value of current or voltage in an electrical circuit have certain features in common. The quantity to be measured is caused to produce a mechanical force on a pivoted or suspended member, tending to rotate it. The rotation is opposed by a mechanical spring, and the equilibrium position of the movable element, where the torque resulting from the action of the electrical quantity is just balanced by the counter torque of the displaced spring, depends on the magnitude of the electrical quantity. This equilibrium position is indicated by a pointer attached to the moving element, and its reading on an appropriate fixed scale is a measure of the electrical quantity.

Such a mechanical system, rotating about a fixed axis under the action of opposing forces, will tend to oscillate about its equilibrium position unless damping means are provided to absorb the energy of motion and bring the system to rest. Two types of damping are regularly used. Magnetic damping utilizes conductors which form a closed electrical circuit and move in the field of a permanent magnet. The motion of the conductor in the field induces an e.m.f., and the resulting current dissipates energy as heat in the resistance of the circuit. The circuit may be the local eddy-current circuit of a metal vane or sheet attached to the moving element, or it may include the coil which forms the moving element (as in a galvanometer) together with the external circuit to which it is connected. Fluid damping makes use of the viscous flow of air (sometimes oil or another liquid) across a moving element to absorb the energy of motion. In practice a vane, attached to the rotating element of the instrument, moves with small clearance in a closed chamber. The air which it compresses ahead of it as it moves flows back over its edge and provides the desired energy absorption. In either fluid or magnetic damping, energy of motion is absorbed by the damping mechanism and dissipated as heat in bringing the moving system to rest. In the design of an instrument, damping is usually adjusted to be somewhat less than critical, *i.e.*, the moving system overshoots its equilibrium position slightly and quickly settles back to its proper indication.

Instruments whose indicating element turns in bearings have additional frictional forces which oppose motion. Because the deflecting torque is always small, it is essential that bearing friction also be minimized, and such bearings usually consist of hardened steel pivots turning in sapphire cup jewels with the bearing contact area held to the smallest value which will support the weight of the moving system. Where friction must be further reduced, diamond pivots in sapphire bearings have been used to advantage. Bearing friction can be avoided altogether by suspending the indicating system from thin metal ribbons or "torsion bands" which also act as the instrument springs. This is done where the deflecting torque is extremely small (in galvanometers) or where the instrument has to endure heavy shock or vibration in use.

A. Current and Voltage Measurements

Instruments used to measure current or voltage have many features in common. In fact, any instrument whose basic response is to current can be adapted to the measurement of voltage and an instrument which responds to potential differences can be adapted to the measurement of current. This follows from Ohm's law, that the voltage E appearing across a resistance R which carries a current I is the product of the current by the resistance $E = IR$. Thus, if a known resistance be connected in series with a current-sensitive device, the response of the instrument is a measure of the voltage across the combination.

Similarly, if a voltage-sensitive device be placed across a known resistance carrying a current, the instrument response is a measure of the current in the resistor.

1. Potentiometer.—The potentiometer is the most precise instrument available for measuring direct current or voltage. It consists of a circuit in which voltages are compared with the known e.m.f. of a standard cell. An elementary potentiometer could be a long uniform slide-wire MN (*see* fig. 1[A]), which carries a fixed current I. If R is the resistance of the wire per unit

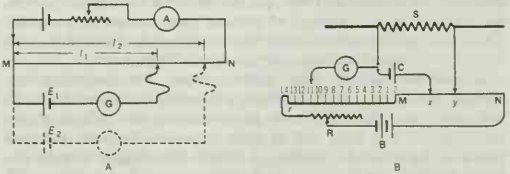


FIG. 1.—POTENTIOMETER: (A) SLIDE-WIRE TYPE; (B) CROMPTON TYPE

length, the voltage difference between two points on the wire separated by a distance l is $E = Rll$. Then if a cell of known e.m.f. E_1, in series with a galvanometer G to detect the presence of any potential difference, is connected to two contacts on the slide-wire and one of them is moved until the galvanometer indicates that the voltages are equal, $E_1 = Rll_1$, where l_1 is the dis-

tance between the contacts at balance.

On substituting another cell of e.m.f. E_2 and moving the contact until a voltage balance is again obtained at a separation l_2, then $E_2 = Rll_2$. If the wire is uniform and the current, measured at the ammeter A, remains constant between the two balances,

$$\frac{E_2}{E_1} = \frac{l_2}{l_1} \text{ or } E_2 = E_1 \frac{l_2}{l_1}$$

The unknown e.m.f. E_2 is thus determined from the known e.m.f. E_1 and the ratio of slide-wire lengths required to balance E_1 and E_2 against the potential drop along the wire.

The potentiometer can be made direct reading and at the same time more convenient to operate by the following modification, known as the Crompton potentiometer (*see* fig. 1[B]). Suppose the slide-wire is 1 m. long, its resistance 10 ohms and it carries a current of 0.01 amp. The total voltage drop along it will be 0.1 v. or 0.0001 v. per millimeter. Then any number of fixed resistors of 10 ohms each can be connected in series to one end of the slide-wire and, for the same current, will each have a voltage drop of 0.1 v.

The diagram of fig. 1(B) shows a potentiometer with such a slide-wire MN, a standard resistance S and a dial of 14 fixed coils, whose current is supplied from a battery B and adjusted to proper value with rheostat R by using a reference cell C. If C were a cadmium cell having an e.m.f. of 1.0187 v., the left-hand contact (on the dial) could be set on the eleventh contact of the dial (1.0 v.) and the right-hand contact at 187 mm. from the left-hand end of the slide-wire (0.0187 v.). When the current is brought to its proper value by adjusting the rheostat R, the total voltage drop will exactly balance the e.m.f. of the reference cell (1.0187 v.), and the potentiometer is ready for use. Any other source of voltage up to 1.5000 v. can now be substituted for C and balanced by varying the positions of the dial and slide-wire contacts. At balance the voltage may be read directly from the dial and slide-wire contact positions.

Higher voltages, up to 1,000 v. or more, can be measured by using a volt box, which consists of a group of series resistors of known ratio such that, when the high voltage is placed across the group, a low voltage (within the range of the potentiometer) appears across a section and is measured. The total voltage is then the potentiometer reading multiplied by the volt-box ratio. For example, a volt box could be made up with 10,000 ohms resistance and tapped at a point 100 ohms from one end. This voltage divider would have a ratio of 100:1 and could be used to measure voltages up to 150 v. on the potentiometer described above. If a current is to be measured, it is passed through a resistance (1 ohm, 0.1 ohm, 0.01 ohm, etc., depending on the magnitude of the current) and the voltage drop across the resistor is measured with the potentiometer. For example, a current of 100 amp. through a 0.01 ohm shunt would develop a voltage drop of 1 v., and this could be measured on the potentiometer.

The potentiometer is not only the most precise of all D.C. instruments, but is also the basic tool in a measurement program. It measures voltage and current in terms of standard cells and standard resistors that need not be more than a single step removed from the primary electrical standards. Simultaneous measurements of current and voltage can be used to measure power, since power is the product of current and voltage in a circuit. Thus, the potentiometer is the instrument with which D.C. ammeters, voltmeters and wattmeters are calibrated.

2. Galvanometer.—The galvanometer, for indicating extremely small currents, is usually a suspension instrument. In its common form, the d'Arsonval galvanometer, the deflecting system consists of a light coil of wire suspended between the pole pieces of a permanent magnet by means of a copper or gold ribbon a few thousandths of an inch wide and less than a thousandth thick. A small mirror, mounted on the coil, serves as an optical pointer and indicates the coil position by reflecting a light beam onto a fixed scale.

Current is conducted to and from the coil by the suspension ribbons, and the reaction of the current in the coil with the radial magnetic field in which it is suspended produces a torque that tends to rotate the system. The action can be likened to that of a tiny motor winding up a spring.

Modern galvanometers may have a sensitivity of as much as 1 mm. of deflection (on a scale 1 m. distant from the mirror) for a current of 0.00001 μamp. (10^{-11} amp.), with a coil resistance of 800 ohms. Current sensitivity is increased by using more turns of finer wire in the moving coil and by reducing the cross section and stiffness of the suspension ribbon.

Galvanometers may also be used for the detection or measurement of very small voltages in closed electrical circuits. In this instance it is advantageous to use a few turns of relatively coarse wire in the moving coil. A galvanometer having a resistance of 12 ohms and a response of 1 mm. for 0.1 μv. (10^{-7} v.) in a 25-ohm circuit is an example of a modern voltage-sensitive instrument. In general, current-sensitive instruments are characterized by relatively high resistance, while voltage-sensitive instruments have low resistance.

In addition to appropriate current or voltage sensitivity, it is important in selecting and using a galvanometer that consideration be given to the resistance of the circuit in which it is to be used. This should be equal to or slightly greater than the critical damping resistance of the instrument in order that the moving system slightly overshoot its equilibrium position and come to rest in the minimum possible time. If the circuit resistance is too low, the galvanometer will be overdamped and its motion will be sluggish; if too high, the galvanometer will be underdamped and the moving system will oscillate about its equilibrium position with gradually decreasing amplitude.

In addition to its use for the detection and measurement of minute currents or voltages of constant value, the galvanometer may be used ballistically to integrate a transient current or voltage pulse of short duration. The electric charge in a capacitor can be measured by allowing it to discharge through a galvanometer and observing the magnitude of the moving system's first excursion from its rest position. The response of the instrument to a current of short duration defines the coulomb sensitivity. The deflection is proportional to the time integral of current, or to electric charge.

Similarly, a voltage pulse arising from changes in a magnetic field linking a coil of wire is a measure of the total change in coupling between the field and coil, the time integral of voltage during the change. This type of response is defined by the e.m.f.-time (or flux-linkage) sensitivity of the galvanometer.

Thus, a galvanometer has four different sensitivities which describe its performance in various applications. It is of interest to note that only one of them, current sensitivity, is completely defined solely by the galvanometer design constants—the strength of the magnetic field in which the coil moves, the area turns of the coil and the stiffness of its suspension. Voltage, coulomb and e.m.f.-time sensitivities are all functions of resistance of the circuit to which the galvanometer is connected. Both steady-state and transient voltage response increase with decreasing circuit resistance, while response to a transient current increases with increasing circuit resistance.

As stated above, the galvanometer and numerous other types of indicating instruments make use of the reaction between a magnetic field and a current-carrying conductor to achieve a measure of the current in the conductor, or of some related quantity. However, it is not essential that the current be carried by an indicating element suspended in the field of a fixed magnet system as is done in the d'Arsonval galvanometer.

Similar response can be accomplished, and with equal sensitivity, by making a magnet the moving element, and conducting the current through fixed coils. In galvanometer applications the chief advantage of this alternative construction is that the suspensions of the moving system, which do not now have to carry current, can be made of extremely fine quartz fibres, with much reduced stiffness. As the response of the indicating system depends on balance between the driving torque (resulting from the interaction of the magnetic fields of magnet and current) and restoring torque (resulting from suspension stiffness), the lower driving torque available in this arrangement is compensated by reduced suspension stiffness.

The principal disadvantage of the moving magnet, fixed-coil galvanometer is that its response is affected by the ambient magnetic field to a much greater extent than is the fixed magnet, moving-coil arrangement. For reasonable performance a moving magnet galvanometer must be elaborately shielded from external magnetic fields by a series of nested enclosures of high-permeability material, and for best results the construction must also be astatic, *i.e.*, the moving magnet and coil system must be arranged in matched pairs in such a manner that the torques resulting from a uniform external field will be in opposite directions and neutralize one another, while the torques that result from the reaction between the suspended magnets and the current in the coil pairs are additive. Despite the high sensitivity that can be achieved with this arrangement, it is little used in modern practice because of the difficulty of achieving adequate shielding from external magnetic fields.

3. Permanent Magnet Moving-Coil Instruments.—This basic class of instruments is used for indicating direct currents and voltages. The indicating system is similar to that of the d'Arsonval galvanometer. A coil with an attached pointer rotates in the field of a permanent magnet. In order that the angular response of the moving system be uniform, the magnet structure is designed so that its field is radial throughout the length of the air gap in which the coil turns.

Another design requirement is that the magnet maintain an unchanging field in the air gap, so that the calibration of the instrument shall not change in time. This requirement leads to the use of the characteristic horseshoe shape for instrument magnets of tungsten or chromium steel, whose length must be very great compared to their cross section for optimum energy storage, and to short thick magnets when dispersion-hardening steels such as alnico are used.

The moving-coil system usually turns on pivots in jewel bearings, and the attached pointer moves over a graduated scale from which the value of current or voltage is read. In this construction spiral springs are used to conduct current to the coil and to supply the required counter torque. In some instances the moving system is suspended between taut metal bands which act both as springs and as current leads. This construction avoids the friction of mechanical bearings, and is used in some types of precision instruments.

For low current values (microammeters and milliammeters with ranges up to perhaps 20 milliammeters [ma.]) the current to be measured is carried by the springs and coil of the instrument. Larger currents would produce a significant temperature rise in the springs and alter their stiffness. Consequently, currents larger than 20 ma. are passed through a resistor (or shunt) across which a millivoltmeter is connected in parallel. Thus a voltage-sensitive element, responding to the voltage drop (up to 50–100 mv full scale) across the current-carrying shunt, is used to measure larger currents. Its scale is marked, of course, in terms of current in the shunt. All permanent magnet moving-coil ammeters use such a parallel circuit arrangement. For small currents the shunt may be within the instrument case. For large currents, where a substantial amount of heat must be dissipated by the shunt, it must be external to the instrument.

In measuring voltages it is always desirable that the current drawn by the instrument be small in order to minimize both the power consumed by the instrument and the load it imposes on the voltage source. Hence, for the measurement of direct voltages, a permanent magnet moving-coil system which will attain full-scale deflection with a current in the range from 0.1 to 10 ma. is used together with a series resistor (or multiplier) of such resistance that the rated voltage of the instrument produces full-scale current. The instrument scale is marked to read the voltage impressed on the combination of moving element and multiplier. Here also, for low and moderate ranges where the power dissipation is small, the multiplier is incorporated into the instrument case; for high ranges the multiplier is frequently external and must be connected in series with the instrument.

Permanent magnet moving-coil instruments respond to the average value of their operating current and so, while they are ideally suited to the measurement of unidirectional currents and voltages, they cannot be directly used for the measurement of alternating currents, which vary rapidly and continuously between equal values in opposite directions, so that the average value is zero. The torque produced on the moving system of such an instrument would reverse in direction with each reversal of current, with the result that the coil could never move from its zero position, or at most would vibrate about it with small amplitude. However, such indicating systems can be adapted to the measurement of alternating currents by one of several devices.

Rectifier Instruments.—Copper oxide and other types of dry rectifiers can be used in combination with permanent magnet moving-coil indicating systems in the construction of voltmeters and low-range milliammeters for measuring alternating voltages and currents in the power and audio-frequency regions.

A full-wave four-element bridge-type rectifier, connected as shown in fig. 2, is used with the A.C. input impressed across one

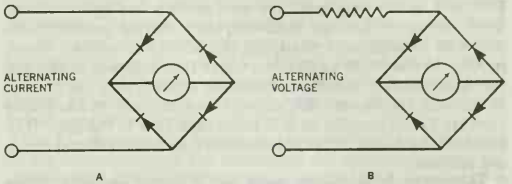


FIG. 2.—RECTIFIER INSTRUMENT CONNECTIONS: (A) MILLIAMMETER; (B) VOLTMETER

bridge diagonal and the D.C. milliammeter connected across the other. For voltmeters a resistance of appropriate value is connected in series with the input terminals. The rectifier assembly consists of copper disks, $\frac{3}{16}$ in. or less in diameter, with a surface layer of cuprous oxide, assembled into a stack with appropriate electrodes and sealed in a housing. Small disks are used to keep the current density high in the rectifying surfaces (with low consequent forward resistance), and to keep the capacitance of the bridge low in order to reduce the errors of the instrument at the higher audio frequencies. The milliammeter responds, as would any D.C. instrument, to the average value of the current in its moving coil.

For engineering applications the root-mean-square (r.m.s.) value of current or voltage is generally desired, and consequently the scales of most rectifier instruments are marked in terms of r.m.s. values for an assumed sine-wave input. This scale convention coupled with the actual response to average rather than r.m.s. values results in errors of indication on nonsinusoidal inputs. Also both the forward and reverse resistances of the rectifier elements have large but different temperature coefficients of resistance, resulting in a substantial temperature coefficient of indication. Because of their frequency, wave form and temperature errors, rectifier instruments must be considered as devices of low or moderate accuracy. However, they are very rugged, have high sensitivity and are quite suitable for audio-frequency applications in which accuracy requirements are moderate. Also, the D.C. mechanism is directly available when the rectifier is disconnected. Consequently, this type of instrument is widely used in compact test sets with which, by suitable switching, both A.C. and D.C. currents and voltages can be measured.

Such instruments, with a large number of A.C. and D.C. current and voltage ranges, are very convenient for use on the test bench, in electronics laboratories and in servicing electronic and electrical equipment.

Thermocouple Instruments.—The permanent magnet moving-coil systems for alternating current and voltage measurements are also employed in thermocouple instruments. The current is passed through a heater element (usually a fine wire) in thermal contact with one junction of a thermocouple. The thermocouple, consisting of wires of two different metals or alloys joined together in series, has the property of generating a small e.m.f. where the junction points between the dissimilar metals are at different temperatures. Thus, at the thermocouple junction in contact with

the hot wire, an e.m.f. is generated which is proportional to its temperature rise and hence to the square of the current to be measured. The thermocouple circuit is completed by a low-range D.C. millivoltmeter and its scale is marked in terms of the r.m.s. value of heater current.

A thermocouple voltmeter uses the same arrangement but with the addition of a resistance in series with the heater element. In this instance the millivoltmeter scale is marked in terms of the r.m.s. input voltage across the resistor-heater combination. Since the instrument responds to the square of the heater current, no wave form error results on nonsinusoidal inputs.

Depending on the size and resistance of the heater element, current-indicating instruments are made with full-scale ranges from 1 ma. to 100 amp. At higher current ratings a thin-walled tube rather than a wire is used as the heater element. With proper heater construction and thermocouple arrangement, such instruments can be used to indicate current with negligible error from D.C. to 1 mc. in frequency, and with small errors up to 100 mc. They are much used for radio-frequency current measurements and, with suitable precautions, can also be used as transfer instruments. In this latter application, where their response is identical for equal values of direct or alternating current, they can be used to calibrate instruments that respond correctly only to alternating currents, *i.e.*, to transfer an A.C. calibration back to the basic D.C. standards by means of the potentiometer, standard cell and standard resistors.

Thermocouple voltmeters make use of heater elements of low current rating (a few milliamperes) and are useful from D.C. up through the audio-frequency range without serious error. With properly constructed resistance multipliers, having negligible inductive or capacitive residuals, the frequency range can be extended upward to 1 mc. or more. These instruments can also be used for transfer measurements from direct to alternating voltages if proper precautions are observed.

Electronic Voltmeters.—Vacuum-tube voltmeters also make use of D.C. indicating elements. In one of its simpler forms, such a voltmeter has an input circuit in which a miniature diode is arranged to charge a capacitor. A low-range D.C. milliammeter or a microammeter is connected with a high series resistance across the capacitor, and the current is a measure of the input voltage. If the discharge time of the resistor-capacitor combination is long compared with the period of the input voltage, the current in the D.C. meter is practically constant, and the response depends on the peak value of the input voltage.

Thus the lower frequency limit of the arrangement is determined by the time constant of the discharge circuit; the upper frequency limit for operation without substantial error is fixed by the distributed parameters of the input circuit and may be 100 mc. or more. It is fairly general practice to mark the scale in terms of r.m.s. values for an assumed sine-wave input and, as the response is to peak values, wave-form errors will appear on a nonsinusoidal input.

It should be noted that in the above arrangement, as is usual for indicating instruments, the power required to accomplish and maintain a deflection is supplied by the source on which a measurement is being made. This is not true of all electronic voltmeters. Starting with the same input circuit, a diode and capacitor, the voltage of the charged capacitor may be impressed on the grid of a triode or a more elaborate vacuum tube which acts as the initial element of a D.C. amplifier.

In such an arrangement the auxiliary power source, which is an integral part of the amplifier, supplies the power to operate the indicating instrument, and the drain on the measured source is extremely low. This is of great importance if the voltage from a high-impedance source is being measured.

There are many types of electronic voltmeters that use elaborations of the basic circuits above. The performance of the amplifier may be stabilized by a feedback loop of appropriate design. Also, such a circuit may be preceded by an attenuator for multirange operation, or by a preamplifier to extend the range of measurements to lower voltages. A typical commercial electronic voltmeter has an input impedance of 8 megohms at low frequencies, an input capacitance of 10 micromicrofarads, ranges from 0.1 to 150 v. and a frequency influence of no more than 3% up to 50 mc. and 12% at 100 mc.

4. Iron-Vane Instruments.—These are the commonest type of ammeters and voltmeters for laboratory and switchboard use at commercial-power frequencies. Such instruments can be built to measure current or voltage to all the accuracy needed for most engineering work, and still be produced more cheaply than any other type of A.C. instrument of equal accuracy and ruggedness. A vane or plate of high-permeability steel, together with spring, pointer and damping structure, forms the moving element of the instrument. This vane is situated in the field of a stationary electromagnet consisting of a coil of wire and, usually, a second iron vane which is fixed in position. The excitation of the electromagnet derives from the current or voltage to be measured, and the motion of the vane, when the electromagnet is excited, is always such as to increase the flux through it. Thus the torque produced by the reaction between the magnetic fields of the stationary and moving elements is in such a direction as to increase the inductance of the combination.

The energy stored in the magnetic field of a current-carrying inductor is proportional to the second power of the current, and it follows that the torque in the moving element increases with the square of the current in the fixed coil. Hence the response of the instrument is to r.m.s. current or voltage.

It should be noted that in this construction the measured current does not go through the moving element, and the sole function of the instrument spring is to provide the required counter torque. Approximately 200 amp.-turns are required to produce a deflection of 90° in the actuating coil of a portable instrument with a 5-in. scale. The coil, about 1 in. high, may be wound with the needed turns of appropriate size wire for any desired range; *i.e.*, 40 turns for a 5-amp. instrument or 200 turns for a full-scale current of 1 amp. For the highest range that is possible in a 200 amp.-turn instrument—200 amp.—a single turn casting is used. For a milliammeter, a coil of 4,000 turns will give a full-scale sensitivity of 50 ma.; such a coil, connected in series with an appropriate resistance, is used in a voltmeter. Throughout the entire group of instruments the iron structure and moving system are identical.

The operating magnetic field of an iron-vane instrument is relatively small, at most 60–75 gausses at full-scale deflection. As a consequence, moderate external fields will have a significant effect on the deflection unless the entire operating system, coil and vanes, is enclosed within a magnetic shield. For example, an error of as much as 10% may result from operating an unshielded instrument in a 5-gauss field; but the corresponding error in a properly shielded instrument may be no more than a few tenths of 1%.

While the most common use of iron-vane instruments is at commercial-power frequencies, they are by no means limited to these applications. They can be used effectively at frequencies well above 1 kc. However, the frequency range over which an individual iron-vane instrument may be employed without significant errors of indication is quite limited; both ammeters and voltmeters should be calibrated at a frequency that does not differ by more than 10% from that at which they are to be used.

The change of response of an ammeter with frequency results principally from eddy currents in the iron vanes and other metal parts of the structure within and around the coil. These eddy currents, whose magnitudes are proportional to the square of the frequency, give rise to local magnetic fields that modify the reaction between the iron vane and the field of the coil carrying the measured current. Thus, the torque of the moving system and the indication of the instrument for a given current are functions of frequency. This eddy-current effect is also present in voltmeters, but here there is another important source of frequency error. The inductance of the instrument's current coil, proportional to the square of the number of turns, becomes quite large in a voltmeter, whose coil may have several thousand turns. Consequently the combined impedance of the coil and series resistance increases substantially with increasing frequency, while

the voltage at the instrument terminals, required to provide operating current in the coil, increases at a corresponding rate.

As the voltmeter scale is marked in terms of the voltage needed at the instrument terminals to produce the operating current, the frequency range of the instrument is limited by the impedance change. The operating range can be substantially increased by shunting a portion of the voltmeter multiplier by a capacitor to compensate for the coil inductance but, since capacitive reactance decreases, there will be an upper frequency limit at which compensation is no longer adequate.

5. Electrodynamic Instruments.—Electrodynamic ammeters and voltmeters are usually made only in the best accuracy classes (laboratory standard and portable standard instruments) and are little used outside the calibration laboratory, although instruments of a similar construction are used almost universally to measure electric power. This is because they are much better adapted to make precise measurements of power than is any other type of instrument, whereas, for current and voltage measurements, the less expensive and more rugged iron-vane instruments are adequate in most engineering work.

Electrodynamic instruments are, however, used in the laboratory to check the calibration of other less precise A.C. ammeters and voltmeters, and to transfer calibrations from D.C. standards to instruments that respond correctly only to alternating currents and voltages.

Electrodynamic instruments make use of the magnetic fields of two sets of coils, one fixed and the other movable. Each coil carries a current which is a function of the current or voltage to be measured, and the reaction between the fields of the fixed and movable coils supplies the torque for the moving system. Here also, as in the iron-vane instruments, the energy storage in the magnetic fields of the coils is proportional to the square of the coil current, and electrodynamic instruments respond to r.m.s. current or voltage.

In the usual construction a moving coil is pivoted or suspended in the field of a pair of fixed coils, and has attached to it springs, pointer and damping vane. The moving-coil current is carried by the instrument springs and is limited to a fraction of an ampere. As the available torque is small, the weight of the moving system must be kept low. The result is a structure that is considerably less rugged than is the moving system of an iron-vane instrument.

The operating field is usually less than 60 gausses for full-scale deflection, and either the entire operating mechanism must be protected by a magnetic shield against external fields or the coil system must be astatic so that the presence of external fields will not result in any net deflecting torque.

In an electrodynamic voltmeter the fixed and moving coils are connected in series to carry the entire current, and a suitable multiplier fixes the voltage range. A low-range electrodynamic milliammeter would also have its coil system connected in series to carry the entire current. However, as the current capacity of the instrument springs limits the moving-coil current, higher current ranges make use of a parallel-coil arrangement. The fixed coils, which can have whatever current capacity is required, carry all but a small fraction of the measured current and have in series with them a resistor of appropriate size and current capacity. The moving coil, also with a resistor in series, is connected in parallel with the fixed-coil-resistor combination. The time constant of each branch of the circuit, *i.e.*, the ratio of inductance to resistance, must be the same in order that the division of current shall not change with frequency. Modern electrodynamic ammeters are seldom built in ranges above 10 amp. A current transformer together with a 5-amp. instrument is generally used for precise measurement of higher currents.

Frequency errors in electrodynamic ammeters arise from two causes. Metal present in coil supports and other parts, and in the instrument shield, will have eddy currents induced in it and will cause a change in deflection with changing frequency, in the same manner as for an iron-vane instrument. However, by proper construction eddy-current errors can be kept to a considerably lower level than is possible in the iron-vane ammeter. In addition to eddy-current errors, another must be expected. Because of the parallel branches, the ammeter coils operate in a closed loop of comparatively low impedance, and the coupling between fixed and moving coils will produce a circulating current in this closed loop, resulting in a torque which is a function of frequency. Frequency errors in electrodynamic voltmeters arise from eddy currents and from the self-inductance of the coil system. These also are similar in kind but smaller in amount than are to be expected in iron-vane voltmeters.

Before using an electrodynamic instrument in transfer measurements, the difference in its performance on D.C. and at the desired frequency should be checked.

6. Electrostatic Voltmeters.—In this type of instrument the deflecting torque results from the action of an electric field on charged conductors (electrodes). Such instruments are useful at low voltages when no appreciable current can be drawn from the circuit. They can also be designed for use at extremely high voltages. In fact the total range of voltage covered, with small errors in measurement, is greater than for any other class of deflecting instrument. They are built regularly in ranges from 50 to 100,000 v. Any good electrostatic voltmeter can be considered as a low-loss capacitor, so that on D.C. voltage, the operating current (after the initial charging current) is merely the very small leakage current required by the insulation resistance of the instrument (which may be as much as 10^{14} ohms).

On A.C. voltages the current is determined by the capacitance of the instrument and the frequency, the operating current increasing with increasing frequency as the reactance decreases. A 15,000-v. instrument, having a capacitance of 20 micromicrofarads, would require 120 μamp. for full-scale deflection at a frequency of 60 c.p.s.

In low-voltage electrostatic voltmeters the fixed and moving systems consist of groups of flat interleaved sector plates. As fixed and movable plate systems are insulated from each other, a voltage impressed between them results in the appearance of charges of opposite sign on the two sets of plates. The force of attraction between these charges produces a torque which is opposed by a spring or, in the case of a suspended system, by stiffness of the suspension bands.

In higher-voltage instruments, where large clearances must be maintained between the electrodes to prevent electrical breakdown of the surrounding air, fixed and moving elements may be sectors of coaxial cylinders, or the combination of a fixed flat disk and a moving cylindrical sector. Damping may be either by means of a vane attached to the moving element, moving with small clearance in a closed sector box, or by means of a disk which moves in the field of a permanent magnet.

Energy storage in the electric field of the voltmeter is proportional to the square of the voltage between its electrodes, and the response of the voltmeter is to the r.m.s. value of the impressed voltage. Operating torque is always small in electrostatic instruments, and may be increased only within rather narrow limits by increasing the capacitance between the fixed and moving electrodes. If either the number of plates or their area is increased, the weight of the moving system will be greater, with a consequent increase in bearing friction. If capacitance is increased by decreasing electrode separation, a limit is reached in low-voltage instruments at the mechanical clearance required for reliable operation, and at high voltages by the clearance needed to avoid corona or electrical breakdown.

Electrostatic voltmeters have a response that is independent of frequency and indeed, if they are suitably constructed and operated, they have no differences in indication on direct or alternating voltage. Thus, they can serve as transfer instruments to determine the difference between A.C. and D.C. response of other types of instruments. In fact, the National Physical laboratory of Great Britain employs electrostatic instruments as their basic transfer standards in the same way that the national bureau of standards of the United States uses electrodynamic instruments.

7. Instrument Transformers.—Ratio devices in the form of transformers are needed to extend the range of alternating current instruments, so that current, voltage, power and energy can be measured with instruments of moderate size and capacity. This

is important in the laboratory, and of even greater importance in commercial metering. Here power is frequently handled in large blocks at high currents and voltages, and it is necessary that the devices used to measure large currents or high voltages be both accurate and of low power consumption. The requirement of low power consumption precludes the use of shunts for current measurements beyond a few amperes and of series resistors in voltage circuits beyond a few hundred volts.

A transformer consists of two coils of wire, closely coupled by means of a magnetic circuit of high permeability which threads through both coils. It is the property of such an arrangement that when one coil (the primary) is excited by an alternating current, an alternating voltage of the same frequency is induced in the other coil (the secondary). If the secondary circuit is completed by an external impedance that is very large compared with the impedance of the transformer winding, the ratio of the voltages at the primary and secondary terminals of the transformer is very nearly the same as the ratio of turns in the primary and secondary windings. This is an elementary picture of a voltage transformer.

On the other hand, if the secondary circuit of the transformer is completed by an impedance that is very small, the ratio of currents in the primary and secondary circuits is very nearly equal to the reciprocal of the primary-secondary turn ratio, and one has a current transformer.

Thus, the two basic types of instrument transformers (for voltage or current transformation) are similar in that each consists of a primary and secondary coil closely linked by a high-permeability magnetic core. They differ in details of construction and in the conditions under which they operate. A voltage transformer, used to step voltages down from high to low values, may have many times as many turns in its primary as in its secondary winding. It supplies a very small operating current to the high-impedance voltage circuits of the instruments connected across its secondary winding, at a voltage which is a known fraction of the voltage across its primary winding. A current transformer, used to step currents down from high to low values, may have many times as many turns in its secondary as in its primary winding; in fact, the primary winding is often either a single turn or even the high-current conductor passed through the central window of the magnetic core. It supplies the low-impedance current elements of instruments or meters connected across its secondary winding with a current which is a known fraction of the current in its primary winding.

Voltage transformers are usually designed with a 120-v. secondary, and current transformers with a 5-amp. secondary. Primary voltages may be 200,000 v. or more in some instances, and the rated primary current of current transformers sometimes ranges as high as 12,000 amp. Both by refinement of design and by the use of high-quality magnetic core materials, the modern instrument transformer produces a current or voltage for the instruments connected across its secondary terminals that is within a few hundredths of 1% of the intended value, and consumes very little power in its operation. Good instrument transformers reflect accurately, on a known reduced scale, the current or voltage of their primary circuits, and thus serve to broaden enormously the range of A.C. values that can be measured with relatively simple instruments.

B. Power Measurements

The power at any instant in an electric circuit is the product of that current in the circuit and the voltage across its terminals at that instant, and is a measure of the rate at which energy is being transformed or made available. For direct current under steady-state conditions, power can be calculated from a measurement of any two of three quantities—current I, voltage E, resistance R—by using the appropriate one of the following relations

$$\text{Power} = EI = I^2R = E^2/R$$

In the case of an alternating current the instantaneous power varies continuously as the current and voltage go through a cycle of values.

If the current and voltage are both sinusoidal, the time average of power, which is usually the quantity of interest, is given by the expression

$$\text{Power} = EI \cos \phi$$

where E and I are the r.m.s. or effective values of voltage and current respectively, and ϕ is the electrical angle between them. Cos ϕ is the power factor and may assume any value between unity and zero as the phase angle between voltage and current varies from 0° to 90°.

1. Electrodynamic Wattmeter.—This instrument, of similar mechanical construction to the electrodynamic instruments already described, is well suited to the measurement of A.C. power at low frequencies. The field coils of the instrument are connected in series in the circuit so that their current is that of the load being measured, and the moving coil (with appropriate resistance) is connected across the load so that its current is proportional to the load voltage. Then the instantaneous torque from the reaction of the field-coil current with the moving-coil current is proportional to the product of the current and voltage in the circuit, and hence to the instantaneous power. As the variations of instantaneous power are too rapid for the moving system to follow, the equilibrium position it takes up will correspond to the average torque and therefore to average power. The instrument scale is marked in watts. The voltage and current elements are brought out to separate terminals so that they may be connected properly to the load circuit.

For small or moderate currents (up to 5 or 10 amp.) the load current is sent directly through the field coils of the wattmeter. For voltages up to perhaps 300 v., the moving-coil circuit, including a series resistor to limit its current to 25 ma. or less, is connected directly across the load. When power measurements involve larger values of current or voltage, instrument transformers of appropriate ratios are used to step down at the instrument to values that can be applied to a wattmeter having a 5-amp. current range and 150-v. voltage range.

The use of electrodynamic wattmeters for power measurements is restricted to low frequencies, a few hundred cycles per second at most, because of eddy currents and self-inductance of the moving-coil circuit, both of which tend to alter the phase relation between the magnetic fields of the current and voltage elements of the wattmeter, and give rise to errors of indication that increase with increasing frequency. These frequency errors can be made negligibly small at commercial-power frequencies by suitable design and construction, and the electrodynamic wattmeter is much used as a transfer instrument for the calibration of other A.C. instruments in terms of D.C. measurements of current and voltage. Such D.C. measurements can be referred readily to the basic electrical standards of resistance and e.m.f. by means of a laboratory potentiometer.

2. Electrostatic Wattmeter.—The electrostatic wattmeter is substantially free from eddy-current and inductance effects, and can be constructed to be independent of frequency over a much broader range than can the electrodynamic instrument. Hence, it also is used as a basic transfer instrument by several of the national standards laboratories. However the available torque is quite small, as with all other electrostatic instruments. Because its construction is inherently delicate and the techniques of operation require great care and skill, the electrostatic wattmeter is almost never used in routine power measurements. The instrument torque results from the electric field between fixed and moving electrodes, but the electrode arrangement is more elaborate than in the electrostatic voltmeter.

There are two sets of stationary electrodes maintained at a potential difference proportional to the load current. This potential difference is provided by the voltage drop across a resistor that carries the load current. The voltage drop across the load is impressed between the moving element and the midpoint of this shunt (*i.e.*, at the mean potential of the two stationary electrodes). The instantaneous torque is proportional to the product of load voltage and load current at any instant, and the deflection of the moving element is proportional to the average power into the load.

3. Bolometer.—The wattmeters described above are designed to measure power into a load, and are applicable only at low fre-

quencies. The accurate measurement of power into a load becomes more difficult with increasing frequency, and no simple or even adequate techniques are available for such measurements at radio or microwave frequencies. However, the power output of a generating circuit can be accurately measured at any frequency by absorbing the output and converting the electrical energy to heat. This can be done in the laboratory with a calorimeter in which the rate of heat production, measured by differential temperature rise, is a measure of the power output of the generator.

A more convenient means of measuring power output is with a bolometer bridge. A thermistor element, having a very large temperature coefficient of resistance, forms one arm of a Wheatstone bridge and is arranged to absorb energy from the generator. Its resistance change, as its temperature rises with the absorption of energy, becomes a measure of the power output of the generator. Such a device can be calibrated in terms of the product of the measured direct current and voltage required to produce the same resistance change in the thermistor.

C. Energy Measurements

The measurement of electrical energy is, from the viewpoint of economics, one of the most important of electrical measurements. Where electric power is generated or consumed, the commodity that is sold is energy, the time integral of power. The basic unit of power is the watt, and the corresponding unit of energy is the watt-second or joule.

More familiar units are the watt-hour (3,600 watt-seconds) and the kilowatt-hour (36×10^5 watt-seconds or 1,000 watt-hours). This latter unit, the kilowatt-hour, is the energy unit commonly used in billings for electrical service.

1. Commutator Watt-Hour Meter.—Developed by Elihu Thomson in 1889, this device is commonly used for metering D.C. energy. It is essentially a small motor provided with a magnetic brake and geared to a register or set of dials, whose count is proportional to the total number of revolutions. The gear train between the rotor shaft and the register dials is of such a ratio that the dials read directly in kilowatt-hours. The motor field consists of a few turns of heavy copper wire carrying the current of the load being metered.

The armature (or rotor) current is proportional to the line voltage. In this respect the instrument resembles the electrodynamic wattmeter, and its driving torque is proportional to the product of load current and line voltage. The armature has a silver commutator and silver- or gold-tipped brushes; it is carried on jewel bearings to minimize friction. For proper operation it is essential that the rotor speed be proportional to driving torque (and to the power being metered), and this is assured by providing a retarding or braking torque of sufficient magnitude to keep the speed of rotation rather low.

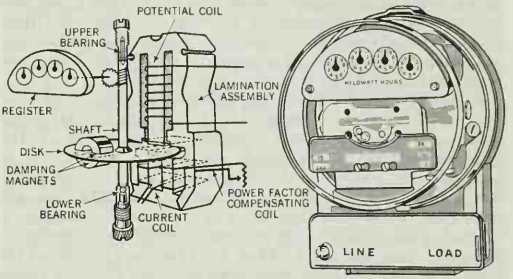
An aluminum disk is attached to the motor shaft and intercepts the flux of a permanent magnet. As the disk rotates, eddy currents are induced in it by the flux that it cuts, and the counter torque which results from the reaction between these eddy currents and the field of the magnet is proportional to the disk speed. Therefore, the speed of rotation of the motor shaft is proportional to the load power, and its total number of revolutions over a time interval is proportional to the energy consumed by the load during the interval.

2. Induction Watt-Hour Meter.—The induction watt-hour meter is used almost universally for metering A.C. energy. Its principle of operation, identical with that of the induction motor, may be understood by considering two laminated electromagnets A and B, situated on either side of an aluminum disk and displaced slightly from one another along its periphery. The alternating magnetic field of A induces eddy currents in the disk that intercept the field of electromagnet B, producing a torque on the disk. Conversely eddy currents induced in the disk by electromagnet B intercept the field of magnet A, and react to produce a torque. If the magnetic field of B lags in phase behind the field of A, the two torques are in the same direction and their sum is proportional to the product of the currents producing the fields and to the sine of their angular phase difference.

To produce a torque in the rotating disk proportional to load power, one of the electromagnets (say A) is wound with a few turns of heavy wire and is connected to carry the load current. The other electromagnet (B) is wound with many turns of fine wire and is connected between the power lines so that its current is proportional to load voltage. This electromagnet is designed to have a very large inductance and the current in its coil lags almost 90° behind the voltage producing it. By using an additional shading coil, the flux of this magnet intercepted by the disk, is made to lag precisely 90° behind the voltage and, since the sine of 90° is unity, maximum torque is developed if the current in the series coil (electromagnet A) is in phase with the voltage, *i.e.*, for a unity power-factor load. As in the commutator meter, the aluminum disk passes between the poles of a permanent magnet to provide a braking torque proportional to speed.

A gear train drives a register whose count is proportional to total revolutions of the shaft, and thus to energy consumption, providing a basis for billing the power customer.

Fig. 3 shows a single-phase meter such as is employed to meter the energy used in the ordinary household. Other meter types have two driving elements for a three-wire distribution system, or three elements for a four-wire system. For very large currents,



BY COURTESY OF SANGAMO ELECTRIC CO.

FIG. 3.—SINGLE-PHASE WATT-HOUR METER: (LEFT) SCHEMATIC; (RIGHT) ASSEMBLED

where huge blocks of power are metered for an industrial customer, the current coils of the watt-hour meter are connected through current transformers. When the metering must be done at high voltages, voltage transformers are also used to connect the meter to the power lines.

Because of the very large number of meters in use, and the high total value of the electrical energy consumed annually, a great deal of engineering talent has been devoted to refining watt-hour meter design. A modern meter may be expected to have an accuracy of nearly 1% over a wide range of loads and at temperatures ranging between the extremes of winter and summer, and to retain this accuracy over a period of many years with little or no maintenance.

D. Resistance Measurements

Depending on the accuracy required, it is possible to measure a resistance with a deflecting instrument called an ohmmeter, or compare its value with that of a known resistance in a ratio network such as the Wheatstone bridge.

Deflection methods generally may be expected to yield an accuracy of a few per cent, whereas bridge methods may be used with ordinary precautions for work which requires values to 0.1% and, with care, to 0.01% or better. In the national standardizing laboratories and in other laboratories having comparable equipment, nominally equal resistances can be compared in a bridge network to 1 part in 10,000,000.

1. Ohmmeter.—Ohmmeters are of two types. The series ohmmeter, which forms a part of many inexpensive multipurpose testing instruments, consists of a D.C. milliammeter in series with a small dry-cell battery and an adjustable rheostat. A gap in this circuit is provided with binding posts or test leads so that the resistance to be measured can be inserted conveniently into the circuit. With the test gap shorted out, the milliammeter is set by

means of the rheostat to a reference point on its scale marked zero. The pointer position with the gap open, so that there is no current in the circuit, is marked infinity.

When a resistor is connected across the gap to complete the circuit, the instrument pointer assumes a position intermediate between the zero and infinity marks, and the scale is marked in terms of resistance.

The ratio (or crossed-coil) ohmmeter represents a substantial improvement, as its reading is nearly independent of supply voltage and it need not be set to a reference mark each time it is used. It is a permanent magnet instrument with two moving-coil systems arranged so that their torques oppose one another. The circuit, containing a voltage source, is so arranged that the current in one coil is proportional to the voltage across the resistor to be measured. The current through the other moving coil goes also through the resistor. Thus the torques resulting from the currents in the two moving coils represent respectively the voltage across the resistor and the current through it. As these torques oppose one another, the instrument pointer takes up a position representing their ratio, the quotient of the voltage by the current in the resistor.

The instrument scale is marked in resistance units. Such instruments, with a supply voltage ranging from 500 to 5,000 v., are used for measuring the resistance of electrical insulation, and their scales are usually marked in megohms. A somewhat similar type of crossed-coil instrument is arranged for four-terminal measurements, and its scale may be marked in microhms.

2. Wheatstone Bridge.—The Wheatstone bridge consists of two parallel branches (as shown in fig. 4), carrying currents i_1 and i_2 respectively, supplied from a common voltage source. If the individual resistors of one branch, say p and r, have a ratio of fixed value, the resistors in the other branch can be brought to the same ratio by adjusting the value of one of them. The ratios are equal when the potential drop caused by the current i_1 in resistor p is equal to the potential drop resulting from i_2 in q. Simultaneously, of course, $i_1 r = i_2 s$. Thus, when the resistance ratios are equal in the two branches, there is no potential difference across the galvanometer; and its zero indication demonstrates balance in the bridge. For this condition $p/r = q/s$ or $q = s \times p/r$. The value of the resistor q is determined from a known ratio p/r and a known resistance s. At balance it is also true that $p/q = r/s$ and it follows that the galvanometer can be interchanged with the voltage source in the network without affecting the balance condition.

This interchangeability is, in fact, characteristic of any bridge network, and can frequently be used to advantage, by placing the voltage source and the detector of unbalance to obtain best sensitivity; *i.e.*, larger detector response to a given proportional unbalance of the bridge and, hence an observable response to a smaller unbalance.

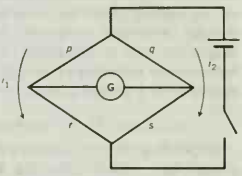


FIG. 4.—WHEATSTONE BRIDGE

If the voltage sensitivity of the galvanometer is known for the circuit resistance which it encounters in the bridge, its response to any specified proportional departure from the balance condition can be computed easily. The unbalance voltage e, acting to deflect the galvanometer, is given by the formula

$$e = E\Delta\frac{pr}{(p+r)^2} = E\Delta\frac{qs}{(q+s)^2}$$

where E is the supply voltage at the bridge terminals and Δ is the proportional unbalance. It should be noted that the alternative formulas provide for a departure of any arm from the balance condition; *i.e.*, the expression is used which includes the unbalanced arm.

The Wheatstone bridge is regularly used in a variety of forms for the precise measurement of resistance in the range from 1 ohm to 100 megohms. For a resistance less than an ohm, the resistance introduced at the terminals of the bridge when connecting it into a circuit becomes increasingly important with decreasing total resistance. For example, if the terminal resistance amount to 0.001 ohm and the resistor itself is 0.01 ohm, the terminals contribute 10% of the whole. Hence, the precise definition and measurement of low resistances must avoid inclusion of these terminal resistances.

Low-valued resistors in the precision class have four rather than two terminals, the current being introduced through one pair and the potential drop measured between the other pair. The resistance of a four-terminal resistor is defined as the ratio of the voltage difference between the potential terminals to the current entering and leaving the current terminals. Bridges for measuring or comparing four-terminal resistors must have two pairs of ratio arms rather than one. The Kelvin bridge network shown in fig. 5 is such an arrangement.

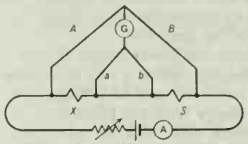


FIG. 5.—KELVIN BRIDGE

E. Capacitance and Inductance Measurements

Alternating current networks similar to the Wheatstone bridge are used to measure capacitance or inductance. One of the network branches may form a ratio pair and the other branch may be used to compare one inductor with another, or one capacitor with another. The value of the unknown element is determined from a known standard of the same kind, and the known ratio. The ratio arms of the bridge may be made up of two resistances, two inductances or two capacitances.

In any A.C. bridge, balance is possible only when there is no potential difference across the detector at every instant throughout the A.C. cycle. Thus, the ratio arms should have the same time constants, and the elements being compared should have equal phase angles. In other words, both magnitude and phase-angle balances are required in an A.C. bridge. This usually means that a resistance must be inserted in the arm containing one or the other of the elements being compared, to bring their phase angles to equality.

The Wheatstone network can also be arranged in a form known as the product-arm bridge, in contrast to the ratio-arm network just described. In this arrangement a capacitor can be compared to an inductor in the opposite arm, the remaining opposite pair of arms being resistors. Thus a capacitance can be measured in terms of an inductance and the product of two resistances, or an inductance can be measured in terms of a capacitance and a product of resistances.

To summarize the possibilities, if two capacitors (or two inductors) are to be compared in a four-arm bridge, they must be in adjacent arms. If a capacitor is to be compared with an inductor, they must be in opposite arms.

V. RECORDING INSTRUMENTS

In industrial and laboratory operations it is often necessary to have a record of the variations of voltage, current, power or some related quantity over an extended time interval. To make such a record, moving a pen over a paper chart, requires much more power in the operating mechanism of the instrument than is needed merely to indicate with a pointer the value of an electrical quantity. Direct-writing recorders have moving systems similar to those of the corresponding indicating instruments except that the torque requirements may be a hundred or even a thousand times greater. Some kind of clock mechanism must be incorporated into the instrument to move the chart paper at a uniform rate.

A second type, called a servo-recorder, has a small motor which takes its power from an auxiliary source and moves the pen across the paper. Servo-recorders make use of either a bridge or a potentiometer network in which a quantity is measured in terms of the balance position of a slide-wire that forms part of the network. When the network is unbalanced, the output of a detector or sensing element is fed into an amplifier. The amplifier output is applied to the motor which drives the slide-wire and the recording pen in the proper direction to restore balance to the network.

Large numbers of servo-recorders are used in industrial plants to record temperatures of furnaces or stills, using a thermocouple or resistance thermometer, or to record, by means of an electrical weighing device, the rate of flow of a material used or produced. In short, servo-recorders can be used to make a continuous record of any quantity which can, by some type of transducer be made to produce an electrical signal.

Frequently the amplifier output from the unbalance signal, or the position of the recording pen, is used to initiate controlling devices so that the entire operation is automatic except for supervision.

See also references under "Instruments, Electrical Measuring" in the Index.

Bibliography.—B. Hague, *Alternating Current Bridge Methods*, 3rd ed. (1932), *Instrument Transformers* (1936); F. Harris, *Electrical Measurements* (1952); H. Curtis, *Electrical Measurements* (1937); E. Golding, *Electrical Measurements and Measuring Instruments* (1940); C. V. Drysdale and A. C. Jolley, 2nd ed. rev. by G. F. Tagg, *Electrical Measuring Instruments* (1952); A. Palm, *Elektrische Messgeräte und Messeinrichtungen* (1948).

Continuing sources of information on electrical measuring instruments include the transactions of the American Institute of Electrical Engineers, the Institute of Radio Engineers and the Institution of Electrical Engineers (London). Other journals are *Review of Scientific Instruments*, *Journal of Scientific Instruments* (London,), *Archiv für Technisches Messen*, and *Zeitschrift für Instrumentenkunde*.

See also the technical publications of the various national laboratories, which are also useful, as are the electrical instrument specifications of the American Standards Association and of the corresponding standards bodies of other countries. (F. K. H.)

INSTRUMENTS, MATHEMATICAL: *see* Abacus; Computing Machines, Electronic; Mathematical Instruments; Office Machines and Appliances.

INSTRUMENTS, MEDICAL: *see* Artificial Organs; Diagnosis: *Instruments of Precision;* Electrocardiography; Electroencephalography; Endoscopy; Microscope; Nervous System, Surgery of; Radiology; Stethoscope; Ultrasonics: *Biological Effect and Applications.*

INSUBRES, a Celtic people of upper Italy, the most powerful in Gallia Transpadana. Their origin is obscure. Livy, whose account (v, 34) is not reliable, regards them as Aedui who came into Italy over the Montgenèvre pass. By about 400 B.C. the Insubres controlled a large area around their capital city, Mediolanum (Milan). From 225 to 194 B.C. they were frequently at war with the Romans; they helped Hannibal in the Second Punic War. In 222 B.C. they were defeated at Clastidium (mod. Casteggio) by M. Claudius Marcellus, who gained the *spolia opima* by slaying with his own hand their king Viridomarus; and in 194 B.C. they were finally subdued by L. Valerius Flaccus. Thereafter their tribal identity was gradually lost in the rise of municipal communities. The area was given Latin rights in 89 B.C. and full Roman citizenship in 49 B.C. *See* Gaul, Cisalpine.

INSULATING MATERIAL (ELECTRICAL). Electrical insulation is nonconducting material used to hold electrical conductors in position, separating them from each other and from surrounding structures. Insulation forms a barrier between energized parts of an electric circuit and confines the flow of electric current to wires or other conducting paths as desired. The insulation of electric circuits is a necessary requirement for the successful operation of all electrical apparatus.

Various types of materials are used as insulation, the selection being made on the basis of the specific requirements of each application. The copper conductors used in the electrical wiring in homes are insulated from each other and from the building by rubber or by plastics. These materials are low in cost, long lived and sufficiently flexible to withstand necessary bending. Extension cords of heating appliances are usually insulated with asbestos, a material which is capable of withstanding high temperature without deterioration. Overhead power lines operating at high voltage are supported on porcelain insulators which are unaffected by outdoor exposure. Paper is used to insulate the small wires of telephone cables and the conductors of high-voltage power cables; in the latter case the paper is impregnated with insulating oil to improve the quality of the insulation. Large electric generators and motors which operate at high voltages and high temperatures are insulated with mica. In some applications, solid insulation is used in conjunction with liquid or gaseous insulation. For example, in high-voltage transformers, solid insulation provides mechanical rigidity while insulating oil contributes to increased insulation strength and serves to carry heat out of the structure.

Electrical insulation is ordinarily regarded as a nonconducting material, but is, in fact, better described as a poor conductor or a substance of high resistance to the flow of electric current. Different insulating and conducting materials are compared with one another in this regard by means of a material constant known as the resistivity, the resistance measured across identically dimensioned samples of the several materials. The resistivities of a number of insulating materials are shown in the following table, along with the resistivity of copper, the most commonly used conductor material. As may be seen, the resistivities of the insulating materials are vastly greater than the resistivities of the metal. Nevertheless, in the normal operation of electrical equipment, minute conduction currents flow through the insulation separating the energized parts and a small amount of heat is thereby released within the insulation.

Under the influence of ordinary voltage application, insulation has extremely high resistance to current flow. However, if the voltage gradient (volts per centimetre thickness of insulation) exceeds a critical value, the resulting rearrangement of the atomic structure of the material results in a sudden decrease in the resistance of the material to such an extent that high-value currents may flow through local regions. Such a change leads to breakdown or "puncture." In the case of solid insulation, puncture represents permanent damage to the material, whereas in the case of liquid or gaseous insulation, the interruption of the current flow and the removal of the offending overvoltage restores the material to substantially original conditions. The puncture strength of several insulating materials is shown in the table.

Characteristics of Insulating Materials

Material	Resistivity ohm-cm.	Puncture strength volts per cm.	Relative permittivity
Air (20° C., 760 mm. Hg)	Very high	3×10^{4}	1.0
Amber	5×10^{18}		2.9
Bakelite			4.5–5.5
Glass	2×10^{13}	$0.5–3.0\times10^{6}$	5.4–9.9
Mica	2×10^{17}	$3.5–7.0\times10^{6}$	2.5–6.6
Oil	1×10^{12}	1.0×10^{5}	2.2–4.7
Paper		$1.0–4.0\times10^{6}$	2.0–2.6
Porcelain	3×10^{14}	1.0×10^{5}	5.7–6.8
Quartz	5×10^{18}	$2.0–2.5\times10^{5}$	3.5
Rubber	1×10^{15}		2.0–3.5
Copper	1.6×10^{-6}	...	...

Data from *Standard Handbook for Electrical Engineers*, 8th ed. (McGraw-Hill Book Company, Inc., New York, London, 1949). Electrical properties may vary considerably, depending on the processes of material preparation and the methods of test.

Two conducting bodies separated by insulation form a capacitor which is said to possess capacitance, the ability of the assembly to store an electric charge while voltage is being applied. The capacitance is influenced by the relative permittivity of the material employed as insulation. The relative permittivity of a material is defined as the ratio of the two capacitance values: (1) the capacitance between the two electrodes separated by the insulating material; and (2) the capacitance between the same electrodes with a vacuum replacing the subject material. The relative permittivities of several insulating materials are shown in the table.

The insulation material separating two electrodes is stressed when normal voltage is applied to the electrodes and this stress is reversed with each reversal of the applied voltage. This change of stress involves molecular rearrangement within the insulation with the attendant release of a small amount of heat with each reversal. If the applied voltage is of low frequency (such as 60 cycles per second), this release of heat is ordinarily of little concern. At the high frequencies employed in many communications systems (millions of cycles per second), this heat release may be evident by insulation temperature rise and by a loss of energy from the electric circuit. Special plastics, ceramics and glasses, exhibiting very low heat loss at high frequency, have been developed for the communications industry.

Insulating materials are subject to many deteriorating influences, the most important of which are moisture absorption and chemical changes. Porous materials, such as cotton and paper, must be effectively sealed against moisture, usually by immersion in oil or by impregnation with insulating varnishes. Silicone varnishes are used extensively as they form a very effective barrier against moisture and can withstand fairly high temperatures.

Insulating materials deteriorate under influences which change their chemical structures. Chemical changes which progress very slowly at room temperatures are, in some cases, greatly accelerated at elevated temperatures. For this reason, many types of electrical apparatus have specified maximum operating temperatures.

If operated at higher temperatures, insulation life will be noticeably shortened. Some organic compounds are damaged by exposure to ultraviolet light and corona, a product of high-voltage stress in air.

See ELECTRIC POWER: *Transmission; see* also references under "Insulating Material (Electrical)" in the Index. (J. R. E.)

INSULATING MATERIAL (THERMAL). The advantages of heat insulation must have been known very early in history. The comforts of fur clothing and snowhouses of the Eskimo, for example, certainly were realized hundreds of years ago. Wood was used for insulating steam boilers, engine cylinders and pipes early in the 19th century. The extensive development of commercial insulation, however, did not begin until about 1900.

Purposes of Heat Insulation.—The chief use of insulation is to retard the rate of heat flow. This may reduce the heat flow outward from a building or furnace, for example, or inward to a cold-storage warehouse. Great savings in fuel and electricity are made possible by the proper installation of insulation and it is often used to prevent condensation of water vapour on the inside of factory roofs where the manufacturing process requires or develops a high relative humidity, as in cotton or paper mills. Cold-water pipes in buildings are frequently insulated solely to prevent condensation and consequent dripping on warm humid days.

Working and living conditions can often be made more comfortable by the use of insulation. Buildings can be made cooler in summer and the working conditions around furnaces, hot flues, etc., improved. The addition of insulation to buildings, bake ovens, furnaces, etc., tends to produce a more uniform temperature distribution.

The low heat capacity of insulating firebrick is an important factor in saving fuel used by intermittently heated furnaces. The time required to reach a desired temperature may be reduced by the use of lightweight insulating firebrick to one-quarter that needed when conventional heavy firebrick is used.

Insulation is sometimes applied to structural steel in buildings to reduce the fire hazard. Underwriters' tests indicated that unprotected structural steel collapses quickly in a hot fire. The thermal expansion of concrete roof slabs can be much reduced by the use of insulation.

Proper insulation also will minimize the formation of lath patterns on walls of plaster over wood lath.

Factors Affecting the Value of Insulation.—The coefficient of thermal conductivity or K value of insulating materials increases with an increase of temperature. The loose fibre type generally increases much faster than the more solid type such as corkboard or 85% magnesia, as shown below:

Glass wool	2.1 lb./cu.ft.	0.28 @ 100° F.	0.55 @ 300° F.
85% magnesia	12 lb./cu.ft.	0.38 @ 100° F.	0.43 @ 300° F.

When referring to a K value of an insulating material, it is important to note the corresponding temperature. For insulating materials used at temperatures below 70° F. (21.1° C.), provision should be made to prevent moisture from entering the insulation. This is necessary because water has a K value more than ten times that of most insulating materials, and if it is present in the insulation the effective K value is increased materially and usually other difficulties develop. In cold-storage plants as well as houses, water vapour tends to enter from the warmer side and condense in the cooler parts of the insulation. Thus every effort should be made to seal the warmer sides of such walls so that they will be impervious to water vapour. This problem becomes especially serious when extremely low temperatures are encountered.

In general, for any given insulating material, the K value will increase with density but there are notable exceptions in the case of many loose fibrous materials and some powders. Bagasse (sugar cane fibre) has a minimum K value at a density of four pounds per cubic foot, the K value increasing if the density is made greater or less than this amount. Another factor that tends to increase the K value of a few insulating materials is radiation through the material and, in special cases of loose fibrous materials, there may be convection currents of air transmitting heat from the warm side to the cool side.

Types of Insulation.—Heat insulating materials may be roughly classified as follows: (1) powders, such as diatomaceous earth, silica aerogel, sawdust, etc.; (2) loose fibrous materials similar to eelgrass, glass wool, rock wool, shredded redwood bark, etc.; (3) blanket insulation, consisting of glass wool, rock wool, wood fibres, etc., enclosed by paper, cloth or wire mesh; (4) board or block insulation, such as corkboard, fibreboard, expanded glass block, 85% magnesia, vermiculite block, etc.; (5) insulating refractories such as diatomaceous earth and kaolin bricks; (6) heavy refractories such as fire clay, magnesite, silica bricks, etc.; (7) reflective insulation, consisting usually of aluminum foil with an adjoining air space. Reflective insulation is effective because it reflects a high percentage of the radiation striking it and also emits a small percentage of the amount of heat radiated by ordinary (nonmetallic) surfaces under the same temperature conditions.

See HEATING AND VENTILATION; *see* also references under "Insulating Material (Thermal)" in the Index. (G. B. Ws.)

INSULIN is a hormone secreted into the blood by cells situated in the pancreas; its chief function is to regulate sugar metabolism. Insulin, extracted from the pancreas of certain domestic animals, is administered to persons suffering from diabetes mellitus, in whom there is an absolute or relative deficiency of insulin. It is also used to some extent in the treatment of mental disease.

In mammals, in which the pancreas is well defined, the insulin-secreting cells lie in scattered groups called the isles of Langerhans, distributed among the relatively much larger groups, or acini, of pancreas cells. In certain fishes in which the pancreas does not occur as a definite gland but is spread out diffusely in the mesentery, the islet cells form compact encapsulated glands called the principal islets, which are often of considerable size and contain no pancreatic (acinar) cells.

In 1889 J. von Mering and Oskar Minkowski found that complete extirpation of the pancreas in dogs immediately caused severe diabetes, and it was not long before the hypothesis was formulated that this must be due to the withdrawal from the body of a hormone having the function of regulating the metabolism of the carbohydrates.

The name insulin was first suggested for a hypothetical internal secretion of the pancreas by J. de Meyer in 1909. Many attempts were made to extract it from the pancreas, but with little success. In 1921, however, Sir Frederick Banting and Charles H. Best, working in the laboratory of J. J. R. Macleod, found that extracts of partially degenerated pancreas and later of normal pancreas contained the hormone.

These observations demonstrated that insulin does exist in the pancreas, and the next step was to devise a method for extracting it in more purified form and in quantity from normal pancreas. Alcohol was found to be a suitable extractive, in that it dissolved the insulin and at the same time eliminated undesirable contaminants. Crude insulin prepared in this way by Banting and Best was first administered to human patients in Jan. 1922. Later J. B. Collip succeeded in sufficiently purifying the alcoholic extracts, by a process of fractional precipitation, so that they could be injected subcutaneously in man without causing local irritation. Very potent extracts were also prepared from the principal islets of fishes. Further purification of the extracts was effected by precipitating the insulin, either by adjustment of the reaction (isoelectric precipitation) or by means of picric acid followed by treatment with alcoholic hydrochloric acid (insulin hydrochloride).

The structure of the insulin molecule was elucidated theoretically in 1955 by Frederick Sanger (*q.v.*) of Cambridge university. Artificial synthesis of insulin (the first such synthesis of a naturally occurring protein) was achieved in 1964 by P. G. Katsoyannis and colleagues at the University of Pittsburgh.

The function of insulin is to promote the formation and storage of glycogen (a complex sugar), of fat and of protein; it increases the burning of sugar and decreases its excessive new formation from protein; it helps in the regulation of potassium and phosphate metabolism. Insulin counteracts the inhibitory effects of several other hormones on these processes.

When insulin is absent from the blood, as after surgical removal of the pancreas or when the islets are destroyed by disease (diabetes), less sugar is used and sugar production takes place in the liver more rapidly. The blood sugar becomes very high (hyperglycemia) and sugar appears in the urine (glycosuria). At a later stage substances known as ketone bodies also appear in the blood and urine (ketonuria), being derived from the incomplete oxidation chiefly of fatty acid but partly also of certain of the amino acids. Death ultimately occurs, either because of starvation caused by the excessive using up of the available foodstuffs of the body, or because of toxic effects for which the ketone bodies are believed to be largely responsible (diabetic coma). Insulin promptly removes all these symptoms when injected under the skin or into a blood vessel; it is inactive when given by mouth, because it is destroyed by the digestive ferments of the intestine. The effect passes off in a few hours, so that the injections must be repeated at least twice daily unless some material is combined with the insulin to slow the rate of its absorption. There are available various forms of slow-acting insulin.

When insulin is injected into normal animals the blood sugar, which usually stands at about 0.10%, rapidly diminishes; when it reaches a level at between 0.04% and 0.05%, curious symptoms supervene.

In most of the laboratory animals these hypoglycemic symptoms consist at first of nervous overexcitability leading to convulsions, and later of coma and fall of temperature. That the symptoms are related to the disappearance of free glucose from the blood is indicated by the fact that they are promptly removed by restoring glucose to the blood, either by giving sugar by mouth or by injecting solutions of glucose. Glucose is conspicuously more efficient as an antidote than any other sugar, even than mannose and laevulose which are so closely related to it chemically. The mechanism by which excess of insulin causes hypoglycemia in the normal animal is an exaggeration of its usual action; *i.e.,* it increases the burning of sugar and its storage as glycogen and fat.

There are no true substitutes for insulin, though a great variety of oral hypoglycemic agents have been tested. Some of these are related to guanidine (*q.v.*) and have produced liver injury. A series of compounds resembling the sulfonamides in chemical structure also have been tested in animals and man. One of these, called tolbutamide, produces very little toxicity in human subjects and gives very promising results in certain older mild cases of diabetes. Since tolbutamide, unlike insulin, is a substance foreign to the body, careful watch must be kept for many years to make certain that no ill effects appear. Some insulin, either natural or administered, must be available in the body for the hypoglycemic effects of tolbutamide or related drugs to be exerted. This agent is not effective in childhood diabetes or in the adult diabetic who is in acidosis or coma.

Since insulin can be prepared in crystalline form (J. J. Abel and E. M. K. Geiling) it may be weighed out for medicinal use, but it is more convenient to use it in liquid form, which keeps well in acid reaction. The strength of the liquid in actual insulin is determined by biological methods, one of which depends on the lowering of blood sugar in a normal rabbit. The strength is gauged in units, one unit of insulin being originally defined as the amount that on subcutaneous injection will lower the percentage of blood sugar to the convulsive level, 0.045%, for a period of five hours in a fasting rabbit of two-kilogram weight. In order to ensure uniformity in the strength of insulin manufactured in different countries, the health committee of the League of Nations set up a sufficient quantity of dried insulin. Later this original "yardstick" was replaced by purer, more potent standard preparations.

Testing laboratories maintain their own standards but they can have them checked against the international standard from time to time. By such international uniformity in strength of insulin, the diabetic patient is insured against variable dosage.

See also Animal Extracts; Diabetes Mellitus; Hormones, Vertebrate; Pancreas; and references under "Insulin" in the Index. (J. J. R. Macl.; C. H. B.)

INSULL, SAMUEL (1859–1938), U.S. public utilities executive known for his contributions to good utility operations and his mistakes in utility financing, was born in London, Eng., Nov. 11, 1859. He studied bookkeeping, worked with one of Thomas A. Edison's representatives and in 1881 went to the United States to become Edison's private secretary. When the Edison General Electric Co. was formed in 1889, Insull became a vice-president in its main office at Schenectady, N.Y. In 1892 he became president of the Chicago Edison Co., and four years later became a U.S. citizen. By 1907 the entire business of supplying electricity to the city of Chicago was in the hands of Insull's organization, now named the Commonwealth Edison Co. As a utilities executive he advocated the practice of supplying many communities from a central electrical station, and by 1917 his systems covered most of Illinois and extended into neighbouring states. He formed his first holding company, Middle West Utilities, in 1912.

During the 1920s Insull's electrical systems grew phenomenally, based in part on the use of central stations and in part on the formation of holding companies. Insull also promoted the sale of electrical utility stock to a great number of investors during the speculative era of the 1920s. With the depression of the early 1930s, his ambitious holding company pyramid collapsed, and in 1932 he fled to Europe, where he waged a losing battle to escape extradition. He was returned to Chicago in 1934 and was tried three times on charges of fraud, violation of federal bankruptcy laws and embezzlement, but was acquitted each time. He died on July 16, 1938, in Paris.

See Francis X. Busch, *Guilty or Not Guilty* (1952); F. McDonald, *Insull* (1962). (J. R. Lt.)

INSURANCE. Insurance may be described as a social device whereby a large group of individuals, through a system of equitable contributions, may reduce or eliminate certain measurable risks of economic loss common to all members of the group. Its primary function is to substitute certainty for uncertainty as regards the economic cost resulting from the accidental occurrence of disastrous events. Its effect is to spread the cost, which normally would fall upon a single individual, in an equitable manner over the members of a large group exposed to the same hazard.

Throughout the history of the institution there has been a tendency to restrict the word "assurance" to life business, although in England during the 18th century the word was also applied to other classes of business, *i.e.,* fire and marine. Even today in England, lawyers use the word "assured" to describe any person insured. An attempt has been made in the past to distinguish between "assurance" and "insurance" on the basis that the former relates to the insurance against a contingency which must happen (as for example in life business, where a person must either die or attain a certain age), while insurance is supposed to relate to all other contingencies (which can be insured against, but may not occur, as in the case of fire or burglary). The point is largely academic, but in England, life business is usually referred to as "assurance" and other classes as "insurance." From the beginning the term "insurance" seemed to find greater favour in the U.S.

Risk and Insurance.—Not all risks are insurable, nor is insurance the sole method of dealing with economic risk. Risk itself is the result of hazard. Risk is the chance of loss; hazard, the source of the loss. Hazards may be classified as physical or moral, or as those affecting all members of a community alike, such as business cycles and earthquakes, and those affecting only particular individuals, such as fire and theft. Risks based on a moral hazard are not regarded as insurable. Many of those affecting all mem-

bers of a community alike, such as unemployment arising out of the business cycle, are insurable only by the device of social insurance to be discussed later.

For insurance purposes it is important to distinguish the two broad classifications of risk, namely (1) pure risk and (2) business or speculative risk. The first is unilateral and negative, involving only the chance of loss. The second is bilateral, including the alternative possibilities of loss or gain. The latter is usually sought by those willing to incur the chance of loss as an appropriate price to pay for the prospect of a possible gain. Only pure risks are regarded as appropriate subjects for insurance. In addition, to be insurable, a risk must be measurable in quantitative terms, for which purpose the law of large numbers and the theories of probability and chance are employed. The law of large numbers is based on the observation that the larger the number of instances taken, the closer the result approaches the theoretical probability. Probability of loss may be expressed as a fraction, of which the denominator is the number of units exposed to loss and the numerator the number expected to be lost within a given period. Assuming adequate data on exposure and loss, probability of loss then becomes the ratio of losses to exposed units. To convert the probability of loss into "expectation of loss" or value of the risk, the probability of loss is multiplied by the average value of the units exposed to loss. Assuming, for example, the average value to be $10,000 and probability of loss 10/10,000, the expectation of loss will be 10/10,000 × $10,000 or $10.00. This amount may be called the pure premium or the individual loss-cost-share applicable to each unit in the group. Thus, if each unit in the group contributes this amount and experience conforms to the expectation, all losses will be covered.

In addition to the requirement that risks, to be insurable, must be of the pure variety as described above and must also lend themselves to measurement in quantitative terms, certain other conditions must be met before the institution of insurance may function. (1) The risk must be genuine, must exist for large groups of people, and its existence must be recognized by a sufficient number to warrant the establishment of an organization or organizations to insure it. (2) Persons exposed to the risk must feel a sense of responsibility for the possible loss and its consequences. (3) Those concerned must possess the resources with which to pay their pro rata share of the cost or the premiums. (4) The magnitude of the potential loss must be sufficient to cause a real hardship for the individuals upon whom actual losses may fall (magnitude, of course, is important only relatively to the resources of the individual). (5) The events concerned must be accidental, or fortuitous in character; they must occur according to the laws of chance and not be subject to control by those seeking to insure. Finally, (6) if a catastrophe hazard exists for a particular insurer, it must lend itself to effective control through appropriate risk-selection methods, reinsurance or other means.

Risks which ordinarily meet the requirements for insurance may be classified for convenience into two broad categories—risks to persons and risks to property. Those in the first group may be called personal risks, and the forms of insurance which may be applied are called personal insurance. Loss of income to the individual or his dependents may result from death, disability from accident or illness, unemployment or old age and may be insured against by life, health or unemployment insurance. Insurance applying to those in the second group is called property insurance. Loss may result from damage or destruction of specific property by fire, windstorm, hazards of the sea, earthquake, water leakage, explosion, riot and civil commotion, vandalism, theft, forgery, and, in the case of vehicles and their contents, collision. In addition, loss of property may result from the liability to pay compensation to injured employees under a workmen's compensation statute, or to pay damages because of injury to the persons or property of others, because of negligence in personal conduct or in the maintenance or operation of physical property. Although injury to a person may be the source of liability, insurance against this risk is normally provided by companies operating largely in the property insurance field. Similarly, business interruption or use and occupancy insurance also may be included in the property insurance category, for property insurers normally cover such risks, adapting direct-loss policy forms for the purpose.

Voluntary or Commercial Insurance.—The modern institution of insurance is divided into the two broad categories of voluntary or commercial insurance and compulsory or social insurance, both relying on the same basic principles but differing in many details of philosophy and organization. The description of insurance as set out above applies equally to both categories. A somewhat narrower definition may be employed, however, to describe those forms falling within the voluntary or commercial category. A widely cited definition was first enunciated in Great Britain in the case of *Lucena* v. *Crawford*, 2B & PNR 269 (H.L. 1806): "Insurance is a contract by which the one party, in consideration of a price paid to him adequate to the risk, becomes security to the other that he shall not suffer loss, damage, or prejudice by the happening of the perils specified to certain things which may be exposed to them." The document evidencing the transaction is known as a policy and the price paid is the premium. Those seeking insurance are required to have an insurable interest, *i.e.*, they must stand to lose by the happening of the event contemplated; otherwise the transaction would constitute merely a wager and would be unenforceable if not actually illegal. Where insurable interest exists, payment of a loss becomes an indemnity, not a gain as would be the case with a wager. Because such interests attach to persons, and because the character of the person is an important element of the risk, the insurance contract is spoken of as a personal contract and is not transferable without the agreement of all parties.

The business of voluntary or commercial insurance as usually conducted falls into four general divisions—life, fire, marine and casualty. In England the term "accident insurance" is applied to the branch of insurance for which the term "casualty" is used in United States practice. Marine insurance, which traces its origin back to the Italian traders of the 15th century or earlier, continues as a specialized branch of the business. Life assurance, known to have existed in England as early as 1583, did not at first merge with other forms to any great extent. By the 1950s, however, many of the life assurance companies had come to transact all classes of insurance business, either directly or through subsidiaries. The sale of annuities is usually coupled with that of life insurance.

Fire insurance, originating in its modern form following the Great Fire of London in 1666, continued for many years to be concerned with the fire hazard exclusively. Not until the 20th century were the hazards of wind, water damage, explosion and other so-called allied fire lines added extensively to the list of those insured by fire companies. The expansion of this branch of fire insurance company operation was particularly marked in the United States. Inland transportation hazards are also usually insured by fire insurance companies in the United States.

Personal accident insurance, which came into being about the middle of the 19th century, is a specialized branch of the business that has expanded to include the hazards of illness, hospital and surgical expense and related costs of illness and accident. Other special forms, such as steam boiler explosion, glass breakage, employer's liability, public liability, workmen's compensation, automobile insurance, as well as corporate bonding, are handled by specialized insurers or, in the U.S., by so-called casualty carriers.

Only after 1948 in the United States could a single company on a wide scale offer insurance of virtually all the forms mentioned above (except life insurance and annuities). This so-called multiple-line underwriting had long been practised in the rest of the world, but only in the second half of the 20th century was it permitted by the laws of all the states.

The extent to which property hazards are insured at different times and in different parts of the world tends to vary with the amount of property subject to loss and with general commercial and industrial development. While life insurance, which may be regarded as typical of the personal forms, depends upon the availability of income for its purchase, the extent to which income is so employed seems to depend more upon the customs and attitudes of the people.

Organization of Commercial Insurance.—The organization for the conduct of insurance on a commercial basis consists of four principal parts, as follows: (1) insurers, whose principal function is to assume and carry the risk; (2) a field organization, the principal function of which is to maintain contacts with the public for the writing of insurance and the settlement of losses; (3) intercompany organizations called associations or bureaus, with a variety of functions, including the establishment of standards, the making of rates, research, institutional advertising, dissemination of information, influencing legislation, and other activities designed to promote the interest of insurers; and (4) organizations of agents and brokers, called associations or boards, which, in the United States, perform many of the functions listed under (3) and are designed in general to promote the interests of agents and brokers.

Insurer organizations fall into two classes: those organized as private enterprises, including individual underwriters, syndicates of underwriters, and corporations or joint-stock companies organized on a capital stock basis; and those organized as co-operative enterprises, including mutual companies or associations, reciprocal or interinsurance exchanges, and a number of special types. Although important at one time, the practice of individual underwriting, so-called because of the practice of indicating acceptance of the risk by a signature written at the bottom of the policy, together with an indication of the fraction to be assumed, has largely disappeared, except as carried out through Lloyds of London. The capital stock form of organization is employed to provide all forms of commercial insurance but dominates in the property insurance fields. In the United States, mutual companies dominate in the field of life insurance, but this is not the case in Great Britain.

In property insurance, mutuals play a minor role but are a growing factor in the various forms of liability insurance, especially in the United States. The reciprocal or interinsurance exchange appears to be peculiar to the United States. Operations are managed by an attorney in fact through whom members exchange certificates of insurance, each member thus becoming both insured and insurer. Its use is not extensive and is confined to the property insurance field, primarily the automobile lines.

Field organizations are maintained through a variety of channels. The functions include selling, inspection of property, to some extent underwriting (in this sense, acceptance or rejection of applications or conditions of acceptance to be imposed), and investigation and settlement of claims. Home offices of insurers may, of course, maintain direct contact with the public through their own salaried employees. Inspection and claims are frequently handled in this way, but sales only rarely. Branch offices or, particularly in the United States, general agencies usually stand between the insurer and the sales force. The British counterpart of branch offices in the United States is a chain of branches subject to effective head office control. Only in the United States did the insurance agency become a full-time business or profession. Elsewhere direct selling or the use of part-time agents remained the rule. In Great Britain, bankers, merchants and other business or professional men act as agents, and even large owners of property may receive commissions on the insurance sold, in effect, to themselves, a practice frowned upon in the United States.

The tendency toward association is highly developed in the insurance business—partly because of the highly technical character of some phases of the business and the need for exchanging ideas, and partly because of the desire of various groups within the business to establish and maintain standards. A desire to provide protection against damaging legislation played a part in association activities in the United States. In the United States, also, state statutes encouraged property insurers to associate for rate-making purposes.

A number of associations exist in England to watch over the special interests of sections of the business. Their names alone indicate the field of their operations: the Accident Offices association, the Fire Offices committee, the Life Offices association and the Industrial Life Offices association, the Institute of London Underwriters and the Liverpool Underwriters association, the Mutual Insurance Companies association. Perhaps overriding all these is the British Insurance association, comprising insurance companies, tariff and nontariff, mutual and proprietary, transacting all or any class of insurance or reinsurance business. It handles problems of wide and general common interest. Membership is restricted to companies with head offices in the British Commonwealth or Republic of Ireland.

The importance of insurance in modern economies, its technical nature and the difficulty faced by most persons in attempting to appraise contracts and the companies offering them have led to some measure of government regulation in all countries. The extent of the regulation varies from country to country. In the United States it is quite detailed. Until the 1940s, regulation had been regarded as coming within the exclusive province of state and local governments. Then the U.S. supreme court in 1944 (*United States* v. *South-Eastern Underwriters Association et al.*, 322 U.S. 533) ruled that insurance is commerce and, since insurance transactions cross state lines, the business falls within the regulatory powers of congress under the commerce clause of the constitution. Congress then adopted public law 15, giving the states until Jan. 1, 1948 (later extended to June 30, 1948), to revise their regulations to meet certain standards laid down in the act. The system of state regulation as revised apparently proved acceptable to congress.

In contrast to extremely detailed regulation in the U.S., British insurance is subject to only a minimum, pursuant to the Companies act, 1948, and the Assurance Companies act, 1958.

Social Insurance.—The second broad division of the insurance field, social insurance, is of much more recent origin than voluntary or commercial insurance. The shift from an agricultural and handicraft economy to modern industrial society in the western world brought with it a new type of social insecurity for which social insurance was evolved as at least a partial solution. Germany, under Prince Otto von Bismarck, was the first nation to establish a system of social insurance on a national scale. Sickness insurance, compensation for industrial injuries, old-age and invalidity insurance were included in the original program, and survivors' insurance was added later. The schemes initiated in Germany relied upon existing institutions for their administration in so far as possible—funds established by community, industry or occupation in sickness insurance, workmen's compensation by trade associations, and old-age and invalidity insurance by territorial institutes. All funds were mutual, and costs were shared by employer and worker or were borne by the employer alone.

The principle of utilizing existing institutions generally was followed in other countries. Compensation for industrial accidents received world-wide acceptance, but provision for insurance varied widely. Compulsory sickness insurance was adopted in many European countries before World War II. At the same time a shift from noncontributory pensions to compulsory old-age insurance was well under way. Twenty-one countries, 16 of them in Europe and 5 in Latin America, had such plans, and in many cases survivors' insurance and invalidity coverage had been added. Several European countries followed England's lead in adopting unemployment insurance.

Social insurance made its appearance in the United States during the 1930s. Following the adoption of old-age pension plans by a number of the states and an unemployment insurance law by one (Wisconsin), the Social Security act of 1935 provided for federal financial participation in state old-age pensions, aid to dependent children and to the blind, federal old-age and survivors' insurance, and inducement to the states to adopt unemployment insurance plans. After 1935, amendments to the act increased benefits and extended the scope of old-age and survivors' insurance.

See also SOCIAL SECURITY; LIFE INSURANCE; ACTUARY; ANNUITY; FIRE INSURANCE; MARINE INSURANCE; CASUALTY INSURANCE; GROUP INSURANCE; CREDIT INSURANCE; AVIATION INSURANCE; MOTOR VEHICLE INSURANCE; UNEMPLOYMENT INSURANCE; LLOYD'S. The article VETERANS ADMINISTRATION, U.S., includes some discussion of insurance. Some of the institutions that anteceded social insurance are treated in the article POOR LAW.

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INTEGER: *see* NUMBER.

INTEGRAL CALCULUS: *see* CALCULUS, DIFFERENTIAL AND INTEGRAL.

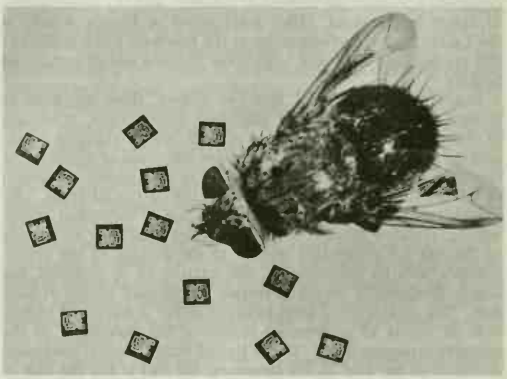
INTEGRAL EQUATIONS: *see* OPERATORS, THEORY OF.

INTEGRATED CIRCUIT. An integrated circuit consists of a number of electronic circuit elements fabricated and inseparably associated on or within a continuous body to perform an electronic function. Before the advent of integrated circuits, electronic circuits were composed of separate devices, each encapsulated in a package of glass, metal, ceramic, or plastic, connected together by soldering or welding (often using printed circuit boards) to perform an electronic function such as amplification or switching. Component devices of a circuit were either active (*i.e.*, exhibiting electrical gain) or passive. Passive devices include the resistor, capacitor, inductor, transformer, diode, and crystal. The first useful active electronic devices were vacuum tubes, later largely supplanted by transistors, which, in the early 1950s, heralded an electronic revolution. Many other active solid state devices followed (*see* TRANSISTOR). But in the early 1960s, a scant ten years after the introduction of the transistor, a second electronic revolution occurred with the impact of integrated circuitry.

An integrated circuit is composed of many unencapsulated devices, active and passive, interconnected in a package to perform an electronic function. A significant feature is that the component devices are often fabricated in or on the same piece of solid material. Sometimes referred to as microcircuits, integrated circuits can be miniaturized to the point where a circuit composed of more than 25 active and passive devices can fit within the letter "O" of this type.

Among the many advantages of integrated circuits, particularly for use in such items as hearing aids, space vehicles, and computers, are their great reductions in size and weight. Also, the uniformity of package shapes facilitates system interconnection and heat dissipation. Although a great many steps enter into the fabrication of an integrated circuit, many circuits can be processed simultaneously so that the cost per circuit may be low. A very important aspect of integrated circuits is improved reliability, a direct consequence of more uniform process technology and simplified interconnections.

The semiconductor parts (generally silicon) of an integrated circuit are fabricated starting with a large crystal about 1 in. in diameter and 12 in. long, which is cut into round wafers about 0.01 in. thick. A typical process for forming a P-N junction diode on a silicon wafer begins with the silicon substrate part of a wafer (N+) containing a high concentration of a donor impurity (phosphorus). A thin layer (about 0.001 in.) of N-type silicon containing fewer donor impurities is grown epitaxially on one side of the wafer by the pyrolytic decomposition at 1,200° C of a gas such as silicon tetrachloride, $SiCl_4$, containing a trace of phosphorus trichloride, PCl_3. The water is then oxidized in steam at 1,000° C, forming a 1-μ-thick layer of silicon dioxide, SiO_2. Next, a layer of photoresist (a photosensitive organic emulsion) about 1μ thick is spread on the surface. A glass photographic plate (mask) with the desired pattern is placed on top of the photoresist layer and illuminated. The photoresist polymerizes in a pattern duplicating that on the photographic plate, and the unpolymerized photoresist is washed away. A hydrogen fluoride (HF) acid solution is then used to etch away the exposed SiO_2, and the resist layer is removed to leave a patterned SiO_2 layer, with holes typically 0.0001 to 0.01 in. wide. The wafer is next placed in a 1,200° C diffusion furnace in an atmosphere containing an acceptor impurity vapour (boron as B_2O_3). This impurity diffuses into the silicon only where the SiO_2 layer is missing and is in turn covered by a SiO_2 layer. Another photoresist sequence (with a different mask) is used to etch contact holes through the SiO_2 layer. A metal film (aluminum) 1μ thick is deposited over the wafer surface by vacuum evaporation or sputtering. Another photoresist sequence is used to pattern the metal film, which extends along the surface to connect to other devices on the wafer.



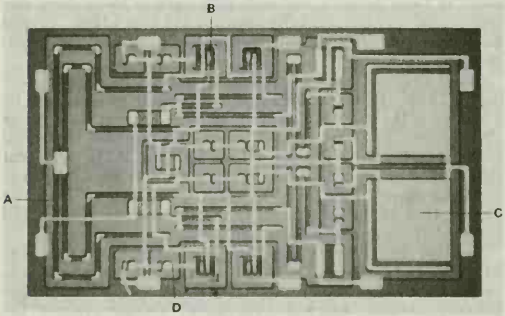
U.P.I.—COMPIX

MAGNIFIED PHOTOGRAPH SHOWING A COMMON HOUSEFLY, ABOUT ½ IN. LONG, IN COMPARISON WITH TINY INTEGRATED CIRCUITS

The various devices (transistors, resistors, etc.) can be isolated from one another in the silicon by their (lower) P-N junctions or by thin glass layers. Also, thin-film resistors (*i.e.*, nickel-chromium, tantalum, or tin dioxide, about 0.1μ thick) may be deposited on top of the SiO_2 layer. By successively depositing patterned metal, dielectric, and metal layers on the SiO_2, thin-film capacitors are formed on top of the SiO_2 layer.

The finished wafer, composed of about 60 to 100 circuits, is separated into individual circuit chips by scribing the surface between patterns with a sharp, hard point and breaking (much the same as a diamond is cleaved). A chip is soldered down to a package, and fine wires (0.001 in. in diameter) are connected between the integrated circuit and the package terminal leads. The package is capped by welding, soldering, glassing, or plastic molding. Sometimes more than one silicon chip is used to make the circuit, and miniature passive components may be included in the package.

In contrast with a semiconductor integrated circuit, a thin-film integrated circuit utilizes a glass or ceramic substrate. Thin-film components are deposited on the substrate and patterned, and other miniature components are attached.



BY COURTESY OF MOTOROLA SEMICONDUCTOR PRODUCTS DIVISION

ENLARGED VIEW OF AN INTEGRATED CIRCUIT, 0.05 × 0.1 IN., CONTAINING 12 RESISTORS, 4 TRANSISTORS, 2 CAPACITORS, AND ABOUT 40 FILM INTERCONNECTIONS

(A) Resistor; (B) transistor; (C) capacitor; (D) metal-film interconnection

See R. M. Warner, Jr., and J. N. Fordemwalt (eds.), *Integrated Circuits—Design Principles and Fabrication* (1965); *Proceedings of the Institute of Electrical and Electronic Engineers*, Special Issue on Integrated Circuits (Dec. 1964). (I. A. L.)

INTEGRATION AND MEASURE, in mathematics, represent ideas which have developed from the need of primitive people to express the amount, degree and intensity of objects and events in the physical environment. As mathematical thinking developed beyond concrete description, the notions of integration and measure became increasingly abstract. An attempt will be made here to trace this metamorphosis, assuming an understanding of such topics as discussed under ANALYSIS; ANALYSIS, ABSTRACT; ANALYSIS, COMPLEX; CALCULUS, DIFFERENTIAL AND INTEGRAL.

The abstract concepts of measure and of integration are best understood in the light of the historical evolution and growth of the problem of measure. This problem always has been present in everyday life as well as in organized acquisition of knowledge; *i.e.*, in science. It pertains to "measures" of such properties as the length of a curve (rectification), area of a surface (quadrature), volume of a solid (cubature), mass or weight or electric charge of a body, probability of a random event, and so on. Yet the abstract concept of measure, of which the preceding "measures" are but particular concrete cases, has been isolated only in the 20th century. The corresponding evolution may be loosely divided into several periods, each characterized by its attitude toward the problem of measure.

The Empirical Period.—The purely empirical period began with prehistory and lasted until the 6th century B.C. The most advanced organized knowledge of this period was Babylonian and Egyptian, providing precise and correct rules for finding areas and volumes of such geometric figures as the triangle, trapezoid and circle. For the Babylonians π equalled 3 (this value of π is also found in the Old Testament) and for the Egyptians π equalled $256/81$ ($= 3.160\ldots$). They also had correct rules for the parallelepiped, prism, pyramid and circular cylinder, thought of in concrete terms—mainly as grain storage containers. The ancient Egyptians even had a correct rule for measuring the frustum of a square pyramid.

Apparently these rules were discovered empirically. To become "proven" mathematical propositions, deduced from a set of definitions and postulates, they had to await the "Greek miracle": the emergence of organized abstract thinking in Greece which includes the earliest known treatment of mathematics as a deductive discipline. Available information prompts some historians to attribute the birth of abstract mathematics to Thales (6th century B.C.), one of the Seven Wise Men of ancient Greece.

The Greek Period.—This period began with Thales and lasted until about 200 B.C. By the 5th century B.C. problems of quadrature and cubature were so popular that Aristophanes in his satirical comedy *The Birds* alludes to the quadrature of circles, while the problem of duplication of cubes is attributed to the Delphic oracle. The first abstract proofs of rules for finding some areas and volumes are said to have been developed by Eudoxus of Cnidus (*c.* 400–*c.* 347 B.C.). His method of approximation was developed and exploited by Archimedes (*c.* 287–212 B.C.), called the greatest mathematician of antiquity. This method, called the method of exhaustion in the 17th century A.D., was at the root of all further developments of the mathematical problem of measure. The method culminated in the 19th-century isolation of the concept of Riemann integration, defined by means of approximating Riemann sums (which in all justice could be called Eudoxus or Archimedes sums or, as shall be seen later, Cauchy sums).

In modern terms, the method of exhaustion applied to surfaces, for example, may be stated as follows: Let S be a surface of unknown area s. Denote by S' a surface of known area s' contained in S and denote S'' a surface of known area s'' containing S; thus $s' < s < s''$. The approximating surfaces S' and S'' are polygons or sums of slices, mainly trapezoidal or rectangular, selected by Eudoxus and by Archimedes according to the particular figure S. In fact, sums of rectangular slices (whose area is particularly simple to compute) were to become predominant from the 16th century A.D. on. To complete the proof Archimedes used the following proposition: If a known area a is such that for every positive ϵ there exist surfaces S' and S'' with $s' < a < s''$ and $s'' - s' \leq \epsilon$, then $s = a$. Archimedes did not isolate this proposition, and proved it in concrete geometric terms for every particular figure he considered by a double *reductio ad absurdum* (double, because negative numbers were not available to him): If $s < a$, take $\epsilon < a - s$ and if $s > a$ take $\epsilon < s - a$; in either case a contradiction is reached, so that $s = a$. The method is not complete, for it does not say how to find the value a. In fact, Archimedes filled the gap, but the letter to Eratosthenes which told about what is sometimes called the Archimedes method remained unknown until 1906. In the letter Archimedes gave his heuristic approach: A surface is thought of as a sum of lines to each of which is applied the lever principle.

The idea of sum of lines was rediscovered in Italy in the 16th century. Hindu-Arabic numerals were adopted. Algebra was stimulated, letters began to stand for quantities, and symbols were introduced to denote operations. Inexorably, through the indivisibles period to the emergence of calculus, these representations led to a new attitude, an analytic one in lieu of the geometric attitude of the Greeks.

The Indivisibles Period.—This period extended from 1615 to about 1670, heavily influenced by Archimedes whose works became available in 1544 in Greek and in Latin. The concept of integration gradually emerged, but neither in Archimedean nor in modern dress—especially in England; there, integration became for a time not a primary operation but the inverse of the operation of differentiation.

After S. Stevin and other followers of Archimedes came the pioneering work of J. Kepler, *Stereometria doliorum vinorum* (1615; "Solid Geometry of Wine Barrels"). From then on and until the 19th century, Archimedean rigour was abandoned in favour of an intuitive "infinitesimal" reasoning. For Kepler the circle consisted of an "infinity" of infinitesimal triangles with common vertex at the centre; the sphere consisted of an "infinity" of pyramids, and so on. But he obtained over 80 new results for areas and volumes. The language of infinitesimals or method of indivisibles was then codified by B. Cavalieri in his *Geometria indivisibilium continuorum nova quadam ratione promota* (1635). For the first time in the history of the problem of measure, instead of measures of specific geometric figures, general principles for quadratures and cubatures were announced. While not proved rigorously, the principles were at least "justified" in the language of infinitesimals.

The Cavalieri principle, say for quadratures, may be stated as follows: If the ratio of lengths of sections of two surfaces generated by a straight line which moves parallel to a fixed direction is a constant then the ratio of their areas is this constant. The justification of this principle in the language of infinitesimals can be described in modern terms as follows: Associate to every real-valued nonnegative function f defined on a set A of reals its ordinate set in the (x,y)-plane; that is, the set of all points (x,y) such that x belongs to A and y varies from 0 to $f(x)$. When A is the segment $[0,a]$, then the ordinate set of f is the surface in the x,y plane whose boundaries are the vertical lines $x = 0$ and $x = a$, the horizontal line $y = 0$, and the graph of the function f. For two such functions f and g on $[0,a]$ with co-ordinate sets $S(f)$ and $S(g)$ of areas $s(f)$ and $s(g)$, the ratio of the sums of equidistant ordinates $\sum_{k=0}^{n-1} f(ka/n)$ and $\sum_{k=0}^{n-1} g(ka/n)$ can be made as close as desired to the ratio $s(f)/s(g)$ of the areas, provided n is sufficiently large. (The question of existence of these areas was not raised until the middle of the 19th century.) Therefore, letting n approach infinity, the unknown ratio is the "limit" of the ratio of the sums of ordinates. However, the concept of limit was not isolated at that time and Cavalieri actually took n to be directly equal to infinity. Thus appears the *summa omnium linae* (sum of all lines). However, some mathematicians of this period such as B. Pascal and G. P. Roberval spoke of "rectangles with infinitely small bases" instead of lines.

During the indivisibles period the method of indivisibles yielded a very large number of special integrals as quadratures, cubatures and centres of gravity. Most were formulated geometrically. But already more abstract algebraic formulations were apparent: P. Fermat and Cavalieri integrated x^n for rational

$n \neq -1$; Gregoire de Saint Vincent integrated it for $n = -1$ in a geometric form at once recognized as the logarithmic function; and Pascal integrated $\cos x$. Fermat, Pascal and J. Gregory geometrically manipulated changes of variables and integrations by parts. In fact, geometric methods, formulations and results were gradually made analytic. Pascal first discussed the types of sums he would need and then only computed them in the concrete geometric case under consideration. J. Wallis in *Arithmetica infinitorum* (1655), which has to be translated as "infinitesimal" algebra, started straight from algebraic grounds, introducing infinite series and infinite products, and N. Mercator discovered (1668) the series expansion of $\log (1 + x)$.

The impetus and the tools for abstraction were provided by the growth of algebra, the birth of analytic geometry with R. Descartes' *Geometrie* (1637), Fermat's *Isagoge* (written before 1637) and the birth and growth of kinematics. Consideration of time as a concept in kinematics and the notion of abscissa in analytic geometry led to a gradual emergence of the idea of independent variable. Velocities and slopes of tangents led to the concept of differentiation. Performance of rectifications, such as that of parabolic arcs, forged a first link between differentiation and integration, because rectification of curves $y = f(x)$ was reduced to the quadrature of $\sqrt{1 + [f'(x)]^2}$, where $f'(x)$ is the derivative of $f(x)$. In fact, integration lost its predominant role in favour of differentiation. The basic link was provided by the recognition that differentiation and integration are inverse operations, to be found in I. Barrow's *Lectiones geometricae* (1670). While a crowning of the indivisibles period, Barrow's work also represented the dying spirit of the period. He began with kinematical considerations which seemed to lead at once to the basic link. Yet, the relation between differentiation and integration was given much later in two widely spaced propositions, and in geometric terms; the derivative in terms of slopes of tangents and the integral in terms of areas.

The Calculus Period.—This period extended from about 1670 to the beginning of the 19th century, beginning with the creation of the calculus by G. W. Leibniz and I. Newton. Newton, influenced by his teacher Barrow and his preoccupation with dynamics, used a universal independent variable conceived primarily as time; thus, he had no concept of functions of several variables, hence no partial derivatives. The primary concept was that of fluxion (derivative) and arose from kinematical considerations. The concept of integral was not isolated and no symbol for integration was introduced. His first basic problem was to find fluxions. Integration was treated in a geometric form as a search for fluents (antiderivatives, primitives, indefinite integrals), functions whose fluxions are given.

Newton depended mainly on the fact that the derivative of a variable area $F(x)$ under a curve is the ordinate $f(x)$ of this curve. Moreover, for Newton integration was only a particular case of his second basic problem: Given an equality relation containing fluxions, find the relation for fluents (solve ordinary differential equations). He solved them formally by means of series.

Leibniz, influenced by Pascal, conceived the derivative as the slope of a tangent, and the integral as *summa omnium linae*. The main purpose of all his activity is to devise a universal language, that is, a general formalism for the acquisition and organization of knowledge. He largely succeeded in the creation of such a formalism for the calculus. In fact, the present formalism is still essentially and properly his, including the integral symbol (a stylized form of the letter S standing for *summa omnium*). His are the terms constant, variable, parameter and (with the help of Johann Bernoulli) the terms function and integral.

An unpleasant fact is that in the third quarter of the 20th century, freshman college calculus was still being taught largely in the spirit of 1700 with a thin modern varnish, ignoring the 250 years of evolution of mathematical thought which followed.

The heroic years of the calculus at the end of the 17th century saw the constant flow of new results from Leibniz and his school: Jakob Bernoulli, Johann Bernoulli, G. F. A. de l'Hospital. During the 18th century, C. Maclaurin pursued and developed Newton's ideas and attempted to clarify them in his *Treatise of Fluxions* (1742), while L. Euler pursued further the ideas of Leibniz and his school in his *Introductio in analysin infinitorum* (1748) and attempted to found the calculus upon an obscure passage to the limit starting with the calculus of differences.

Mathematicians of the 18th century devoted little effort to the shaky foundations of the calculus, apparently happy with the powerful tools at their disposal, the fecundity of the methods, the beauty and consistency of the results. Discussions about the metaphysics of calculus were left to philosophers and theologians, among whom figured prominently Bishop George Berkeley. Then, the whole subject of metaphysics of calculus vanished into thin air with J. d'Alembert's two articles on "Limite" and "Différentielle" in *Encyclopédie* (1751–65). At last was isolated the concept of limit, which runs as an almost invisible thread in the fabric of infinitesimals as woven since Stevin and others at the turn of the 17th century, and the concept of differentiation was finally defined rigorously in terms of limits. Yet, after d'Alembert, J. Lagrange still tried to define integration in terms of Newton's conception of a function as a power series.

The Analysis Period.—A new period opened with A. L. Cauchy's *Calcul infinitésimal* (1823), at the basis of which was the concept of limit. Differentiation was defined by a passage to the limit. At last, the integral was defined directly and in purely analytic terms by returning to the very essence of the method of exhaustion as follows: Let $f(x)$ be a bounded function defined for $a \leq x \leq b$. Divide the interval $[a,b]$ into n subintervals by means of points $a = x_0 < x_1 < \ldots < x_n = b$. Form the Eudoxus-Archimedes-Cauchy sums (called nowadays Riemann sums) $\sum_{k=0}^{n-1} f(t_k)(x_{k+1} - x_k)$ with $x_k \leq t_k \leq x_{k+1}$. The limit of these sums as the largest length of the subintervals converges to zero is, by definition, the integral $\int_a^b f(t)dt$ of the function f on $[a,b]$, provided this limit exists and is independent of the choice of the t_k.

A new way of thinking was born; existence of integrals as well as that of derivatives was no longer a question of faith but a problem to be studied. Cauchy gave an incomplete proof of existence of integrals of continuous functions, and his proof was completed only in 1875 by J. G. Darboux. Meanwhile, G. F. B. Riemann in 1854 (published in 1867) gave necessary and sufficient conditions for the existence of the integral called Riemann integral, and showed that continuous and piecewise monotone functions satisfy these conditions. Instead of Riemann sums, Darboux introduced the upper and lower Darboux sums $\sum_{k=0}^{n-1} M_k(x_{k+1} - x_k)$ and $\sum_{k=0}^{n-1} m_k(x_{k+1} - x_k)$ where M_k and m_k are, respectively, the least upper and the greatest lower bounds of $f(x)$ as x varies between x_k and x_{k+1}. The passage to the limit yields the upper and lower Darboux integrals. These two integrals coincide if and only if the bounded function f is Riemann-integrable on $[a,b]$.

Meanwhile, the general concept of a real-valued function of a real variable which appeared in a more or less vague or restrictive form throughout the calculus period was finally isolated by P. G. L. Dirichlet (1829). Dirichlet examined the problem of convergence of Fourier series. Since the coefficients of these series are given by integrals of the form $\int_a^b f(x) \cos nx dx$ and $\int_a^b f(x) \sin nx dx$, knowledge about Fourier series expanded with the evolution of the concepts of integration and of function. From Dirichlet and Riemann on, the knowledge of trigonometric series and, more generally, of harmonic analysis gained in depth and in extension as understanding of integration and the functions increased.

In fact, modern set theory, which changed the whole outlook on measure and integration, began in 1872 with G. Cantor's investigation of the structure of some exceptional sets of trigonometric series: sets S such that if a trigonometric series

$\sum_{n=-\infty}^{+\infty} c_n e^{inx}$ converges to zero except at the points of S, then all $c_n = 0$. The evolution of set theory between 1872 and 1890, due primarily to Cantor's genius, together with the parallel investigation of the system of reals and of functions of reals by such mathematicians as J. Dedekind, K. Weierstrass, P. du Bois-Reymond and V. Dini, brought on the "Great Mathematical revolution."

The revolution occurred at the turn of the 20th century and can be compared only to the birth of mathematics as a deductive discipline some 25 centuries ago. The problem of foundations was revived but applied to the tremendous wealth of accumulated knowledge at a level of abstraction far beyond that known to the ancient Greeks. In particular, the problem of measure was no longer confined to a few special sets—the geometric figures available to Eudoxus or Pascal. Moreover, the very nature of the problem was different.

Eudoxus' or Pascal's problem was to find the measure (area, volume) of some specific geometric figure. The existence of this measure was a question of faith and it was approximated by sums of measures of simple figures. The new problem was to define a measure for as large a class of sets as possible by means of such approximations. The first attempts were made in 1884–85 by A. Harnack, O. Stolz and Cantor. They did not succeed because they used only approximations from above; they assigned to any set S the greatest lower bound of sums of ordinary measures of simple sets—intervals, rectangles, parallelepipeds, whose finite unions cover S.

The outer content so defined does not correspond to the intuitive idea of measure, for it is not additive: in everyday experience as well as in experimental science, the "measure" of a union of two disjoint sets is the sum of their "measures." For example, the volume (or mass) of two disjoint bodies is understood as the sum of their volumes (or masses). This requirement was recognized by G. Peano and C. Jordan who introduced approximations both from above and from below. To a set S contained in a bounded interval I they assigned also its inner content (the difference between the ordinary measure of I and the outer content of S). If the inner and outer contents of S are the same, then their common value defines the content of S. This content measure is additive. However, the most important types of sets encountered in analysis, such as the set of all rationals or general open sets, have no content. Thus the content measure is of limited use.

The Extension Period.—The extension (or theory of measure) period opened in 1898 with E. Borel, the modern Eudoxus. It has been characterized by the extension of the idea of measure to wider and to more abstract classes of sets and the parallel extension of the idea of integration to wider and to more abstract families of functions until both ideas coalesce. It was stimulated by and intricately interwoven with the explosive growth of general topology following M. Fréchet's thesis in 1902.

At the root of the theory of measure lie a few crucial remarks by Borel in his *Leçons sur la théorie des fonctions* (1898). While studying series of functions Borel found the need for a measure such that sets whose measure is not zero are not countable. Thus, he introduced the Borel measure on the Borel field, prototypes of all measures and all σ-fields to follow.

From now on, it will be convenient to use the following terminology: Unions of disjoint sets will be called sums and then the symbol $\cup$ for union will be replaced by Σ. Countable will mean finite or denumerable. Countable (or finite) set operations are complementations and taking countable (or finite) unions and intersections. A σ-field (or field) of sets is a class of sets closed under countable (or finite) set operations.

Borel began by extending the ordinary measure on intervals to a measure on open sets, as follows: Cantor had shown that every open set G of reals is a countable sum of open intervals I_j and Borel realized that the "natural" extension consists in assigning to G the sum of ordinary measures of its constituent intervals I_j. Note that if G is not bounded this sum may be infinite; but it always exists. By indefinite iteration of countable set operations and the same extension procedure, he then extended the class of open sets and their measure to the class of Borel sets and their Borel measure. This class is a σ-field (the smallest σ-field containing the class of open sets), and this measure is σ-additive; the measure of a countable sum of sets is the sum of their measures. From then on, the Borel field of Borel sets in any topological space will be the smallest σ-field containing the topology, that is, the class of open sets in the space. (In fact, some authors use the term Borel field as a synonym for σ-field.)

The Archimedes of the extension period was H. L. Lebesgue. He took the decisive step in his thesis *Intégrale, aire, volume* (1902), which he immediately applied to trigonometric series (1903), and pursued further in *Sur l'intégration des fonctions discontinues* (1910). Lebesgue combined the ideas of his immediate predecessors, Jordan and Borel, and created and exploited powerful tools of modern measure and integration. In fact, contemporary theory of measure still dances to Lebesgue's tunes. The evolution of his ideas, methods and results consisted primarily in the gradual shedding of their extraneous coverings.

The Lebesgue measure is defined by extending the ordinary measure on intervals by means of outer and inner Lebesgue measures, exactly as the Jordan content was defined, except that coverings by countable unions of intervals replace coverings by finite unions. The intervals are one-dimensional or N-dimensional, and the same method applies. Then the Lebesgue integral of a function $f \geq 0$ defined on a set becomes simply the Lebesgue measure of the ordinate set of the function, provided this set is Lebesgue-measurable. As may be expected, every Riemann-integrable function is Lebesgue-integrable, but the converse is not true. Riemann's integrability condition for bounded functions f becomes: the discontinuity set of f is of Lebesgue measure 0. Thus, the famous Dirichlet function $f(x) = 0$ or 1 (according as x is irrational or not) which is Lebesgue-integrable on every bounded interval is not Riemann-integrable.

The main contribution of Lebesgue does not reside in the above concepts. For example, the Lebesgue measure is simply the completed Borel measure; that is, a Lebesgue-measurable set is a Borel-measurable set up to a subset of a set of Borel measure 0. What really counts is the discovery and use by Lebesgue of the properties of his concepts of measure and of integration.

Let us mention that, using the Lebesgue approach, the problem of finding a process of integration which includes both that of Leibniz (*summa omnium*) and that of Newton (primitive) was solved by A. Denjoy (1912) and also by O. Perron (1914).

The cleaning up of Lebesgue's ideas was essentially achieved in the 15 years or so which followed his thesis. It yielded a general answer to the problem of measure for areas, masses, probabilities, . . . and finally isolated its conceptual substance. However, the answer and the substance were to be formulated in terms very far removed from the everyday experience. The steps in the cleaning-up process included the generalization which stemmed from T. J. Stieltjes and was due to J. Radon, and the abstraction which began with Fréchet (1915) and with C. Carathéodory (1918).

Stieltjes, in *Recherches sur les fractions continues* (1894), in order to express the limit of a particular sequence of analytic functions, replaced (in the approximating sums for Riemann integration) lengths of intervals by masses spread on them. He introduced a distribution of masses by means of a nondecreasing function g. It assigns to every interval $[a,b]$ the increment $g(b) - g(a)$ of the function g; if $g(x) = x$ then the increment reduces to the length $b - a$ of the interval. Thus, in Riemann or in Darboux sums the increments $x_{k+1} - x_k$ are replaced by the general increments $g(x_{k+1}) - g(x_k)$, and the usual passage to the limit of the so-formed Riemann-Stieltjes or Darboux-Stieltjes sums yields Stieltjes integrals. Then, in 1909, F. Riesz, solving a problem set by J. Hadamard, discovered that these Stieltjes integrals $\int_a^b f\,dg$ are the most general nonnegative continuous linear functionals on the space of all continuous functions f defined on the bounded interval $[a,b]$.

In 1913 Radon, working in N-dimensional euclidean spaces, combined Lebesgue's ideas with the Stieltjes generalization of

ordinary measure and integration, and with Riesz's discovery. Thus appeared Lebesgue-Stieltjes measures and integration. Lebesgue-Stieltjes measures are defined like the Lebesgue measure, except that the ordinary measure on intervals is replaced by the mass spread on them given by the increments of nondecreasing functions. Lebesgue-Stieltjes integrals of nonnegative functions are then the masses spread on the co-ordinate sets.

In 1915 Fréchet eliminated the topology for the measurable sets and the integrands, while Carathéodory (1914, 1918) got rid of topology for the extension of measures. At last, the concepts of measure and of measurability were isolated. The following points summarize the basic concepts of the theory of measure:

1. A set Ω with a σ-field $\mathcal{A}$ of its subsets (to be called measurable sets) is a measurable space $(\Omega, \mathcal{A})$. A function f on Ω, say, to the real line R is said to be measurable if the inverse images by f of Borel sets in R are measurable. (The inverse image by f of a set A is the set of all points ω belonging to Ω such that the values $f(\omega)$ of f at these points belong to A.) The tremendous advantage of a family F of all measurable functions on a measurable space, as compared, say, to the family of all continuous functions on a topological space, is that not only is F closed under arithmetic operations but it is also closed under sequential limits. In particular, if there is a topology on Ω, and $\mathcal{A}$ is the σ-field of Borel sets in this topological space, then F contains the family of continuous functions on it. This is the abstraction of Borel's set-up.

Denote measurable sets by A (with or without subscripts) and to every such A assign its indicator $I_A = 1$ on A and 0 elsewhere. A measurable function with a finite number of distinct values $x_1, \ldots, x_n$ is called a simple function and is denoted by $\sum_{k=1}^{n} x_k I_{A_k}$.

2. A measure μ on a class $\mathcal{E}$ of sets in a space Ω is a nonnegative countably additive function of sets (not necessarily finite). If, to simplify the statements, Ω is one of the sets of the class, then this measure can be extended to an outer measure μ^0 on all sets A in Ω by assigning to every A the greatest lower bound of sums of measures of sets of $\mathcal{E}$ whose countable union covers A. This is the abstraction of the Lebesgue outer measure. The restriction of the outer measure μ^0 to μ^0-measurable sets yields then the extension of μ on $\mathcal{E}$ to a measure on the σ-field (containing $\mathcal{E}$) of μ^0-measurable sets; a μ^0-measurable set B is such that $\mu^0 C = \mu^0(B \cap C) + \mu^0(B^c \cap C)$ for all sets C in Ω (the symbol $\cap$ means intersection and the superscript c means complement of). The μ^0-measurable sets are the abstraction of Lebesgue-measurable sets. The extension is unique provided the initial measure given on a field $\mathcal{E}$ is σ-finite; that is, Ω is a countable union of sets of $\mathcal{E}$ with finite measure.

3. The triplet $(\Omega, \mathcal{A}, \mu)$ where μ is a measure on the σ-field a is a measure space. The integral $\int f d\mu$ of a finite simple function $f = \sum_{k=1}^{n} x_k I_{A_k}$ is defined as the (Eudoxos-Cauchy-Riemann-Stieltjes-Lebesgue-Radon) sum $\sum_{k=1}^{n} x_k \mu A_k$. Every nonnegative measurable function f is the limit of a nondecreasing sequence of nonnegative simple functions f_n. Set $\int f d\mu = \lim_n \int f_n d\mu$. This limit always exists but may be infinite. It is independent of the choice of sequences $f_n \uparrow f$. Every measurable function f can be written as a difference of two nonnegative measurable functions: $f = f^+ - f^-$ with $f^+(x) = f(x)$ or 0, and $f^-(x) = 0$ or $-f(x)$, according as $f(x) \geq 0$ or $f(x) < 0$. The integral $\int f du$ is the difference of the integrals of f^+ and of f^-, provided it exists, that is, is not of the form $+\infty - \infty$. The function f is μ-integrable if its integral exists and is finite. Since the absolute value $|f| = f^+ + f^-$, it follows that f is integrable if and only if $|f|$ is integrable. This is the abstraction of the constructive definition of the Lebesgue integral.

The importance and usefulness of this integration is due to its monotone convergence property, which means that for nondecreasing sequences of nonnegative measurable functions f_n, passage to the limit and integration commute; in symbols, if $0 \leq f_n \uparrow$ as $n \to \infty$, then $\lim_n \int f_n = \int \lim_n f_n$. All other convergence properties of this integration, in constant use in analysis, follow from it.

4. The indefinite integral ϕ on measurable sets A of a function f whose integral exists is defined by $\phi(A) = \int_A f d\mu = \int f I_A d\mu$. This is the abstraction of the Lebesgue indefinite integral. Its fundamental property which may serve as a descriptive definition of integration, first obtained by Lebesgue then generalized by Radon and finally abstracted by O. Nikodym, is as follows: On a σ-finite measure space, a set function ϕ is indefinite integral of one and only one function f but defined only up to values on a μ-null set if, and only if, ϕ is a difference of two measures, and is σ-additive and μ-continuous, that is, $\phi(A) = 0$ whenever $\mu(A) = 0$. This property plays a basic role in the theory of measure and, especially, in the theory of probability.

The foregoing (1–4) represent the basic set-up of the theory of measure and also yield the foundations of probability theory. Also deserving mention is the concept of stochastic independence, which was, and to a great extent still is, essential to the evolution of probability theory since its inception in 1654 by Pascal and Fermat. It too became measure–theoretic with the creation and abstraction of finite and infinite product measures by Lebesgue and by P. J. Daniell.

Throughout the evolution of the problem of measure, integration appears as means for finding measures of sets or assigning measures to sets. Thus, seen in the historical light, measure, integration and the related concepts of measurable sets and measurable functions ought to have coalesced in one primary concept from which they would be derived. This was done by Carathéodory and Daniell by cleaning up the extension procedure.

Carathéodory (1918) emphasized the measure as the primary concept. Given a σ-finite measure μ on, for example, a field of sets A, it is extended uniquely to a measure on a σ-field as in 2 above. It is also used to define a product measure of μ with the ordinary measure on intervals (the product measure of a rectangle, with sides A in Ω and interval I in R, is the product of the measures of its sides) and then similarly extended on the corresponding σ-field in the product space $\Omega \times R$. Thus are formed measurable sets in Ω with the extended measure on them and measurable sets in $\Omega \times R$ with the corresponding product measure on these sets. The ordinate set of a function $f \geq 0$ is a set in $\Omega \times R$. The function is measurable when the ordinate set is measurable and the integral of f is the measure of its ordinate set. If f is not of constant sign, write $f = f^+ - f^-$ and proceed as in 2 above.

Daniell (1918) abstracted W. H. Young's approach (1911) emphasizing the integral as the primary concept and was followed by S. Banach (1937), M. H. Stone (1948) and the immortal N. Bourbaki. Integration assigns numbers $\int f d\mu$ to functions f; that is, the integral is a functional. The main properties of this functional are that it is linear $(\int (af + bg) = a \int f + b \int g)$, nonnegative (if $f \geq 0$ then $\int f \geq 0$) and, above all, it has the monotone convergence property (if $0 \leq f_n \uparrow f$ then $\int f_n \to \int f$). These three properties suffice: Given a functional $\int$ with these properties on a space F of bounded functions which is a vector lattice (closed under linear combinations and undertaking *suprema* and *infima* two by two), call it an integral on F. The extension problem is to extend this integral on F to as large a family of functions as possible on which the integral still has the same properties. For example, the Cauchy-Riemann integral on the space F of all continuous functions on a bounded interval has the required properties and the extension will yield the Lebesgue integral on the Lebesgue-integrable functions.

The extension procedure is as follows: First extend F to the space U of limits f of nondecreasing sequences of functions f_n in F and then extend the integral by imposing the monotone convergence property so that, by definition, $\int f = \lim_n \int f_n$. This extension is unique. Then extend the integral to the space $-U$ of negatives $-f$ of functions f belonging to U by imposing the linearity property so that, by definition, $\int (-f) = -\int f$. Finally,

approximate an arbitrary function f by functions g in $-U$ and h in U: $g \leq f \leq h$. Define the lower integral of f as the least upper bound of integrals of functions g and the upper integral of f as the greatest lower bound of integrals of functions h. When the lower and upper integrals of f coincide and are finite then take their common value to be the integral of f, to be called integrable function. This is primarily the abstraction of the Darboux approach in Lebesgue's context. The space of integrable functions and the integral on it have the desired properties. In particular, the integrals of integrable indicator functions of sets (equal 1 on the set and 0 elsewhere) define a measure on these sets with the usual properties.

Since about 1930, when integrals of functions with values in a Banach space were introduced by S. Bochner, a further abstraction began and grows. Measures and functions (hence, integrals) take values in more and more abstract spaces instead of taking numerical values as above and various types of convergence are used. Of particular importance are the various stochastic integrals (*see* PROBABILITY AND STATISTICAL THEORY). In fact, the foregoing indications on the set-up of the theory of measure and integration have many variants even in the numerical case. In final analysis, their conceptual substance is the same, but seen from different points of view in various settings, from Eudoxus and Archimedes, through Leibniz and Riemann, to Lebesgue and the present day variations on the same theme. The most important fact is the ever spreading use of the powerful tools these concepts provide for such areas as differentiation theory, boundary problems, ergodic theory, probability theory, group theory, potential theory and harmonic analysis. (ML. LE.)

INTELLIGENCE. The word intelligence (*inter-legentia*) was introduced by Cicero as an almost literal translation of Aristotle's term *dia-noesis*. In the scholastic psychology derived from Aristotle, its use implied a preference for the twofold classification of mental characteristics into intellectual or cognitive (*i.e.*, discriminative and directive) characteristics, as contrasted with dynamic or orectic (*i.e.*, affective and conative), which Aristotle proposed in place of the threefold scheme favoured by Plato. "Intelligence" was thus the abstract quality common to, and peculiar to, all "intellectual" processes; *i.e.*, sensation, perception, memory, imagination, reasoning and the like (*see* PSYCHOLOGY).

In the writings of Herbert Spencer and his successors—Sir Francis Galton, Alfred Binet, Cyril Burt and C. E. Spearman—the word intelligence acquired a standard meaning as a technical term, and has usually been held to imply three basic distinctions: (1) it connotes a cognitive or intellectual capacity, as distinct from other characteristics of the total personality; (2) it implies a general quality (*i.e.*, it enters into all types of intellectual processes and is not specific to any one type of ability); (3) it is an inborn or innate quality, as distinct from abilities acquired through individual experience at home, at school or elsewhere.

In the first instance this concept of an inborn, all-round, general ability was derived mainly from introspection, general observation and philosophical speculation or reason. The conclusions so reached therefore required to be more closely checked and verified by experiment and statistical analysis. The leaders in this scientific approach were Galton (*Human Faculty*, 1883, and later writings), Binet (1890–1911) and students of animal psychology such as C. Lloyd Morgan (1890), E. L. Thorndike (1910) and Wolfgang Köhler (1915). The first effective tests of intelligence (partly suggested by those of Galton) were developed by Binet and his collaborators in France, revised for other countries by Burt (Britain), W. Stern (Germany) and Lewis Terman (U.S.); and the earliest systematic studies (based on the statistical methods introduced by Galton) were those of Karl Pearson, Spearman, Burt, Thorndike and William Brown.

The method adopted by the leaders in their numerous inquiries involved a combination of experimental testing and statistical analysis. It consisted essentially in observing what mental capacities tend to go together, and it led to the theory that there does exist in human beings a single broad mental power (additional to various special abilities) which may be called general intelligence. On comparing the efficiency of various types of test, it appears that intelligence is revealed particularly in good use of verbal symbols, ability to perceive analogies, capacity to abstract and classify, mathematical ability, problem solving and those capacities for understanding relations and causal connections which have been increasingly invoked in experiments on intelligence.

Some educators believe erroneously that intelligence is defined by a mere average score on whatever combination of such subtests a psychologist happens to use. But the exact weights to be given are actually fixed through intelligence's being uniquely and objectively defined by the simple structure criterion in factor analysis. The typical processes in such "highly *g*-saturated" performances can be seen in such modern tests as the Stanford-Binet, the Moray House tests and Raven matrices in Britain, the American Bellevue-Wechsler and A.C.E., the Cattell Culture-Fair scales and the Thurstone Primary Mental Abilities battery.

Biological Conditions.—The effects of age and of inheritance as indicated by results obtained with tests of intelligence (as above defined) have become well understood through the work of such researchers as Terman, Burt and Jean Piaget. There is a rapid augmentation of reasoning and perceptual ability between 3 and 6 years of age, followed by a flattening of the development curve around 14 years of age. Indeed, after 14 there is negligible increase in the basic ability to understand the most general relations. Nevertheless, the individual increases his actual problem-solving capacity by increased knowledge and can better perceive relations in special fields when given close acquaintance with the particular problems of those fields. After the age of about 23 there is actually a slight decline in score on speeded intelligence tests (*i.e.*, as they are usually given), but, if reasoning capacity without speed is tested, no such decline occurs until senility.

No significant differences in intelligence have been found between men and women, and it is not even certain that qualitative differences, as shown by the somewhat higher scores of men in mechanical reasoning and of women in verbal ability, may not be considered as temporary cultural effects. On the other hand, there is ample evidence from comparing the intelligence of identical twins reared in different homes with that of, for example, unrelated children reared together that intelligence is largely inherited. Burt among others presented evidence for the inheritance of differences in intelligence, the correlations and other constants agreeing closely with what would be expected if intelligence (like stature and other graded characters) were transmitted in accordance with the Mendelian laws for multifactor inheritance.

The usually accepted figures, based on the soundest and most extensive studies (*e.g.*, of Barbara Burks in the U.S. and Burt in Britain) employing verbal intelligence tests, assign 75% to 80% of the observed test variation in the general population to genetic factors and the rest to environmental physical and mental conditions and opportunities in home and society. Later work by Cattell, G. F. Stice and N. F. Kristy, using the Culture-Fair tests and improved statistical designs, gives a value of 78:22 to the heredity: environment variance ratio in the general population, but shows that this arises from a 70:30 ratio for intelligence variation *within* families and a 93:7 ratio for variation *among* families. In all these researches, whatever unreliability exists in test administration and scoring tends to inflate the percentage assigned to environment. By contrast, no experimental design has been found for reliably assigning to heredity and environment the true fractions of the appreciable differences of average intelligence test score found among widely different races.

Social and Educational Associations and Uses of Intelligence Measures.—Tests of intelligence are validated in a pragmatic sense by the widespread finding that what is called intelligence in social and educational evaluation turns out to be closely identified with what is measured. Thus children drafted to schools for mental defectives score very low, selective schools average above other schools, and universities above high schools. Test scores are predictive of educational success and of occupational success in most (especially complex) occupations.

Socially there is a slight tendency for higher social class (or complexity of occupation) to be associated with higher intelligence score, even on culture-free intelligence tests, and this fits the school

observation that some trend exists for better mental capacity to segregate to better social status levels. Nevertheless, the greatest absolute storehouse of high mental capacity is the lower middle class—skilled and semiskilled workers—because it is the largest class in sheer numbers.

Since it has been shown that, even in the same social class, less intelligent parents tended, in the first half of the 20th century, to produce a larger fraction of the following generation, it is probable that, apart from dominant genes and a survival rate favouring the intelligent, a decline occurred in average intelligence in industrial countries in the first part of the century. However, a survey around 1950 showed that the negative correlation of intelligence with family size had been much reduced in Britain and had practically vanished in Sweden.

Surveys in the U.S. suggested that the national resources of intelligence, for supplying persons fitted for training as higher scientific, administrative and professional workers, are not so great as once had been thought. Of persons with the requisite intelligence and monetary support to obtain, for example, a medical degree, perhaps only one-fifth also have the persistence to face continuous study or the temperamental qualities to deal with the emergencies and social demands of such a profession.

Attention to resources of intelligence, particularly in regard to manpower for scientific research, led to application of intelligence tests still more widely in industry and education. Their use in selecting for military promotion and specialized training in World War II was very extensive. In the U.S. systematic surveys of community intelligence were proposed and pursued by J. B. Wolfle, R. L. Thorndike and others, while in Britain the nation-wide systematic guidance of children at 11+ years of age into different educational streams is made about equally on intelligence tests and on school achievement at the time.

Physiological Basis of Intelligence.—This is a complex matter about which only a few basic concepts receive general agreement. From a comparison of differential animal species it has long been evident that intelligence is closely correlated with the size of the cortex or that fraction of the brain which is not directly concerned with internal bodily adjustments, muscular balance, etc. Brain operations on animals show that the decline in problem-solving capacity, as well as in the ability to learn complex habits, is just about proportional to the weight of brain removed. Brain injuries in man point to the same relation. A particular habit or capacity may be lost through injury and may be relearned, but there tends to be a loss in general power of abstraction and problem solving roughly proportional to the extent of cortical damage. In the human brain certain areas appear to be definitely associated with relatively specific bodily functions; *e.g.*, the area at the back of the head with visual perception, other areas with hearing, touch, smell, etc., others again with voluntary movement.

Intelligence, however (in the technical sense), according to most anatomists, is associated with somewhat general structural qualities characterizing the brain cortex as a whole. Thus, microscopic studies of the brains of low-grade defectives show that their nerve cells are comparatively few in number and exhibit comparatively few branches, and both the cells and their branches appear to be arranged far more irregularly than those of the normal person of the same age.

No drug that significantly increases intelligence in normal persons is known. Caffeine in coffee (as well as Benzedrine and related drugs) produces increased problem-solving ability, largely by improving memory and alertness. However, in depressed mental patients such drugs also lead to significant improvements—returns to normal—in general intelligence-test performance.

On the other hand, there are many special physiological influences that will reduce intelligence. Twenty grams of alcohol will produce, in the average person, a measurable decline in intelligence-test performance or other forms of judgment; failure of thyroid secretion produces a considerable decline, as is well known through the history of cretinism; and failures of judgment are rapidly produced by anything that interferes with the supply of oxygen to the brain.

Intelligence in Animals.—The capacity of animals, even of the higher apes, to perceive complex relationships is far below that of adult man and seldom exceeds the level of a three-year-old child, yet it is of the same nature as the intelligence of man. Blind trial-and-error behaviour, the very antithesis of intelligence, is common in animal behaviour. But if animals are presented with sufficiently simple problems, such activity is observed to give way to a thoughtful pause, followed by sudden insight and rise to a new level of adaptive but untaught behaviour. In Köhler's classical experiment a chimpanzee given two hollow sticks, each too short to reach a banana outside the cage, was observed thinking and then fitting one stick into the other to provide a new tool long enough to do the job. Similar switches from random behaviour to "insightful" solutions have been observed experimentally in dogs and even in hens. However, the majority of complex and seemingly very intelligent things that animals do represent either inherited patterns, which go wildly astray anywhere outside the natural environment, or are the result of prolonged, blind, trial-and-error learning, as in most circus animals. Most of their relation-perceiving capacity is concerned with spatial or very simple causal relations, and they conspicuously lack the ability to abstract, generalize and deal with relations between abstractions which makes possible man's use of general symbols in language, mathematics, etc. *See* also ANIMAL BEHAVIOUR; PSYCHOLOGY, COMPARATIVE.

Relation of Intelligence to More Specialized Abilities.—Spencer, in his account of the development of cognitive capacities in the race and the individual, held that the general cognitive capacity which he termed intelligence progressively developed into more specialized abilities. The application of factorial methods to the results obtained with mental tests provided some confirmation of this view. Between 1913 and 1917 a series of investigations among British school children of various ages provided conclusive evidence for certain special abilities (*e.g.*, verbal, numerical, manual and spatial abilities) as well as more formal capacities such as memory and imagination.

Among younger children the general factor of intelligence accounted for the greater part of the individual differences; but with increasing age there appeared increasing specialization, most of the more specific abilities maturing before the end of the pubertal period. In the U.S. a number of researches carried out between 1930 and 1950 by Louis Thurstone and his colleagues threw further light on the number and nature of these more specialized capacities.

The primary abilities (as Thurstone termed them) include what may be labeled as verbal, numerical, spatial, reasoning, perceptual and other capacities of restricted form. A person may develop to a considerable extent in all aspects of one of the forms of ability without equivalent development in the others, though there is also some tendency for all of them to be related as different manifestations of one general intelligence. The causes of these differential developments, whether innate or depending upon interests and environment, are not known.

Intelligence Contrasted With Related Powers.—The reverse procedure from that of predicting adult accomplishment from childhood performance was carried out in Terman's studies of the childhood records of well-known men of genius. These performances, compared with those of living children of known ages, show that children who became geniuses showed intelligence decidedly above their age, though some (*e.g.*, Charles Darwin) did not do well in school. Genius, as the follow-up studies of highly intelligent children show, requires something more than intelligence—perhaps also that touch of madness of which John Dryden wrote ("Great wits are to madness near allied, and thin partitions do their bounds divide"). But intelligence is the first ingredient. Creative imagination has a considerable association with intelligence, though always some indefinable additional power is found at work (*see* CREATIVITY; GIFTED CHILDREN).

On the other hand, though intelligence, as capacity to comprehend, must be analyzed out from the total realm of intellectual performance, it is astonishing to see how many apparently unrelated powers are actually considerably dependent upon intelligence. Though memory can be conceptually separated from

intelligence, goodness of memory (in all but rote, or meaningless, memory) is highly related to goodness of intelligence. The size of the vocabulary, for example, is an excellent indication of intelligence. Again, intelligence operates not only in reasoning but in almost every act of perception, so that the ability to judge where a ball will be in a game of tennis involves intelligence. However, although it is clear from both human and animal psychology that by intelligence is meant the capacity to perceive and handle relationships, and that by higher intelligence is meant capacity to handle more complex relationships, the logician has not yet come to the psychologist's aid by indicating criteria through which the "complexity level" of a relationship, in the hierarchy of relationships, can be independently stated. Until that is done, there is some degree of circularity in the definition of higher intelligence.

See PSYCHOLOGICAL TESTS AND MEASUREMENTS; THINKING AND PROBLEM SOLVING, PSYCHOLOGY OF; *see* also references under "Intelligence" in the Index.

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INTELLIGENCE, ANIMAL: *see* ANIMAL BEHAVIOUR; PSYCHOLOGY, COMPARATIVE.

INTELLIGENCE, MILITARY AND POLITICAL, the acquiring of information on a national scale, usually about a rival, but sometimes about an ally or a neutral country. Counterintelligence (or security) is the safeguarding of a country's own secrets. Although mainly related to war and to defense measures in peacetime, intelligence and counterintelligence are also concerned with the collection and safeguarding of diplomatic, economic and industrial information. Clearly the acquisition and safeguarding of information are closely associated; in most countries they are both the concern of the same organization.

The effectiveness of counterintelligence measures may often depend on the amount of positive intelligence available; correspondingly, the efficient acquisition of information may hinge on adequate security. Intelligence work involves not only the collection of information, but also its collation and the estimation of its value and reliability, and the making of reasonable deductions from it.

The outstanding examples of intelligence designations in accordance with the general purpose for which the intelligence has been produced are strategic and tactical. Strategic intelligence is designed primarily to satisfy the needs of the strategic planners and policy makers of national governments or very high-level commands.

Tactical intelligence, which is known also as both combat and operational intelligence, is intended chiefly for use by military tactical commanders and units. For example, the broad intelligence which influenced the Allied decision to attempt a major landing on the Normandy peninsula in World War II was strategic; the detailed intelligence used in the preparation of military plans for carrying out this strategic decision was tactical.

Designations of intelligence according to subject matter are numerous and continue to multiply with the increasing division of labour and specialization in large and complex intelligence organizations, especially at the government or strategic level. For example, military intelligence, which was once the comprehensive term for all intelligence relating to military matters, has been partially superseded in practice by army, air and naval intelligence. Each of the latter three, in turn, has been broken up into several fields of intelligence specialization. Order-of-battle intelligence, for instance, deals largely with the organization, strength, disposition, weapons, equipment, logistics, training and tactics of armed forces.

Geographic intelligence, the comprehensive term for land, sea and air data required for military plans and operations, includes several subdivisions of major importance, such as topographic, hydrographic, weather and meteorological intelligence. Transportation intelligence, which was once an integral part of geographic intelligence, has itself become a separate major field. Tremendous advances in the weapons and equipment of warfare have led to the emergence of technical intelligence as a field of vital importance to national security everywhere. Part and parcel of technical intelligence is scientific intelligence, which has brought forth its own progeny of intelligence specializations on nuclear fission, electronics, guided missiles, telecommunications and chemical and biological warfare.

The fields of political, economic and sociological intelligence have come to be regarded as having great importance for a nation's armed forces as well as for its foreign service. Military scientists are in general agreement that the military planner and policy maker must know the governmental structure, the political groupings, the national policies and objectives, the industrial complex and the social matrix of a potential enemy. Moreover, commanders of forces operating in foreign countries must be similarly informed if they are to deal effectively with guerrilla and resistance activities, satisfactorily administer local government on a wartime basis and conduct a sound psychological program. The fact that the Nazis either did not have or did not use adequate political, economic and sociological intelligence on the Soviet Union has often been cited as a significant factor in the failure of the World War II invasion of the U.S.S.R. by Germany.

Historical.—From earliest times, rulers and governments have attempted to acquire information about rival countries, and rival armies about their opponents and about the topography and other matters in a probable theatre of military operations. Local military information during a campaign, or before battle, was sometimes obtained from local inhabitants, but more often by means of cavalry patrols, while long-term information was obtained through agents (or spies), traitors and casual travelers.

Indeed, the history of intelligence, as distinct from military reconnaissance in the field, is very largely the story of agents and spies. To define a spy precisely is difficult and the word has slightly different meanings according to the country and conditions. A man seeking information while dressed in military uniform is generally considered not to be a spy or an agent but a scout who, if apprehended, is entitled to treatment as a prisoner of war. On the other hand, one whose role is to obtain secret information, by clandestine methods while dressed as a civilian, is an agent or spy and in most countries is liable to the death penalty if caught.

Further, an individual may be a traitor as well as a spy or an agent if he works for a foreign country against his own. Difficulties arise in interpreting these definitions in the case of irregular forces who do not wear proper or easily recognizable uniforms and with revolutionary forces. (*See* ESPIONAGE; PRISONERS OF WAR.)

From the middle ages to the late Renaissance diplomacy and intelligence were so closely bound together that foreign ambassadors were sometimes regarded as little better than spies. In particular, the Venetian republic established embassies and missions abroad and made a point of obtaining what would now be considered remarkably full intelligence reports from its ambassadors and agents. In England espionage was a serious business by Elizabeth I's reign, when an elaborate intelligence system was organized by Sir Francis Walsingham (*q.v.*) in order to obtain information from the continent, mainly from Spain. So great was Walsingham's enthusiasm for intelligence work that, in the absence of public funds, he devoted almost the whole of his considerable private fortune to furthering it.

More than a century later, in the reign of Queen Anne, the chief organizer of British intelligence was Daniel Defoe, who may be said to have been the founder of the modern British secret service —a role in which the author of *Robinson Crusoe* is not familiarly known.

Espionage flourished in the Napoleonic Wars and it is difficult to select individuals for special mention. Perhaps Napoleon's great intelligence organizers, Joseph Fouché and René Savary (duc de Rovigo), were the best known and most successful. Much of Napoleon's military success was a result of the diligence with

which his famous chief of staff, Marshal Louis Alexandre Berthier, collected information in the field.

Until several years after the Napoleonic Wars intelligence activities were greatly restricted by the limitations of communications. The horse was in those times the swiftest means of travel on land and the sailing ship by sea. These were also the quickest agencies for passing information, with the exception of the carrier pigeon—popularly believed to have been used to convey the result of the battle of Waterloo to Nathan Mayer Rothschild in London. This means, however, was not practised extensively or properly understood until later, by which time it had been superseded by telegraphy.

The limitations of the times were naturally less hindrance to the collection of long-term, or strategic, information than to that of tactical or battle intelligence. Rival navies were nearly always completely in the dark about each others' movements, the first warning of the approach of an enemy squadron invariably being given by the lookout in the crow's-nest of a scouting frigate only a few miles ahead of the main fleet. On land, comparatively large armies could bivouac or maneuver within a few miles of each other in mutual ignorance. In spite of his considerable force of cavalry Napoleon was unaware of the direction of the withdrawal of Marshal Blücher's Prussian army after Ligny and Quatre-Bras and was largely surprised when it reappeared on the battlefield of Waterloo 48 hours later.

Developments Since the Mid-19th Century.—The latter half of the 19th century saw revolutionary changes in means of transport and so of passing information. Railways, the steamship, the submarine cable and the telephone, and the internal-combustion engine all played their part. Together with developments in other fields, these increased the tempo of diplomacy. Under these conditions a good intelligence service paid large dividends and in consequence the great powers tended to maintain intelligence organizations of ever-increasing size and efficiency. The 20th century was to witness the introduction and rapid development of aircraft and the universal use of wireless telegraphy—two inventions which further increased the potentialities of a good intelligence system.

Apart from new scientific aids, the general conditions of World War I favoured intelligence activities in neutral countries. In western Europe—the main theatre of war—the rival armies faced each other in static positions at close quarters for four years, on a front extending from the English channel to Switzerland. This line of battle was flanked by neutral countries—the Netherlands and the Scandinavian countries to the north and Switzerland to the south—where spies and agents of both sides could work in comparative safety. British intelligence earned a deservedly high reputation during the years 1914–18. Two of its earliest successes were the immediate and unobtrusive arrest on the outbreak of war of practically all enemy agents in the United Kingdom, and the acquisition of the German naval cipher, which, for some time, gave the British admiralty prior notice of all major movements by the enemy fleet. M.I.5 became a legendary organization and, it must be confessed, often got credit which was properly due to other agencies.

World War I produced many agents who worked in neutral countries as well as from belligerents. Among the best known was the German Kapitän Franz von Rintelen who was sent to the United States in 1915 to sabotage American aid to the Allies. The security measures in neutral America at that time were lax, as the United States had up to then escaped the intensive espionage activity which Europe had experienced for centuries. In consequence von Rintelen had considerable success, until U.S. entry into the war in April 1917 put an end to his activities. Perhaps the most publicized spy of all time was the Dutch-born agent known as Mata Hari (born Margaret Gertrude Zelle) who operated in Paris, Rome, Vienna, Berlin and other continental cities, from 1905 until her execution as a spy in France in Oct. 1917.

Long before the outbreak of World War II in 1939 intelligence and counterintelligence had ceased to be solely concerned with diplomatic and military secrets; it became one of the main duties of a national intelligence service to uncover industrial and scientific data on which the war potential of its enemies, or likely enemies, increasingly relied.

After the end of hostilities in 1945 "cold warfare" conditions, and the development of nuclear weapons, further extended the scope of the work of the intelligence organizer as well as of its urgency. There was hardly a field of human activity which was not liable to be probed by the intelligence agent, or which had not taken on a security aspect.

The methods of obtaining intelligence have been largely misrepresented by fiction writers and film producers. In popular estimation intelligence is usually associated with the glamorous spy, disguise, forged passports and clandestine meetings. It is untrue to say that these methods are never employed, but they are the exception rather than the rule. A very considerable part of all useful intelligence is gained by routine methods: from the press, through travelers, businessmen and others who may pick up something in the course of their normal work; by piecing together a number of apparently trivial facts which in isolation are worthless, but together may be of considerable value. The professional agent or spy is, generally speaking, sparingly employed, or reserved for missions of special urgency. Most of those who provide information are casual agents with no professional status in the intelligence world.

The so-called international spy is, however, worthy of mention. Mostly men, but sometimes women, they may be said to be products of the 20th century. Invariably persons with little or no national loyalties, they are often of mixed race, frequently with a grievance against their own country. Many have criminal records. Their information is rarely of much value; they work for the highest bidder, but are quite prepared to double-cross their first employer if they find a better one. Nevertheless, they flourished in considerable numbers in the period between World Wars I and II. Paris, Brussels, Geneva, Cairo and other cities where communications meet and international affairs are conducted, were their clearinghouses. They were thoroughly unreliable, and their haunts were usually well known to the police and security agencies. Yet, a few of them seem to have had some success, and even standing, in the intelligence world, as was revealed by a number of arrests and trials in the 1930s.

Intelligence in World War II.—By reason of the development of scientific equipment, and the world-wide and fluid nature of military operations, intelligence during 1939–45 reached a high pitch of activity and efficiency. In most theatres of land operations there was no continuous and heavily manned front line; sometimes the belligerents became inextricably mixed. The number of different nationalities involved and the frequent difficulty of distinguishing friend from foe made the work of the agent and military intelligence personnel profitable in countries such as Belgium and France (1939–40 and 1944–45), Norway (1940), the middle east, Burma and Malaya. Conversely, counterintelligence was much more difficult.

The means of gathering information was greatly increased by scientific developments. Aircraft, and particularly photographic reconnaissance, made it possible to unmask installations and troop dispositions in both the strategic and tactical fields. Wireless interception and ability to "break" mechanically even the most intricate cipher or code, made the acquisition of information by this means a regular feature of intelligence procedure.

In this connection it should be noted that the United States' intelligence successfully broke the Japanese cipher before Pearl Harbor. This enabled the United States government to have prior information of Japan's generally hostile intentions, although it did not give early warning of the actual time, place or manner of attack. *See* CRYPTOLOGY.

Deception was practised to a greater extent than ever before. Every plan of operations was masked by a skilfully prepared "cover plan"—in other words a bogus plan which the enemy was intended to discover and to regard as the real plan. Before the battle of El Alamein in Oct. 1942 a concentration of troops was simulated by means of dummy tanks, vehicles, camps and water points. Before the landings of U.S. and British troops in Normandy in June 1944 a most elaborate cover plan was designed

with the object of giving the Germans the impression that a landing in the Pas-de-Calais was contemplated. Large camps and vehicle parks were established in Kent and Essex, and bogus wireless traffic was maintained in order to direct attention toward the Dover and Calais areas and away from Normandy. A possible landing in Norway from the east coast of Scotland was also simulated on the wireless.

The older intelligence methods were greatly extended in World War II. Elaborate Allied espionage systems were organized in Norway, Denmark, the Netherlands, Belgium, France, Greece, Burma, Malaya and other occupied territories. Contact was maintained by means of clandestine wireless sets and personnel dropped by parachute or landed from submarines or small craft. (In Japan a most successful spy was the German press correspondent Richard Sorge, who was a member of the Nazi party but nevertheless a convinced Communist and a Soviet spy.)

Intelligence in the Cold War.—After 1945 many new factors arose which affected intelligence work. International frontiers were redrawn; countries with centuries of independence became satellites of the U.S.S.R.; colonial and protected countries gained full independence. As an outcome of these great changes many thousands of persons became displaced and stateless and many others left their old homelands and sought sanctuary elsewhere. These conditions made infiltration by agents, and the path of the spy, comparatively easy. In addition, the division of most of the world into two sharply defined blocs—eastern Communism and western democracy—produced subversive elements of a new type. Educated men and women holding responsible positions in the west had, for what they believed to be idealistic motives, defected to Communism. Conversely, individuals from Communist countries sought and obtained political asylum in the west.

In Sept. 1945 Igor Gouzenko, an official in the Soviet embassy in Ottawa, defected to Canada and thereby uncovered the activities of Klaus Fuchs and Alan Nunn May who were employed in Britain in nuclear research work of the greatest secrecy. The extent to which these two men's subversive activities helped the U.S.S.R. is difficult to judge, but they may have assisted Russia considerably in developing the atom bomb, and thereby hastened the end of the British-U.S. monopoly.

At that time Bruno Pontecorvo was also employed in Canada on atomic research. In 1950 he disappeared from Helsinki, Fin., and went to the U.S.S.R., where he remained.

In 1954 a Soviet agent, Vladimir Petrov, and his wife, who were both employed at the Soviet embassy in Australia, dissociated themselves from the U.S.S.R. and were given political asylum by the Australian government. This disclosed a vast network of Soviet espionage in Australia. Not all these individuals were professional agents. With some their defection was due to genuine, if misguided, ideological beliefs.

The number of defections from one ideology to another in the years after World War II was greatest from east to west. In Berlin alone tens of thousands crossed permanently from the eastern to the western sectors each year, whereas the numbers in the opposite direction were small. Only a very few were spies; but some were, and it demonstrated the ease with which agents could be transferred to the west from eastern Europe. Nor was Berlin the only place. Similar facilities existed in many parts of Europe where east-west frontiers were contiguous, and in many parts of the world outside Europe; *e.g.*, Hong Kong. After 1945 the opportunities for "planting" agents in research establishments, service units, government offices, docks and factories increased.

As a consequence of such conditions the security side of intelligence developed and expanded in all national intelligence organizations. Security in Great Britain was clearly easier than in most countries. Its position as an island made it possible to impose strict control over entry and exit, and its population was unusually homogeneous. This reduced the number of likely traitors and the chances of subversive activities. States with land frontiers with other countries had a much more difficult security problem. The U.S.S.R. had the additional anxiety of satellite states and a large non-Russian population of doubtful loyalty. Although otherwise favourably placed from the security point of view, the United States had a less homogeneous population than Great Britain and this is reflected in the very elaborate security organization which it maintained.

The Korean War (1950–53).—This conflict provided unique opportunities to both sides for the acquisition of tactical information. After the first few weeks, when operations had stabilized, it was very difficult for either side to make a tactical move of any significance without its opponents receiving prior warning. This was due very largely to the fact that North Koreans and South Koreans are of the same race, speak the same language and dress in a similar manner. This made the task of the native intelligence agent a relatively easy one.

Conversely, the task of those responsible for tactical security was more difficult. On the other hand, it was probably more difficult for both sides to gain useful strategic information than is customary in modern war—due to the North Korean and Chinese "volunteer" forces possessing practically no aircraft, and the strategic reconnaissance of UN aircraft being confined, for political reasons, to areas south of the Yalu river. In this connection it should be noted that the original attack by North Korea on the Republic of Korea (South Korea) in June 1950 was to a very large extent a surprise, as was the participation of Chinese troops in Oct. 1950.

Modern National Intelligence Organizations.—The general pattern of intelligence systems in all countries is very similar. In all there is a higher directing organization in the home capital which deals with political, economic and industrial intelligence, security policy and, where necessary, co-ordinates intelligence work in the separate fighting services. Intelligence organizations are represented abroad at embassies, consulates and vice-consulates. Within the fighting forces intelligence is organized, collected and sifted by the service intelligence staffs.

Although the general organization and methods of collecting information are common to most countries, there is a marked difference in security, or counterintelligence, methods. In most democracies the conduct of security measures is somewhat limited by the need to proceed according to ordinary law, which is applicable to military and police personnel engaged in security duties in the same way as to other citizens. In many other countries the secret police, who are responsible for security, have exceptional powers of arrest, detention and interrogation.

It is one of the chief duties of the security side of a national intelligence organization to safeguard the system and methods by which it operates. It is, therefore, not surprising that detailed information concerning the organization of intelligence in various countries is scanty. The following notes give in outline the organization in the four major countries: the United States, Great Britain, France and the U.S.S.R.

United States.—The United States has shown great generosity and understanding in giving asylum, and a home, to large numbers of political refugees and stateless persons from Europe. Since 1945 this liberal immigration policy, although it has served the country well, has placed emphasis on the security side of intelligence, since among so many foreigners, without inborn loyalty to the United States, some were almost certainly spies. The three fighting services have their own intelligence services; in addition there are many other agencies which deal with various aspects of intelligence. All intelligence is controlled by the Central Intelligence agency (CIA), which was established in 1947 to work under the National Security council. The functions of the agency are: (1) to advise the National Security council on security matters; (2) to co-ordinate all departments and agencies in relation to intelligence; (3) to correlate, evaluate and distribute intelligence information to the appropriate agencies; (4) to deal with certain matters common to all intelligence agencies; (5) to perform such other intelligence functions as the National Security council may direct.

A body known as the Operations Coordinating board is also concerned with the security side of intelligence. The director of the CIA is a member of this board, the purpose of which is to provide for the integrated implementation of national security policies by the many agencies involved.

Great Britain.—The central organization for British intelligence is the Joint Intelligence bureau which is responsible for: (1) coordinating intelligence in the three fighting services; (2) intelligence work common to all three fighting services; (3) economic and scientific intelligence; (4) intelligence relating to guided missiles and other new weapons.

Each fighting service has its own intelligence organization. Those of the Royal Navy and Royal Air Force are mostly concerned with technical matters; that of the army is of a more general nature and on a larger scale. Before the formation of the Joint Intelligence bureau after World War II, military (*i.e.*, army) intelligence was the agency mainly responsible for many items of general intelligence now within the province of the Joint Intelligence bureau.

The acquisition of intelligence overseas is to a considerable extent the responsibility of the service intelligence organizations, mainly the army. Counterintelligence at home is vested in a number of agencies. Those primarily responsible are the Joint Intelligence bureau and the three service intelligence organizations, but the civil police, through the home office, are also closely concerned. The personnel of intelligence agencies have no powers of arrest, detention or interrogation. The general procedure is that the intelligence agencies provide the information, while Scotland Yard and the various city and county police forces act on the information. Sometimes the civil police in their normal anticrime work unearth espionage activities. The special security agencies and the civil police work in close co-operation.

France.—Each of three fighting services has its own intelligence department, known as the *deuxième bureau,* which deals with various aspects of intelligence. These three service *bureaux* are linked to the headquarters of the *deuxième bureau* at the ministry of defense. All security matters (including counterespionage) are dealt with by *S.D.E.C.E.* (Service de Documentation Extérieure et de Contre-Espionnage) and *D.S.T.* (Direction de la Surveillance du Territoire). Each ministerial department is responsible for its own security. Security within the armed forces and services is the responsibility of the *securité militaire.* As in Great Britain all security agencies work in close co-operation with the civil police.

U.S.S.R.—Before the 1917 Revolution Russian intelligence was primitive and inefficient; security was confined largely to the investigation of movements and plots against the regime. After the early 1930s a highly efficient Soviet intelligence and counterintelligence system spread its net over every phase of national life and over activities of the U.S.S.R. in foreign lands. At the beginning of the 1960s, under the direction of the State Security committee, there were two main branches of the organization, located within the U.S.S.R.: the G.R.U. or chief intelligence directorate of the Soviet army and the intelligence unit within the secretariat of the Communist Party of the Soviet Union which is responsible for furthering Communism in foreign countries. Each of these branches handles a variety of intelligence and security matters in foreign countries, but there is much overlapping and many of the subject headings fall outside the term "intelligence" as known in non-Communist countries.

The following are among these activities: sabotage; political and military intelligence sections (including secret intelligence groups) organized by Soviet embassies in foreign capitals; guerrilla movements (actual and potential); spy groups and intelligence agents; and agitation and propaganda for the Communist parties. Contrary to the custom with most countries, where intelligence is in the hands of specialists, it can be said that every Soviet citizen in a foreign country is in some degree a Communist agent or an agent for some branch of the intelligence system of the U.S.S.R.

International Intelligence.—NATO has no intelligence organization of its own, but relies on those maintained by its member countries. The signatories of the Warsaw treaty are believed to rely very largely on the Soviet intelligence system which is known to operate extensively in the satellite countries.

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INTELLIGENCE TEST: *see* PSYCHOLOGICAL TESTS AND MEASUREMENTS; INTELLIGENCE; DIFFERENTIAL PSYCHOLOGY.

INTENDANT, a commissary of the king under the *ancien régime* in France. The institution was both the instrument of crown centralization and the focus of provincial life. Its origin, however, remains obscure, because of the complexity of the circumstances to be taken into account and the absence of any document specifically creating it. When "intendants of justice, police and finances" are found mentioned in 1625, this title in fact covers functions which were being exercised long before that date by men who enjoyed the king's confidence; and it was not until the reign of Louis XIV that the intendants received their full status.

The institution had its beginnings in the crown's obligation to recover the authority which it had alienated through the sale of offices. This it did by placing, over the royal officials who by purchase had become the proprietors of their offices, agents with well-defined powers under *lettres de commission* for a certain length of time. It was thus that Francis I in 1526 appointed some *maitres des requêtes de l'hôtel* ("masters of requests of the household") to be sent on tours of the provinces. In 1551 these agents were given the title of *commissaires départis pour l'exécution des ordres du roi* ("commissaries sent out to execute the king's orders"); and a decisive step was taken in May 1555 when Henry II gave to each of his *maîtres des requêtes* in the provinces a particular sphere of action or *généralité.* Special commissaries were also dispatched to particularly troubled areas, to an army in the field or to a provincial governor, with the title of "intendant of justice" or "intendant to the army." The word "intendant" as yet meant no more than supervisor, so that the sphere of supervision always had to be exactly defined. Intendants to the army appeared in 1555 in Touraine, at Lyons and in Corsica. It was at Lyons that intendants of justice were first made permanent, notably from 1601 to 1607; before that their task had been essentially to apply edicts of pacification after civil war, in which capacity they were called *commissaires de l'édit.*

The cardinal duc de Richelieu made systematic use of institutions which had been established long before his time but which had been used only as occasion required. Richelieu, who recommends the use of intendants in his *Testament politique,* himself increased the number of commissaries sent on provincial tours or on missions of inquiry to provincial governors; but he never gave to these envoys power to make decisions. Inevitably these *commissaires départis* (as they were then generally called) became the rivals of the local authorities, particularly of the treasurers general of the *bureau des finances* functioning in each *généralité.* The commissaries' authority was extraordinarily enhanced by a ruling of Aug. 22, 1642, which associated them with the *bureaux des finances* to help with the apportioning of the *taille.* This growing power so much disquieted the local governors and officials that in the declaration of July 11, 1648, inspired by Mazarin, Louis XIV revoked the powers of all the intendants except those in certain frontier provinces; but this decision, taken when the Fronde was breaking out, had no lasting effect, and "intendants of justice, police and finance" were re-established by Mazarin at the beginning of 1653.

From the start of his personal government (1661), Louis XIV maintained the intendants, who thenceforth became the regular

representatives of royal power. An intendant was appointed to each *généralité* except Toulouse and Montpellier, which were combined under the intendant of Languedoc, so that there were 33 intendants for the 34 *généralités* in 1789. Appointed by the king, who could likewise recall him when he wished, the intendant received *lettres de commission* which laid down his duties and which he deliberately refrained from having registered at the local sovereign courts for fear of losing his liberty of action. Intendants were recruited particularly from among the *maîtres des requêtes* and the *noblesse de robe* or judicial nobility. Moved readily from one *généralité* to another under Louis XIV, they tended to fix themselves during the 18th century, though this did not prevent them on occasion from living in Paris. They handed over their duties to subordinates or *subdélégués*. These men, chosen at first personally by the intendants, were made royal officers in 1704. There were several *subdélégués* in each *généralité*. An intendant could also have a council, often called the *conseil d'avocats*, for consultation in difficult cases.

The authority of the intendants extended into every sphere of the administration: indeed the use of the latter term in its modern sense grew up with them, since they were the forerunners of the change from the judicial magistrature as exercised by *parlements* or by *bureaux des finances* to the administrative magistrature as exercised by prefects. As *commissaires départis*, they were responsible for carrying out the central power's orders in their *généralités*, supervising the local officials, representing the crown at the local autonomous bodies (provincial estates in particular) and informing the central power about the economic situation and public opinion in their *généralité*. From this point of view their correspondence with the *contrôleur général des finances* and the *mémoires* which they kept up to date from the end of the 17th century are particularly valuable. Their mission remained always one of providing information rather than of making decisions, and in order to act they had to obtain an order from the king's council, which however would often be drafted on the lines that they suggested. As intendants of justice they could preside over local courts, suspend unsatisfactory magistrates and install extraordinary tribunals to suppress brigandage and sedition. As intendants of finance, they determined the incidence of the *taille* (*q.v.*) in the *pays d'élection* and discussed with the assemblies the amount of the annual tax to be voted in the *pays d'états*, and it was their responsibility to collect the new taxes levied at the end of the 17th century. It was, however, as intendants of police that they played their most important role. Responsible for public order, they co-ordinated the activities of the *prévôts des maréchaux* (the police force under the marshals of France) and sometimes intervened in the affairs of private persons, prompting the dispatch of *lettre de cachet* (*q.v.*). They likewise controlled municipal administration, and it is to them that many provincial towns owe their magnificent squares. In road building, Daniel Charles Trudaine, intendant of Auvergne from 1730 to 1734, was especially distinguished.

Enlightened administrators in the century of the Enlightenment, the intendants were champions of the physiocratic school (*q.v.*) and also of the use of statistics: the baron de Montyon (Antoine Auget), intendant of Auvergne from 1768 to 1773 and Provence from 1773 to 1775, wrote under the pseudonym of M. Moheau the first reasoned demographic treatise, *Recherches et considérations sur la population de la France*, two volumes (1778). Yet their omnipotence and their omnipresence made them unpopular, and it was partly to remedy their excess of power that the so-called *assemblées provinciales*, with consultative and administrative powers, were set up throughout France in 1787. The powers of intendants were suppressed by the Constituent Assembly on Dec. 22, 1789.

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INTER-ALLIED DEBTS: *see* WAR DEBT.

INTER CAETERA, a papal bull of May 4, 1493, defining areas of sovereignty over newly discovered lands, was issued by Alexander VI after reports of the first voyage of Christopher Columbus reached the pope and the Spanish and Portuguese rulers.

Under this bull and one of May 3, a line of demarcation was drawn 100 leagues west of "the islands commonly known as the Azores and Cape Verde," and the rulers of Castile and León were confirmed as the sovereign power over all lands already discovered or to be discovered west of that line which were not "in the actual possession of any Christian king or prince."

Portugal, which held colonies along the coast of Africa, was to retain its rights and privileges east of the line. In September of the same year, the pope expressly confirmed in another bull the Spanish rulers' right to hold lands to the "eastern region and to India."

Under the treaty of Tordesillas, June 7, 1494, the Spanish crown agreed to move the line of demarcation 370 leagues west from the Cape Verde Islands, thus giving Portugal a claim to Brazil.

INTERCOLUMNIATION, in architecture, the distance between the columns (*q.v.*) of a colonnade; usually defined by the number of times in which the bottom diameter of the column is included in the distance between the two closest points on adjacent columns. Thus the distance between the centre lines of two columns is one diameter more than their intercolumniation. The intercolumniation of classic columns was systematized at an early date, and the following standard intercolumniations have been listed by Vitruvius and others: (1) pycnostyle, equal to $1\frac{1}{2}$ diameters; (2) systyle, 2 diameters; (3) eustyle, $2\frac{1}{4}$ diameters, so-called "well-columned," as the one most generally satisfactory; (4) diastyle, 3 diameters; (5) areostyle, 4 diameters; and (6) areosystyle, a complex form in which the columns are arranged in pairs with the distance between the pairs greater than the distance between the columns of each pair, as in the colonnade of the Louvre, Paris (by Claude Perrault, 1665). No such absolute standardization of intercolumniation as Vitruvius' list would suggest exists in classical work; frequently all the intercolumniations of a single colonnade differed, with the widest in the centre. The list must therefore be considered, like the so-called rules for the orders, merely as a summary of the averages. *See* ORDER.

INTEREST is the price paid for the use of credit or money. The term is used to denote either a payment expressed in money ($8 per $100 per year, or similarly in other currencies) or the rate of payment (8% per year).

Measured in money, interest is the difference between the total that is repaid and the sum originally advanced, which is known as the principal. If, for example, $100 is borrowed for three years and the borrower pays the lender $112 at the end of the third year, the interest is $12. The rate of interest is the ratio between the amount of interest earned during a unit of time and a unit of principal. In interest computations, a rate is expressed as a decimal. Thus 8% (which really means $\frac{8}{100}$) is written as .08. The traditional unit of time in finance is one year, but by agreement some other period of time, such as a month or day, may be used.

Interest charges vary in amount directly with time: the longer the period that the principal is in use the more interest must be paid. Similarly, interest varies with the principal and the rate. The mathematical relationship between these components of any interest problem is expressed in the familiar formula: $I = P\,r\,t$. In this formula, I represents the total interest paid in money; P represents the principal, the amount of money borrowed; r represents the rate of interest expressed as a decimal; and t represents the time covered by the transaction, expressed in the agreed upon units of time. If any three of the four components are known, the

fourth can be computed by the formula. For example, if $350 is borrowed for three years at the rate of 5% per year, the formula will read as follows:

$$I = \$350 \times .05 \times 3$$
$$I = \$52.50$$

Another important use of the formula is to calculate the rate of interest in a given transaction. Using the same example given above, the problem may be stated as follows: What is the rate of interest when $350 earns $52.50 in three years? To solve this problem, the formula is written thus: $r = \frac{I}{pt}$. Substituting the given values, the problem is solved as follows:

$$r = \frac{52.50}{350 \times 3} = \frac{52.50}{1050} = .05 = 5\%$$

For periods less than one year, time is measured in days, and the time element in the formula is expressed as a fraction of a year. For example, if money is borrowed for 30 days, t in the formula becomes $\frac{30}{365}$ (or in leap year $\frac{30}{366}$). Interest so computed is called exact interest. For ease in computation it is customary in commerce and banking to use 360 days instead of 365 in the denominator. Interest so computed is called ordinary interest and is always slightly more than exact interest.

Interest may be paid in one of three ways: (1) all paid at the very beginning of the contract; (2) all paid at the very end of the contract; (3) paid in part at different times as the contract progresses.

When all the interest is paid at the beginning of the contract, the interest charge is called discount. The borrower who applies for a loan of $100 for one year at an interest rate of 5% a year receives only $95 in cash but pays back $100 at the end of the year.

Interest paid according to (2) is called simple interest. It is computed only once, at the end of the contract, for the entire elapsed time. All results are computed by the formula

$$I = P\,r\,t.$$

Interest paid according to (3) becomes compound interest. This type involves interest paid on interest, because as interest is received periodically it is added to the existing principal to form a new principal. This enlarged principal earns more money in the subsequent period, though the rate remains the same. The following example illustrates the method of computing the compound amount when $100 gathers interest for three years at a rate of 4% per year:

Starting principal	$100.00
Interest at 4% the first year	4.00
Amount at end of first year	104.00
Principal at start of second year	104.00
Interest at 4% for second year	4.16
Amount at end of second year	108.16
Principal at start of third year	108.16
Interest at 4% for third year	4.33
Amount at end of third year	112.49

At simple interest the amount at the end of the third year would be $112.00. For periods of more than one year compound interest is always more rewarding than the corresponding simple interest, and for long periods of time the advantage becomes substantial.

To distinguish compound interest from simple interest it is customary to use n for the units of time and s for the sum of principal and interest.

The formula for determining the compound amount is usually written as $S = P(1 + r)^n$.

The amount of compound interest, as distinguished from the compound amount, is determined by subtracting the original principal from the compound amount. For large values of n the computation of $(1 + r)^n$ is tedious and time consuming. Standard tables of such computations are available for many values of r and n.

Instead of annual compounding, interest is often compounded at fractional periods of a year. Banks, for example, frequently pay interest quarterly on savings accounts. If the quoted interest rate is 4% compounded quarterly, interest is earned at the rate of 1% each quarter. On $100 the compound amount at the end of each quarter (to four decimal places) would be successively $101.0000, $102.0100, $103.0301 and $104.0604. The standard tables carry such computations to eight or more decimal places.

By simple interest the $100 on deposit would earn $4 in interest by the end of the year. By compounding quarterly the same principal would earn $4.06. In such transactions the quoted rate is called a nominal interest rate. The rate actually earned is called an effective rate and is designated by i. In this example $i = 4.0604\%$.

The formula $S = P(1 + r)^n$ can be used to compute the effective rate, but r must be the rate per conversion period (when interest is credited and becomes part of the principal) and n must be the total number of conversion periods in the whole transaction. The following example illustrates the method: If $400 is invested at 6% (per year), compounded quarterly for 20 years, the formula becomes $S = 400(1.015)^{80}$, because 1.5% is earned each quarter and there are 80 quarterly conversion periods in 20 years.

In time payment plans, so popular and useful in consumer buying or borrowing, the amount of principal of which the consumer has use reduces as each payment is made. These partial payments of principal introduce new difficulties in rate computation. The true interest rate in installment plans can be computed accurately by annuity formulas, but such computations require special training and access to tables. There is available, however, the so-called constant ratio formula, $i = \frac{2ml}{P(n + 1)}$, which requires no tables and no special mathematical skill. This formula gives an approximate result that is close enough to the effective rate for most practical purposes. In this formula m is the number of payment periods within one year (12 for monthly payments, 4 for quarterly payments) and n is the total number of payment periods in the contract. The following example illustrates the procedure: A loan of $100 is to be repaid in 12 equal monthly payments at a charge of 7% discount. What is the effective interest rate? In this case, P is $93, I is $7, m is 12 and n is 12. The constant ratio formula works out as follows:

$$i = \frac{2 \times 12 \times 7}{93\ (12 + 1)} = \frac{168}{93 \times 13} = \frac{168}{1209} = 13.895\% \text{ or } 13.9\%$$

By the more accurate annuity method, i equals 13.6%. *See* also CAPITAL AND INTEREST and references under "Interest" in the Index.

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INTERFERENCE OF LIGHT: *see* LIGHT: *Waves and Interference;* INTERFEROMETER.

INTERFEROMETER. An interferometer is an instrument which makes use of the interference of waves for the purpose of measurement. After an introduction which includes a classification of interference effects, this article is divided into the following sections:

I. Interferometers Using Division of Wave Front
  1. The Väisälä Interferometer
  2. Michelson's Stellar Interferometer
II. Interferometers Using Division of Amplitude
  1. Fizeau-Laurent Surface Interferometer
  2. The Jamin Interferometer
  3. The Michelson Interferometer
  4. The Twyman-Green Interferometer
  5. The Linnik Interference Microscope
  6. The Mach-Zehnder Interferometer
  7. The Bates Wave-Front Shearing Interferometer
  8. The Fabry-Pérot Interferometer
  9. The Echelon and Lummer Plate Interferometers
III. Multiple-Beam Interferometry
  Some Applications of Multiple-Beam Interferometry

Interferometers are most commonly adapted for use with sound or light waves. For a discussion of acoustic interferometry *see* SOUND: *Applications of Sound.*

This article will be devoted entirely to optical interferometers,

which can be conveniently divided into two broad groups. In the first, metrical interferometers, light waves of known wave length are used for the measurement of metrical or optical lengths. In the second group, interference spectroscopes, the objects under study are the light waves themselves (*see* SPECTROSCOPY). Because the wave length of visible light is only of the order of $\frac{1}{2,000}$ of a millimetre, metrical interferometers can only be used for the evaluation of quite small differences in length; nevertheless it is possible to compare large lengths provided they only differ by small amounts. Thus it becomes convenient to subdivide metrical interferometers into those used for measuring quite small lengths and those which can be used for the evaluation of lengths up to as much as 100 m.

Although the existence of phenomena caused by optical interference was known to Robert Boyle, Robert Hooke and Sir Isaac Newton as early as about 1665, it was not until 1802 that the fundamental mechanism was clarified by Thomas Young, who was the first to enunciate the theory that optical interference involves the principle of coherence and the principle of superposition (*see* LIGHT). The essential features are (1) that light beams from two independent sources, being incoherent, can only combine their intensities; but (2) light beams from any one point of a source, which may have traveled over different paths and then come together again, being coherent, can combine their amplitudes, and this can lead to stationary fluctuations of intensity in space, called interference fringes. An interferometer is essentially an optical system that divides a beam of light from a source into two (or more) beams which follow different paths and then are recombined. If there are differences in either the optical or metric paths, then each wave-length difference leads to a shift of one interference fringe. Thus small differences become measurable.

Varieties of interference fringes were discovered successively during the first half of the 19th century by Young, A. J. Fresnel, Sir John Herschel, Sir David Brewster, Humphrey Lloyd, W. K. von Haidinger, W. H. F. Talbot, F. Billet and others. They were treated as academic curiosities until J. C. Jamin in 1856 invented his celebrated interference type of refractometer (*q.v.*), followed in 1859 by A. H. Fizeau who carried out an ingenious interferometric test of the water-velocity-drift formula proposed by Fresnel. Then in 1862 Fizeau applied thin-film fringes to the measurement of the thermal expansions of small bodies. Following Fizeau there were many developments, leading to a great expansion of interest in the subject by the mid-20th century and increasing use of interferometers for precise physical measurement.

Classification of Interference Effects.—Interference phenomena can be conveniently classified according to (1) chromatism; (2) wave division; (3) fringe localization; (4) multiplicity.

1. Some interference phenomena can be produced with white light; others require an approximately monochromatic source. The line width (departure from true monochromaticity) imposes restrictive limitations in many interference experiments.

2. The condition of coherence requires the division of the wave front into separate beams. This can be done either by (a) division of the wave front by slits or apertures or (b) division of the amplitude of a wave front by the double act of partial reflection and partial transmission at a reflecting interface.

3. Fringes, according to their mode of origin, may be non-localized (*i.e.*, extend into space), localized on a surface or appear at infinity.

4. While many interference systems use two interfering light beams (two-beam interference) others use many geometrically related beams (multiple-beam interference). Correct use of multiple beams leads to a considerable reduction in the widths of the interference fringes and thus to an increase in sensitivity and accuracy.

I. INTERFEROMETERS USING DIVISION OF WAVE FRONT

In such instruments a coherent wave front is divided, usually by two parallel slits or by two separated mirrors. The Rayleigh interference refractometer, described in 1896 (*see* REFRACTOMETER), incorporating the modern improvements of F. Haber and F. Löwe (1910), is widely used for the determination of the refractive indices of gases and liquids. A diagram is shown in fig. 1.

Fig. 1(A) shows a plan view and fig. 1(B) an elevation view. From a slit source S, light rendered parallel by the lens L_1 falls on two fairly wide slits 1 cm. apart (S_1S_2). After passing through the tubes T_1T_2 and a compensating device G_1G_2 (invented earlier by Jamin), the beams are reunited at F by the lens L_2. Fringes appear at the lens focus and are viewed with a high-magnification cylindrical lens.

As shown in fig. 1(B), T_1T_2 occupy only the upper half of the field of view so that similar systems of fringes appear at F_1 and F_2, the lower set at F_2 becoming a reference-fixed system, which is brought close to the movable system at F_1 with the tilted glass plate H. The Jamin compensator G_1G_2 consists of two similar glass plates inclined at a small angle, the beam from the two separate slits going through separate plates. By a slight rotation, a

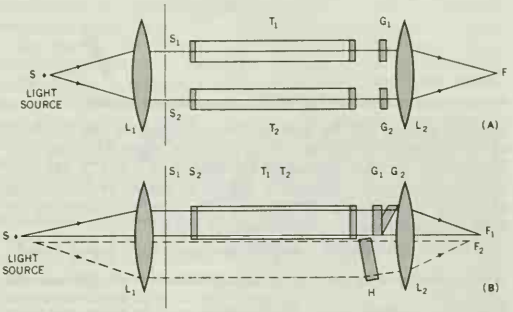


FIG. 1.—(A) PLAN AND (B) ELEVATION DIAGRAMS OF THE INTERFERENCE REFRACTOMETER

small path difference can be introduced into either path so as to compensate any differences created in T_1 and T_2 by differential gas filling. The fringe displacement per degree of rotation is predetermined with light of known wave length, the final observations being made with white-light fringes; for by this means the central achromatic white-light fringe enables exact identity of path to be re-established with the compensator. If one tube is evacuated, then for a tube length L the refractive index μ is given by $n\lambda = (\mu - 1)L$ in which λ is the wave length of the calibrating light and n the number of fringes which the compensator reintroduces. A shift of $\frac{1}{10}$ fringe is just measurable, and for tubes 1 m. long this corresponds to a change in refractive index of 1×10^{-8}.

1. The Väisälä Interferometer.—A striking adaptation of this interference system was introduced by V. Väisälä (1927) for the purpose of measuring very long paths (*e.g.*, of the order of 100 m.) for use as a base line in geodetic survey. Two arrangements were used. In the first (fig. 2), light from S, separated by the two slits S_1S_2, produces fringes at F, after reflection from mirrors A, B, C. If white light is used, then fringes are only seen if AB is equal to BC to within a light wave or two. If AB is a substandard metre then BC can be matched equal to this to within a fraction of a light wave. The length AC is now 2 m. BC can now be

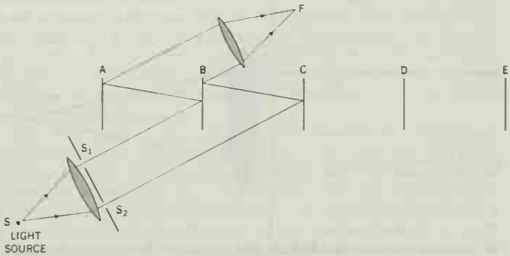


FIG. 2.—INTERFERENCE SYSTEM INTRODUCED BY V. VÄISÄLÄ

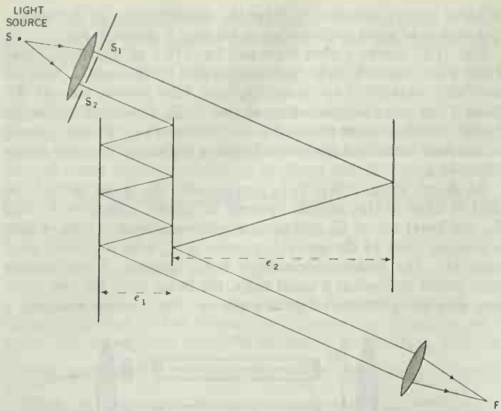


FIG. 3.—MODIFICATION OF THE VÄISÄLÄ INTERFERENCE SYSTEM

matched against CD by altering the inclination of the incidence of the beams on the mirrors, so an accurate length AE is secured. The system does not depend on the lengths of AB, CD, etc., but on their differences. Because of difficulties caused by inclinations of beams, atmospheric disturbances and earth microtremors the method is restricted to an upper limit of 100 m.

In a later modification a step-up procedure was adopted as indicated in fig. 3. In practice a step-up ratio $\frac{e_2}{e_1}$ of 5:1 was the largest that could be used. To determine 50 m. to within one wave length is a precision of one part in 10^8.

2. Michelson's Stellar Interferometer.—In 1868 Fizeau described an elegant method for measuring the angular separation between two distant objects (slits or stars) by superposing and confusing the independent fringe patterns given from each source by a two-slit device which divided the separate wave fronts from each source. Thus, in fig. 4, let F be the fringe pattern from the one source appearing at the lens focus. Let the other source produce a similar pattern at F_1. If the F_1 fringe system is displaced from the F fringe system by half a fringe width, then maxima fall on minima, and no fringes are visible. This happens when the angular separation of the two slit sources (θ) equals $\frac{\lambda}{2a}$, or odd multiples thereof. By this technique, J. M. Stephan (1878) tried to measure the angular diameters of stars. He failed insofar as stellar distances are so great that no available telescope had an aperture big enough to give an a value sufficiently large. The first success on astronomical objects was achieved by A. A. Michelson in 1890, who with the large Lick telescope determined the angular diameters of Jupiter's moons (some 1 sec. of arc). Then in 1920 Michelson hit upon the ingenious device of effectively increasing a by building large girder extensions onto a massive telescope, thus constructing his celebrated stellar interferometer. The method as applied to a refracting telescope is shown in fig. 5. B and C are small rectangular mirrors fixed over the telescope objective, E being a screen to cut out direct light from the star. The mirrors A and D can be moved out symmetrically. In effect the aperture of the system (a) becomes AD. Now while for two separate point sources the fringe dissonance occurs at $\theta = \frac{\lambda}{2a}$ it can be shown that a dissonance will also be produced by the separate parts from one disk-shaped source of angular diameter θ, and this occurs when $\theta = \frac{1.22\lambda}{a}$.

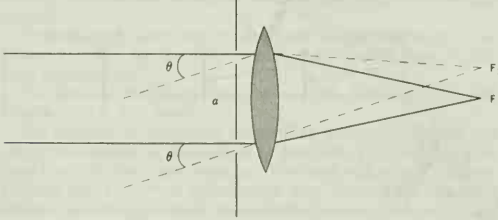


FIG. 4.—METHOD FOR MEASURING THE ANGULAR SEPARATION BETWEEN TWO DISTANT OBJECTS, DESCRIBED BY A. H. FIZEAU IN 1868

For the first star examined, Betelgeuse, the fringes vanished when a was 10 ft. 1 in., leading to an angular diameter θ of a mere 0.05 sec. of arc, a quantity far too small to be detected even by the largest telescope using ordinary visual methods. An extensive program was under way in the early 1960s in several observatories, and many stellar diameters have been determined.

II. INTERFEROMETERS USING DIVISION OF AMPLITUDE

The first interference effects seriously studied, Newton's rings, involved division of amplitude. A fraction of the amplitude of an incident plane wave front is reflected from one face of a thin film and a second comparable fraction from the other face, the two recombining to give interference fringes. If very strict attention is paid to parallelism of the incident light, the two faces need not be close together and can indeed be centimetres apart. The fringes produced by division of amplitude are governed by the expression $n\lambda = 2\mu t \cos\theta$ in which n is the order of interference, t the separation between the two surfaces in medium of refractive

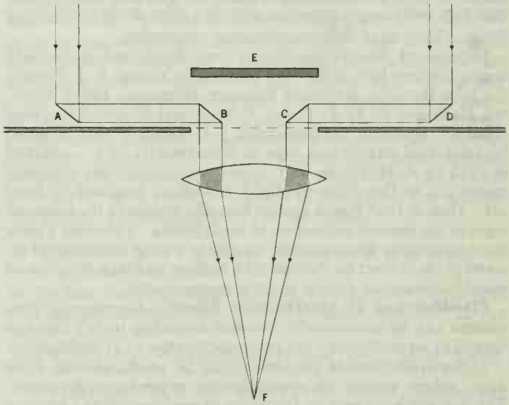


FIG. 5.—DIAGRAM OF STELLAR INTERFEROMETER DEVELOPED BY A. A. MICHELSON IN 1920

index μ and θ the angle of incidence. It is often convenient to use an air medium (taking μ as unity) and parallel light of normal incidence ($\cos\theta = 1$); then with light of one wave length the fringes follow any variations in t. They are therefore called fringes of equal thickness. If, on the contrary, t is constant (*i.e.*, parallel-sided plates), then by using an extended range of angles of incidence (a range of θ values) there result circular ring fringes. First discovered by Haidinger in 1849, these are called fringes of equal inclination since each arises as the envelope or locus of rays making the same inclination to the normal to the plates.

Interferometers which use fringes of equal thickness will be considered first. Fizeau's classical determinations (1861–64) of the thermal expansions of small polished crystals, using a variation of Newton's rings, introduced the first interferometer explicitly using division of amplitude for metrical determinations. A modern variant (U.S. bureau of standards) is shown in fig. 6.

A, the main surface of which is optically plane, is cut from fused quartz, which has a low thermal expansion. On a polished knife-edge at B rests a quartz optical flat. The specimen C whose expansion is required is cut so that there remains a thin air film

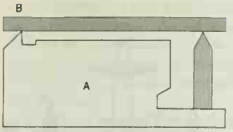


FIG. 6.—MODERN VARIANT OF AN INTERFEROMETER USING DIVISION OF AMPLITUDE

between A and B, with the two surfaces nearly parallel. Between these, the localized wedge fringes of equal thickness are formed with monochromatic collimated light. On heating C, the relative expansion of C to A leads to movement of the fringes. A correction for the small expansion of A is predetermined by using as C a material of known expansion.

1. Fizeau-Laurent Surface Interferometer.—An optical system, originally described by Fizeau (1862), was adapted by L. L. Laurent (1883) into an interferometer now extensively used in the optical industry. It reveals departures of polished surfaces from the plane, and enables the optical polisher to see and remove surface defects. The system is shown in fig. 7. A small pinhole A, at the focus of a well-corrected lens L, is illuminated with monochromatic light. The surfaces to be matched are a reference plane C_1 and the workpiece C_2. Incidence on C_1 is normal; and by setting a slight angle between the two surfaces, fringes of equal thickness are seen at E through interposition of a reflector at D. Laurent was the first to realize that these fringes constitute a contour map of the surface, being in effect contour lines which change successively in height by $\frac{\lambda}{2}$. It is this fact which proved so valuable to the optical industry. An interesting extension was proposed in 1893 by Lord Rayleigh, who pointed out that a steady liquid surface could be used as a reference plane. The workpiece can be held either above or below the surface. H. Barrell and R. S. Marriner (1940) tested the flatness of quite large plates in this way and had no difficulty in detecting errors as small as $\frac{\lambda}{10}$. Curvature of the earth causes a hillock $\frac{\lambda}{500}$ high over a 25-cm. diameter disk, and it is found that surface tension effects vanish 2.5 cm. from the disk boundary.

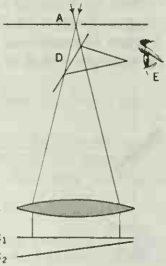


FIG. 7.—FIZEAU-LAURENT SURFACE INTERFEROMETRY SYSTEM

2. The Jamin Interferometer.—In 1856 Jamin described an interference refractometer which exploited the fringes of equal inclination discovered by Brewster in 1817. Brewster fringes form when light is reflected back from two identical thick parallel plates inclined at a slight angle to each other. Jamin used Brewster fringes formed under the special condition of 45° incidence as illustrated in fig. 8. Two thick identical glass blocks, P and Q, are set nearly parallel. The shaded faces are heavily silvered. A narrow beam of parallel light, incident at A, divides and traces the two paths ABCD and AFGD, recombining as two beams of the same intensity in the direction E, where straight line fringes of equal inclination are observed with a telescope set on infinity. Secondary reflections such as GP and DH are cut out by suitable stops. The two plates I and J constitute the Jamin compensator. Initially the two tubes T_1 and T_2 are evacuated, and with white light the central achromatic white fringe is set on the telescope cross wire. Introduction of gas into one tube leads to a fringe displacement; and the fringes are then brought back with the compensator, which has been precalibrated with monochromatic light.

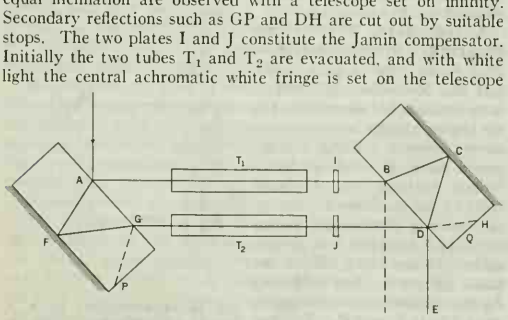


FIG. 8.—INTERFERENCE REFRACTOMETER DESCRIBED BY J. C. JAMIN IN 1856

3. The Michelson Interferometer.—It is probable that no single instrument has more profoundly influenced modern physics than the Michelson interferometer (1881). With it Michelson laid the experimental foundation to the theory of relativity, established the existence of hyperfine structure in line spectra, standardized the metre in terms of light waves and measured the tidal effect of the moon on the earth. Modifications have been used for testing lenses and prisms, as refractometers and also for the examination of surface microtopographies.

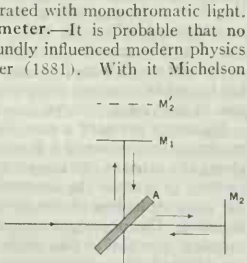


FIG. 9.—A. A. MICHELSON INTERFEROMETER (1881)

The instrument consists of a half-silvered mirror A (fig. 9) which divides a light beam incident at 45° into two equal parts, one of which is transmitted to the mirror M_2 and the other reflected to the mirror M_1. The beams retrace their paths and recombine in the direction B where fringes form. An observer looking along BA sees the mirror M_1 and also M_2', the image of M_2. The mirror M_2 can be moved parallel to itself with a fine-pitch screw on an accurately machined bed. Both M_1 and M_2 can be tilted with screws. The observer sees fringes formed in the air film M_1M_2'. If the two planes M_1 and the virtual image M_2' are parallel, then circular fringes of equal inclination appear. If they are inclined, then fringes resembling wedge fringes are seen. If, further, the two planes intersect, then where they cross, white-light fringes are obtained (*i.e.*, in the region near to zero path difference). A means is thus available for setting AM_2 equal to AM_1 to within a small fraction of a light wave, usually estimated to be about $\frac{\lambda}{80}$.

To secure these white-light fringes, the two optical paths AM_1 and AM_2 must be the same for all wave lengths. Since the reflecting film A is on the front of a glass block, an identical compensating block is placed parallel to A in the path AM_1.

One of the first applications of this instrument was the carrying out of the celebrated Michelson-Morley experiment (*see* RELATIVITY; MICHELSON-MORLEY EXPERIMENT), an attempt to measure the relative motion between earth and ether. The interferometer was set up with equal arms, and rotated so that at one time light traversed AM_1 along the direction of motion of the earth and shortly after this in a contrary direction. With the particular instrumental dimensions used, computation predicted a fringe shift of 0.4 of a fringe. No shift exceeding 0.04 of a fringe was found. On this null result the whole superstructure of relativity physics was constructed.

R. J. Kennedy confirmed the result in 1926, using a greatly increased sensitivity. On the mirror A and across half of it he deposited an extra silver film of thickness $\frac{\lambda}{20}$. At the boundary the fringes showed a discontinuity of $\frac{1}{10}$ of a fringe. Broad fringes were arranged to give a practically uniform tint of the illumination on either side of the step, both sides being equally off the true maximum. A very small displacement led to one side, brightening up relative to the other. Indeed, the remarkably small quantity of $\frac{1}{1,000}$ of a fringe was detectable, corresponding to an optical path change of a mere 2.5 Å.

The Structures of Spectral Lines.—Of considerable importance to atomic nuclear physics is the study of nuclear spin and magnetic properties obtained from measurements of the hyperfine structures of spectral lines. Such structures were first detected by Michelson using his interferometer. In 1891 Michelson made a systematic study of the visibility of the fringes given by a range of spectroscopic lines. Defining fringe visibility from the intensity of the maxima and minima as $(I_{max} - I_{min})/(I_{max} + I_{min})$ he

plotted these visibilities as a function of the separation between the interferometer plates. The visibility is determined only by the width and complexity of the spectral line. For a theoretically monochromatic line the visibility curve is a horizontal straight line, but of course even a single line has a width due to a variety of factors, which leads to a smooth curve. If in addition the line has hyperfine structure components, then maxima and minima appear in the visibility curve.

Michelson invented a most ingenious harmonic analyzer which mechanically performed a Fourier analysis on the visibility curve, giving the original line shapes and line structures which had synthesized to produce the observed visibility curve. By this means the close structures of the lines of the hydrogen spectrum were obtained. One important observation was the finding that the red cadmium line 6438 Å was single and narrow. Thereupon Michelson adopted this narrow line as his standard in his next classical research, namely the evaluation of the standard metre interferometrically in terms of light waves.

Evaluation of the Metre With Light Waves.—The metre is internationally defined as the distance between two fine scratches on a bar of platino-iridium kept at Sèvres, near Paris. Michelson (1892) set himself the problem of counting the number of red cadmium light waves in this length. The line width is such that no fringes are visible with a path difference exceeding 20 cm., and in any case there are about 1,500,000 waves to the metre. Thus a system of subdivided standards, called etalons, was adopted. The first was 10 cm., and this was halved progressively eight times to 0.3906 mm., a length containing about 1,200 fringes and therefore reasonable for direct counting. The number of fringes in this smallest etalon A was directly counted by matching its front face against the interferometer movable mirror, retracting the latter slowly and counting until the mirror coincided with the back face. Coincidence was assured with white-light fringes, but the counting was carried out in red cadmium light. This etalon was doubled up against the next etalon B, and the only measurement which then had to be made was the difference $B \sim 2A$. This procedure was repeated until the exact length of the 10-cm. etalon was obtained. Finally this was stepped up ten times against itself, and this exactly known length then matched against the standard metre. The final result, given to 1 part in 2,000,000, was 1,553,163.5 red cadmium waves to the metre.

4. The Twyman-Green Interferometer.—In 1916 F. Twyman and A. Green introduced a slight modification, adapting the Michelson interferometer for lens and prism testing, and this became standard equipment in optical workshops. The essential feature is the introduction of strict Fizeau-type collimation by using a point source of monochromatic light at the focus of a well-corrected lens. The way in which the interferometer is used for testing a prism is shown in fig. 10 and for testing a lens in fig. 11. With a perfect prism P, a plane wave incident on P returns as such to D and a uniform field of illumination is seen. Local errors, either of surfacing or as knots in the glass with different refractive index, distort the wave front. The optician can then suitably correct these by working the glass until the emerging wave front is plane.

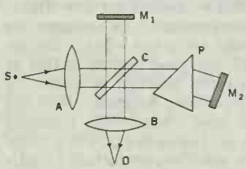


FIG. 10.—TWYMAN-GREEN INTERFEROMETER (1916) AS IT IS USED FOR TESTING A PRISM

For testing the lens L the plane mirror M_2 is replaced by a convex mirror M and the light strikes this normally, to retrace its path. Imperfections in the lens result in fringe distortions which can be interpreted in terms of spherical aberration, coma, astigmatism, etc.

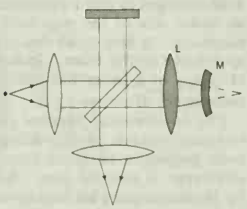


FIG. 11.—TWYMAN-GREEN INTERFEROMETER AS IT IS USED FOR TESTING A LENS

5. The Linnik Interference Microscope.—A valuable modification was the interference microscope of W. Linnik (1926), which permits evaluation of surface microtopography to fringe accuracy in the up-down direction, and with magnifications up to 1,000 times across the surface in extension. The system is shown in fig. 12. A is the beam splitter, P the surface under examination and Q a reference flat. L_1 and L_2 are carefully matched high-power microscope objectives (usually 4-mm. lenses) so that L_1 together with lens systems L_3 L_4 constitutes a high-power microscope. One sees through this the surface P crossed with the fringes formed by P and Q so that the microtopography is contoured by fringes. Several interference microscopes were developed in which division of amplitude takes place in a specially designed objective. An example is that of J. Dyson (1950).

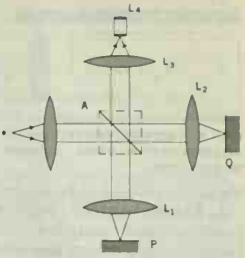


FIG. 12.—SYSTEM OF LINNIK'S INTERFERENCE MICROSCOPE (1926)

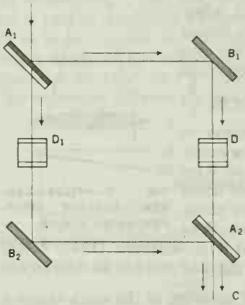


FIG. 13.—MACH-ZEHNDER INTERFEROMETRY SYSTEM, DEVELOPED IN 1891

6. The Mach-Zehnder Interferometer.—Ernst Mach and L. A. Zehnder (1891) independently developed a modification of Jamin's interferometer, which though difficult to adjust has been widely used for studying air flow around models of aircraft. The system is shown in fig. 13. The mirrors A_1 and A_2 are half-silvered while B_1 and B_2 are fully silvered on the front faces. The object (aerodynamic model) is supported in the air chamber D through which a high-velocity air jet is blown. D_1 is an identical compensating chamber. Local pressure variations, due to flow, lead to local refractive index changes so that the flow pattern is revealed by fringe distortions.

There are two reasons why this instrument is better than Michelson's for aerodynamics. First, the optical circuit is such that the light traverses the observation chamber one way only, whereas in Michelson's instrument it passes and returns. Strong local refractive index variations have a prismatic action and displace the beam which would not quite retrace the same path on the return journey. Second, and more important, is the question of fringe localization. In Michelson's instrument the fringes are localized on the mirror M_1 (*see* earlier figures) whereas in the Mach-Zehnder system the fringes can be placed so as to coincide with the object in D. Thus both object and fringes can be photographed sharply in focus.

7. The Bates Wave-Front Shearing Interferometer.—W. J. Bates (1947) slightly modified the Mach-Zehnder system, with considerable advantages for the testing of large lenses or large curved mirrors. Using a collimated beam, he produced interference between two displaced parts of the same wave front by the shearing arrangement shown in fig. 14. A perfect lens gives a spherical wave which falls on the beam splitter A_1, and by tilting A_2 one secures two overlapping wave fronts Y and Z. The images from these wave fronts can

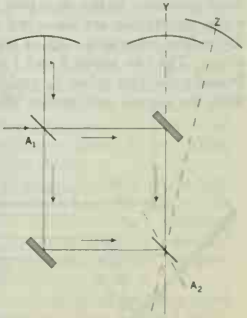


FIG. 14.—ARRANGEMENT OF W. J. BATES'S WAVE-FRONT SHEARING INTERFEROMETER (1947)

be localized on A_2 and if these wave fronts are truly spherical, then any tilting of A_2 leads to no change in the field of view. If the wave front departs from the spherical, changes are seen which can be interpreted. Important is the fact that a large mirror or lens is matched against itself so that a large reference plane is not required.

8. The Fabry-Pérot Interferometer.—Ranking almost in importance optically with the Michelson interferometer is that of C. Fabry and A. Pérot, which has an interesting history. In 1836 G. B. Airy had computed the effect on interference fringes of taking into account the successive multiple reflections (neglected previously because of negligible intensities). He showed that if light is incident at angle θ onto a plane parallel plate of thickness t then the transmitted intensity has the form

$$\frac{1}{1+\frac{4R}{(1-R)^2}\sin^2\left(\frac{2\pi\mu t}{\lambda}\cos\theta\right)}$$

in which R is the reflection coefficient. This formula remained a forgotten academic curiosity until A. Boulouch in 1893 drew attention to the fact that when the reflectivity R is high (say, exceeding 80%) then this formula establishes that a profound sharpening in the fringes will take place. Indeed, Boulouch showed this to be the case experimentally.

However, it remained for Fabry and Pérot (1897) to realize the full implication of this when they produced their celebrated variable-gap interferometer. This consists of two very accurately worked planes (errors not exceeding $\frac{\lambda}{80}$ in the best instruments) maintained by optically worked spacers strictly parallel, to within a quite small fraction of a light wave. The two plates, called an etalon, are coated with a thin transmitting film of high reflectivity (originally sputtered silver). Reflectivity should exceed 90%, and with modern techniques 95% and even 97% reflectivities are achieved with only perhaps 1.5% absorption, the rest being transmitted. Special techniques are needed to secure such low absorptions.

This simple instrument is an extremely powerful optical system. Being essentially a parallel air plate, it produces Haidinger rings, localized at infinity. However, the important feature is that the successive multiple reflections, diminishing very slowly in intensity because of the high reflectivity, lead to the formation of very sharp narrow fringes. Fringes can be defined by their half width; *i.e.*, that fraction of an order occupied by the width at a region where the fringe intensity is half the peak maximum value. For 95% reflectivity the half width is about $\frac{1}{60}$ of an order separation, and as one can set to $\frac{1}{5}$ of a fringe width, this setting corresponds to $\frac{1}{600}$ of a wave length. Only a brief résumé can be given of the many and varied uses of this interferometer.

Analysis of Hyperfine Structures in Line Spectra.—The instrument is very widely used for the high resolution needed for revealing hyperfine structures in line spectra. At a wave length of 5000 Å, a reflectivity of 95% and a plate separation of 10 cm. (which has been used) give a resolving power of 20,000,000, so that one can resolve components separated by a mere 0.00025 Å. Compare this with the resolving power of 100,000 available in the first order of a typical high-quality large diffraction grating.

Measurement of Line Width.—The high resolution and high dispersion enable the instrument to be used for evaluation of the widths of even quite narrow spectral lines. For example, interesting conclusions have been drawn about the temperatures in the upper atmosphere from measured line widths of auroral spectral lines.

Determination of Precision Wave Lengths.—The Fabry-Pérot interferometer is the standard instrument for accurate determination of the wave lengths of spectroscopic lines. By the use of three standard wave lengths (the cadmium lines 6438.4916 Å, 5085.8220 Å and 4799.9088 Å), each of which has been directly interferometrically evaluated against the standard metre, the spacing of the interferometer plates can be derived with high accuracy. Then, from the measurement of the diameters of the fringes of the spectral lines under study, their wave lengths can be computed from the knowledge of this spacing, with an accuracy, in the best cases, of ± 0.001 Å.

The Evaluation of the Metre.—J. R. Benôit, Fabry and Pérot (1913), combining the principles of the Brewster fringes with that of the Fabry-Pérot interferometer, redetermined the metre.

Multiple-beam Brewster fringes are produced in transmitted light by two Fabry-Pérot interferometers in series behind each other, their lengths being in the ratio 2:1. First the exact spacing in terms of the red cadmium line is found interferometrically for an interferometer with as near as possible a 6.25-cm. spacing. This is then matched, by Brewster fringes, against a 12.5-cm. etalon, then this against a 25-cm., then this against a 50-cm. and finally the last is matched against an approximate 1-m. etalon. This etalon, the length of which is exactly known in wave lengths, can be compared with the standard metre quite rapidly, since only the difference is required.

Between Michelson's 1892 experiment and 1940, nine precision determinations were made by different laboratories; and the mean wave length for red cadmium was found to be 6438.4696 ± 0.0010 Å, which by chance was exactly the value adopted by international agreement in 1907.

Refractive Index of Air.—The etalon gives the best values for the refractive indices and dispersions of gases. The exact metrical spacing of an enclosed interferometer is first found *in vacuo*. Then the new optical path is measured when air (or gas) is introduced. As typical of modern precision the refractive index for air (at 760 mm., temperature 15° C. and 0.03% CO_2 content) for the red cadmium line is given by H. Barrell and J. E. Sears (1939) as 1.000276380.

9. The Echelon and Lummer Plate Interferometers.—The echelon interferometer of Michelson and the Lummer plate interferometer, both used in spectroscopy, are discussed elsewhere (*see* SPECTROSCOPY) and need only be mentioned here.

III. MULTIPLE-BEAM INTERFEROMETRY

What is called multiple-beam interferometry is an important extension made by S. Tolansky (1946) of Boulouch's multiple-beam principle to include the case of wedge interference systems. The Fabry-Pérot interferometer was concerned with the circular fringes given by thick parallel plates. Such fringes arise from integration of light across the interferometer plates, hence the necessity for extreme flatness and parallelism. Tolansky showed how the multiple-beam principle could be applied to thin-film localized wedge fringes; and succeeded in securing for topographical studies that same increase in power and sensitivity which the Fabry-Pérot interferometer had given to metrological and spectroscopic studies. With highly reflecting plane surfaces inclined at a small angle, multiple reflections can lead to highly sharpened wedge fringes as shown in fig. 15.

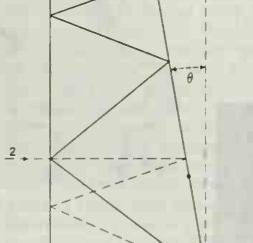
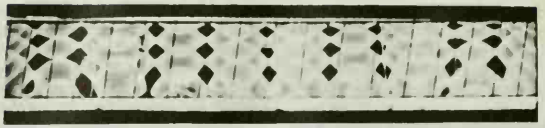


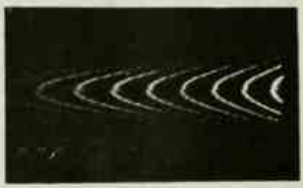
FIG. 15.—MULTIPLE-BEAM INTERFEROMETRY AS DEVELOPED BY S. TOLANSKY IN 1946

Three successive beams, 1, 2, 3, are shown meeting at the point D. The beams are not in arithmetical phase behind each other, for the nth beam lags behind the arithmetical progression by an amount $X = \frac{4n^3\theta^2 t}{3}$ in which AD = t. Only if X is appreciably less than $\frac{\lambda}{2}$ will the necessary condition for Airy summation hold, to produce very sharp fringes. Since effective values of n up to some 80 are involved, sharpening takes place only if t is very small, indeed of the order of one or two light wave lengths.

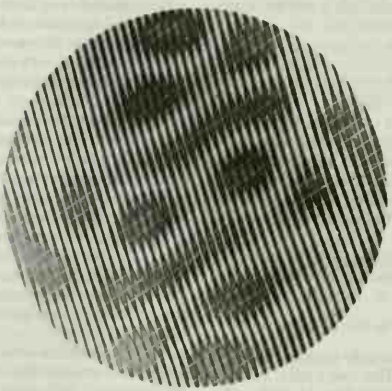


A

B



C



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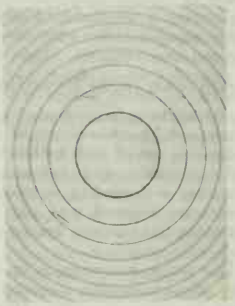

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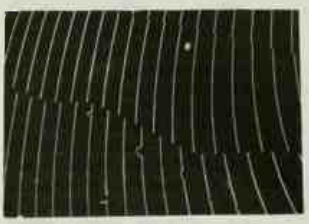

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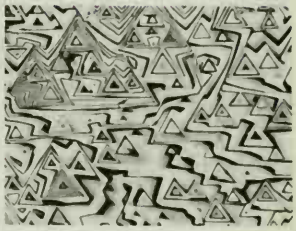

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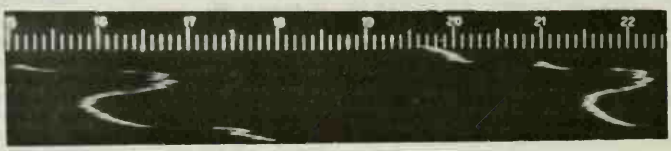

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FIG. 16.—SOME APPLICATIONS OF MULTIPLE-BEAM INTERFEROMETRY (*see* TEXT)

In the Fabry-Pérot-type fringes the fringe shape is determined by the term $\frac{4R}{(1-R)^2}\sin^2\left(\frac{2\pi\mu t}{\lambda}\cos\theta\right)$ in which the only variable is θ. In multiple-beam localized wedge fringes the same formula holds, but θ is constant and the variable is t. The fringe widths in the two systems obey a similar relation.

The surfaces to be studied are coated with a high reflector, placed very close together and illuminated from a small pinhole with strictly collimated monochromatic light at normal incidence. The resulting considerable improvement in fringe sharpness is shown in fig. 16. In (E) are shown Newton's rings obtained with two beams and in (F) the same secured with multiple beams. In the other sections, a selection is given from some of the studies made by Tolansky employing multiple-beam methods.

Some Applications of Multiple-Beam Interferometry.—*Microtopographies of Surfaces.*—A new high order of accuracy has been achieved in the study of surface microtopography. The fringes are contour lines of 2500 Å height. Fringes are of the order of some $\frac{1}{50}$ wide, and displacements of $\frac{1}{4}$ of a fringe width are clearly measurable. Thus step heights of 10 Å can be recorded, a quantity of molecular dimensions. Indeed crystal lattice spacings of from 12 to 20 Å have been measured to within 1 Å.

Fig. 16(H) shows the fringe pattern at a cleavage step on mica; such pictures establish that the steps are small integral multiples of the lattice spacing. Many crystals reveal beautiful topographies; fig. 16(I) shows a complex microtopography on the octahedral face of a diamond (*see* CRYSTALLOGRAPHY).

Experimentation has established that vacuum deposition of silver by thermal evaporation leads to strict contouring by the silver of the surface features, even down to molecular dimensions.

Thickness of Thin Films.—The multiple-beam interferometer is widely used for the precise measurement of the thicknesses of thin films. The film is coated with an opaque layer of silver, extending over the film boundary so that a step appears in this thick silver film equal in height to the original film being measured. This step is then measured against a silvered optical flat with multiple-beam fringes in reflection. Film thicknesses as small as only 25 Å can be measured. Fig. 16(B) shows the fringe pattern given by a film 550 Å in thickness. The fringes are very narrow and the accuracy in the step measurement is high.

Oscillations of Piezoelectric Crystal Plates.—Quartz plate oscillators play an important part in precision electronic circuitry as frequency stabilizers and precision clocks. A most interesting application reveals the distribution of nodes and antinodes and the exact local values of amplitudes on such oscillators. The crystal surface, polished and silvered for interferometry, is one electrode, and a wire meshwork is the other. The silvered crystal rests on a silvered optical flat. When set into oscillation the initially straight line fringes take on a stationary pattern which reveals the distribution of the vibration, and the local fringe shape gives an exact measure of the amplitude. Fig. 16(A) shows a vibrating bar and fig. 16(D) a vibrating disk. Frequencies in both cases are several kilocycles, yet the patterns are completely stationary.

Fringes of Equal Chromatic Order.—Tolansky in 1946 developed a system of white-light multiple-beam fringes which have considerable power and are advantageous in specific instances. Their formation is shown in fig. 17. A white-light source A is imaged on a small aperture C and a parallel beam directed at normal incidence onto the silvered pair of interferometer surfaces E. The two surfaces must be very close together, but it is advantageous if they are near parallelism rather than wedged. With the achromatic lens F an image of E is projected onto G, the slit of a spectrograph, which thus selects a very narrow section of the surface under examination. Sharp multiple-beam white-light fringes form at H, each fringe being the locus of points for which $\frac{t}{\lambda}$ is constant. They have been named fringes of equal chromatic order.

FIG. 17.—FORMATION OF WHITE-LIGHT MULTIPLE-BEAM FRINGES

For discontinuous steps, these fringes offer advantages. Examples are shown in fig. 16(C) which illustrates the fringes of equal chromatic order given by a silvered Newton's rings lens-plate combination. Fig. 16(J) illustrates the fringe pattern given by a very small surface depression with a depth of 4×10^{-6} cm. Each fringe is a contour line-profile over the same region on the object, but of different wave length. The separation between fringe pairs can be made very great. Magnifications of 500,000 times, with resolution of 10 Å, can readily be obtained. These great powers are in the up-down direction only.

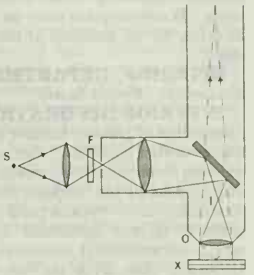


FIG. 18.—ARRANGEMENT WHEN A METALLURGICAL TYPE OF MICROSCOPE IS USED TO STUDY OPAQUE OBJECTS

Studies on Opaque Objects (Metals, etc.).—Many problems connected with surface flow, hardness indentation testing, crystal dislocation movements, electrodeposition, etc., on metal surfaces have been studied with the multiple-beam interferometer. A metallurgical type of microscope must be employed with the arrangement shown in fig. 18. From a source S a point image I is formed at the back focal plane of the microscope objective O. The objective must illuminate the interferometer system with strictly parallel light at normal incidence and at the same time give a good microscopic image of the object X. As an example, fig. 16(G) shows the distortions produced on a metal surface which has received a small micro-indent from a diamond pyramid, a procedure used in testing metal hardness. The distorted pattern is of crystallographic interest; for this indentation has been made on the surface of a single crystal of tin. The interference pattern indicates the character of the surface-flow distortion which results from the indentation. The asymmetry is even more marked than at first appears; for the extended horizontal lobes are elevations, while the smaller lobes at right angles to these are depressions. This shows that in one direction the surface "piles up," while at right angles to this it "sinks in." In fact, X-ray examination shows that these lobes lie along crystallographic axis directions. They reveal a differential directional hardness variation in the tin crystal. Such interferometric studies have already revealed much new information about surface-flow phenomena when materials are distorted. (*See* X-RAYS: *Modern Industrial Applications.*)

In the 1960s, with the extension of maser devices into the range of visible light (lasers) and the infrared spectrum (irasers), interferometry was in the process of making further strides forward. These first generally available optical masers incorporated interferometers in their construction and provided substantial improvements over ordinary sources of light in terms of such characteristics as intensity, coherence and monochromaticity (*see* LASER; MASER). *See* also references under "Interferometer" in the Index.

BIBLIOGRAPHY.—The long article on interferometry by W. Feussner and L. Janicki in E. Gehrcke's *Handbuch der Physikalischen Optik*, 2 vol. (1927), is detailed and learned. *See* also C. Fabry, *Les Applications des interférences lumineuses* (1923); A. A. Michelson, *Studies in Optics* (1927); A. C. Candler, *Interferometers* (1951); S. Tolansky, *Introduction to Interferometry* (1955), *High Resolution Spectroscopy* (1947), *Multiple-Beam Interferometry of Surfaces and Films* (1948), *Surface Microtopography* (1960); A. J. Hale, *Interference Microscope in Biological Research* (1958); A. Vasicek, *Optics of Thin Films* (1960); A. G. Fox and T. Li, "Resonant Modes in a Maser Interferometer," *Bell Syst. Tech. J.*, vol. xl (1961); W. W. Rigrod and A. J. Rustako, "Diffraction Studies With Plane-parallel Maser Interferometer," *J. App. Physics*, vol. 34 (1963). (S. TY.; X.)

INTERGLACIAL STAGES: *see* PLEISTOCENE EPOCH: *Glacial and Interglacial Ages.*

INTER-GOVERNMENTAL MARITIME CONSULTATIVE ORGANIZATION (IMCO), a specialized agency of the United Nations, came into existence on March 17, 1958, and was organized in Jan. 1959. IMCO was established to promote international co-operation in maritime navigation and encourage the maximum use of safety measures; to encourage also the removal of discriminatory action and unnecessary restrictions by governments affecting international shipping; and to consider matters concerning unfair restrictive practices by shipping concerns. It concentrated early on technical aspects of shipping such as safety at sea, pollution of the sea and tonnage measurement of ships.

(M. H. H.)

INTERIOR, DEPARTMENT OF: *see* GOVERNMENT DEPARTMENTS: *United States*.

INTERIOR DECORATION. This article is devoted to the preparation of plans of interior decoration for both residential and nonresidential buildings. The major part of the article is devoted to living accommodations, where the major portion of the planning may be done by the resident; included are detailed suggestions for treatments of the various parts of the interior. The general principles of interior decoration discussed in this section apply as well to nonresidential structures, where the interior decoration is frequently done by a professional interior designer. The final section of this article gives a brief account of the development of the interior design profession and of the procedures followed by a professional designer in planning a commercial interior.

For period decoration *see* INTERIOR DECORATION, HISTORY OF. Other articles of related interest include HOUSING, a broad general discussion; HOUSE DESIGN, on the planning and building of a single-family dwelling; RESIDENTIAL ARCHITECTURE, a historical account of buildings for human habitation; LANDSCAPE ARCHITECTURE; and MODERN ARCHITECTURE. Articles on the various elements of interior decoration, such as rugs and carpets, are referred to at appropriate places in the text of this article, which is divided into the following main sections:

I. Residential Interiors
  A. Basic Considerations
    1. Planning Aims
    2. Space Organization
  B. Light and Colour
    1. Kinds of Light
    2. The Effects of Light on Colour
    3. The Selection of a Colour Scheme
    4. Colour Harmonies
    5. The Use of Colour
  C. Surface Treatments
    1. Walls
    2. Fireplaces
    3. Windows
    4. Doors
    5. Floors
    6. Ceilings
  D. Furniture
    1. Selection
    2. Arrangement
  E. Accessories
    1. Pictures and Wall Hangings
    2. Plants and Flowers
    3. Special Hobbies and Collections
II. Commercial Interiors
    1. The Development of the Interior Design Profession
    2. Design Procedures

I. RESIDENTIAL INTERIORS

A. BASIC CONSIDERATIONS

1. Planning Aims.—The approach to any scheme of interior design or decoration should be analytical so that the precise nature of the problem is understood. The aim of redecorating or replanning a building, or part of a building, is obviously both to improve its appearance and to make it more convenient. The drawbacks to the existing structure must be perceived clearly; for instance: Does it cause irritation and fatigue? Have space requirements changed so that certain areas are not used adequately? What are to be the most important functions of the new surroundings? All possible improvements should be considered and defined in order of priority; even if the cost makes it impossible to carry out the complete scheme at once, there should still be an over-all plan since improvements that have been treated piecemeal invariably give less satisfactory results. One of the commonest mistakes is lack of this foresight.

Unity of effect is most important in providing a satisfying interior. While the taste and character of the occupants should be expressed, a measure of restraint and adherence to an over-all plan gives better results than selecting colours, patterns or pieces of furniture in isolation. These may be well designed in themselves but unsuitable when related to the whole. It is in visualizing these relationships between the component parts that the principal difficulty lies, and reference to well-illustrated books and periodicals often helps the amateur to compare different amalgamations of colour and design.

Completely matching suites of furniture can give an impression of monotony but the confusion caused by too many different shapes and designs is equally to be avoided; pleasing decoration is often achieved by a balance between the two. Furnishings of many periods may combine satisfactorily provided there are similarities in their style; for instance, modern Scandinavian textiles and furniture, with their emphasis on texture of weave or grain of wood, may blend happily with early American Colonial wood furniture, and some sophisticated new Italian pieces can fit in with elegant Regency furniture.

Most modern dwellings are comparatively small, and, as they still must provide for the varied needs of a family, flexibility is usually desirable. This may be achieved by replacing fixed walls and furniture with sliding wall panels, folding doors, roll-down partitions, portable screens or storage units.

(E. C. D.; G. A. E.)

2. Space Organization.—Evaluation of individual and family activities is the starting point in organization of space in an interior. At this stage it is most helpful to think in terms of functions rather than fixed spaces. For example, the function of eating may be fulfilled in places other than a dining room. Likewise, it is helpful to consider "food preparation" rather than "kitchens"; "quiet recreation," "noisy recreation" and "entertainment of guests" rather than "living rooms"; "storage of specific items" rather than "closets"; etc. Flexible arrangement of space is usually highly desirable because of the modern tendency toward construction of relatively small living units despite varied family demands. The Japanese home with its movable wall panels and minimal furnishings achieved flexibility more successfully, perhaps, than any other. Relatively large areas of space unobstructed by fixed walls or furnishings may be used in a variety of ways, simply by rearrangement of furniture or movable partitions.

Often in the remodeling of old homes the first step is to remove some of the fixed walls and partitions in order to achieve greater flexibility and openness. Another way of achieving openness in an area without loss of privacy is to extend a partition wall only part way to the ceiling; in fact, a wall may be open at the bottom as well as at the top. The same effect of openness may be achieved by a storage wall that does not extend to the ceiling. Sometimes the fireplace may be located so that it serves as a partial divider between living and dining or food preparation areas, yet neither area is closed-in or isolated.

Window walls or large picture windows also bestow an illusion of greater space but are scarcely satisfactory unless there is a fine view outside and provision is made for privacy and lack of glare inside. Also, some transition between inside and outside is often thought desirable, for instance, a miniature garden border indoors, or a terrace, porch or balcony. A sense of unlimited space, however, is to be avoided, as it tends to make the inhabitants feel vulnerable. An impression of security is often created by lowering a section of the ceiling.

In a number of homes designed by Frank Lloyd Wright, for example, a low ceiling over the fireplace contrasts with an adjoining area where a long view of a garden or landscape may be emphasized by a high ceiling. The same effect has been achieved in some old, large, high-ceilinged interiors through remodeling. A comfortable sense of seclusion can be achieved also, by dividing large areas into smaller ones with screens, wall panels or storage units, or furniture groupings, or by using warm colours, such as yellows,

oranges, reds and warm beiges and browns.

An illusion of spaciousness, on the other hand, is created by arranging the furniture near the edges of the room and furnishing in cool and relatively light colours, such as medium to light blues, greens, cool grays and off-whites. The illusion of space is also strengthened by mirrors and by paintings employing perspective, especially if placed where they can be seen from some distance.

The specific areas to be planned for in homes include the following:

General Living Areas.—Some means of dividing the area is desirable in order that various incompatible activities can be pursued simultaneously. Many people find that a satisfactory solution is to have two rooms, a small one for reading or conversation and a larger one for more active hobbies and children's games. Provision also must be made for television viewing, the set being best placed in the fireplace wall, or in a storage wall where it can be enclosed when not in use.

Dining Space.—A great number of houses are designed with the dining area at one end of the living room or in an adjoining area, an arrangement which has the advantage of flexibility. Some people prefer to eat in a large kitchen-dining room, others more formally in a separate room. In each case, however, it is essential that the cooking arrangements should be easily accessible. Comfortable furniture, adequate cupboard space, pleasant lighting, a good view and an adjoining outdoor dining space are added advantages.

The Kitchen Area.—Kitchen equipment should be placed so that it can be used with minimum effort and movement. Generous storage space and heat-resistant working surfaces make for ease and speed. When the area is part of the living room it is sometimes effective to furnish it in a similar manner. If the cabinet building material is natural wood, it is often possible to buy range, refrigerator and sink units which harmonize with it, or separate units of stainless steel which can be installed as part of the cabinet work.

Bedrooms.—Quietness and privacy are obviously the first considerations but lighting (natural and artificial) and ventilation are also important. Built-in cupboards help to prevent clutter, and in warm climates venetian blinds and an adjoining terrace or balcony are desirable. It may be preferable to plan a bedroom as a bed-sitting room (especially if there is a separate space for dressing) and it should be possible to decorate it in a more individual style than is practicable in the common living areas.

Bath and Dressing Rooms.—If several people share the facilities it is sensible to separate the lavatory, bath and dressing space. Well-planned storage and airing cupboards (usually built-in) and good lighting, heating and ventilation are advantageous. Provision may also be made for such luxuries as a private sun-bathing deck or terrace, a reclining couch, a large plunge-type tub and a space to grow plants.

Storage Space.—The convenience of a house is greatly increased if each area has enough storage space for its own equipment, and thought should be given to bulky items like sewing machines, movie projectors and sports equipment. Adjustable shelves and partitions are often a great help, and, where the storage space is handled as part of the architecture, a whole or partial storage wall, built to order or made from portable units, and accessible from either side, will be found an efficient and compact arrangement.

Children's Rooms.—In families with several children and limited space, portable walls may be used to close off areas for sleep or study or where older and younger children may each entertain their own visitors. Young children need low cupboards for toys and clothing (adjustable units are the most practical) and windows low enough to look out of. Furnishing and decorating materials should be durable; some sort of warm flooring, such as linoleum, cork or some of the resilient plastic tiles, is better than cold materials like ceramic and asphalt tiling. Ceiling and wall lights are safer than table and floor lamps. As a rule children prefer clear colours, neither dark nor pastel, and red and blue are favourites. Slate and bulletin boards are useful in a young child's room.

In the general living areas the furniture should also be sturdy and easy to clean. (G. A. E.)

B. Light and Colour

The planning of colour schemes is one of the most important aspects of interior decoration, but one which often fails to provide full satisfaction; the most common difficulty is failure to appreciate the fact that the appearance of a coloured surface depends on the nature of the light that illuminates it. All kinds of light source, including daylight, which are normally used to light interiors have different effects on colours; and this is true even of different kinds of sources whose lighted appearance may seem to be identical in colour.

A blue surface looks blue because it reflects blue light (if any is present) but absorbs other colours of light; similarly a yellow surface reflects yellow light but absorbs other colours of light; and so on with other coloured surfaces. It follows that if all colours of surface are to be seen at the same time in their true colour relationship, then the illuminant used must contain all colours of light at equal strength. Such an illuminant will appear white (*i.e.*, uncoloured). If the illuminant contains all colours of light but not at equal strength, surface colours take on a different appearance; if, for example, green light is dominant, green surfaces will be emphasized; if green light is weak or absent, green surfaces will appear dull and greyed.

1. Kinds of Light.—Daylight from a lightly overcast north sky (in the northern hemisphere) contains all colours of light in about equal proportion and is the "truest" of all lights for revealing colour, but daylight is very variable. A blue sky will emphasize the "cool" colours—the blues and greens—and will tend to weaken the "warm" colours, the yellows and reds. Noon sunlight has a slightly "warmer" effect on colours than north sky light, and the golden sunlight of the late afternoon brings out reds and yellows very strongly at the expense of blues and greens.

Decorative colours can of course be chosen to offset to some extent the kind of daylight most often available. In climates where many months of cold cloudy weather are to be expected, and for rooms into which sunlight seldom or never penetrates, it may be desirable to decorate in predominantly warm colours, and conversely for hot sunny climates cool colours are usually chosen. Tinted translucent window curtains or tinted venetian blinds may be used on occasions to add extra apparent warmth (or coolness) to the light entering the room, but since such devices work by extracting unwanted cool (or warm) colours from the light, they may spoil the appearance of room decorations chosen without this possibility in mind.

In comparison with daylight, ordinary incandescent lamp bulbs give an excess of red/yellow light and a deficiency of blues. Warm decoration colours are therefore emphasized and cool colours dulled. Various coloured bulbs are available to produce overall warmer or cooler effects, but here again the process is one of extraction which reduces the total amount of light available. The "daylight blue" lamp, for example, has a light-blue bulb which absorbs the excess yellow/red light generated by the filament; but it cannot change other colours of light into blue. Thus, although the resultant light given by the lamp appears white and somewhat similar to daylight, there is still in fact a deficiency of blue light, and cool decorative colours therefore still show weakly. Coloured shades or tinted glassware surrounding the lamp modify the colour of the light by a similar process of extraction.

Fluorescent lamps produce light with a balance of component colours of light generally quite different from that of daylight or incandescent lamp light, though there are varieties made especially to simulate north-sky daylight and incandescent lamp light. The first fluorescent lamps, which were made primarily to produce light at highest possible efficiency, overemphasized decorative colours in the yellow and green parts of the spectrum but were very weak on reds and blues, and it was therefore a matter of some difficulty to plan successful decorative schemes for them. In the newer types of high-efficiency lamps the colour-rendering has been somewhat improved and there are now also other types (sometimes referred to as the "deluxe" types) in which some of the luminous efficiency is sacrificed in order to obtain better colour rendering, especially at the red end of the spectrum. With the wide range now available it can be claimed that there is a fluorescent lamp

colour suitable for any normal purpose and decorative scheme.

2. The Effects of Light on Colour.—There is no colour without light. Within practical limits, the stronger the light the greater one's appreciation of colour. Very strong colours are generally more suitable for dim than for strong lighting, and very strong lighting usually requires colours in pastel shades if they are not to become overpowering.

Except perhaps for those living in equatorial regions, a warm colour of light is preferred if the lighting is dim. The stronger the lighting, the more a cooler colour of light is preferred, but a cool light may be considered uncomfortably cheerless if there is not much of it present.

Since decorative schemes are normally to be seen both by daylight and by artificial light, colours should be selected for their appearance under both kinds of light and if possible under about the intensities of each kind of light that they are likely to receive. Under the two kinds of light, decorative schemes predominantly of a single colour are likely to change most in appearance; each individual colour of a multicolour scheme will also change, but since all the colour changes are likely to be in the same direction the over-all effect may not be materially altered.

Normally there is no reason, other than personal preference, why more than one colour of artificial light should not be used in the same interior. A room might be mainly fluorescent-lit, for example, but an incandescent lamp spotlighting a vase of flowers or other special feature will emphasize it partly by extra light intensity and partly by the change of colour; a similar effect for a dining recess could separate it from a kitchen almost as effectively as a room divider. (*See* also LIGHTING.)

(A. D. S. A.)

3. The Selection of a Colour Scheme.—Many considerations are involved in successful colour planning: the relationship between colour and light, mentioned above; physiological and psychological reactions to colours; the effect of colours on the apparent size and shape of rooms and furnishings; problems of upkeep; and, of course, personal preference. Most colour research has dealt with the scientific aspects rather than with the aesthetics of colour, yet both kinds of information are necessary to the interior designer.

A designer may draw on many sources for his ideas but nature is an obvious and inexhaustible source of supply. The subtle combinations of green and yellowish green in spring foliage seen against a clear blue, might well be adapted to an interior colour scheme, as might the ever-changing contrasts of red, yellow and dark green of early autumn, or the delicately graded hues of later autumn colouring. Colouring in nature is never uniform: at first glance a lawn or forest looks solidly green; closer study shows that it is composed of myriad shades and many other colours besides. It is found in practice that interiors which have some of this variety are likely to be more successful than those which rely on single notes of each colour. New colour combinations may also be suggested by paintings, although the artist's scheme must be treated carefully: colours which may be stimulating on canvas may be unsuccessful when used in much larger quantities and in different relationships. The colouring of boldly patterned fabrics, likewise, may form the basis of a colour scheme, but this too must be adapted with discretion. In short, while nature or art can directly inspire many fruitful ideas it cannot provide an infallible formula for success; but the study of nature and art bestows indirectly an even greater benefit, the gradual quickening of one's sensibilities.

Generally speaking, shades of yellow, orange and red are found to give an impression of warmth; conversely, blues and greens give the impression of coolness. This fact often influences the choice of decorative colour and gives rise to the terms "warm" and "cool" colours.

4. Colour Harmonies.—The greatest degree of harmony is attained by using related colours. A room might have a floor covered with a grayed, medium yellow rug or matting, a storage wall made of light birch paneling, one other wall of dark yellow-brown cypress, a fireplace of yellow-gray brick or stone, and furniture of both light and dark yellow-brown woods. Upholstering materials might include textured light neutral yellows, yellow-browns and brighter yellow leather, with various accessories in gold, brass and other yellow colour notes. However, some contrasting colour would probably be necessary, for example, a cool grayish-blue, green or white. Similarly, a basically neutral-coloured interior employing shades of white and gray in varied textures with accents of black looks well with a touch of strong, gay colour. Many other related colour schemes can be worked out by using colours that are next to each other on the colour wheel.

As a general rule, contrasting colour schemes, defined here as those which emphasize shades of more than one of the following—blue, yellow, red (the primary colours), black and white—are most satisfactory when one colour is used in the largest areas and repeated in various tones (degrees of lightness and darkness) in other parts of the room. The other colour or colours should also be used more than once to avoid a spotted effect.

5. The Use of Colour.—Large expanses of bright colour should be avoided since they cause eye fatigue, though in smaller quantities they can be pleasantly stimulating. One of the commonest errors in choosing paint for walls is to get colours that are too bright because colours in small samples look much duller and paler than when painted over large areas.

If some measure of unity is desired throughout the house, it can be achieved by making floors or walls or windows the same colour throughout, or by using the same colours differently related in adjoining areas. For example, the colour of a wall in one area might be repeated in the upholstery or carpeting in the adjoining one. Interchangeable furnishings make colour schemes more flexible and are also economical.

Colour can be used to emphasize or minimize architectural characteristics. A large room, for example, can be made to seem even larger by the use of cool and light colours such as blues and greens; warm dark colours reduce its apparent size. Similarly, the walls in a small room may be made to seem farther apart if they are cool and light; if dark and warm in colour, they may seem either cozy or oppressively close together. Similarly, ceilings look higher when they are painted in light colours, lower when they are painted in dark ones. In practice the needs of a room often conflict, for example if a small cold, north-facing room is to be painted a warm colour, like yellow, the colours must be kept light in value or they will make the room seem smaller. If cool colours are used on the walls or floors to provide an illusion of spaciousness, some warmth of colour might be provided by paintings or other accessories or by upholstered furnishings that are relatively small. When a desired colour is not well suited to the size or orientation of a room, choice of companion colours may provide a solution.

Unpleasant irregularities, such as poorly spaced window and door openings, may be minimized by painting the woodwork the same colour as the walls and by using draperies that are similar to the walls in colour effect.

Furniture which is unattractive in shape or too bulky can be made less obvious by making it the same colour as the wall or the same tone in a different colour. Strongly contrasting tones will emphasize sizes and shapes.

Colours of medium tone are the most practical: most soil and foot marks show readily on very light colours, while dust and lint are most evident on black or dark colours. It is especially important to remember this when choosing colours for floors and upholstery, which both have very hard wear.

The function of a room also affects the choice of colour to some extent. Generally speaking, strong contrasting colours and tones suggest activity, and closely related colours and tones suggest rest. An area such as a playroom might be designed with basic colours that offset the noise and confusion and enough bright contrasts to be in keeping with the lively atmosphere. Sharp contrasts in tone must be avoided for close work. The extreme relationship of white and black gives a brightness ratio of 28 to 1 (since white may reflect 85% of light and black only 3%) whereas lighting experts recommend ratios ranging from 3 to 1, which is preferred, to 10 to 1. These ratios relate not to details but to walls, draperies, floors, ceilings, desk or work counter surfaces and other major areas within line of vision of a worker.

Precise specifications cannot be laid down for the colour rela-

tionship of floor, walls and ceilings. In the most common scheme the floor is darkest in value, not very bright and usually somewhat warm in effect; walls are a little lighter than the floor and often somewhat neutral and warm; the ceiling is the lightest of all and is usually completely neutral in hue or just slightly tinted. It may be significant that a similar relationship normally exists in natural surroundings between the earth, the vegetation and the sky. It has been shown how other arrangements are employed to modify the apparent shape of rooms, to harmonize furnishings, and to cater to personal preferences.

Finally, thought must be given to the order in which materials for a new decorative scheme are acquired. The most permanent and expensive item should always be purchased first, especially if it may be difficult to find. Usually this is the rug, or perhaps the draperies, or even a very special wallpaper. Other fabrics, too, should be chosen before the colour of the paint, because paint can easily be mixed to harmonize with them, whereas the selection of fabrics in a certain colour may be greatly limited. In certain other interiors architectural materials, such as exposed wood and stone, will have to be given first consideration and will continue to influence the other choices of colour. Lastly, light and colour planning should always be done together. *See* also COLOUR.

C. SURFACE TREATMENTS

1. Walls.—*Permanent Finishes.*—The same materials that are used on the outside of a house—brick, stone, wood, glass and cement blocks—may be used on interior walls to give a unified character to the building. Although the original installation cost of such materials may be high, care and upkeep are easy and cheap. However, they do not allow changes in decoration to be made easily.

In the past wood paneling was a favourite means of decoration and also provided much needed insulation. The intricately fitted pieces of recessed or raised sections and moldings of solid wood paneling required skilled hand craftsmanship. Contemporary interior wood paneling usually consists of large plywood sheets which can be installed with a minimum of time, labour and skill. Although a choice hardwood, such as mahogany or walnut, may be used for the surface veneer or lamination, the core and inside sections can be cheaper soft woods which are durable and in greater supply.

Other materials that are relatively permanent and durable include some that are more often considered for floors only, such as linoleum (either in sheets or tiles) and cork, plastic, ceramic or marble tiles. However, ceramic and marble, as well as other rock substances and glass, are used for making mosaics, a form of surface decoration which has been used for walls, floors and to a lesser extent ceilings, for thousands of years. At mid-20th century renewed interest in mosaic work was seen, but it remains an expensive and specialized technique. (*See* MOSAIC.)

Flexible walls are being used in increasing number. Panels of glass fibre or other transluscent forms of glass give privacy without cutting off light, while folding or roll-away units are made with fabric, split bamboo, matchstick or hinged wood panels. Storage walls may be of wood finished to harmonize with other woods in the interior or of fibreboard or plastic on metal frames.

Painted Walls.—The commonest and least expensive wall finish is paint, which can be easily applied and changed. Textured paints may be used where irregularities in surface need to be camouflaged. Glossy or semiglossy paints forming hard smooth surfaces are desirable in areas that need frequent washing (nurseries, bathrooms, kitchens); otherwise, dull finishes are generally pleasanter.

The walls of a room may be painted in one colour, or one or two walls may be painted a lighter or darker tone of the basic colour, or even a contrasting colour. A contrasting wall changes the apparent proportions of a room and for that reason may be especially desirable in a square boxlike area. A contrasting wall colour is generally best used where there is an unbroken expanse of wall or in a niche or alcove that deserves emphasis.

Woodwork and doors may be painted with a colour contrasting to the wall colour, but generally a pleasanter, more unified effect is achieved when the wood trim is painted the same colour as, or one that is only slightly darker or lighter in value than, the walls. Where the size and shape of the window and door openings are irregular or ill-proportioned, it is important that they should match the walls.

Although the approximate colour of walls must be decided before furnishing materials are chosen, the paint should be purchased after the fabrics because it can then be mixed to harmonize exactly with them. As a rule it is desirable to plan background colours that are somewhat lighter or more neutral than the colours of the furnishings fabrics. If possible, a portion of the wall should be painted, allowed to dry, and examined both in the daytime and at night under artificial light before the final colour decision is made. It is unwise to make a final colour choice from a tiny paint sample.

Pictorial designs or murals may be painted directly on plastered walls, using a fresco technique, or they may be painted with oil colors on canvas which is then stretched on the wall surface. (*See* also PAINT.)

Wallpaper.—Wallpaper was used as early as 200 B.C. by the Chinese who painted designs by hand on rectangular pieces of rice paper about 12 by 16 in. in size. Chinese papers were first imported into England and France in the 16th century, but hanging of these papers was made difficult by their small size and by the casual matching of patterns from one piece to another. In a late 16th-century French work is described a "guild of painters and paper hangers," *dominotiers*. About 1688 a master dominotier, Jean Papillon, invented a continuous matching design in wallpaper strips, and a method of producing these strips in continuous rolls was invented in France in 1798. Scenic papers accompanied by a numbered chart and special instructions for matching the strips together were next developed.

Flat-headed nails were first used to hang paper, but later in both France and England paste was used. Ready pasted wallpaper was developed in the mid-20th century.

Most modern inexpensive and medium-priced papers are machine-printed by the roller or cylinder process. A greater variety of special colour and design effects are made possible by a second method of printing, the silk process, which requires more hand labour and results in costlier paper. Hand-blocked papers are also available to a limited extent. (For the history of wallpapers *see* further WALLPAPER.)

With the great variety of wallpapers available, it is possible to achieve almost any effect. Since patterned walls limit the number of paintings, accessories and patterned fabrics that can be used effectively, a person to whom accessories are important should choose plain or only slightly patterned paper. In a room with no special accessories, or with no focal point such as a fireplace or a fine view from a large window, one wall might be papered with a fine distinctive design. Some of the difficulties of using patterned paper as a background for furniture were avoided by the 18th-century interior designers who generally used paper only on the upper wall above a plain-coloured painted dado.

Some wallpapers have co-ordinated matching fabrics for use as draperies or slipcovers in the same room or in adjoining areas to be seen against plain-coloured walls. It is important to consider size or scale of wallpaper design in relation to size of room. Large designs in bold colours are suitable only for spacious areas, small designs for small spaces.

However, designs that are small but so close together as to form a general over-all effect of texture may be equally effective in large and small areas. Wallpapers with strong contrasts of dark and light, and those which give a three-dimensional effect, should perhaps be avoided, since they will violate the natural flatness of the wall.

Wall Fabrics.—Fabrics as wall covering have an even longer history than does wallpaper, which, in fact, was originally an inexpensive substitute for fabric hangings. Almost any kind of cloth may be used on walls, and it may be draped in folds, stretched over panels or pasted directly on the wall. Paneled walls of silk damask, velvet and brocade were widely used during the Renaissance and 18th century in the palaces of Europe, while cotton fabrics were used in modest provincial homes. Tapestries were hung freely from walls or were stretched over panels. Leather was

used in similar ways, particularly in Spain.

In contemporary times the fabrics most commonly used for wall covering are durable ones such as canvas, burlap, denim, chintz and gingham, which may be applied directly to a wall. Grasscloth, which is more sheer, may be purchased already glued to a paper backing so that it may be hung like ordinary wallpaper, and other sheer materials must be handled similarly.

Plastic or plastic-coated fabrics may also be used. They are more durable and easier to clean than either untreated fabric or paper.

2. Fireplaces.—Although a fireplace is often no longer necessary for warmth, it continues to serve as a pleasant focal point for group gatherings and as a symbol of warmth and hospitality. Fireplace materials and design are largely architectural matters. Usually the fireplace is an integral part of a wall. Traditionally it was centred on a major unbroken wall space, giving it maximum effectiveness as a source of warmth. Often the central position suggested a formally balanced group of furniture on either side. In contemporary homes it may be part of the only thick and solid wall in an interior which otherwise has window walls and screen partitions. It may divide two areas and be accessible from both sides, although this arrangement has some practical drawbacks. In other cases the fireplace may be like a piece of furniture—a portable unit placed in a central location, accessible from all sides, with a hood and chimney above.

Special furnishings are needed to prevent the fireplace opening from being a stark, black, gaping hole when the fire is not lighted. Brass, copper and other metals which catch highlights from the fire are attractive both as hearth fixtures and as general accessories. (*See* also CHIMNEY PIECE; FIREPLACE FURNISHINGS.)

3. Windows.—The decoration of windows and doors should be closely co-ordinated with that of the solid wall areas. Light, privacy, outside view, ventilation, traffic through the room, the size and shape of the openings in relation to each other and to the total architectural unit, and, finally, purely personal preferences, are all important considerations.

Because outside light and temperature change both daily and seasonally, as do the needs of the house occupants, flexibility is one of the most important requirements for window treatment. Durability, including resistance to sun and moisture, and ease of maintenance are also considerations.

Shades, Blinds and Shutters.—Roller shades are the device most commonly used to ensure privacy and control of daylight. These can be obtained in varying degrees of opaqueness as well as a variety of colours. Pyroxylin-impregnated cotton shades, durable, washable and fire- and weather-resistant, are usually preferred. The disadvantage of roller shades is that when they are pulled they block out the best light, that from the top of the window; they also cut off ventilation. Bamboo and matchstick shades may be hung in the same way as roller shades or like draw draperies. Their special advantage is that they allow some ventilation, but they do not give complete privacy. In addition, many attractive colour combinations of woven fabrics, wood slats and decorative textured yarns may be used as window or door shades, controlled from a rolled position above the window or treated as draw draperies.

Venetian blinds, consisting of horizontal slats supported by tapes and controlled by cords, provide a maximum of light control and privacy without loss of ventilation, and the pattern of light they produce may be decoratively pleasing; however, they are tedious to clean. Vertical slat blinds are available in a variety of fabrics and colours. Though rayon or other man-made fibres are most commonly used, plastic strips are available for use in such areas as bathrooms and kitchens. The strips may be removed for cleaning or laundering.

Shutters provide a relatively permanent way of controlling light and privacy from within. Usually they seem to be part of the architectural detail of an interior.

Curtains and Draperies.—The purposes of curtains and draperies are varied and their selection is one of the most exacting and important tasks in interior decoration. Their practical functions include absorption of sound and control of privacy, light and temperature. In their decorative functions, curtains and draperies serve to soften hard structural lines of openings; they may provide an inconspicuous transition from indoors to the outside; and they may have distinctive colour and pattern that is important in the interior decorating plan. Although curtains and draperies are generally confined to windows they are sometimes used in doorways, as partitions or on walls for camouflage or acoustical purposes.

Fabric.—Some knowledge of textile fibres and weaves is helpful in making a wise selection of curtain or drapery material. No fabric is perfect for all purposes. The natural fibres, most familiar to consumers, include cotton, flax, silk and wool.

Cotton can be made into many kinds of materials, from canvas and heavy hopsacking to sheer net and gauze. Unless it has been given special finish, cotton stains and soils readily, but it is likewise easily laundered. Mercerizing increases the strength and lustre of cotton cloth, and, in addition, cotton fabrics may be made crease resistant, water- and mildew-repellent, and fire- and flame-proof. Glazed chintz is cotton fabric that has been given a permanent glaze by the addition of resins.

Flax is strong, durable and nonresilient. The fabric into which it is woven is known as linen and is fresh, crisp and easily laundered. Linen fabrics range from the sheerest curtaining to thick drapery material. Jute, a fibre similar to flax but less widely used, is often combined with flax, cotton or wool. When used alone, as in burlap, it has an attractive, rough texture but it deteriorates in sunlight and, when dyed, its colour fades quickly in a strong light.

Wool drapes well and does not soil readily. It can be dyed to produce beautiful colours and is an excellent soundproofing material as well as insulator. Its disadvantages include vulnerability to moths, mildew, strong sunlight and moisture; it is therefore unsuited to the tropics and, in other areas, drapes are usually lined to protect them from the sun. Often wool is combined with cotton in uneven twill-weave constructions that keep the wool yarns mostly on the surface and the cotton ones on the back, a device which lessens cost and increases serviceability.

Silk is used for the most luxurious drapery materials—for example, velvets, brocades, taffetas and fine damasks—or sometimes for less formal materials. It takes dyes well and drapes beautifully but it is expensive and not highly resistant to the sun. As with woolen draperies, a lining will lessen considerably the deterioration caused by sunlight.

Of the ever-increasing number of man-made fibres available for use in textiles, some are so new that little is known about their long-term serviceability. Much has yet to be learned about fabrics made of blends of two or more man-made fibres and of combinations of natural and man-made fibres. It is important that users read and observe with care the directions for maintenance of these fabrics given on labels. Following is a brief list of some of the man-made fibres commonly used in curtain and drapery fabrics.

Orlon is highly resistant to sunlight deterioration and to gas-fading. It drapes well and can be produced in lightweight and thick fabrics.

Nylon possesses great strength, elasticity and resilience and is easy to clean and dry. It is not attacked by moths or mildew and although it is not highly resistant to sunlight, it gives satisfactory service if directions are followed. Nylon curtaining is available in white and pastel colours, in fine ninons or marquisettes, some decorated with embroidery or flock printing.

Dacron has been used widely because it preserves its original size and crispness through extreme changes of humidity. Lengthwise Dacron yarns are sometimes combined with other yarns to eliminate sagging or stretching under humid conditions. Much glass curtaining is made of pure Dacron.

Dynel, made into a wide range of fabrics, is resistant to moths, mildew and flame, and does not shrink or stretch. It washes well and often is blended with other fibres.

Velon fabrics absorb little water and retain their crispness after repeated laundering.

Acetate is available in several forms. Fortisan acetate is durable and strong and may be woven into sheer fabrics. Chromspun and Celaperm, solution-dyed acetates, possess a "locked-in" colour which resists fading by sunlight and gases.

Fiberglas is made into curtain and drapery fabrics in a wide range of textures and weights. It is resistant to sun deterioration, mildew, moths and fire and is very easily cleaned. Conventional fabrics filter light through spaces between the yarns; Fiberglas yarns diffuse the light and themselves transmit it, the effect being softened and diffracted.

Plastic vinylite films are inexpensive draperies. They are resistent to moisture and soil but are affected by extremes of temperature.

Bamboo and split-wood materials, sometimes called matchstick, can be used in place of textile drapery. (*See* above, *Shades, Blinds and Shutters.*)

Colour.—Glass curtains are usually white, cream, beige or very light pastel in colour, because outside light needs to be filtered through them. White glass curtains do least to change the colour of natural light and give a fresh, airy quality to an interior. Light colours, however, may be used to give special light effects: very light blue or cool green tints or gray give coolness, while beige, cream, yellow or orange tints give warmth to an interior. The exterior effect of the curtain colour also requires consideration; usually it is well to have similar colours on all windows facing the same direction.

Since windows are a part of the wall background, drapery colours similar to the colour of the rest of the wall area give maximum unity to an interior, an effect especially to be desired in small rooms and in areas that have many fine accessories as a part of the decor. Treatment of windows as part of a quiet wall background also is called for in interiors that have especially fine outside views or those having distinguished architectural details and materials. In situations where the window treatment is to be the principal decorative feature of an interior, wall tones and other furnishings may be planned to harmonize with them.

The choice between plain or patterned fabric also depends upon the structure of the room and any existing decoration. Where the walls or floors are figured, or where many accessories are desired, plain fabrics may well be the best solution—though in some rooms, multicoloured patterned draperies may give unity to all other elements and add special interest. The scale of the pattern should be related to the size of the interior and to the furniture. Large-patterned fabrics can be used effectively only in relatively large areas and at windows where they can hang in long folds, usually to the floor. Smaller designs are usually more versatile. Finally, for a really satisfactory decorative scheme, the over-all effect should be in keeping with the function of the area and the characters of its occupants.

In considering drapery fabric, a sample should be hung at the window in folds so that its effect on the light, and the effect of light upon its colours, may be observed. Also, the sample should be held against other furnishings in the room to see if its colours and patterns harmonize with them.

Hanging Draperies.—The way in which curtains and draperies are hung affects the apparent size and shape of the openings and wall areas, as well as the sense of openness or warmth.

In general, draperies are most effective when they hang in straight folds, covering the window frame and starting and stopping at structural points. They may hang from the top of the window frame or from the ceiling and extend to the floor (actually about ½ in. above the floor) or to the bottom of the window frame. Sometimes because of special considerations, such as radiators or shelves under windows, they may need to extend only to the window sill, but the longer lengths are usually more desirable, especially if the fabric is bulky or is hung from the ceiling.

The width of draperies needs to be generous, usually from 2 to 2½ times as wide as the window area to be covered. If the fabric is sheer, a width three times the window area is better.

A group of windows can be unified by a cornice or valance. A cornice is a horizontal band of wood or fabric-covered wood placed across the tops of windows to cover curtain and drapery edges and rods. A valance is similar but is made of a strip of fabric or fabric-covered wood.

An effect of greater length is created by hanging the valance above the window casing, thus increasing actual length of drapery as well as height of window. A short drapery can be used like a valance at the top of a window above interior louvers or shutters.

Where windows meet in a corner, an effective treatment is to hang draperies only at the side of each window where it joins the wall, so that when they are drawn they will meet at the corner structural line. For greater privacy, corner windows could have sheer draperies or curtains hung over the entire glass area, with stationary draperies at the far sides. A large picture window is usually most effectively treated by simple draw draperies that can hang over the wall on either side of the window, thus giving maximum openness, or that can be drawn over part or all of the glass. It is important that the fabric hang in generous folds.

Windows of different width in one room can be made to look uniform by extending some draperies beyond the window casings. Windows of varying height in the same room are given unity by hanging a valance from the ceiling to the top of the window casing. A high narrow window looks wider if the drapery covers the wall a little on each side, the extent of the extra drapery depending on the proportions of the wall spaces. Similarly, if the window is overly low and wide, an opposite effect is achieved if the drapery is close to the window and allowed to hang to the floor. If the ceiling is low, it is better to omit valances and to hang draperies in straight vertical folds from ceiling to floor. Several windows separated by small wall spaces may be treated as a single unit and the whole area hung with a ceiling-to-floor drapery with valance extending across the top; if the drapery starts at the top of the window frame, the valance may be omitted.

Glassed doors, or French doors, are often hung with draperies or curtained with a lightweight fabric held in place by rods at both top and bottom. If the doors open to the exterior, they may be covered entirely by draperies. Crane-type door fixtures, which permit the draperies to be swung free from the doors, are available.

Draperies may be hung for decorative purposes, as a sound absorber or to camouflage an ugly wall even when there are no openings in it. They may also act as a partition, the most convenient form being a draw drapery hung from a ceiling track.

Hanging Curtains.—Curtains are hung inside and close to the window frame and glass, and are short enough to clear the sill. When they are used as draperies, they are hung outside the frame and may extend to the bottom of the sill, or to the bottom of the window frame, or to within ½ in. of the floor. (*See* also CURTAIN; WINDOW.)

4. Doors.—A door that is much used for major traffic yet is closed most of the time may be treated simply as part of the solid wall background; *i.e.*, it may be painted the same colour as the wall or be of wood finished similarly to other wood surfaces in the room. A door that is never used may need to be removed; many old houses have unnecessary interior doors which take up valuable wall space when left open and give a cramped look to small rooms when closed. If a door is needed for privacy, but there is limited space for the conventional swinging door, a hinged folding door, hinged shutters or sliding doors may be used. A door with adjustable louvers may suffice where an opening is needed for ventilation but privacy is required; furthermore, louvered doors may give a pleasantly decorative effect.

Glass doors are usually treated in much the same manner as windows. Glass curtains may be hung directly on the door casing itself, with rods at both top and bottom. Draw curtains or draw draperies generally are hung from the frame above the door with provision for drawing them to the side to give clearance when the door is opened. Occasionally, side draperies are used over the framework on each side of a glass door. Wherever door curtains or draperies are used, they should be integrated with the window and solid wall treatment of the interior. Glass doors that need no provision for privacy or light control may be left uncurtained.

Doors may serve special decorative purposes. There is traditional precedent for each of the following suggestions: a door may be painted a colour that contrasts sharply with the walls of a room, or it may have decorative designs painted on it; in either case the colours should be related to the general interior decor and the door placement be such that it becomes a pleasant design accent. Coloured glass panels in a door may serve a similar colour and

design accent purpose. Leather, either plain or stamped, may be mounted or nailed onto a door surface to give a richly handsome texture and colour. Fabrics or plastics also may be used to cover a whole door or its inside panels. An inset of a mosaic panel or a painting or a piece of wood or metal sculpture may be used for decorative purposes on a focally located door. Japanese doors with a geometric latticework pattern made of strips of wood backed with paper or fabric may be used as sliding partitions in an interior area. (*See* also DOOR.)

5. Floors.—Durability and ease of upkeep are vitally important considerations in selection of floors and floor coverings, but since floors also contribute importantly to the beauty of an area their appearance cannot be neglected. The amount of emphasis to give floors depends upon the total decorating scheme. Usually it is desirable to be fairly conservative and to provide a floor surface that is restful in effect, not only because of the relatively high cost and long life of floor coverings but also because the floor needs to appear stable. Yet in an otherwise plain room with few distinguished characteristics, a handsome patterned rug, such as an oriental or other handmade rug, may be the most important design element.

Floorings.—Inside floors and outside living terraces may be handled as one continuous floor, covered with such materials as brick, stone or ceramic tile, for a durable flooring and a maximum degree of unity. These materials, however, are costly to install and give a surface that is noisy and hard to stand on. Other flooring materials, such as linoleum, rubber tile and a variety of plastic-type tiles, which may be used on inside floors requiring frequent cleaning, are less costly and more resilient, though they are also less distinguished in appearance. Cork tile is resilient, durable and attractive for general living areas; it is also pleasantly warm and comfortable and so is suitable for family or playrooms. Wood, of course, continues to be one of the most generally useful and beautiful floor materials. No material, however, is completely satisfactory for all kinds of situations.

Rugs and Carpets.—Generally some kind of additional floor covering is desirable to give softness of texture in at least a few areas of a house. Choice of carpeting or rugs depends upon many factors. Wall-to-wall carpeting hides nondescript floors and gives maximum spaciousness to an area but, unless that area is entirely regular in shape, wall-to-wall carpeting cannot be turned for even wearing. Furthermore, such carpeting is costly, especially if made of high-quality materials. A rug that is seven or eight inches smaller than the room dimensions gives almost the same effect as wall-to-wall carpeting and can be turned easily. Use of rug pad or cushion lengthens the life of a rug or carpet.

Smaller rugs may be used to unify furniture groupings and to provide colour and softness of texture in areas having fine-quality floors as well as in areas that need to be uncarpeted for special activities. For example, in a living-dining area used by an active family with young children it may be desirable to leave the dining space uncarpeted but to place an area rug in the living room part of the space to give a pleasant textural quality and absorb sound as well as to unify the furniture arrangement. In some contemporary homes of open plan with very few interior wall partitions, rugs may be used to define activity areas.

Small rugs tend to give a sense of coziness. They need to be large enough, however, to be in scale with the furnishings and the over-all room size, although several small rugs can be grouped together to give the appearance of a larger one. It is usually desirable to arrange rugs parallel with the structural lines of a room. They should have a rubberized backing, or separate rug anchoring material should be placed under them.

Well-designed rug patterns are much like well-designed patterns in any fabric or wallpaper. First, they are relatively flat in appearance. Designs which give a sense of three-dimensional depth, whether in geometric shapes or natural forms, produce an unstable and distracting effect, as do very strong contrasts of dark and light colours. Fine oriental carpets set a high standard of design in patterned rugs; although most of them have intricate patterns in many colours, the designs are flat and non-naturalistic in effect.

A number of contemporary artist craftsmen, particularly in the Scandinavian countries, are designing and making beautiful rugs for floor or wall coverings. Hand-braided and hooked rugs, which have a long history, continue to be a handicraft of importance to a limited number of people. These handmade rugs can be used to give individuality to homes where they are in keeping with the decorating plan. Machine-produced rugs and carpets, however, must supply the major decorating needs.

Figured rugs or rugs with some over-all mixture of colour do not show soil so readily as plain colours do, and for that reason are especially desirable for hallways and dining areas. Medium colours, neither very dark nor very light, are good for the same reason. A plain coloured rug that has some variation in the texture, such as twisted yarns for the pile or an irregular length of pile, is easier to care for than is a smooth one.

The effect of different colours of floors on the size of an area is discussed in the section on *Light and Colour*, above.

To make a wise selection of carpeting from the wide variety available on the market it is important to have some knowledge of fibres and construction techniques used in their manufacture. These are discussed at some length in the article CARPET MANUFACTURE. Types of rugs and their designs are discussed in RUG AND CARPET. (*See* also FLOOR.)

6. Ceilings.—Although ceilings in most 20th-century homes are given little thought in either building or decorating, they may play an important part in establishing the character of interiors. High ceilings may give a feeling of openness, airiness, spacious dignity or unpleasant vastness of space; low ceilings may give a feeling of coziness and intimacy, informality, or crowding and oppressive weight. Where either unpleasant extreme is present, the interior designer can create optical illusions of change of height through change of paint colour or by means of various structural and lighting devices.

In the too-high room a lowered ceiling panel sometimes may be used effectively. In a large room, only one area may have the lowered ceiling and the space between the upper and lower ceilings may be used for installation of indirect lighting. Sometimes a lowered ceiling may be made of translucent glass or plastic with lighting installed above, giving excellent, even, general illumination. Warm dark colours of paint or wood or patterned paper may be used to make a ceiling look lower. When this is done, it is necessary to use lighting fixtures that direct the light down or to place a light-reflecting disk above the fixture, since dark colours absorb a large amount of light.

Not so much can be done for the too-low ceiling, except in terms of optical illusion with colour, line and scale of furnishings. Painting the ceiling a very light, cool colour such as blue-white, and using long draperies without horizontal breaks, and furniture that is relatively low and light, help in obtaining a feeling of spaciousness.

Skylights are useful in interior areas that get little light, and they give a visual extension of space. Artificial illumination may be used above the skylight at night to provide a general glow of light. Coved ceilings give a pleasant curved transitional line between ceiling and walls and provide an excellent place to install indirect lighting.

Exposed ceiling beams give a substantial quality to flat ceilings as well as to those which follow the line of a sloping roof. Beams of fine-quality wood well fitted together can produce a ceiling design that may be the dominant feature in an interior, establishing the character of the whole decorating scheme. It need not necessarily be rustic in effect.

Ceilings may be covered with porous materials that improve the acoustics of an interior. This is especially important for areas where there is considerable noise and where there may not be many fabrics or other soft textures that absorb sound.

See also CEILING.

D. FURNITURE

1. Selection.—Obviously the first considerations in furniture selection are comfort and suitability. Yet these are not always easy to achieve. With sitting pieces there is the problem of providing enough variety in height and depth of seat to accommodate people of different size. Furthermore, no chair is comfortable for

very long periods of time, and frequent changes of position must be made. This would suggest that closely matched sets or suites of furniture are less desirable than varied pieces individually chosen for the proportions of the family. The design of various pieces of furniture should be compatible in general character, however. For example, one home may have a living area that has an informal, casual, almost rustic character, while another may have rooms with a sense of polished elegance. Both may be comfortable and suited to use.

Successful combinations of contemporary and period styles of furniture depend upon this compatibility: the factors to note are texture, weight or scale and line. Early American Colonial pieces have been used effectively with simple, sturdy, informal contemporary furniture, just as the elegant French and Italian 18th-century styles have been well used with some more polished, sophisticated-looking modern ones. Likewise, dark and light natural woods, painted pieces and metals may be used in the same room or area if they are basically similar in line, scale and texture.

Adaptability is an important consideration. Chests which may be used equally well in living, dining or sleeping areas are more economical than single-purpose chests. Study or bedroom chairs that harmonize with those in the living and dining areas can be used in those areas when needed. Modular furniture units, made in storage and desk pieces as well as sectional sofas and chairs with separate but co-ordinated footstools or ottomans, have a very wide range of use.

In small living quarters double-duty furniture is especially helpful. Small low chests may be used to replace end tables. Coffee tables with extra shelves or drawers provide valuable storage space. A dining or work table that is hinged to a wall and may be lowered for use and raised when not in use is a saver of floor space. Sliding or hinged, folding cupboard doors require less space than do full swinging doors.

Many fabric and wood finishes have been developed that are resistant to dirt and wear, an important consideration in selecting dining and coffee tables, and sitting pieces in much-used areas. Because the greatest amount of wear on upholstered furniture occurs on the arms, many pieces are designed with wooden arms and upholstery only on the body of the chair.

2. Arrangement.—Convenience is the first consideration in furniture arrangement, and for its achievement two kinds of information are needed: (1) activities that will take place in the area and (2) space needed for those activities.

Daily activities need first consideration, and furniture should be so grouped that a minimum of shift is needed. A room that is disarranged most of the time is one that was not arranged for convenience in the first place.

It is desirable to separate the kinds of activities in a room. For example, in a living room there may be a relatively small quiet conversation grouping, a place for desk and book shelves nearby, and piano and game table farther removed at one end or in a separate alcove or L. If possible, major traffic should not be routed through an activity area—especially the conversation grouping.

The "arc of conversation" or the maximum distance at which people can converse with comfort is approximately eight feet. In a large area, a couch or chairs may be placed toward the centre of the room at right angles to the wall in an L arrangement to create an intimate group and some separation from other activities. In a small room, one end or a portion of a side wall and an end wall may be used for such a grouping. In small rooms the doors often are so placed that it is difficult to contrive any conversation grouping unbroken by a major traffic lane. In this case, sometimes a low room divider (book shelves or other storage unit, or even a narrow table) may be used to direct flow of traffic and provide a pocket of uninterrupted space in a room.

Chairs and couches need table or other flat surface space near at hand for ash trays, magazines, etc. Good light is also important. Isolated chairs have little use in living areas except as additional accommodation for unusually large groups; small folding tables that may be opened and set up near pairs of chairs may be provided.

Besides the eight-foot conversation arc, a number of other dimensions need to be kept in mind in arranging furniture. The distance between coffee table and couch should be a little over a foot, to allow for knee room yet not exceed the distance for comfortable reach. Each person needs about two feet of space at a dining table, the host eight inches to a foot more. Passage space, whether between dining chairs and wall to accommodate serving, between counter and table in a kitchen or between bed and dressing space, needs to be planned with the utmost care. Three to four feet is generally needed, depending upon the number and size of people who will use it and the heights of the furnishings or walls.

Traditionally in most European and American homes the principal pieces of furniture were placed around the edges of rooms. This continues to be a satisfactory practice in some situations, particularly in very small rooms. However, in many contemporary homes there is little solid wall space because outside walls may be composed almost entirely of windows and doors, and inside partitions may be movable panels or storage walls. In such situations the large furniture may be used to divide the room into different zones, but whether it occupies the centre or the edges of the room it should be placed either parallel or at right angles to the walls. This is not only the most satisfactory arrangement visually but is also space-saving. Smaller pieces of furniture and those which are circular or irregular in shape generally may be deployed in a variety of positions. Lighter, open pieces of furniture can be used effectively against window walls, whereas solid pieces often look clumsy there. Some unfilled space should be left in every room or area to accommodate people and additional activities as well as to provide a sense of openness.

A design which provides a focal point and a number of subordinate points of interest is usually desirable. In living areas the focus is very often the fireplace, or perhaps a fine view, or it may shift from one focal point to another depending on the time of day or the season. When arranging a room it is helpful to sit and to stand in each part of it in order to ensure that the furniture groupings and the relationships between colour, light and texture will be satisfactory from every angle.

A balanced design might be defined as one in which there is a pleasant distribution of "visual weights," and it is not difficult to recognize a lack of balance in room arrangement. In the past, the principal pieces of furniture were placed in formally balanced groups that gave a sense of dignified stability and corresponded to the symmetry of the exterior. Most contemporary homes are basically asymmetric in architectural plan, and interiors, likewise, are often best handled in this fashion, though a mixture of styles in either setting can be successful.

Careful attention needs to be given to the relative sizes of the pieces, and also to their relative heights, since these make a linear pattern in a room. Once again, the most satisfactory arrangements in each case are those that avoid both extreme contrast and monotonous uniformity.

A sound way to plan an arrangement is to measure the floor space and to draw it to scale on a sheet of graph paper. All architectural details such as fireplace, doors, and windows, also need to be drawn to scale. Then, furniture pieces may be drawn in the same manner on a separate sheet and cut out so they can be moved about on top of the floor plan. Thus when a purchase is contemplated its effect on the room can be tested diagrammatically. The disadvantage of working with a flat plan is of course that it does not show the heights of furniture, and allowances must be made for this: for example, a coffee table may cover a relatively large amount of floor space yet actually not look very large because it is low, whereas a tall bookcase may cover a relatively small amount of floor space yet actually look heavy because of its height. If heights can be visualized, however, cut-outs can be of great help not only in buying the furniture but for trying out rearrangements of the various pieces without the labour of pushing them around. Distances between the pieces, paths for the traffic, and total composition can all be studied, and more efficient use of space and more effective composition are likely to result from such careful planning.

For a full discussion of FURNITURE DESIGN, *see* the article under that title. Furniture construction, quality, etc., are dealt with in FURNITURE MANUFACTURE. *See* also articles on individual fur-

niture pieces, as BED; CABINET FURNITURE; CHAIR AND SOFA; LAMP; SCREEN; TABLE.

E. Accessories

Accessories may be the most individual part of the furnishings. They include such items as paintings, books, rock collections, flower arrangements and ash trays. They may or may not serve a utilitarian purpose, but if they are to be worthy of inclusion in a home they need to have special significance for the persons living there and be so arranged as to enhance and enrich their surroundings. An interior without accessories is as noncommital as a hotel room, yet conversely too many can make a house seem cluttered or even museumlike.

Space must be provided for storage of accessories not in use. The Japanese traditionally exhibited only a minimum number of items at a time, and only those appropriate to the season. Certainly periodic change gives variety and freshness to interiors. Paintings, pieces of sculpture, ceramics or other such items give more pleasure when they are not displayed continuously. Books, on the other hand, may form a pleasant background which changes little except as they are used and additions are made.

In general, small accessories are difficult to use effectively in interior decoration. Miniature glass figures, for example, which may be exquisite in colour and the special hobby of a member of the family, will not even be noticed unless they are specially grouped and displayed with proper lighting.

It is difficult to generalize concerning proper location of accessories. It may be helpful to note focal points in a home, however, and to decide whether enrichment is needed at any of them. For example, the end of a hallway, the view through a doorway, the wall opposite a major seating space in a room or the view from bed would all suggest focal points at which accessories might be placed unless architectural detail or other furnishings are already prominent.

1. Pictures and Wall Hangings.—Pictures are usually not needed, nor are they effective, in rooms with patterned wallpaper. However, if the paper design is ordered and relatively quiet in effect, paintings may be used provided they have wide, plain-coloured mats or relatively wide frames or a scale of design in contrast to the wall pattern.

In hanging pictures, the total room composition needs to be considered. Pictures usually are best grouped with some furniture or architectural feature, their exact placement depending upon the size and shape of wall space, the furniture group and the height from which they are to be viewed. For example, pictures generally to be seen from a sitting position, as in a dining room, need to be lower than those to be viewed from a standing position in a hallway. In each case they should be at about eye level.

Small pictures are difficult to use effectively, though sometimes several may be grouped together. Lighting may be used to dramatize especially fine paintings.

Fabrics—tapestries, embroideries and special printed textiles—may be used like pictures for fine decorative effect. Large wall maps may serve decorative purposes only, or they may record family travels or be used to locate home town or country of guests. Enlarged photographs (particularly those taken by members of the family), grouped in a gallerylike arrangement or even covering a whole wall, are effective in decoration. Usually it is desirable to make sure the prints can be changed easily.

Mirrors used as an integral part of decorating need to be placed with much care. They are most effective where they reflect a pleasant view or lovely colours, a flower arrangement or some other accessory, or where they multiply the sparkle of metals or glass. Mirrors in conversation areas, however, can be disconcerting, and on some wall locations they seem to create an unpleasant void. (*See* also FRAME DESIGN.)

2. Plants and Flowers.—Plants provide a transition from inside to outside and soften severe structural lines. From a decorative point of view they may be chosen for variation of texture, line, size and shape of leaf or of the whole plant. However, it is also important to choose those which are suited to the room's particular light and humidity conditions. With plants as with other accessories, the larger ones are generally more effective in decorating, although small ones such as African violets may be grouped for a beautiful concentration of colour. Furthermore, position determines the size of plants to be used. A small plant is perfectly suited for a small end table, a larger plant or a tray with two or three small plants on it might be better for a medium-sized coffee table, while floor plants and those placed on large low chests need to be massive (three to six feet high).

Flower arrangements give a special charm to interiors, and because they must necessarily be changed frequently they encourage variety. (*See* also FLOWER ARRANGING.)

3. Special Hobbies and Collections.—Perhaps the most interesting and individual accessories are those which result from hobbies. The collector of fine glass and ceramics may choose items that can be enjoyed during regular meal service as well as in display. A well-lighted tank of tropical fish, with its fascinating colour and movement, is a hobby accessory that can be beautiful and highly interesting to the casual visitor as well as the hobbyist.

Many articles in the field of art also contain material relevant to interior decoration; *see* ANTIQUE; ENAMEL; GLASS; METALWORK, DECORATIVE; POTTERY AND PORCELAIN; SILVER AND GOLD WORK; WOODWORK, DECORATIVE. (G. A. E.)

II. COMMERCIAL INTERIORS

1. The Development of the Interior Design Profession.—Prior to World War II, most nonresidential interiors were either designed by the architects for the building or were not designed at all. More often than not, the building itself was at violent odds with its interior requirements: while the structure might be neoclassical, the functional requirements of the interiors were frequently modern in the extreme, so that either the interior spaces would match the exterior (and thus not function at all), or they would be made to function reasonably well—in which case the furnishings were not likely to match the style of the building.

This inherent conflict was resolved by a number of pioneer architects in the early part of the 20th century, although their example (contained in a few isolated buildings in Europe and the United States) did not have any great impact until after 1945. Long before World War II such men as Frank Lloyd Wright in America, Ludwig Mies van der Rohe, Walter Gropius and Marcel Breuer in Germany, Le Corbusier in France, and Alvar Aalto in Finland designed and built commercial and industrial structures in which exterior form and interior space were completely integrated, and both served the needs of 20th-century building programs. To achieve this complete integration, these architects discovered that they had to design the furniture as well as the actual building. As a result, almost all the really significant, early innovations in modern furniture design were carried out by architects such as those listed above.

The reason these architects had to design their own interiors down to lighting fixtures and doorknobs was obvious: the "interior decorators" of the time had no knowledge of modern architecture—or, if they had, they were generally out of sympathy with it. It took several decades to educate a new kind of professional: the interior designer, an expert consultant who understands and is in sympathy with modern architectural problems and solutions, and who is able to interpret the architect's and the client's intentions and translate these into functional and pleasant spaces in which to work.

To illustrate some of the ways in which interior design can help answer the needs of architect and client, it may be useful to describe two significant projects of the postwar years.

The first example, the General Motors Technical centre in Warren, Mich., designed by Eero Saarinen in 1949, is an illustration of complete design of structure and interiors by one person—the architect. The center is a complex of buildings remarkable not only for its enormous size but also for the painstaking attention to the smallest detail in every one of its thousands of working spaces. The "modular grid" of the exterior walls is echoed in the "modular grid" of interior partitions and ceiling systems; the elegance of exterior detail and finish is carried all the way inside and is found there in such seemingly unimportant details as directional signs,

lettering, elevator pushbuttons, clocks and even chairs and tables designed by the architect. Saarinen frequently said that a good piece of architecture had to be "all of one thing"; in the General Motors centre he himself designed every interior detail. Later, as the interior design profession grew in skill, Saarinen and others found that there were trained professionals to whom the interior design could be delegated.

A good example of this more recent collaboration between architect and interior designer is the headquarters complex for the Connecticut General Life Insurance Co. outside Hartford, completed in 1957. The architects, Skidmore, Owings & Merrill, delegated the interior design assignment to Knoll Associates' Planning Unit, whose designers were in complete sympathy with the architects' approach. At Connecticut General, and in many industrial and commercial structures since, the interior designers sat down with each executive of the client company, studied his or her needs, built models of different kinds of office spaces, and arrived at special solutions to many special problems. In some other instances, interior designers have built full-size mock-ups of offices to show each executive what sort of space he or she might expect in the new building.

In other countries, especially in certain parts of Europe, interior designers are frequently required to work within the framework of existing buildings. Sometimes the contrast of the ornate architecture of the past with the simple, light and almost transparent furniture of the 20th century enhances both. In Italy in particular interior designers have been successful in creating such harmony by contrast.

The interior designer is now an accepted, indeed essential consultant to architects throughout the world. In the United States, in the Scandinavian countries, in Japan, in Latin America—in short, wherever specialization has become a part of modern life—interior designers are found to collaborate with architects. In Germany, the birthplace of the famous Bauhaus (*q.v.*), interior design has long been an accepted discipline.

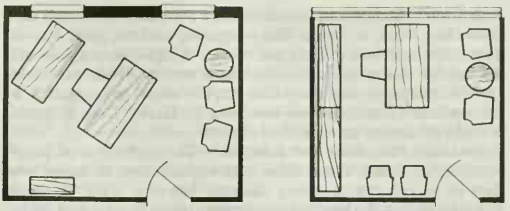
2. Design Procedures.—Interior design begins with the concept of the building. It is the architect's function to envision the basic interior space and anticipate the problems of detailed planning. The interior designer's work includes programming, space planning, relation of design to mechanical equipment, selection of materials and colour, furniture design and placement and, finally, selection of art objects and accessories. The line between architecture and interior design is impossible to define precisely.

Programming.—A program of the client's needs is of paramount importance in achieving a successful design. The client himself shares in this responsibility; he must thoroughly analyze his needs and present them to the designer, who, by applying his professional knowledge to the total problem, is then able to formulate a final program that will best serve the client's needs, functionally and aesthetically.

Space Planning.—Once the general concept of the design is developed, the next step is the planning of space. This is determined by the size and nature of the building plus the needs of the client. Because of the high cost of building, every square foot of space must count. It is important for the designer of a large building, with a multiplicity of room units, to study the basic requirements in detail. Careful arrangement of the furniture units can result in a significant saving of space. The floor plans illustrate this point.

Plan A is a typical office plan of the 1940s. Except for variation in size, it was standard for offices ranging from junior executive to company president. In such an office there was always a diagonally-placed desk, with a table set parallel behind it, a few chairs scattered around the edge of the room, and a glassed-in bookcase. The table behind the desk generally became an unsightly storage receptacle.

In Plan B, the furniture has been rearranged and the functions of the table and the bookcase are combined in the long cabinet, which provides work surface with storage space below for books, files and a dictating machine. The office in Plan B is more comfortable and efficient to work in and it appears orderly and large, yet by careful planning the dimensions have been reduced from the 12 x 15 ft. of Plan A to 12 x 12 ft., a saving of 36 sq.ft.



UTILIZATION OF OFFICE SPACE (*see* TEXT)

This sort of economical design can be applied to any type of room—in dormitories, in hospitals, in schools. The object is not to make rooms smaller simply to reduce cost but to make them the size that they reasonably should be to fulfill their function.

The importance of planning to achieve economy of space in a multiple-unit building is indisputable. Nevertheless, even in the most economically-planned building some areas should have a sense of spaciousness for visual counterpoint to a series of small rooms.

Relation of Mechanical Equipment to Interior Design.—In conjunction with space planning the designer must consider the visual appearance of such mechanical features as air conditioning, heating and lighting. These items, if selected and placed properly, can be a handsome addition to a room. If their placement is not carefully planned, however, the walls and ceilings of the room may be defaced by unsightly grilles and lighting fixtures.

Several methods of concealing air conditioning and heating units have proven successful in achieving an integrated interior. One of the simplest is a perforated acoustical ceiling which admits or exhausts air into the ducts through small holes, leaving the ceiling surfaces smooth except for lighting fixtures. Another effective system is a linear register, a long, narrow slot or parallel series of slots which run the length or width of the ceiling. Another system, particularly effective for large areas, is an open gridwork of vertical acoustical baffles, first employed in the General Motors Technical centre. This system, simple to build and maintain, provides economical distribution of ducts, registers and lighting units above the baffles and creates the over-all illusion of a ceiling.

The lighting of a building is a functional element, but it also has emotional appeal. The objective is to promote better vision in work areas and provide the right atmosphere in any kind of space, for without the proper kind of light a room loses its character. Good light is not a matter of abundance, but of the right type for the right location. A sewing room on Seventh avenue in New York may need 500 foot-candles of shadowless light; a dinner table may be charmingly lighted with candles. Fluorescent lighting is generally most serviceable and economical for utilitarian areas, whereas incandescent fixtures are more attractive and suitable for most other areas. The sources of light may be from the ceiling, walls, or even the floor.

The fields of air-conditioning and illumination are at the threshold of new developments. Such inventions as electronic temperature conversion for heating and cooling and electroluminescent room lighting promise exciting new solutions for the future.

Selection of Materials and Colour.—The character of an interior is established by the building itself, by the climate, by the occupants of the building, and by the basic design concept. The creative process is stimulated by seeking individual expression for each of these. The basic concept, once established, is a guide for the selection of colours, textures and furnishings.

Colour is an exciting tool of the designer. In nonresidential as in residential buildings, it sets the atmosphere and mood. It responds to light, natural or artificial. People react to colour emotionally, and their preferences are based on this emotional response. (*See* also *Light and Colour*, above.)

The main sources of colour are floors, ceilings and walls. The selection of wall materials is limited only by budget and suitability. Flooring, more than any other interior building material, must be selected with maximum attention to maintenance and wearability. In most commercial buildings floors are of asphalt or plastic tile,

except where budget and use allow more permanent materials such as marble, stone or glazed tiles. Lighting and acoustics also influence the selection of floor materials. A light-colored floor aids the lighting system of reflection. Hard surface floors may create acoustic problems, and they thus require some compensation by the use, elsewhere, of sound-absorbing surfaces. Deep carpeting is itself, of course, an acoustical element.

Furniture Placement and Selection.—The preference of people for familiar forms about them may explain why so many were slow to accept contemporary designs; however, with its use in many large installations, contemporary design has become an accepted form.

Production copies of furniture by English and French 18th-century designers and by early American craftsmen are not particularly suited to the requirements of large commercial buildings of the 20th century. Pieces designed to meet the aesthetic and economic demands of today are more logical choices for these buildings. Beautiful antiques may have limited use in very special areas, providing they meet the requirements of proportion and proper scale, essential to all good design. The curved lines of a Louis XV chair, for example, effectively complement the simplicity of contemporary forms; however, both rarity and economics curtail the use of antiques.

Contemporary furniture is varied in form because it employs new materials and manufacturing techniques. The molded plastic chairs of Charles Eames and the molded pedestal furniture of Eero Saarinen have beautiful flowing forms unique to the material. Harry Bertoia's sculptured wire chairs have a graceful linear volume. Many straight, simple pieces have been designed in wood and metal. One of the most beautiful chairs is the classic stainless steel-and-leather chair designed by Mies van der Rohe for the German pavilion at the Barcelona exposition in 1929.

Furniture should be selected as carefully as colours. Too many unrelated shapes in an office have the same jarring effect as too much colour. It may be advantageous to relate the dimensions of furniture to the building module. In this way sofas, desks and storage pieces can be co-ordinated with a flexible partition system to fit a wide range of room sizes, creating an order that is both visual and functional.

Placement and scale of furniture can alter the basic proportions of a space; for example, a small, low-ceilinged conference room will appear higher, and both the furniture and room will seem to be in better proportion, if the table height is lowered. Designing for large, open spaces, such as halls or entrance lobbies, presents a problem of scale. Relating the furniture to ceiling height instead of man's height would result in a disproportionate design. The Barcelona chair by Mies van der Rohe, for example, has an elegance and monumentality which make it eminently suitable for large areas.

Art Selection and Finishing Details.—The final step in finishing the interior is the selection of the right art objects, plants, and accessories, without which a room appears cold and incomplete. These must be chosen with the same consideration for scale, colour and texture that has determined all other elements of the interior.

During the Renaissance, painting, sculpture and architecture were closely allied. In the early part of the 20th century this alliance was rare; with a few exceptions the use of art was very limited. Gradually, however, the interest in art for commercial interiors increased. Painters and sculptors were being commissioned for specific building projects, and some large organizations have established art programs for their buildings, purchasing original paintings and sculpture and lithographs. The increased use of art greatly enriches contemporary interiors.

The final details are as essential to the creation of a well-integrated interior as are its basic structural elements. When all are properly interrelated in the design scheme, the result is the attainment of the designer's goal, a goal which applies to 20th-century interior design as to any great period of the past; an interior which is beautiful and serves its purpose.

See also references under "Interior Decoration" in the Index.

(F. K. Ba.)

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INTERIOR DECORATION, HISTORY OF. This article outlines the history of interior decoration and is designed to be read in conjunction with the article FURNITURE DESIGN, arranged on similar lines, so that a picture can be obtained of interiors of all periods in most parts of the world. For practical decorative planning *see* INTERIOR DECORATION and the various articles referred to there. As the religious and monumental types of buildings are dealt with separately (*see* ARCHITECTURE [ARTICLES ON]), the present article is devoted chiefly to domestic buildings, and is divided into the following sections:

I. Introduction
II. Ancient Civilizations
  1. Egypt (*c.* 4500 B.C.–*c.* 1090 B.C.)
  2. Mesopotamia (*c.* 4000–330 B.C.)
  3. Crete, Greece and Rome (*c.* 3000 B.C.–A.D. 476)
III. The Middle Ages
  1. Early Medieval Europe
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  1. China
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  1. Italy
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VI. 19th and Early 20th Centuries in Europe
VII. 17th to Early 20th Centuries in the U.S.
  1. Early Settlers' Homes
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VIII. The Modern Movement

I. INTRODUCTION

The desire to enrich the surfaces of a building usually arises as soon as the structural problems are solved. Treatment of interior surfaces, which was at first restricted to the application of colour to a plain wall surface, developed and became elaborated in the use of many different forms of pattern and material.

At its highest level, the function of interior decoration is to enhance the effect of the whole without obtruding as a separate element. As a general rule it should emphasize the architectural lines of a building although in many instances it has been used as a means of improving or correcting imperfections. At a more modest level the aim of interior decoration is to provide pleasant, comfortable and practical surroundings. On a small scale this has been achieved most successfully by overall simplicity combined with high quality of materials and craftsmanship.

Historical examples give some idea of the numerous resources employed by designers, decorators and craftsmen to excite admiration or create illusion. The overall style in any period reflects, to a great extent, the political and economic conditions. Secular building and decoration has often been the most powerful symbol of status, notably in the reign of Louis XIV of France and in

18th-century England. Fashion and the search for novelty have always played some part in directing trends of interior decoration but the expense of experiment acts as a general counterbalance.

The dominant influences, climate and availability of materials, determine the national or regional characteristics, which may be maintained through many changes of taste and style.

II. ANCIENT CIVILIZATIONS

1. Egypt (c. 4500 B.C.–c. 1090 B.C.).—In contrast with the monumental tombs and temples of stone, many of which remained intact down to the 20th century, Egyptian houses were built of perishable materials of which little has survived. Sun-dried or kiln-burnt mud bricks were used for the walls, and roofs were generally of reed or palm-leaf thatch over timber. Some smaller rooms may have been vaulted with brickwork; floors consisted of beaten earth and a thin coat of smooth mud plaster was often used as an internal wall finish.

In its simplest form the applied decoration was a plain white or coloured wash but in larger houses patterns in varying degrees of elaboration were painted on the plaster. Rush matting was hung across most internal door openings and used as screening inside the small, high windows. It is probable that decorative wall hangings and floor coverings were made of rushes or palmetto woven into a pattern, since painted representations of such hangings have survived from the 5th dynasty in the tombs of Ptahhotep and Ti at Saqqarah. In the workmen's village of Kahun, built in the 12th dynasty (*c.* 1900 B.C.) some of the more well-to-do houses contained rooms decorated with 1-ft.-high brown-painted skirting, then a 4-ft. dado (the term applied to a lower portion of wall which is decorated differently from that above it) striped vertically in red, black and white. Above this the walls were buff coloured, with brightly painted decorative panels in the more important rooms. Outer doors were of wood, fastened with bolts and latches, and ceilings were also often of painted wood. It may be assumed that the lavish tomb decoration of all periods was basically derived from the domestic interiors of their time.

Many Egyptian decorative motifs are stylized from natural forms associated with the life-giving Nile. The lotus bud and flower, the papyrus and the palm appear constantly with borders of checkered patterns or coiled ropelike spirals, giving an air of space and elegance. The palace of Ikhnaton and other large houses at Tell el Amarna (*q.v.*; *c.* 1365 B.C.) reflect a tendency toward naturalism. Ikhnaton, Nefertiti and their daughters are frequently represented, usually grouped affectionately together. Other painted panels show animals and birds with twining surrounds of vegetation. Molded coloured glazed ware was introduced to give a brilliant inlay of grapes, poppies, cornflowers and daisies, all in natural colours. The use of square ceramic tiles as a wall surfacing was uncommon but not unknown. Primary colours were the most common, a brilliant yellow being among the most frequently used, but terra cotta, gray, black and white were all added to give contrast. Even floors were delicately painted to represent gardens or pools. One of these at Amarna shows a rectangular tank with swimming fish and water fowl, bordered with lotus, and papyrus marshland with an outer band showing more birds and young cattle in the meadows beyond. Furniture ranged from the simplest benches and ceramic pots to beautifully designed chairs, small tables and beds in the homes of the rich, where innumerable vases, urns, ceramic, wood and metal utensils evince a fastidious and yet luxurious way of life.

(M. A. M.; E. C. D.)

2. Mesopotamia (c. 4000–330 B.C.).—The mud-brick houses of the Sumerian and Old Babylonian periods in the Tigris-Euphrates valley resembled their modern counterparts in their rectangular outline and the grouping of rooms about a central court, which was either roofed or open. In the majority of houses decoration probably was confined to a wide black or dark-coloured skirting, painted in diluted pitch, with a band of some lighter colour above. Door frames were sometimes painted red, probably as a protection against evil influences, and where doors were used they may have been of palm wood. The poorer houses were simply whitewashed inside and out.

In the most elaborate Assyrian palaces the main decorative features were panels of alabaster and limestone carved in relief, the principal subjects being hunting, ceremonial and war, as in the palace of the warrior Sargon II (*see* SARGON) at Khorsabad (706 B.C.). Panels and friezes of ceramic tiles in vivid colours decorated the walls inside and out and it is evident that this brilliance of colour was a feature of much Assyrian and Babylonian decoration. Carved stone slabs were used as flooring with typical Mesopotamian rosette and palmette borders. Occasionally, Egyptian lotus motifs also appear.

Vigorous and warlike figures characterize both Assyrian and Babylonian work and the standard of execution was extremely high. Naturalistic detail was often engraved on the surface of the figures and animals which themselves were in relief. After the Persian conquest (539–330 B.C.) this vigour declined. The palace built by Darius and Xerxes at Persepolis shows a lighter use of animal figures. Glazed and enameled tiles were used on the walls, while timber roof beams and ceilings also received vivid painted colour.

(E. C. D.)

3. Crete, Greece and Rome (c. 3000 B.C.–A.D. 476).—The most important buildings of the pre-Hellenic Minoan and Mycenaean periods were the citadel complexes, housing the entire court of the ruler. The palace of King Minos at Knossos in Crete (*c.* 1500 B.C.) gives evidence of a small but sophisticated society with a taste for luxury and entertainment and a corresponding skill in applied decoration. The palace was constructed from large blocks of stone, with stone and painted timber columns supporting the lintels or roofs; much of the paving was also of stone. Extensive frescoes and some panels in painted relief decorated the walls of living rooms and ceremonial rooms, which were grouped asymmetrically round a series of courtyards. Many aspects of Cretan life were depicted, the recurring theme being the acrobatic bullfighting on which a religious cult was probably centred. The figures are wasp-waisted and fashionable; male figures are usually painted in red, female figures in yellow, and both wear gold and silver ornaments. Even the backgrounds to friezes and panels, which depicted many-coloured painted birds, animals and flowers, were given an effect of movement, being divided up into light and dark areas. Plain dadoes and borders provided an effective foil and gave articulation to the interiors. A fragmentary imitation of column construction can be seen painted on the walls of the "stepped pavilion," having yellow sham pilasters capped with blue, dadoed in red and surmounted by an imitation architrave in yellow. A narrow frieze of birds above is divided from the ceiling by an even narrower cornice banded in yellow, black and white.

As seafarers, the Cretans could import a rich variety of materials for building and decorative purposes; a wealth of ideas, also, can be seen in the fine pottery, carved ivories, beaten gold, silver and bronze with which their palaces were ornamented. (*See* also CRETE.)

The flowering of Hellenic culture, culminating in Athens in the 5th century B.C., was manifested more in the exterior perfection than the interior treatment of its architecture. In an age of temples and public buildings, dwellings were relatively unimportant. In most cases the Greek house looked inward to a courtyard or to a large, high central room and was built of unbaked brick, with a tiled roof; very little is known of the details of its decoration.

In the Hellenistic period (323–31 B.C.), domestic comfort and decoration were considered once more. Mosaic floors were an important decorative device, originally being made of pebbles as at Olynthus, but later developing into the black and white or coloured mosaics which were widely used throughout the Roman empire (*see* MOSAIC). A central finely designed panel with realistic motifs and a wide, more coarsely executed border of scroll or key patterns acted as a focus for the arrangement of furniture, which was still limited in quantity.

Greco-Roman decoration has been well preserved at Pompeii, Italy, where painted wall decoration began about 150 B.C. By about 80 B.C. plastered walls were being made to look like masonry, with a plinth or dado and several courses of imitation stonework in molded plaster, surmounted by two molded cornices separated

by a flat frieze. Such decoration was combined with the true architectural features—doors, architraves and pilasters. The panels are painted variously in yellow, black, magenta and red with some imitation marbling indicating an earlier custom of applying marble veneers. Rich colour was also supplied by superbly executed mosaic floors, elegant couches with coloured cushions, bronze tripods and lamps, such as those seen in the frescoes at the House of the Faun, Pompeii.

Roman wall painting depicted columns, niches and open windows with elaborate imaginary views and figures beyond. Broken entablatures and painted ruins, as seen in the House of Livia, Rome, were the precursors of the 18th- and 19th-century romantic taste in western Europe.

In the 3rd and 4th centuries A.D., the variety of coloured marbles, imported from Egypt, Greece and various new quarries in Italy, provided fresh material for veneering walls and laying patterned marble floors of *opus sectile*, as at Ostia (*q.v.*). Painted architectural features were still used to frame the wall panels, and formed an integral part of the interior design. Brilliant colours were applied in tempera, oil or encaustic (a preparation of heated wax mixed with pigments which provided particularly vivid and durable colours). Fine stucco was sometimes molded in relief, and modeled terra-cotta plaques and friezes showing mythical and pastoral scenes were let into the walls. Ceilings, which were often vaulted, were frequently coffered (decorated with sunken panels) or painted to resemble coffering. Painted or modeled medallions were introduced, and glass mosaics were applied occasionally to vaults, apses or the soffits (undersurfaces) of arches—for example at the Baths of the Seven Sages, Ostia.

Most of the present knowledge of furnishings and hangings in Rome and its provinces comes from surviving paintings and reliefs. Mattresses, cushions and pillows had colourful woolen or linen coverings woven in intricate patterns, and were sometimes tasselled or valanced (bordered with cloth). The courtship of Venus and Mars in the house of Marcus Lucretius Fronto, at Pompeii, shows a couch draped in dark green, scarlet and purple, striped and banded in yellow and other colours, and a stool with a red, gold and blue covering and a golden fringe. Fur rugs, cloth of gold and Chinese silk were used occasionally and fragments of such materials have been found in tombs at Palmyra, Syria. From Doura-Europus, also in Syria, a piece of material survives with shaded pink and red roses outlined in tan on a green ground. Elaborate furnishings of this kind are mentioned by Horace, Propertius, Cicero and other writers. Statues and statuettes of bronze or marble, vases or dishes of painted and glazed pottery, silver, bronze and coloured glass adorned the homes of the rich. Lamps of varied shapes made in pottery or bronze and braziers and water heaters of bronze also were found at Pompeii. (JN. L.; E. C. D.)

III. THE MIDDLE AGES

1. Early Medieval Europe.—In the 4th and 5th centuries, with the weakening and ultimate fall of Roman order and administration in a large part of western Europe, secure and civilized life came to an end and its refinements vanished, some for five, others for ten centuries. Indeed, certain amenities, such as adequate domestic heating, did not begin to emerge again until the 20th century.

Constant war was waged against invaders from Asia and from northern Europe and material possessions dwindled to a minimum: a man did not own for long anything he could not defend and had little use or opportunity for interior decoration. If he possessed more than one house, his furniture and possessions would go with him from place to place. The arts were monopolized by the church which grew rapidly in the early middle ages and later dominated all aspects of the Gothic world.

Late into the medieval period the larger houses were designed according to military rather than aesthetic principles. The main room was a spacious hall with timber or stone walls (sometimes plastered), an open-beamed roof, narrow slit windows as yet unglazed, and a floor of stone slabs, tiles or beaten earth. In the earlier houses the fire burned in the centre of the floor and the smoke either drifted through a central hole in the roof or dispersed among the rafters, but wall fireplaces soon replaced this unsatisfactory system. Furniture was probably limited to plain stools, benches and trestle tables, made of local timber, and some heavy chests in which clothing, hangings and other personal possessions were stored. The feudal lord and his lady sat on more elaborate chairs on the dais (raised platform), and a coloured hanging of plain fabric sometimes decorated the wall behind them. Wall hangings and tapestries became more common in Norman times, when stone carving on doorways, fireplace, window openings, column capitals and arcading superimposed on the inside walls was also introduced and can still be seen in the Norman castles of Rochester, Kent, and Chepstow, Monmouthshire, in England. The whole community often lived and slept in the one hall, but as time went on two main rooms, the hall and the chamber, were provided. At first rooms were divided by woolen hangings, hung from iron rods or from the rafters; solars (withdrawing rooms) and cabinets or bowers for women's work and recreation developed in this way. The houses of the poor were simple timber-framed shelters with bare earth floors and undecorated walls lined with wattle and daub. Such conditions, with variations according to local circumstances, were generally prevalent in western Europe down to the end of the 12th century.

2. Late Medieval Europe.—The spread of eastern influence resulted in great advances and in some cases, for example Spain and Sicily, it had already begun to take effect in the 12th century. The curious hall of King Roger II (12th century) in the Norman Palazzo Reale at Palermo, Sicily, shows Byzantine derivation in its marble-faced walls and mosaic-encrusted ceiling.

During the 12th and 13th centuries many of the more important landowners and military leaders in France and neighbouring countries took part in the crusades and learned something of luxurious living in the near east. As a more secure way of life was becoming possible at home, they began to improve their own living conditions. Fortification diminished and the castle slowly evolved into the manor house. Household equipment became more elaborate and important, no doubt partly because the women had played a greater part in household management since the absence of their menfolk on the crusades.

Curtains of finer texture began to replace wooden window shutters or heavy homespun hangings. Tapestries relieved the bareness of the walls and gave additional warmth to rooms. Other textiles and tapestries were draped over chairs and tables, and brightly coloured woven or embroidered cushions were used. The fine wood ceilings of the large rooms were sometimes coffered and often painted in bright colours, particularly in France. The disappearance of much of this colour with the passage of time lends a false austerity to surviving medieval interiors.

A greater number of rooms, serving special needs and giving increased privacy, came into use although the house was still not planned as a whole. The kitchen, buttery and pantry were placed at the lower end of the hall beyond a carved timber or stone screen which, in larger houses, supported a minstrels' gallery. At the opposite end, the chamber, or withdrawing room, may have had a solar above it, used as a bedroom or as a special apartment for the ladies. A guest room was occasionally provided. In the 13th and 14th centuries, the wardrobe was a room with presses for storing curtains, hangings, bed and table linen, as well as the clothing and materials needed by the members of the household. Here sewing and tailoring were carried on and the room became a combined workroom and store, furnished with heavy, plain tables and chairs.

In the kitchen, rotating spits and adjustable hooks for suspending cooking pots were fixed into a vast hooded or recessed wall fireplace. Plain but pleasing utensils of wood, copper and iron were kept on hooks on the walls and stools and enormously solid tables stood on the stone or tiled floor, which was strewn with sawdust or rushes.

In the hall the rushes were mixed with fragrant herbs and helped to absorb some of the dirt, smells and grease. By the 15th century, plaited rush mats were common. The introduction of linen tablecloths resulted in a great improvement of manners and cleanliness at meals. Gold and silver plate was displayed in the wealthier

Wall painting with royal vulture motif decorating the porch of the Anubis chapel, temple of Queen Hatshepsut at Dayr al Bahri, Thebes, Egypt; c. 1500 B.C.

ANCIENT WALL DECORATIONS, EGYPT AND MESOPOTAMIA

Formalized patterns in blue glazed brick decorating the facade of the throne room of the palace of Nebuchadrezzar II, Babylon; c. 600 B.C.

PHOTOGRAPHS, (TOP LEFT) HIRMER VERLAG, MUNICH, (BOTTOM RIGHT) FOR ENCYCLOPÆDIA BRITANNICA, INC., WITH PERMISSION OF THE STAATLICHE MUSEEN ZU BERLIN

INTERIOR DECORATION, HISTORY OF

Semistylized fresco painting showing acrobatic bullfighting, from the Royal Palace of Minos, Knossos, Crete; *c.* 1500 B.C.

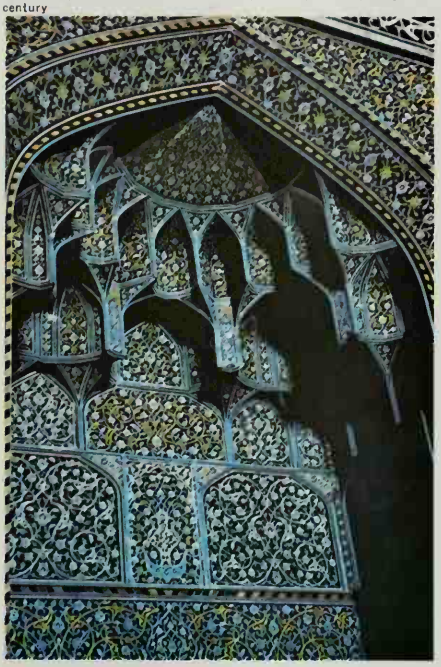
Panel with mythological subject framed by an ornamental border in the interior of the House of Neptune and Amphitrite, Herculaneum; 4th to 3rd century B.C.

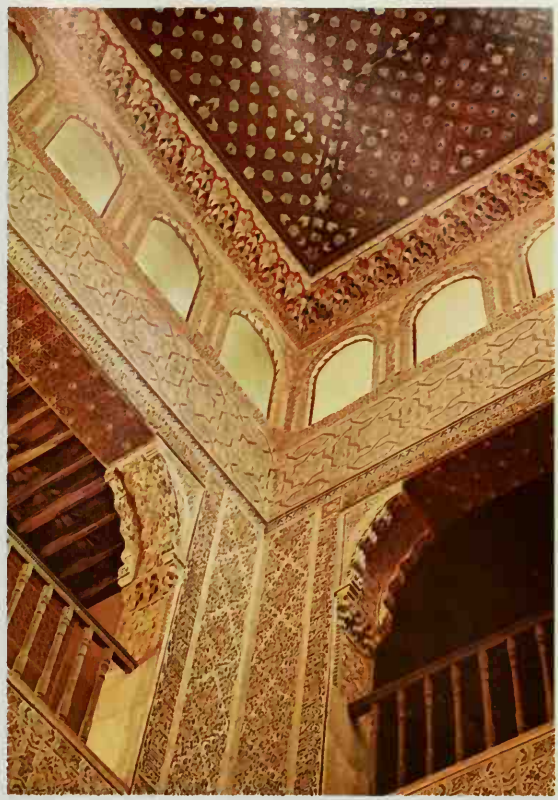
MINOAN AND ROMAN INTERIOR DECORATION

PHOTOGRAPHS, (TOP) S. MARINATOS AND M. HIRMER, "CRETE AND MYCENAE" © THAMES & HUDSON, LONDON (BOTTOM) EDWIN SMITH

MUSLIM INTERIORS IN PERSIA, SPAIN AND TURKEY: 14TH–17TH CENTURIES

Combination of faience mosaic and painted tile decorating the interior of the Masjid-i-Shaikh Lutfullah mosque, Isfahan; Persian, early 17th century



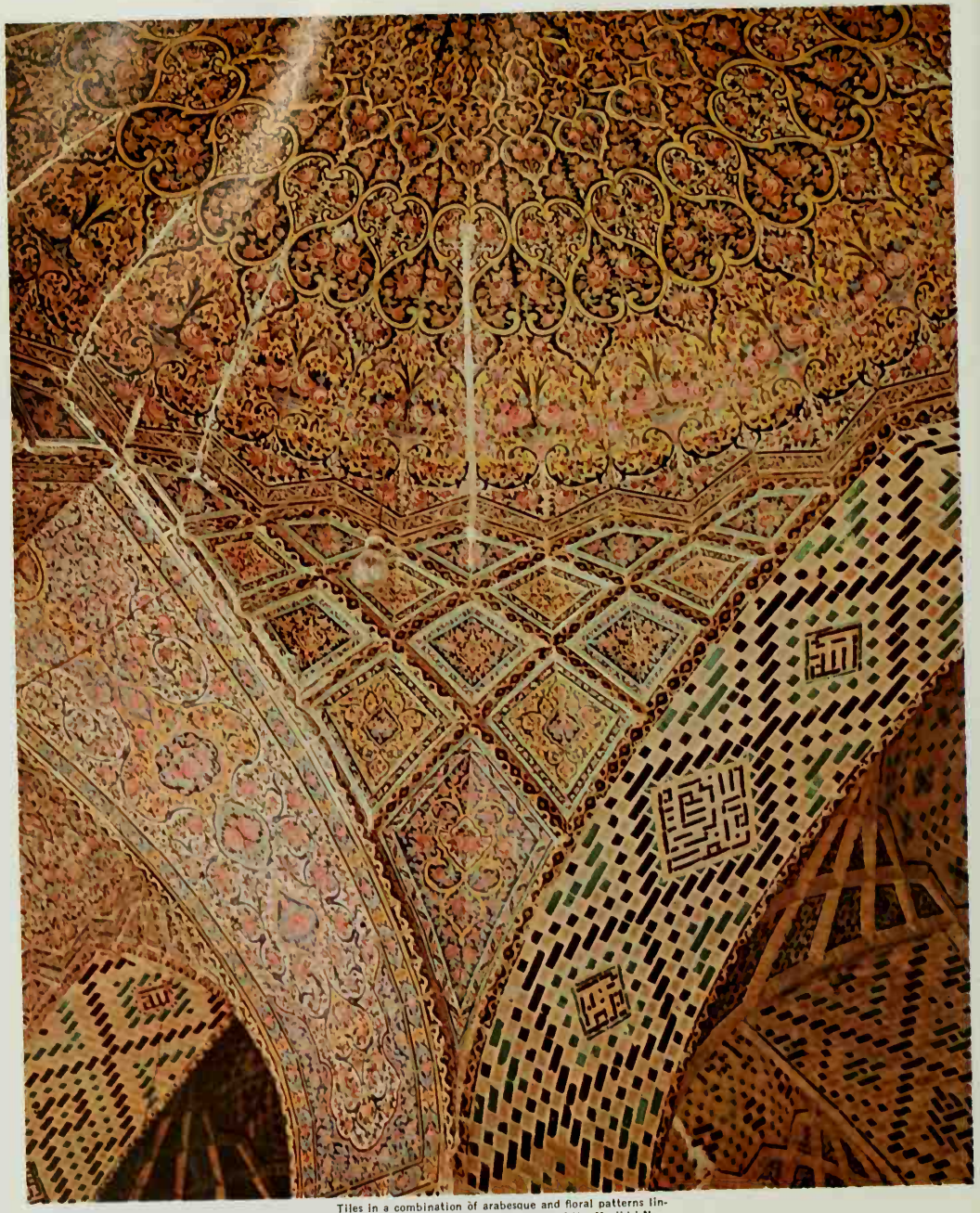


Lacelike intersecting patterns decorating the ceiling and upper parts of the walls in the Sala del Reposo or de las Camas, the Alhambra, Granada; Moorish, mid-14th century

Blue mosque of Sultan Ahmed I, Istanbul; 1616. Ceramic tiling and marble were used more sparingly than in Persian interiors, to give a feeling of space

PHOTOGRAPHS, (TOP RIGHT) AMPLIACIONES Y REPRODUCCIONES MAS, (CENTRE LEFT) JOHN DONAT, (BOTTOM RIGHT) LESLIE HAYTON COLEMAN AND HAYWARD

INTERIOR DECORATION, HISTORY OF



Tiles in a combination of arabesque and floral patterns lining the walls and dome of the interior of the Masjid-i-Nau, or New Mosque, Shiraz, 17th century

17TH-CENTURY PERSIAN INTERIOR DECORATION

PHOTOGRAPH, KEYSTONE PRESS AGENCY LTD

Living room in the Shugakuin imperial villa, *c.* 17th century, showing the *tokonoma* recess, a traditional feature of Japanese interiors

A room in the Nijo palace; 17th-century early Edo style. The wall paintings were done by Kanō artists in the Momoyama manner

JAPANESE INTERIORS IN KYŌTO

PHOTOGRAPHS, (TOP) GENRIOO CO. LTD., KYŌTO, FOR ENCYCLOPÆDIA BRITANNICA, INC., (BOTTOM) MAX TATCH FROM SHOSTAL

INTERIOR DECORATION, HISTORY OF

RENAISSANCE AND BAROQUE INTERIOR DECORATION IN ITALY

Fresco paintings by Paolo Veronese (1528–1588) in the central hall of the Villa Barbero at Maser, near Asolo, Italy; 16th century. The balcony scene is a *trompe l'oeil*

The gallery of the Palazzo Doria, Rome, decorated with Venetian chandeliers and mirrors, gilded furniture and frescos by Aureliano Milani; late baroque

PHOTOGRAPHS, (TOP) EDWIN SMITH, (BOTTOM) FOR ENCYCLOPÆDIA BRITANNICA, INC., WITH PERMISSION OF ITALO BUZZACCHI

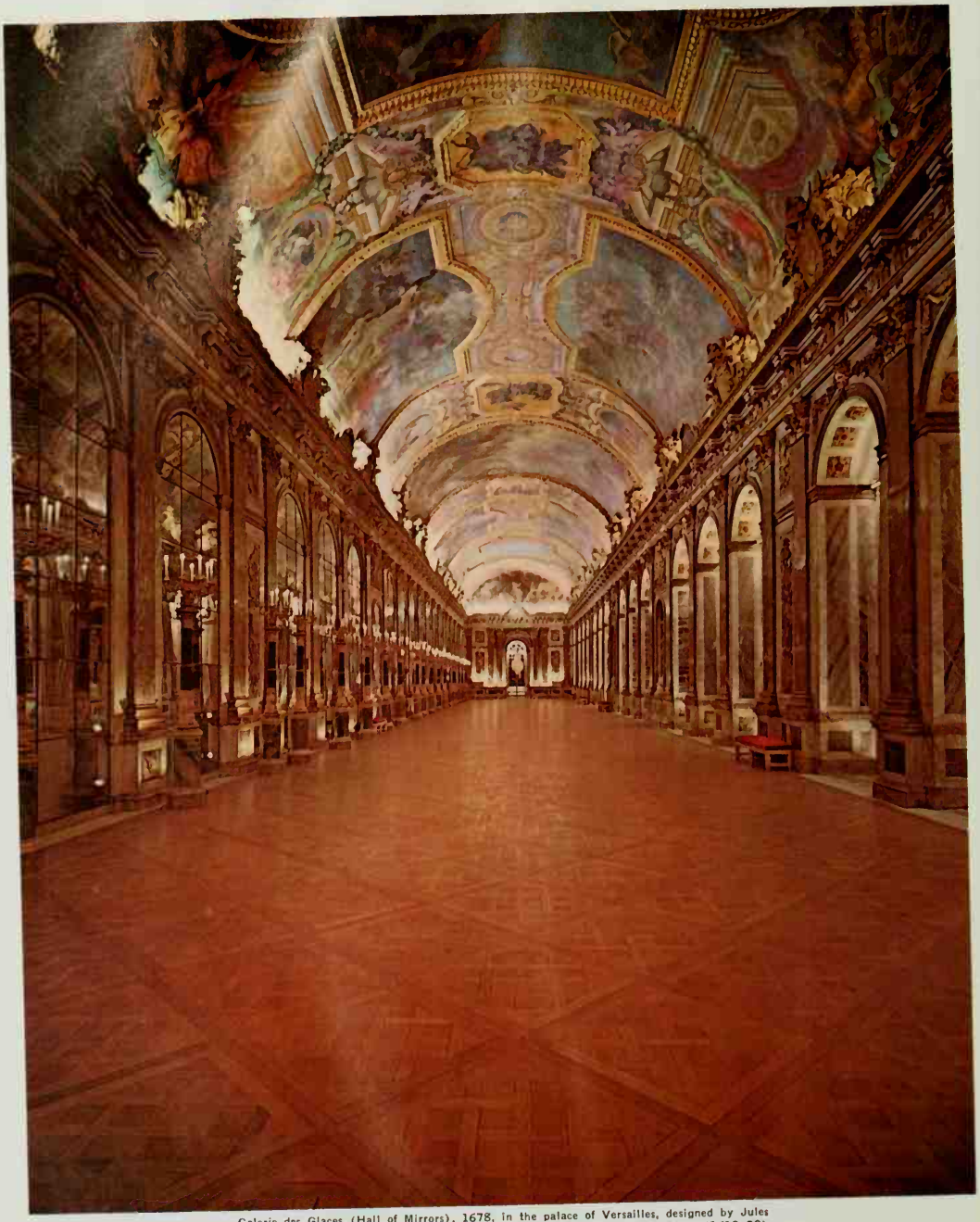
Interior, looking upward, of the ballroom of the royal hunting lodge, Stupinigi, near Turin, Italy, *c.* 1732, by Filippo Juvarra (1678–1736); post-baroque

Room in the Linderhof palace, near Garmisch-Partenkirchen, Germany, 1869–78, built by Georg von Dollmann for Ludvig II, king of Bavaria, in a neo-baroque style

Circular mirror room in the Amalienburg pavilion, a hunting lodge on the grounds of the Nymphenburg palace, Munich, Germany, 1734–39, by François Cuvilliés; rococo

POST-BAROQUE AND ROCOCO INTERIORS OF ITALY AND GERMANY

PHOTOGRAPHS, (TOP LEFT) EDWIN SMITH, (TOP RIGHT) STANLEY J. STRICKLAND—RAPHO GUILLUMETTE, (BOTTOM) GUNTHER SCHMIDT FOR ENCYCLOPÆDIA BRITANNICA, INC



Galerie des Glaces (Hall of Mirrors), 1678, in the palace of Versailles, designed by Jules Hardouin Mansart (1646?–1708). The ceiling paintings are by Charles le Brun (1619–90)

FRENCH BAROQUE INTERIOR

BY COURTESY OF FRENCH GOVERNMENT TOURIST OFFICE

Bedroom in the royal château at Langeais, Loire valley, France, built by Jean Bourré; c. 1467. Some of the furnishings are more recent, but in general the decoration is typical of the early French Renaissance style of the 15th century

Bedroom in the *Oktorp* farmstead at the Skansen museum in Stockholm, Sweden; 18th century. The pine paneling and furniture are characteristic of many Scandinavian and central European interiors

FRENCH AND SCANDINAVIAN INTERIORS OF THE 15TH AND 18TH CENTURIES

BY COURTESY OF (BOTTOM) NORDISKA MUSEET, STOCKHOLM, PHOTOGRAPH, (TOP) PUBLICATIONS FILMÉES D'ART ET D'HISTOIRE

Great hall of Hatfield House, Hertfordshire; *c.* 1610. The tapestries, carved woodwork and marble floor are Tudor in style; the strapwork ornament shows Dutch influence

ENGLISH RENAISSANCE INTERIOR DECORATION

PHOTOGRAPH DR. H. ZINRAM

The vestibule of Syon house, near Isleworth, Middlesex, 1762, by Robert Adam

ENGLISH NEOCLASSIC INTERIOR DECORATION

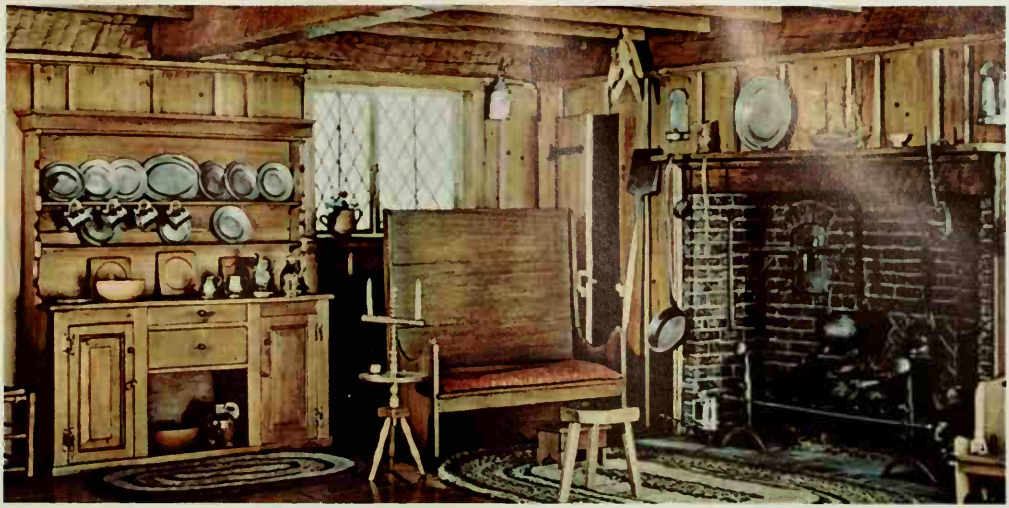
PHOTOGRAPH, A. F. KERSTING

Music room in the Château de Malmaison, near Paris; 1800. The furnishings and decoration are Empire in style and reflect the influence of the Egyptian campaigns of Napoleon

EMPIRE AND LATE VICTORIAN INTERIOR DECORATION IN FRANCE AND SCOTLAND

Detail of a bedroom in Inveraray castle, Argyll, Scotland, decorated in the style of the late Victorian period. The wallpaper is a William Morris design

PHOTOGRAPHS, (TOP) PUBLICATIONS FILMÉES D'ART ET D'HISTOIRE, (BOTTOM) EDWIN SMITH



A typical kitchen-living room, 1675–1700. The room is a model based on features of the Parson Capen house (1683), Topsfield, and an early room in the Concord Antiquarian society

The great room in the Ironmaster's house, Saugus Ironworks restoration; built in 1636. The room contains a court cupboard, wainscot chair and Carver chair. The fireback inside the fireplace dates from 1655

INTERIORS FROM EARLY SETTLERS' HOMES IN MASSACHUSETTS

BY COURTESY OF (TOP) THORNE AMERICAN ROOMS IN MINIATURE, THE ART INSTITUTE OF CHICAGO; PHOTOGRAPH, (BOTTOM) RICHARD MERRILL

Parlor in the Samuel Wentworth house, Portsmouth, N.H.; built in 1671, paneled about 1710

Drawing room in the Powel house, Philadelphia, Pa.; 1768

U.S. PRE-REVOLUTION INTERIORS

BY COURTESY OF (TOP) THE METROPOLITAN MUSEUM OF ART, (BOTTOM) PHILADELPHIA MUSEUM OF ART

The drawing room in Gunston hall, Lorton, Fairfax county, Virginia, done in the Palladian manner; 1755–58. The designs are attributed to William Buckland, an English carpenter

Dining room of Oak Hill, the Elizabeth Derby West house, Peabody, Massachusetts, designed by Samuel McIntire in the classic style of Robert Adam; dating from about 1801. Now in the Museum of Fine Arts, Boston

18TH- AND 19TH-CENTURY U.S. INTERIORS

BY COURTESY OF (BOTTOM) MUSEUM OF FINE ARTS, BOSTON; PHOTOGRAPH, (TOP) LOUIS H. PROHMAN

Living-dining room interior by Herman Miller, Inc. An example of functional interior design in which the living area serves more than one purpose

Living room interior designed by Marianne Willisch. Somewhat spare use of furniture in a room with floor-to-ceiling windows gives a feeling of spaciousness

MODERN INTERIORS

PHOTOGRAPHS, (TOP) HERMAN MILLER, INC., (BOTTOM) MARIANNE WILLISCH

houses and pewter dishes and plates were used. The rooms were lit by tallow or beeswax candles set in wood or metal candlesticks, or lamps formed of a floating wick in a bowl of oil, as well as by torches, standing candelabra and wall sconces.

Ornaments and various luxuries, which had become more common during the time of the crusades, proliferated in subsequent centuries as commerce with the near east increased. Household plate, of gold or silver, was frequently displayed on dressers or cupboards as decoration and to impress visitors; it was not unknown for these to be roped off to prevent pilfering. Indoor arrangements for washing and bathing were considered a luxury. A long trough with a row of taps in the courtyard served most of the household; sometimes there was a tank or cistern with running water. A flat-sided metal bowl was fixed to the wall of a living room, with a swinging ewer or a small cistern with a tap over it and a towel on a hinged rod. Small convex mirrors were hung on the walls as early as the 15th century (one appears in the famous portrait of Giovanni Arnolfini and his wife by Jan van Eyck in the National gallery, London), but only hand mirrors, usually of polished metal, were in general use.

One of the most complete early domestic dwellings remaining in England is Stokesay castle in Shropshire, a fortified manor dating in part from the 13th century. The large hall has a high open-beamed roof, unglazed windows with wide stone seats and a floor of beaten earth. An outside flight of stone steps leads to the solar where there is a built-in fireplace. The house has other separate rooms and exemplifies the development of privacy in English domestic arrangements. Henry III (1216–1272) of England was not only an enthusiastic builder, for example at Westminster abbey, but also a connoisseur of house decoration. The liberate rolls of his reign preserve all the orders he gave for the adornment of his castles and manor houses. Larger windows, and especially rose windows, were built in the halls, their painted glass adding the rich colour which pleased the king and which he achieved at other times by having "histories" painted on his walls, as in the Great chamber at Westminster palace. The frescoes generally depicted historical, biblical and classical scenes and were often executed above wainscoting with painted and decorated boarding. His queen, Eleanor, commissioned an allegorical figure of winter to be painted over the fireplace in her room at Westminster, and springlike flowers on the walls of her whitewashed room in the Tower of London. Roofs were also carved and ceilings painted. Such rich treatment was rare throughout the rest of the country where walls remained bare and hangings were the usual means of decoration used by the wealthier classes.

An illustration from the *Très Riches Heures du duc de Berry*, the celebrated manuscript at Chantilly, France, gives a striking picture of seignorial life in the first half of the 15th century. It represents King René I of Naples seated at a table; behind him is a circular screen of rushes which protects him from the heat of the large hooded fireplace, the wall is covered with tapestry hung on hooks, a white cloth covers the table, and there is rush matting on the floor.

In the Alpine lands, such as Switzerland, the Tirol and south Germany, the use of fir, pine and other soft local woods largely determined the form and ornamentation of interiors. Floors, walls and ceilings were made entirely of wood, as they often continue to be. A bedroom from the Landesfürstliche Burg at Merano, Bolzano province, Italy, is a remarkably well-preserved example of the interior of a well-to-do house in the latter half of the 15th century. Swiss furnished interiors are exhibited at the Historisches Museum in Basel, though only in one case dating back to the medieval period, and there are others in the Historisches Museum, Bern, and Schweizerisches Landesmuseum, Zürich, which cover the period from the 15th to the 17th centuries. Floors are of wood; walls and ceilings are paneled and molded. The moldings are bold, but any carving is usually in slight relief because of the nature of the wood; sometimes there are simple, geometrical inlays of harder and more ornamental woods.

The Castello d'Issogne, in the Valle d'Aosta in northern Italy, exemplifies a medieval domestic interior adapted to the mild climate south of the Alps, where the Gothic style never became so firmly rooted as in northern Europe. The castle was built about 1490 and, though medieval in structure and appearance, is not a stronghold but a summer resort. It is built in a square with a tower at each corner. A kind of vaulted portico supported by pillars opens on the inner courtyard; this was used as a hall, and is furnished with wooden linen-fold paneling and a fixed bench running along the wall. The lunettes above the paneling are filled with frescoes illustrating scenes of daily life—the shops of a provision merchant, an apothecary, a tailor and a draper, and an outdoor market and soldiers in a guardroom. There are also a dining room, an armoury, a kitchen, a servants' hall and a chapel. The coffered ceilings are carved and painted.

Tapestries were hung curtainwise from wood quartering set with tenterhooks; at Tattershall castle, Lincolnshire, Eng., this quartering has been restored, and a great chimney piece carved with heraldic designs and dating from about 1436 is also noteworthy. Flanders tapestries, known by the generic name of arras, were favourite hangings and, being solidly woven, they resisted the wear and tear caused by being moved frequently from house to house. In the 15th century it was not yet customary to have the walls lined with paneling (although wood was used for structural purposes such as hall screens and room partitions) and, except where covered by hangings, the brick structure of the walls was visible. An illustration from an illuminated manuscript (*c.* 1475) made in Flanders for Edward IV shows Richard II sitting under a rich cloth canopy and behind him the brick walls of the hall.

In the 15th century communications improved and there was a corresponding increase in the use of imported ideas and materials such as silks, velvets and cloth of gold; although oriental pile carpets were rare in Europe before the 17th century, they were probably introduced into England by Eleanor of Castile, wife of Edward I. With the advent of the Tudor period English interiors began to take on a more familiar appearance. Large windows followed a similar trend in church architecture and the use of carved paneling and other interior woodwork was extended. Even so, they could not rival the more sophisticated and colourful French interiors or the comfortable solidity of town houses in the Netherlands. (J. E. Le.; E. C. D.)

3. Muslim Countries.—The Arab conquest in the 7th century A.D. and, in the 8th century, Muslim expansion into India and Spain had profound influence on the decorative arts throughout the known world, especially as most of the long-distance trading routes passed through Arab lands. The skills of the conquerors fused with the traditional skills of their subject peoples and as Islam forbade the portrayal of human or animal form, whether for religious or artistic purposes, and encouraged the incorporation of Koranic texts into design, religion played a considerable and direct part in the development of design. As with nearly every other society, the finest and most lasting buildings were of a religious nature, and unfortunately few domestic dwellings have survived.

Architectural quality and form were subordinated to intricate and richly coloured surface decoration. Perhaps the finest results were achieved in Persia, where a high level of technical ability already existed in combination with great lyrical sensitivity. Here the principal decorative features were the ceramic tiles and tile mosaics which encrusted floors, walls, roofs and domes both inside and out. The mosques of Isfahan, Meshed and Tabriz, ranging in date from the 13th to the early 17th centuries, demonstrate a completely satisfactory use of colour in architecture. Lustred tiles with a combination of floral and geometric design date from the 10th and 11th centuries and naturalistic flowers frequently give a gardenlike effect to the tile decoration. Iris, rose, carnation, tulip, pomegranate, pine and date are depicted, always with delicately interlacing stems, and contained within plain or patterned borders. Blues of all shades, from turquoise to a deep ultramarine, are characteristic.

Patterns for tilework and patterns for the Persian carpets are frequently interchangeable. Somehow, for reasons not yet fully understood, carpet designers soon managed to circumvent the ban on the use of animal forms; lions, deer, leopards, ornamental birds and occasionally even mounted huntsmen were depicted,

the figures always judiciously placed to give the maximum decorative effect. Artistic achievement reached its peak under Shah Abbas (A.D. 1587–1629), but well before this time Persian carpets, silks and pottery were known and valued in western Europe, as they still are in the 20th century.

In Cairo and Sicily one of the results of Muslim domination was the introduction of a high degree of ornamentation on wall surfaces, once again principally by means of vividly coloured ceramic tiles. The patterns are more solid than those of Persia filling up the areas between the containing arabesques and with less open backgrounds. Moorish design in Spain shows even more complex interlacing geometrical framework which is filled in with formalized leaves, flowers or calligraphic inscriptions in Kufic and, later, cursive script. Ceilings and the upper parts of walls were modeled in flat relief with coloured and gilded arabesques, while the lower wall areas were tiled. The decoration was partly hand chiseled and partly molded. Such decoration may be seen in the Alhambra, built at Granada in the 13th and 14th centuries, a pleasure palace whose arcaded courts and halls are embellished with stuccoed decoration in honeycombed ceilings, stalactite vaults and capitals, tiers of horseshoe-shaped or stalactite-fringed arches, and pierced or latticed windows.

In the mosques of Turkey walls were veneered with marble and ceramic tiling was introduced only in small areas. Colours, too, are less exuberant in the large mosques, where a sense of space rather than of overwhelming decoration is pre-eminent. Domestic buildings were largely of wood, looking inward to secluded courtyards and gardens, but with elaborately latticed windows projecting at upper-floor level over the street. As in most other Muslim countries, the wealthy furnished their houses with velvet and silk hangings, couches and innumerable cushions.

Islamic influence in India appears at its finest in mosques and tombs of the Mogul period (1555–1707); coloured marbles and sandstone produce a more monumental architecture typified by the Taj Mahal at Agra (*see* INDIAN ARCHITECTURE).

IV. THE ORIENT

1. China.—Architecture has never been the principal medium for the expression of the Chinese artistic impulse; conservatism, perhaps rooted in ancestor worship, has been paramount and stylistic innovation practically unknown. The basic structure of the Chinese house has remained almost unchanged at least from the Shang dynasty (*c.* 1300 B.C.). In all types of buildings the roof is the most important feature and by the T'ang dynasty (A.D. 618–906) the characteristic upturned eaves and heavy glazed and coloured tile covering had developed. The roof is chiefly supported by timber posts on stone or bronze bases, and the walls of the building serve merely as screens in brick or timber. Floors are often of beaten earth packed tightly into a timber surround. Usually a family house was composed of a series of buildings or pavilions enclosing a garden courtyard and surrounded by a wall. The courtyard played an immensely important part owing to the ever-present ideal that man should live in harmony with nature: a small pool with a lotus plant, a tree and large rocks symbolized the whole natural landscape and it was on these features that most care was lavished.

The supporting pillars and brackets of important buildings were carved and painted, many of the designs being similar to those made familiar by Chinese pottery and porcelain. The yellow dragon symbolizes the power of the spirit, the tiger the forces of animal life. Windows were latticed with strips of wood in varying patterns over which translucent white paper was stretched. In addition to the lattice-work patterns, the windows themselves took on great variety of outline, for instance that of a diamond, fan, leaf or flower. Doorways, too, were fancifully shaped in the form of the moon, lotus petal, pear or vase, as structural support was not required from the light panel-type walls. Some walls may have been removable altogether as they were subsequently in the Japanese house; others were of painted wood, hung with tapestries, or paintings on silk and other materials.

Furniture, probably dating back to 500 B.C., was made with patient craftsmanship. Low stools and tables were early in use, and chairs, dressing tables, altar tables and canopied beds were common by the early Han dynasty (206 B.C.–A.D. 9). Designs and materials underwent very little change in the intervening years. Rosewood has always been widely employed and in the palaces elaborate pieces were encrusted with gold and silver, jade, ivory and mother-of-pearl. A description of a Ming (1368–1644) home of the leisured class mentions ceilings with *cloisons* (compartments) in yellow reed work, papered walls and pillars, black polished flagstones and silk hangings. Richly coloured rugs, chair covers and cushions contrasted with dark furniture, which was arranged according to strict ideas of asymmetrical balance.

Scrolls of painting or calligraphy were displayed, being changed from time to time to give freshness to the decorative scheme and also to emphasize their quality. Similarly a vase with a single branch of peach blossom or other flowers would be set out with care. Cabinets and storage chests were of great importance and were often made of camphor wood. An important feature in the houses of north China was the *k'ang* or heated brick platform, on which the family slept or sat in the cold northern winter.

(E. C. D.)

2. Japan.—Interior decoration in Japan was much influenced by Chinese ideas especially between the 8th and 12th centuries, but it developed on lighter, more austere and elegant lines. As in China it has altered little since medieval days. The most important differences in modern design are that sliding doors have replaced single-leaf screens or curtains and the matting has been extended to cover the whole of the wooden floor.

By the 9th century doors were pivoted in the Chinese manner, and instead of the sliding *shoji*, windows were made of wooden latticing that pushed outward, such as may be seen still in shrines and temples. There was a curtained dais for the most important person and separate mats on the wooden floor for others. Then, as now, there was a connecting corridor outside the rooms. The *Seiryoden*, or ordinary residence of the sovereign in the Kyoto palace, belonged to this period and was reconstructed in the 19th century on the model of the original. A present-day family could live quite comfortably in its simple suite of rooms with walls and standing screens decorated with pictures in the Chinese classic manner.

Late in the 15th century the interior began to assume its present form as a result of a slow blending of the older court style with the more austere type of house favoured by the military caste, which was much influenced by Zen Buddhist architecture. Toward the end of the 16th century came the rise of the tea masters under the autocrats Oda Nobunaga (*q.v.*) and Toyotomi Hideyoshi. These connoisseurs of the "Way of Tea," which involves the construction of the tearoom and its garden and correct deportment in them, established hereditary families and schools who remained the aesthetic advisers on most aspects of domestic architecture, interior decoration and garden planning. They aimed to achieve beauty with frugality, asymmetry and economy of movement, and much of the simple grace of Japanese interiors is due to them.

In a modern Japanese house decoration is almost entirely constructional and the residences of all classes are equally neat and free from vulgarity. Their harmony and delicacy derive from an endless variation of detail in a setting that is completely standardized. The ordinary rooms are multiples of the floor-mat unit of 6 ft. by 3 ft., the sliding doors 5 ft. 8 in. high by 3 ft. wide, the supporting pillars 4–5 in. square, set at 6 ft. intervals, and the ceiling boards 1 ft. to 1½ ft. wide. All woodwork is unpainted and rarely lacquered but there is a great variety in the *fusuma* or sliding doors which divide the rooms and which are covered with paper of many patterns or decorated with paintings or calligraphy. Thus the whole side of a room may present a landscape either in black and white or in colours, often on a silver or gold background. A change of these fusuma will alter completely the appearance of a room and their removal will convert two or more rooms into one. All rooms can be used as bedrooms, since the bedding is stored in spacious cupboards. The reception rooms provide more scope for decoration than the others, for one end of the room is occupied by a *tokonoma*, an alcove with a canopy above it supported by a pillar of fine or uncommon wood, in which

is hung the picture or set of pictures which, with the flower arrangement that usually accompanies it, is the only ornament. Both are changed frequently according to the season or mood. Next to it there is often a built-in writing table. Beside it is usually a *chigai-dana*, an asymmetric arrangement of cupboards and shelves somewhat like a sideboard. Between the top of the fusuma and the ceiling is often a *ramma*, or openwork frieze carved with patterns or landscapes in wood or bamboo. A framed tablet with a poem or painting on it sometimes may be placed there. Other walls are of plain plaster in subdued shades, mostly of gray or brown. The ceilings are usually of thin boards, slightly overlapping, upheld by bars about an inch square, the whole suspended from the roof or floor beams. In large apartments as in shrines and temples the coved and coffered "Chinese ceiling" with lacquered woodwork and pictures and patterns in the coffers is sometimes found. Fancy varieties made of bamboo and reeds and plaited wood are not uncommon. The furniture is sparse, perhaps consisting of a cabinet of blackwood or lacquer, a low writing table or a screen, either twofold or sixfold (the latter generally in pairs), decorated with landscapes on a gold or silver background and mounted in brocade. A single-leaf screen sometimes stands in the entrance hall. Among the well-to-do other valuables such as scroll pictures, braziers, pottery, spare fusuma, books and curios are kept in a detached fireproof storehouse and produced only occasionally to ensure a constant variety in the rooms. It is a principle that rooms that are only occasionally occupied may be more showy and fanciful than ordinary living rooms, and these are most often met with in hotels and restaurants and other places of entertainment. Just as much care is taken with the interiors of the bathroom and privy as with the other rooms, and the doors and windows and walls of these are usually of excellent workmanship. Those in famous restaurants are often wonderfully decorative. Bamboo has many uses in the Japanese house as pillars and window bars and ceiling material, and when split and flattened may take the place of boards. Some idea of the variety of the fitments may be obtained from the series of volumes of *Illustrations of Architectural Details* by Kenchiku Shashin Ruiju (Tokyo, 1916) that give 150 different examples of tokonoma and *chigai-dana* arrangements, 100 of *ramma*, 100 of sliding doors, about 20 of ceilings and 50 of windows. These latter are of many shapes, round, square, bell-shaped, jar-shaped, gourd-shaped, diamond- and fan-shaped and purely asymmetric, and make centres of interest in a blank wall.

(A. L. Sr.)

3. India.—Words of Indian origin such as calico, chintz, palampore indicate the importance of Indian textiles in the history of western interior decoration. Yet the Indians themselves have never been very conscious of this role, their own domestic interiors being of the utmost simplicity, with hardly more than a carpet or prayer mat to offset stone floors and plain white walls. The impermanence of the materials used for the majority of dwellings may have been a contributory factor. However, in more palatial buildings and commonly in both Hindu and Buddhist temples, walls were painted, a practice which, according to literary references, may go back to the Maurya period (323–185 B.C.). Paintings which survive, for instance in cave temples of the Gupta period (A.D. 320–600), usually depict groups of active mythical or human figures and are characterized by their sinuous lines. A late example occurs in the unfinished early 17th-century murals of the Mattancherri palace, Cochin, Madras. Inlay of semiprecious stones, carved and bracketed pillars and capitals, and openwork marble panels also adorned the palaces of local rulers.

In the 17th century, painted calico hangings and bedspreads were exported to Europe in such great quantities that the competition with home industries led to agitation against imported cloth. In 1686 France introduced restrictive legislation and England followed with the acts of 1700 and 1720. In both countries the law was evaded and throughout the 18th century Indian fabrics found their way into every fashionable English household. Yet the influence of Indian design is less revolutionary than has been generally supposed for the patterns employed were mostly of western origin. The East India company (founded 1600) in London sent sample patterns to their agents in India with instructions that the calico printers and embroiderers should produce designs "after the same manner." The samples were probably sent in a form similar to the contemporary pattern books for domestic embroideries—black and white drawings in quarto, or smaller. In making freehand enlargements, the Indian draftsman would have been compelled to invent details of the unfamiliar vegetation and animal life, which perhaps explains why common European motifs are very distorted: the oak leaf, for example, is rendered with exaggerated indentations and the strawberry fruit with unduly large seeds. The resulting designs are hardly recognizable as European and it was their exotic effect which gave them such a wide appeal in Europe.

Toward the end of the 18th century, the traditional Indian methods of calico printing by resist and mordant processes gradually gave way to the cheaper block-printing technique. This was accompanied by degeneration of design and execution, and in the 19th century Indian textiles were but a poor shadow of their earlier counterparts. (*See* also Textiles: *Indian Textiles.*)

Fine collections of the 17th- and 18th-century fabrics are preserved in the Victoria and Albert museum, London, and the Royal Ontario Museum of Archaeology, Toronto. (X.; E. C. D.)

V. RENAISSANCE TO THE END OF THE 18TH CENTURY

1. Italy.—The ferment of new ideas which produced the Renaissance showed itself first in Florence in the later years of the 14th century. Fresh interest in the ancient classical tradition, never entirely lost in Italy, provided inspiration for design and ornament. Liberal patronage of the arts was made possible by the wealth which had accumulated in the powerful trading cities of northern Italy, and was informed by the new humanist approach to the world.

Churches, palaces, private chapels and houses were lavishly built and decorated by architects, artists and craftsmen of great inventiveness and ability. The classical orders (columns with base, shaft, capital and entablature) were borrowed and adapted to dress the new architectural style. Architects became highly skilled in the treatment of space, and decoration often played a major part in defining and enriching their vigorous spatial effects. Classical architectural forms were used in plasterwork, inlaid woodwork and painted decoration as well as for staircases, doors, windows and fireplaces which formed increasingly important and elaborate features of interior design. Decorative details inspired by the antique were also used, executed in a wide variety of techniques; garlands, caryatids, lion masks and grotesques, reclining *amorini* (cupids), cornucopia (horns overflowing with flowers or fruit), arabesques (entwining scroll and plant motifs) and trophies of arms are among the most familiar. Floors of coloured and patterned marble paving are frequently integrated with the overall decorative scheme.

Modeled stucco, sgraffiti arabesques and fine wall painting may be seen at their best in the loggia of the Vatican, Rome, in the work of Raphael, Giovanni da Udine and others (*c.* 1515); the Villa Farnesina, Rome (1506), by Baldassare Tommaso Peruzzi and Raphael; the Villa Madama, Rome (1516), by Giovanni da Udine and Giulio Romano; and the Palazzo del Té, Mantua (1525–35), also by Romano.

In Venice the transition from Gothic to Renaissance building came less abruptly, as demonstrated in the Doge's palace where a Gothic exterior is found in combination with a late 15th-century façade on the east of the courtyard and a series of High Renaissance council chambers, famous for wall paintings by Veronese and Tintoretto. Wood paneling with flat pilasters and a molded frieze forms the lower part of the interior wall decoration, with the fine series of historical and allegorical paintings above, divided into panels between painted and gilded moldings and pilasters. The ceilings of a later date are particularly richly painted, their heavily scrolled carved and gilt cornices and framing introducing a touch of baroque. Windows developed with twin semicircular-headed frames surmounted by a lunette fitted into a third, larger round-arched opening and are a typically Venetian feature of the waterside palaces. In these, as in all the great Italian houses of

the time, the works not only of the finest painters of the time, but of the sculptors, goldsmiths and silversmiths, wood carvers, bronze and iron workers were used to embellish the principal rooms. Silks, embroideries and cut velvets were used as hangings and upholstery, together with elaborately cut and framed looking glasses and carved gilt pendant chandeliers as in the Palazzo Corner Spinelli, Venice (1480). Costly carpets were imported and much fine linen was in use. *Trompe l'oeil* effects of perspective were achieved in the painting of walls and ceilings and also with intarsia decorated paneling such as the Palazzo Ducale, Urbino (completed about 1500), where a startling effect is created as of open cupboards full of books.

In Rome toward the end of the 16th century, the rich, tumultuous work of Michelangelo was followed by a style known as the baroque (*q.v.*). Its deliberate exaggeration of forms displaced the strict logic and precision of the High Renaissance and aimed to convey freedom of movement and to involve the spectator in the drama of the design. Basic materials and techniques were unaltered, but all restraint in their use vanished in bold theatrical effects and sensual luxuriance of modeling. Walls became curved, pediments were broken, columns and pilasters twisted until the buildings seem to come alive with movement. Giovanni Lorenzo Bernini (1598–1680) was one of the most prolific masters of the style and used rockwork, figures and draperies in exuberant combination with columns, paneling and vaulting. Marble or stucco was made to imitate brocaded hangings as in the Sala Ducale, Vatican, where an effect of space from limited means is created. The variety of colour in baroque interiors contrasts with the more sober colourings of the earlier Renaissance decoration.

From Italy these styles spread across Europe where they were absorbed in varying degrees and tempered by the national or local taste and genius. Many Italian designers and craftsmen traveled and worked abroad in France, England, Austria and Spain. In this way the impetus of the Renaissance carried across two centuries, finally dwindling in these countries with the Neoclassicism of the later 18th century. (E. C. D.)

2. France.—From the middle of the 15th century ideas from Italy began to change the face of French buildings; this change came gradually, first in the applied decorative detail superimposed on basically Gothic designs, then extending to a symmetry and regularity of the whole. One of the basic differences between the Renaissance in France and in Italy is that in the latter the revolution in style from the start involved the whole conception of design. The centralization of power and the brilliance of court life was consolidated under Francis I (1515–47) and had already resulted in patronage of artists and craftsmen from Italy. Since the need for churches had been fulfilled in the great age of Gothic building, the king and his court rivaled one another's magnificence in building new châteaux in the early Renaissance style. Climate dictated the characteristic steep roofs, tall chimneys and large windows. Stone and timber were readily available, with masons and carpenters skilled in their use.

Among the earliest attempts in the new manner are the additions made by Francis I to the château at Blois. The spiral staircase, with its own open stonework tower, may have been designed by Leonardo da Vinci, who died nearby at Amboise in 1519. Even at this early stage, the decoration of the staircase ceiling with carved bosses featuring the monogram and heraldic device of the king shows a typical French contribution to Renaissance decoration. Such shields and monograms formed an important element in many decorative features, being used in wall and ceiling panel design or on the large carved stone chimney pieces. The fine galleries of Francis I and Henry II (1547–59) in the royal palace at Fontainebleau illustrate the increasing elaboration of applied decoration and colour. The flat ceilings are of wood, coffered, coloured and gilded in a variety of geometrical forms outlined with fine moldings. Molded panels enclose paintings on the upper section of the walls, and molded or carved wood paneling the lower parts, as in Italy. Floors are of hardwood strips, sometimes repeating the pattern of the coffered ceiling above. Benches supported on consoles are designed as part of the overall scheme of wall paneling. Italian artists had been employed at Fontainebleau and elsewhere, influencing the contemporary French architects toward a more Italian conception. Rosso Fiorentino and Francesco Primaticcio decorated the Galerie de François I while the hexagonal coffered ceiling in the Galerie de Henri II was designed by the Frenchman Philibert de l'Orme, who also designed the 180-ft.-long bridge at the Château de Chenonceaux for Catherine de Médicis. The architects Sebastiano Serlio and Giacomo da Vignola, together with the goldsmith Benvenuto Cellini, all worked for a time in France and much of the decorative work in the châteaux of the Loire valley was executed by Italian craftsmen.

In the early 17th century and during the long reign of Louis XIV (1643–1715) formality and magnificence became paramount in the life of the court. Suites of large rooms elaborately decorated provided a background for "*Le Roi Soleil*" and his courtiers, and consisted of a vestibule, antechamber, dining room, salon, state bedroom, study and gallery. Staircases were stately and spacious, providing a fitting approach to the main rooms. Decorative schemes incorporated the fittings, hangings and furniture with that of the room itself.

By the second half of the century, French influence had become so dominant that even Louis XIV's most violent enemies imitated the decoration of his palace at Versailles. In 1663 Louis and his minister Jean Baptiste Colbert appointed Charles le Brun (*q.v.*), *le premier peintre du Roi*, as director of the Gobelins factory which had been bought by the king and was newly styled the Manufacture Royale des Meubles de la Couronne. The chief aim of this organization was the production of furniture and all types of decorative furnishings for the royal palaces but it also helped to raise the standard of design and execution in France as a whole. Le Brun himself prepared designs for diverse objects, from the painted ceilings of the Galerie des Glaces at Versailles to the metal furniture for a door lock. (It should be noted that at the Gobelins, as elsewhere in France, furniture was designed by the artist or architect with no practical experience of manufacture, whereas in the great age of furniture making in England, most designs were made and executed by the cabinetmaker himself, with an intimate knowledge of his material.)

Though the baroque trend is well established in the Versailles interiors, generally speaking it was regulated in France by an underlying restraint which seldom permitted decoration or movement to dominate entirely. Besides the Galerie des Glaces at Versailles, the Galerie d'Apollon at the Louvre is an example of magnificence in decoration. The vastness of these rooms combined with the lavish use of marble, plasterwork and painted ceilings, with the addition at Versailles of the famous mirror glass panels, created an effect of overwhelming grandeur.

Among the architects and artists working at this time were Jean Berain (*q.v.*), André Charles Boulle (*q.v.*), Jean le Pautre, Robert de Cotte and Jules Hardouin Mansart (*q.v.*). Their work continued in the period of the régence in which baroque ornament was transformed into the airy, delicate rococo of the mid-18th century. The beginning of this more fluent treatment can be seen in the work of Robert de Cotte at Versailles and the Hôtel de Toulouse, Paris. An immense variety of materials was used for the inlaid and decorated furniture; in a piece by Boulle, for instance, as well as the tortoise-shell and brass inlay, ebony, copper, lapis lazuli, green-stained ivory or horn and mother-of-pearl are employed. De Cotte was followed by the later work of the architect and decorator Germain Boffrand. Typical rococo features are seen in his interiors for the Hôtel de Soubise, Paris (1735), where architectural form has been subordinated to the demands of the decoration; the cornice has disappeared and walls curve into the ceiling, appliquéd with ragged C-scrolls, garlands of flowers decked with ribbons, sprays of foliage, trellising and shell motifs. The reduced scale of rooms and reaction from monumental design result in elimination of the classical orders. Relatively small painted panels, idealizing peasant life in the *fête champêtre*, were enclosed in flattened moldings, silvered or gilt; pastel-coloured backgrounds prevented the smaller size of the salons becoming too evident. The use of Chinese motifs typifies the search for novelty and blends well with the general lightness of style. The Cabinet de la Pendule at Versailles (1738) designed by J. Verberckt is

another excellent example of French rococo. G-M. Oppenord, J. A. Meissonier (*q.v.*) and F. Cuvilliés also were distinguished designers and worked with the best artists and craftsmen of the time.

The rococo fashion spread across Europe to the courts of minor royalties where many Frenchmen were employed to provide up-to-date buildings and schemes of decoration. In France the Gobelins factory became restricted mainly to the output of tapestries; equally fine work is seen in Aubusson and Beauvais carpets and tapestry. Improvement in glass manufacture resulted in larger mirror panels, which reflect their paneled surrounds and brilliant crystal chandeliers.

The Louis XVI or neoclassic style began, in fact, to take root before the death of Louis XV in 1774. From 1748 onward the characteristically French regard for formality was stimulated by the archaeological discoveries at Herculaneum and Pompeii and by the other surveys of classical remains published at this time. It is sometimes forgotten that contemporary English styles also had influence in France, mainly through the published works of Robert and James Adam. The asymmetrical, sinuous lines of the rococo were slowly replaced by a more restrained form of decoration based once again on straight lines, right angles, circles and ovals, arranged symmetrically. The lightness and fine moldings were retained but the decorative forms were once more contained by the architectural framework. New motifs, many of them selected from antique Roman wall painting, decorated the paneling, in paint or in flat relief; palmettes, husks, urns, tripod stands, sphinxes, trophies of arms or of musical instruments were frequently combined in the decorative schemes. Gilt bronze was used with wood and plasterwork for moldings and ornamental fillets, emphasizing the rectilinear character of the design. The work of J. A. Gabriel (*q.v.*) in both the Salle du Conseil at the École Militaire (begun 1755) and the Galerie Dorée, Ministère de Marine (begun 1762) may be cited as Parisian examples. The keynote of colourings as well as designs is refined simplicity. Silk-tapestry wall hangings with fine flower and ribbon motifs appear in pale blues, greens, rose and lilac. Similar colourings were used for satin and velvet upholstery. The fine wood carving of the brothers Rousseau, gilt bronze work by Clodion (Claude Michel) and furniture pieces by David Röntgen, C. E. Riesener and J. F. Oeben show Louis XVI decoration at its highest. Exquisite work can be seen at the Wallace collection, London, and in the boudoir of Madame de Sérilly, now in the Victoria and Albert museum, London, where the carved, painted and gilt decorations of the panels with classical figures and baskets of cascading flowers are by Simon de la Rottière and the marble fireplace with caryatids (statues of women used as supporting pillars) and gilt bronze mountings is by Clodion. Apartments for Queen Marie Antoinette at Versailles and her boudoir at Fontainebleau are full of this extravagant delicacy, soon to be obliterated in the French Revolution. (J. E. Le.; E. C. D.)

3. Spain.—Moorish influence mingled with subsequent western classical styles to produce a unique flavour in decorative design. The style known as Mudéjar (*c.* 12th–17th centuries) was the early outcome of these blended Christian and Arab ideas and consists in essence of tiled floors and skirtings in polychrome, plain white walls, carved stucco friezes and intricately decorated beamed wooden ceilings. The Duke of Alba's palace, Seville, contains a fine example of this style.

Yellow tiles decorated with freehand motifs in blue became common in the 16th century. Fireplaces were seldom used in southern Spain, where tiled ground-floor summer living rooms were vacated in the winter for the upper rooms.

The discovery of the new world, with the riches Spain subsequently drew from Mexico and Peru, created a period of Spanish ascendancy in the 16th century which encouraged building and coincided with the spread of Renaissance ideas throughout Europe. The influence of decorative craftsmen from Italy together with the abundance of precious metal encouraged the development of Plateresque (lit. "silversmith like") decoration. This type of Renaissance decoration was first seen in church interiors, in the form of tombs, *retablos* and ironwork screens. The Italian motifs were used in a totally non-Italian manner, encrusting the surfaces as in Gothic or Mudéjar style.

This unique Spanish blend of widely separate styles produced the fine interiors of the late 15th-century Infantado palace, Guadalajara, by Juan Guas, and the palace at Peñaranda de Duero (*c.* 1530) probably by Francisco de Colonia, where interlaced ceiling beams and timber panels were supported on honeycomb cornices and finely ornamented friezes. (Unfortunately much of this work is now damaged or destroyed.)

Smaller houses as well as palaces were built round a patio, usually colonnaded and with modeled or carved friezes, columns and bracket capitals.

Window grilles or *rejas* often form an important part of the decorative scheme, the ironwork being traditionally of a high degree of excellence. Love of closely patterned decoration, enveloping all surfaces which could easily be carved or modeled, is a foremost characteristic of early Renaissance work in Spain, and of the contemporary Manueline style in Portugal. Similar, if rather coarser, work in this style flourished in the South American colonies, where the subsequent Churrigueresque baroque manner also became well established.

High Renaissance decoration in Spain was influenced deeply by the austere character of Philip II and his vast combined palace and monastery, the Escorial (1559–84) near Madrid. This was built for him by Juan Bautista de Toledo and Juan de Herrera. Ornament is reduced to a minimum; much of the granite of which it is built is left unadorned and frescoed vaulted ceilings are the main features.

A revival of decorative arts took place under the influence of José Benito de Churriguera (1650–1725) and his family and followers. The Churrigueresque, which also remained a peculiarly national style, expressed the baroque feeling of the 17th century in extravagant polychrome. Surfaces were broken into scrolls, rosettes, volutes and fantasticated moldings, bunches of fruit and flowers hung from broken or inverted cornice moldings, and the whole interior, for example the sacristy of La Cartuja, Granada (1727–64), appears to drip with ornament. Here, even cupboards and doors were inlaid with silver, tortoise shell and ivory and the only plain surface is the checkerboard tiled floor. Remarkable among domestic examples of this style is the palace of the Marqués de Dos Aguas, Valencia (1740–44).

Under the Bourbons French and Italian influence increased, as can be seen in the interiors of the royal palace at Madrid (1738–64) with its handsomely painted ceilings and brocade wall hangings. Here also subsequent changes of taste are echoed in the lighter rococo treatment of the Gasparini saloon. Toward the end of the 18th century the neoclassic movement gained a limited footing though regional styles continued to incorporate the baroque and older forms.

Fine examples of Spanish colonial work exist in Mexico, Peru and other South American countries where the baroque was allied, as in Europe, with the Jesuits. Churches are painted and gilded with exuberance equal to, or even greater than, that of the mother country, sometimes encrusted with tiles and always possessing elaborate *retablos*.

4. Northern Europe.—After spreading from Italy to France, Renaissance influence began to filter to Belgium and Holland, later reaching the various Germanic states and finally dying out in Scandinavia and Russia.

In the Low Countries and north Germany during the 16th century Renaissance ornament was adapted to form an entirely individual style which can be seen in the pattern books of Vredeman de Vries and Wendel Dietterlin. Strapwork (interlacing bands and fillets) and raised facetted ornament were widely employed, together with muscular, grotesque masked caryatids and distorted architectural features arranged in undisciplined designs. Chimney pieces, with overmantels carried to the ceiling, were embellished with marble columns and elaborate strapwork patterns, while similar ornaments flanked the doorways and enriched the ceilings. The great tapestries for which the Netherlands had long been famous were still in use and oriental carpets were spread as table covers, and not used on the floors. Many town houses and civic

buildings were comfortably appointed without spectacular extravagances and give an impression of modest prosperity. In Belgium the Musée Plantin-Moretus, Antwerp (1550), is unusually richly decorated, showing the influence of Spanish rule in the use of embossed leather as a wall covering. Large windows, with rectangular leaded lights, are again typical of a northern climate. Ceilings are beamed or plastered and floors most frequently are of tiles on the ground floor and timber on upper floors.

The later styles of baroque and the 18th century tastes are copied from French models, particularly in Belgium. The Dutch, after achieving independence in the latter part of the 16th century, developed their decoration on more individual lines. Typical domestic interiors on a small scale are familiar through the paintings of Jan Vermeer (1632–75) and Pieter de Hooch (1629–*c.* 1684). The fine series of town houses by Daniel Marot (*q.v.*) and his sons in The Hague illustrate the cross currents of the various styles; built at the turn of the 17th century they were conceived in the Louis XIV or régence manner, yet could be set down in 18th century London without incongruity (and Marot did, in fact, work for a time in England). Fine stuccoed ceilings and overdoors, largely uncoloured, and wrought iron balustrading are characteristic.

In Germany the general trend was similar but in south Germany and Austria fresh impetus and individuality were given to baroque and rococo design also. French and Italian craftsmen worked throughout the 17th century on the many Catholic churches built in south Germany, Austria, Bohemia and Moravia. The use of colour, fresco and stucco which they introduced has its own particular flavour when seen in cool northern light.

Secular building from the early 18th century, in the hands of Johann Lukas von Hildebrandt, Johann Fischer von Erlach and others, makes use of much sculptural detail. Windows are round or oval, atlas figures strain to support capitals, balustrades are carved in sculptural manner and modeled niches contain larger than life-sized figures; all these give a feeling of movement reminiscent in its impact of Bernini's work in Rome. In Vienna the Palais Daun-Kinsky (1713–16) by von Hildebrandt and Palais Trautson (1710–16) by von Erlach provide examples of this, also of the enormous staircase hall or *treppenhaus* which is one of the most notable interior features. In the halls, colour was frequently confined to the painted ceilings, giving increased force to the novel and delicious colours of the rooms beyond. A vermilion dado or olive green panels may be contrasted with white and gold. In the Nymphenburg palace, Amalienburg (1734–39), by the Frenchman François Cuvilliés, the rococo reaches its crowning achievement: mirrors are framed in freely scrolled moldings which in their turn are interspersed with trellising, garlands, baskets of fruit and flowers, cupids, birds and fountains in silvered stucco on a pale blue or yellow ground, the whole evoking the essence of pastoral romanticism.

Mingled influences from France, Holland and England reached Sweden and Denmark in the mid-17th century and are seen in the baroque and Louis XIV interiors of the Riddarhuset and Royal palace in Stockholm and in the *chinoiserie* of the later Drottningholm pavilion (*c.* 1760). However, Scandinavian interiors largely continued to be of the traditional exposed timber boarding, hung perhaps with painted linen panels and brightened by woven chair and cushion coverings.

Russia imported foreign designers and styles for the palaces built under the westernizing influence of Peter the Great (1689–1725), his daughter Elizabeth and Catherine II. In the mid-18th century the Italian Count Bartolommeo Francesco Rastrelli, at Tsarskoye (Dyetskoye) Selo, at Peterhof and at the Winter palace, St. Petersburg, and the Frenchman, J. B. M. Vallin de la Mothe at L'Hermitage, each designed largely according to his own current national styles; the same is true of the work of Charles Cameron (d. 1820) at Tsarskoye Selo and Pavlovsk.

In many areas of Europe the Italian Renaissance had little effect on interior decoration. In the Alpine lands, where wood was cheap and plentiful, traditional methods continued for a long time. Wooden floors and ceilings and paneled walls, or partly paneled with plain plaster above, were the general rule. The moldings were bold, but carving was usually in low relief and often the woodwork was painted in bright colours. (E. C. D.)

5. England.—The breakup of the feudal system during the Wars of the Roses and under Henry VII (1485–1509) had far-reaching effects on the social structure of the time and consequently on domestic buildings and their decoration. The new conditions necessitated a larger number of rooms and the great hall, though still an important apartment, was no longer the focus of indoor life. Wider distribution of wealth gave rise to a great number of country houses, and for the next four hundred years the English excelled in their building and decoration.

The Italian style reached England in the early 16th century; the earliest example is the tomb of Henry VII in Westminster abbey, designed by Pietro Torrigiano of Florence at the command of Henry VIII and completed in 1519. For the next 40 years or so English craftsmen borrowed from the repertoire of Italian ornament, at first inspired by and imitating the Italian artists and craftsmen, employed on royal works at Hampton Court palace, Middlesex, and Westminster, London, who used arabesque decoration, medallion heads and *amorini* on paneling and plasterwork, often mingling them with the traditional Gothic motifs. The great hall at Hampton court (1515–30) shows a combination of Renaissance carved and gilded detail with the traditional type of open hammer-beam roof and Tudor mullioned windows. In spite of Henry VIII's example, however, the Gothic style died hard in England, lingering in the remoter districts well into the 17th century.

During the second half of the 16th century, as a result of the break with Rome, the newly created and distinctive Renaissance style of the Low Countries and Germany largely replaced the Italian style since it was fostered by the close religious, political and economic relations between England and the Low Countries, the influx of immigrant workmen and the circulation of Flemish and German pattern books. It became the dominant influence in the decoration of paneling and plasterwork, characteristic features being intricate strapwork patterns, pyramid finials (sculptured ornaments used to terminate gables), raised faceted ornament, masks and caryatid figures, scrolls and pilasters. Both the Italian and Flemish styles were adapted and naturalized to some extent by the English craftsmen producing a new style which is peculiarly English—a style that can be seen in the plaster ceiling at Herringstone lodge, Dorset, and in the decoration of the north drawing room at Levens hall, Westmorland.

At this time, also, the internal porch was introduced into many houses; this device excluded drafts from the room and also in some cases made it possible to reach a second room without passing through the first. Broughton castle, Oxfordshire (*c.* 1625), has a fine internal porch in the drawing room.

The frescoing of walls continued, and of the few remaining examples some show scenes taken from biblical and classical sources and incidents from local folklore. A good Elizabethan example depicting scenes from the story of Tobit was found at the White Swan inn at Stratford-upon-Avon. Embossed, painted and gilt leather was less used in England than on the continent, but tapestries and such woven fabrics as velvet and damask for the wealthy and "sayes" (fabrics resembling serge) and "bayes" (baize) for people of more modest means were widely used as wall coverings. The inventories of Henry VIII's palaces show the vast number of tapestries and various hangings possessed by kings and great men, as does an inventory of 1541 from the Vyne, Hampshire, which lists sets in almost every room of the house, including the chambers of dependents. Hangings of painted cloth were widely used as a cheaper substitute for tapestry and also depicted histories from biblical and classical sources and decorative motifs passing from Gothic to Renaissance subjects. Nearly all of this "counterfeit arras" has perished, but a set displaying the acts of the apostles survives at Hardwick hall in Derbyshire. Also at Hardwick is one of the finest plaster friezes in the country. About ten feet in height, modeled in low relief and coloured with tempera, it dominates the paneled presence chamber with scenes of the hunt, coats of arms and panels depicting spring and summer. In the light of the great windows, which gave rise to the rhyme "Hardwick

hall, more glass than wall," the pale colours achieve a frosted magnificence. The plaited rush matting, which was frequently used as a floor covering in Elizabethan interiors, is also noteworthy.

Great chambers and long galleries, usually on the upper floors, are distinctively Elizabethan and were used in many cases for work and recreation in bad weather. Barrel-vaulted ceilings occupying the roof space often increased the height of the rooms, as at Chastleton house, Oxfordshire (*c.* 1600). The plaster ceilings were treated elaborately; narrow interlaced bands formed geometrical patterns, with semi-stylized floral, arabesque or heraldic motifs in the panels between. At Montacute in Somerset, Aston hall near Birmingham and Knole, Kent, there are fine examples from the late 16th and early 17th centuries; another is in the great chamber at Herringstone, where pelicans and swans, fishes and mermaids are modeled in relief between ribs and pendants of plaster. The steep medieval winding newel stair (stair with central pillar from which steps radiate) in wood or, more often, stone was abandoned for the more spacious staircase with straight flights of stairs, easier in gradient and planned round an open well. This was most frequently constructed of oak, with carved strings, newel posts (the upright terminating a flight of stairs) and balusters (individual columns in a balustrade) making the most of the opportunity offered for decoration and enrichment: one of the finest is at Hatfield house, Hertfordshire (*c.* 1610) and another, where the woodwork is painted, is at Knole (*c.* 1605).

Toward the middle of the 16th century, a feeling for classic reserve was spreading and the late Renaissance period might have flowered under Charles I had not political upheaval checked the zest for fine building. Inigo Jones (*q.v.*; 1573–1652) twice visited Italy and was one of the few north European architects completely to absorb the spirit and decorative repertoire of Italian Renaissance classicism. He introduced the new style in the Banqueting house at Whitehall and the Queen's house at Greenwich; and in spite of the Civil War and the Commonwealth period (1649–60) he and his associate and kinsman, John Webb, built Wilton house, Wiltshire, and possibly Forde abbey, Dorset.

At Wilton the incomparable double cube room (*c.* 1650) shows the nobility of effect Jones was able to achieve in quite a small compass, for the dimensions of the room ($60 \times 30 \times 30$ ft.) are not large comparatively speaking. The basic influence is Italian, but the final result, with wide oak-boarded floor, and white- and gold-plastered and paneled walls designed to accommodate the fine Vandyke portraits, white marble fireplace and Corinthian doorcases, is truly English. The coved and painted ceiling, executed by Edward Pierce and Emanuel de Critz, is less distinguished than the decoration below cornice level but plays a vital part in balancing the proportions of the room. Though Renaissance principles are demonstrated in design such as this, they were not fully developed in the country at large until the 18th century and the advent of the Palladian school of architecture and decoration under the aegis of Lord Burlington.

After the unsettled period of the Commonwealth, the Restoration introduced new baroque influences from the continent. These were fused with the restraining classicism which was still considered to be a new style to produce a successful balance of contrast. The designs of Christopher Wren, though mainly for church and monumental buildings, relied for a great deal of their embellishment on the work of the fine artist-craftsmen such as Grinling Gibbons (*q.v.*), sculptor and wood carver, and Jean Tijou, ironworker, whose work can be seen in close association in St. Paul's cathedral. In many country houses large plain-surfaced oak wall panels provided the perfect foil to the grace and liveliness of Gibbons' carved lime-wood swags, garlands and picture surrounds, which incorporated flowers, fruit, musical instruments, cherubs and monograms. In the words of Horace (Horatio) Walpole, Gibbons "gave to wood the loose and airy lightness of flowers and chained together the various productions of the elements with the free disorder natural to each species." At Petworth house, Sussex, Gibbons' genius may best be seen in the series of picture surrounds, perfectly executed, which date from about 1690. Chimney pieces and doorcases were also decorated in Gibbons' manner and similar floral motifs can be seen on the plaster ceilings at Ham house, Surrey. This house, relatively modest in size, represents without ostentation or extravagance the height of luxurious interior decoration in the late 17th century and incorporates many of the decorative innovations of that time. Among these are the practice of painting wood paneling in imitation of marble or wood graining, and of gilding the moldings. A variety of wall hangings includes tapestry, gilt and painted leather and silk damask; there is also elaborate parquetry.

Paintings of allegorical subjects by James Thornhill and Antonio Verrio ornament some of the more important buildings of the age, including the Painted hall at Greenwich, Wren's additions to Hampton court and the great chamber at Chatsworth house, Derbyshire. The intricate work of Daniel Marot, a French Huguenot who had worked for William III in Holland (see *Northern Europe*, above), had a modest influence on the design of many small fittings and shelved cabinets to display china—the collecting of which was a favourite pastime of Queen Mary. Imported lacquer panels were sometimes used for the paneling of rooms in accordance with the Chinese taste of the period.

In the last years of the 17th century and in the early 18th century the woodworker found his domain contracting. Through the influence of the grand tour and under the patronage of Lord Burlington, Italian influence predominated, the work of Inigo Jones was studied and stone and stucco became more widely used, particularly in larger houses. The influence of the architect spread from the outside of the house to the interior decoration and even to the design of the furniture itself. Where wooden paneling was used, it was set in a simple framework. Pine largely replaced oak, and it was painted green, blue, brown and other colours; walnut and mahogany were occasionally used for paneling. The increased use of stone and marble began with John Vanbrugh, playwright turned architect, who, in his first commission at Castle Howard, Yorkshire (1699), showed an individual and masterly interpretation of baroque, sculptural and yet with a certain grim epic quality. Applied decoration was kept to a minimum, a practice which he followed later at Blenheim palace, Oxfordshire, where the severe and spacious entrance hall with marble-paved floor, ashlar-faced (*i.e.*, faced with thin slabs of hewn stone) walls and columns, wrought-iron gallery railing and frescoed dome is the most impressive apartment in the building.

Stone staircases with wrought-iron balustrading came into common use, and by the latter part of the 18th century had almost entirely replaced the earlier, heavier timber stairs such as those at Wolseley hall, Staffordshire, or Eltham lodge, Kent, which had carved openwork balustrades or heavy timber balusters. In the smaller houses of the early 18th century, woodwork continued to provide the main decorative features. Wall paneling, architraves, window shutters and many chimney pieces in simple painted pine echoed the comfortable elegance of the tall sash windows and well-proportioned rooms. Wealthier classes still employed Italian craftsmen, particularly for stuccowork, and the now familiar repertory of garlands, masks and *putti* was applied not only to the designs of Nicholas Hawksmoor, James Gibbs and other architects of the quasi-baroque group, but also to the interiors of William Kent and the Palladians whose influence became dominant toward the middle of the century. In such houses as Holkham hall, Norfolk, designed in strictly classical manner by Kent in 1734, can be seen the results of extensive travel by both architect and owner. The magnificent entrance hall is again one of the most important rooms, designed on the general lines of a Roman basilica with apse and Ionic side colonnades; the columns and plinth are of variegated alabaster and marble, while the coffered and apsidal ceiling surmounts an elaborately decorated frieze. At Houghton hall, also in Norfolk, Kent designed fine suites of furniture for Colin Campbell's interiors; these pieces are usually gilt, with acanthus scrolls, consoles, heads and sphinxes, feet and legs scrolled or of ball and claw type and upholstery in velvet or silk. The plaster ceilings are by Italian craftsmen, with gilded and painted ornament; the walls are dressed with classical plinth, pilasters and frieze; and pedimented marble chimney pieces contain bas-relief panels above the mantelshelf.

Wall hangings were of tapestry, cut velvet or watered silk and

damask. Elsewhere hand-coloured wood-block printed papers and flock papers were coming into use as an economical substitute.

Although the rococo style never fully established itself in England, many interiors were influenced by the asymmetrical *rocaille* motifs found in the designs of such French decorators as Nicholas Pineau and J. A. Meissonier. The stucco and carved decoration became lighter, more fanciful and more tortuous in design. Though many baroque motifs were still used, they were more delicately modeled and the rococo style was characterized by elaborate patterns of interlacing C-scrolls combined with such naturalistic ornaments as flowers, foliage, shells and rocks, arranged subtly in asymmetrical yet balanced patterns. The plasterwork and carved paneling were often painted in light colours and the detail picked out in gold. The music room from Norfolk house, St. James's square, London, now in the Victoria and Albert museum, London, designed by Mathew Brettingham and completed in 1756, is a fine example. The carved wooden panels are enriched with delicate patterns of scrolled acanthus, shells and garlands of flowers, while the overmantel mirror and the main panels are mounted with fanciful trophies of musical instruments. The fine plaster cornice and ceiling are decorated with similar rococo devices. In smaller houses the new motifs were confined to the chimney pieces and doorcases, the remainder of the room being simply paneled or plastered.

Closely allied to the introduction of the French *rocaille* was the revival of the Chinese taste in a new rococo form, for architects and designers, in search of further novelty, turned again to the east for inspiration. Books on travel and topography, notably J. B. du Halde's *General History of China*, published in Paris in 1735 and translated into English in 1736 gave added stimulus. Pagodas, mandarin figures, icicles and dripping water and exotic foliage and birds reached the height of rococo invention. The Chinese taste was particularly popular for bedrooms, where elaborate chimney pieces and doorcases were set against the background of imported or imitation Chinese wallpapers, and the beds and windows were hung with eastern textiles. One of the most elaborate of these rooms was that at Claydon in Buckinghamshire, but a simpler version may be seen in the room from Wotton-under-Edge, Gloucestershire, now in the Victoria and Albert museum. There Chinese wallpaper is combined with a delicate rococo overmantel which provides brackets for small pieces of oriental porcelain. Window hangings, with carved and gilded pelmets, were becoming increasingly important and at Harewood house, Yorkshire, Thomas Chippendale executed a series of pelmets with mock draperies also carved in wood and coloured to deceive the eye completely.

The Gothic taste, a further variation of the rococo, was peculiar to England at this time. The Gothic revival, engendered by antiquarian scholarship at the turn of the 17th century, later spread to literature and during the 1740s appeared in the more concrete forms of architecture and interior decoration. Both William Kent and Sanderson Miller had made essays in the Gothic taste before 1750, and by the middle of the century the fashion was widely popular and many houses, both large and small, were in part Gothicized, both inside and out. As with the Chinese taste, the products of this 18th-century vogue bore little resemblance to the original medieval models. Gothic details, originally worked in stone, were borrowed, adapted, often mingled with *rocaille* and Chinese motifs, and were executed in wood and plaster. At Strawberry Hill, Twickenham, Horace Walpole, leader of the "true Goths," borrowed the designs of medieval tombs and turned them to designs for fireplaces and bookcases. Though this vogue fell out of general fashion in the 1760s, a few enthusiasts remained who carried the Gothic taste through until it was vigorously revived again in the 19th century.

About 1760 the rococo style, with all its vagaries of taste, began to give way before the neoclassic style, largely inspired and introduced by the Scottish architect Robert Adam (*q.v.*), whose work reflected the newly awakened interest in classical remains. Adam returned from Italy in 1758, and strongly influenced by both Roman architecture and interior decoration, he evolved a new style based on classical precedent, using as ornament a medley of paterae (plate-shaped motifs), husk chains, the ram's head, the formalized honeysuckle and other motifs. His style of interior decoration was deeply influenced by the gay and delicate patterns of arabesques and grotesque ornament that he had seen in various classical remains in Rome, and which had already been copied during the Renaissance by Raphael and others. Adam strongly criticized the Burlington school for using heavy architectural features in their interiors, and replaced them with delicate ornament in plaster, wood, marble and painting, against which, in its turn, criticism was leveled. Much of his work, it may be said, is applied decoration—pretty, but without basic architectural quality. With Adam the despotism of the architect over the craftsman was complete. No detail of decoration or furnishing escaped him; his rapid and precise draftsmanship covered the whole scheme, from the over-all treatment of the walls and ceiling to the decorative details of the pelmets and grates. Even carpets were made to order, and often they repeated or echoed the design of the ceiling, bringing the whole room into harmony, as in the green drawing room at Osterley, Middlesex. Wood was not often left unpainted, and although the joinery was still admirable, the enrichment was frequently in composition or metal inlay. There were specially designed temple-fronted bookcases and the plasterwork was often made a frame for the decorative paintings of such artists as Antonio Zucchi or M. A. Angelica Kauffmann.

At this time cheaper and quicker methods of decoration began to be introduced; a considerable amount of the plaster decoration was cast from molds and a composite imitation marble called scagliola was sometimes used for floors and columns, while cheaper woods were disguised by marbling and graining.

At the close of the century the neoclassic style was further refined, the plaster relief decoration being simplified and lightened. The best of this style, strongly influenced by French decoration, can be seen in the work of the architect, Henry Holland, who enlarged Carlton house, London, for the prince regent and built Sothill in Bedfordshire. Holland, like Adam, was inspired by the classical monuments in Italy, where for some time he maintained a draftsman whose drawings of classical detail Holland incorporated in his plasterwork.

VI. 19TH AND EARLY 20TH CENTURIES IN EUROPE

During the early years of the 19th century the neoclassic style continued in western Europe, becoming even more biased toward the literal interpretation of classical remains. Interest in Roman buildings was coupled with a new enthusiasm for Greek and Egyptian features, the latter as a result of the Napoleonic campaigns in Egypt. In England the work of Thomas Hope, a wealthy amateur architect, gained much attention through the publication of his *Household Furniture & Interior Decoration* (1804). He enlarged and decorated his London home in Duchess street and also his country house, Deepdene in Surrey, with somewhat heavy and pedantic design which was at variance with the general trend of the time but influenced later work.

On the continent of Europe, the Directoire and Empire styles of France were pre-eminent for the first quarter of the 19th century. Subsequently, changing social conditions and the developments of the Industrial Revolution were reflected in a welter of eclecticism and the general decay of design.

In Germany the solid bulk of the Biedermeier style, with its thick curtains, draperies, antimacassars and padded upholstery, gave evidence of material prosperity. Many of these features were to become commonplace in Victorian England, but in the meantime, the Regency style was prevalent and contributed many masterpieces of design. Brighton Pavilion (begun 1815) was built by John Nash for the Prince Regent and has recently been restored. It is described by Ralph Dutton in *The English Interior, 1500–1900* (B. T. Batsford, Ltd., 1948) as "A Chinese interior within a fabulous Indian shell, it showed a light-hearted disregard for architectural ethics which rightly should have culminated in confusion and failure, but the contrary is the case, and the rich decoration and brilliant colouring of the ornaments give a fantastic beauty to the rooms." There is much lacquered and bamboo furniture, blending with Chinese wallpapers, fanciful treatments of palm trees as columns and the most extravagant of crystal chande-

liers. However, in general, the Regency style strove for elegance without extravagance; innumerable smaller houses were built and decorated with fine wrought-iron balustrades on curving stone staircases, pleasing carved wood or marble mantelpieces of modest size, and plain or paneled walls of light colourings, on which the use of wallpaper was becoming more common.

The early 19th-century Gothic revival produced a small number of houses in which the pointed arch, together with fan vaulting and crocketed (carved with foliated ornament) or deeply undercut moldings were used with some taste and discretion although without the charm of Walpole's earlier "Gothick." Toddington manor, Gloucestershire (1829), by Charles Barry (who, with A. W. N. Pugin designed the houses of parliament) and Benjamin Disraeli's house, Hughenden manor, Buckinghamshire, are examples of a style which was used later in the century with much greater ostentation and coarseness of detail.

In the principal European countries, interior decoration grew increasingly heavy and elaborate. Ornament came to be considered synonymous with beauty, and pattern covered every possible surface. The products of industrial manufacture were mostly very crude and their use resulted in loss of refinement; for example, aniline dyes, which are harsh in colour, were first made in 1856 and soon replaced the softer, more harmonious colours. Architects decked out their buildings according to whim in a variety of styles: Gothic, Tudor, Roman, Greek, French, Italian, Egyptian or Indian.

In less ambitious schemes of decoration, brightly coloured wallpapers with bold patterns were widely used, and the white plaster ceilings were relieved by modeled cornices and often also by some central feature, frequently in a coarsened rococo design, which made a background for the elaborate light fitting. Rooms became crowded with furniture, and fireplaces were often mounted with elaborate overmantels, fitted with mirror panels and a multitude of shelves and brackets for the display of knickknacks. Both furniture and fittings were draped in dark-coloured plush with heavy fringes. Varnished pitch pine dadoes, stained-glass windows and encaustic-tiled floors were also popular.

William Morris, through his own firm, made a bold and valuable attempt to reassert some definite standards of taste and craftsmanship in interior decoration, producing, with the assistance of such artists and architects as D. G. Rossetti, Edward Burne-Jones and Philip Webb, furniture, wallpapers and tapestries. His influence was limited because like his contemporaries he looked backward to medieval craftsmanship for inspiration and in doing so refused to accept the possibilities of machine production.

Morris' work had an indirect offshoot in the *art nouveau* style of decoration developed in the 1890s primarily by Henry van de Velde in Belgium, as a result of an attempt to disinter the basic form of architecture from its accumulated ornament. The *art nouveau* movement made use of unconventional free-flowing lines, inspired mainly by plant-growth forms both in structural elements such as columns, capitals and arches and in decoration applied to interior surfaces. Although it created much interest at the 1900 Paris exhibition, it never became very widely established but was one of several leavening agents in the sphere of design; another was the study of Japanese art, whose economy of line was in complete contrast to the prevalent European ideas.

Reaction against overcrowded, fussy interiors gathered strength. Plain interior walls in white or very light colours, natural woods and simple doors and fireplaces were used by the more advanced designers in an attempt to create an original style suited to the changed circumstances of life in the first part of the 20th century.

(J. E. Le.; E. C. D.)

VII. 17TH TO EARLY 20TH CENTURIES IN THE U.S.

The story of the domestic interior in the U.S. and its decoration is inseparable both from its own architectural development and from the story of English architecture and decoration from which it was largely derived even long after the Revolution. Any discussion of U.S. decorative design, therefore, must refer constantly to the architectural ideas which prompted change on both sides of the Atlantic ocean.

1. Early Settlers' Homes.—Contrary to popular legend, the log cabin was not the earliest shelter of the first English settlers. The turfed-over dugout hut of mud-chinked saplings, not unlike the Indian wigwam with the addition of a clay-daubed wooden chimney at one end, was probably the first home of the settlers in both Jamestown and Plymouth.

These primitive dwellings were speedily replaced by frame structures, copying the traditional small house of southeast England. At first a single room was flanked by a massive chimney (where brick soon replaced wood and clay), but a second room was soon added on the opposite side of the chimney. The attic, later expanded into an overhanging second story, was reached by narrow winding stairs between the central entranceway and the chimney stack.

This development in New England is well represented by such vestiges as the Capen house, Topsfield, Mass. (1683). The interior clearly reflects the structure with its massive exposed oak corner posts, beams and joists and its huge open fireplace which served as the cooking and heating centre of the household. Inside walls were usually of undecorated lath and plaster, covering the studs and their clay or brick filling. Room partitions and the face of the fireplace wall were sheathed with horizontal or vertical boarding, frequently featheredged or molded. Windows were small and originally of casement type, with small leaded panes in a wood frame. Small windows with low ceilings were needed to conserve heat in the severe winters. Floors of wide riven boards of pine, smoothed and sanded, replaced the beaten clay of the first shelters.

The furniture, with few exceptions, was simple and sparse. It was decorated with simple carved and turned ornament and touches of earth colours.

By the end of the century homespun textiles were supplemented by imported woven materials in the houses of the more affluent; these were used for curtains, table covers, bed hangings and seat pads. Richly coloured damasks and velvets, enhanced by the unpainted wood and plaster surfaces, were found in puritan New England, and probably to a greater extent among the less austere New York Dutch and the comparatively wealthy tobacco planters of Virginia.

While utensils of crude pottery and wood served the needs of most people, pewter and, to a surprising extent, vessels of silver were among the possessions of the well-to-do. A remarkable quantity of fine silver was produced in the last half of the century by silversmiths such as John Hull, John Coney and Jeremiah Dummer of Boston and Cornelius VanderBurgh and Jacob Boelen of New York. Although based mainly on English models, the work of these craftsmen shows a distinctly individual feeling for form and proportion and a craft skill matching that of their English contemporaries.

In the early dwellings south of New England, brick and stone tended to replace wood as a building material, though many small timber constructions must have been used which have now largely disappeared. In the Hudson region the traditional cottage of the Flemish and Huguenot settlers, long and low with steep pitched roof and extended eaves, became the typical farmhouse. At the same time, the narrow Dutch town house of brick with its stepped gable ends gave New Amsterdam, even after the English occupation, an appearance completely different from that of the English settlements to the north and south.

In the Dutch houses windows tended to be larger and ceilings higher. The early fireplace, with its tiled surround, surmounted with a deep hood, was flush with the wall instead of deeply recessed. Dutch features such as the horizontally divided door, the monumental cupboard or *kas*, the built-in bed, tiling and dishes of Delft ware gave the early New York interior an individuality which withstood English influence until well into the following century.

Similar national characteristics must have distinguished the early Swedish settlement on the Delaware, where the log cabin of pioneer tradition may have appeared for the first time later in the century. But the Swedish contribution was only temporary because the settlement was speedily absorbed by both the Dutch and the English. The early settlements of the English in east Jersey

were mainly founded by migrants from New England who at first designed typical central-chimney houses, but before the end of the century largely abandoned them for the Flemish type of house in the neighbouring Hudson region. The first settlers in Pennsylvania, arriving in Philadelphia at the end of the century, built the type of town dwelling devised for the rebuilding of London after the Great Fire of 1666, and their story belongs to the following century.

In Virginia and the south, scant evidence remains of the early 17th-century house. Bacon's castle in Surry county, Va., with its projecting two-story porch in front and rear stair tower, built in brick about 1660, is all that remains of a colonial version of the small English Jacobean manor, though there must have been several other examples. From surviving evidence and deduction it is believed that paneled walls, carefully designed beamed ceilings and ornamental plasterwork in colour were employed in larger Virginia houses but while the milder climate made loftier ceilings and larger rooms possible, it is unlikely that the ordinary early dwelling differed from its northern contemporary save in its greater use of brick and in placing chimneys at the ends instead of at the centre of the structure.

Among the wealthy the principal articles of furniture were undoubtedly English imports; the more humble settler probably had to make shift with articles of the simplest sort, but as few articles survive from this period, little is known about it. Certainly the scattered or rural character of the southern settlements and their concentration on tobacco planting failed to encourage the early development of skilled crafts found in villages and towns of the northern communities.

2. Pre-Revolution Homes.—During this period the late medieval tradition of design and decoration was gradually replaced by the formal full Renaissance style. Inigo Jones (1573–1652) and Sir Christopher Wren (1632–1723) had initiated and established the new architectural mode in England in the 17th century. By 1720 these innovations, as reflected in the Queen Anne style with its strong mingling of Dutch and Flemish elements, had already crossed the Atlantic.

In New England the traditional two-story "salt box" was at first modified in detail rather than size by the substitution of a double-hung sash for the casement and the replacement of wood sheathing by paneling and trim of more formal design. Houses of the 17th century were often so "modernized." The parlour of the Samuel Wentworth house, Portsmouth, N.H., now in the Metropolitan museum in New York city, is an instance.

Wren's influence is increasingly evident in the tendency to employ symmetrical design around an accented central feature and, particularly in the interiors, in the greater insistence on classic ordonnance in the positions of openings and the arrangement of paneling. Paneling, usually of pine in the north, was generally painted. Relatively deep and strong tones—red, blue, green, brown and yellow—were used either singly or in combination, producing an effective background for the walnut furniture of the period.

Additional colour was introduced by more elaborate use of woven and embroidered textiles, in upholstery as well as draperies. Though woven carpets for floor coverings were rare even at the mid-century, frequently their effect was achieved by stretched canvas painted with allover repeat patterns.

Throughout the colonies furniture became more plentiful and varied. Chairs without arms took the place of stools, the cabriole largely replaced the turned leg and small drop-leaf tables replaced the fixed-frame type. Bedroom furniture became differentiated with the development of the high chest (highboy) and dressing table (lowboy), and later the case-top desk or secretary became the principal ornament of the living room. Tall mirrors with crested tops replaced the small square Jacobean looking glasses, and portraits and prints came into more general use, sharing the wall space with bracketed wall lights or sconces. Artificial light still came mainly from small wick and grease betty lamps, but tallow and wax candles held in sconces, in adjustable metal and wood floor stands or in candlesticks of brass or pewter and occasionally in brass chandeliers were used by the wealthier.

Though domestic comfort was improving, north of Virginia the large formal house or mansion remained a rarity until about 1750. In the south the wealth of the slaveholding planter made it possible for him to copy the early Georgian manor house type. Great houses of two or three stories with side dependencies became numerous. Stratford in Westmoreland county and Westover in Charles City county, built about 1725–30 by the Lee and Byrd families, are early examples of the type. The elaborately paneled rooms of these mansions were furnished according to the latest London fashion. Probably only later in the century were these English pieces mingled with those from the cabinetmakers of Philadelphia, New York and Boston. Between 1750 and the Revolution this Georgian phase reached its highest development. Though generally smaller and lacking the forecourt and dependencies of the southern mansion, the larger houses of the north, such as the Wentworth-Gardner house in Portsmouth, mark perhaps the most distinctive achievements of colonial design and decoration by their apt translations into wood of brick and stone Georgian forms.

In the middle Atlantic colonies, particularly in Philadelphia which by 1760 had assumed urban leadership in the colonies, a type of domestic design midway between that of New England and Virginia had developed. There the English rococo decorative style publicized by Thomas Chippendale in his *Director* of 1754 received its most competent and original interpretation. This is well seen in Philadelphia interiors such as those of the Powel house (1768) and in the work of cabinetmakers such as Thomas Affleck and Benjamin Randolph. By this time mahogany, with its fine grain, receptive to carving and high finish, had largely replaced walnut as the principal cabinet wood. Inspired by this material and the challenge of London design both these Philadelphia craftsmen and their northern contemporaries, particularly John Goddard and Job Townsend of Newport, R.I., brought their art to the highest level of perfection.

During the third quarter of the 18th century, the paneled interior reached its most elaborate form in the colonies. North of Virginia a fully paneled room was exceptional; wood paneling was reserved for the chimney breast and its flanking recesses or cupboards. In Virginia and the south full paneling remained the rule. In both north and south, however, the mantel and its overmantel were emphasized as a decorative unit and the baroque broken pediment became the usual crowning feature of overmantel and doorway. Painted woodwork remained popular, but with softer and lighter tones, tending toward white and gray. Plaster wall surfaces were also painted. Block-printed and painted wallpapers were frequently used in the main rooms and there are indications that fabric wall hangings were used also.

Plaster ceilings completely concealed the floor beams by the second quarter of the century, and after 1750 these were frequently decorated with ornament in low relief in the French or rococo manner and hung with many-branched chandeliers of crystal. Floors of hardwood, occasionally parquetry, were more frequently covered with patterned rugs of European or oriental origin.

During the 18th century imports of printed cottons or chintz in the Indian taste and silk brocades and damasks largely replaced the linen and woolen weaves of earlier days. Upholstered furniture, wing chairs and sofas and elaborate draperies increased still further the richness of the fashionable interior.

At colonial Williamsburg, Va., surviving houses have in many cases been carefully restored and furnished, giving a complete picture of the comfortable, paneled rooms dating from the middle decades of the 18th century.

The craft of the silversmith continued to develop in the 1700s. North of Virginia even the smaller communities supported silversmiths of ability. Judging from the quality and amount of work that survives from Boston, New York, Newport and Philadelphia, a phenomenal amount of silver plate must have been produced and distributed among even the moderately well-to-do. Like the furniture, this silver mainly followed the Queen Anne style and depended upon elegance of form and line rather than ornament.

As in Europe, the growth of tea and coffee drinking encouraged production of suitable silverware and the import of English and oriental porcelains, which required corner and wall storage cup-

boards. Demand was also created for a variety of small movable tables and stands for tea and coffee services.

During this century the German settlers in Pennsylvania added their traditional styles of design to the dominantly English tradition of the colony, the effects being more evident in folk arts than in formal decoration. It was to this style and its development after the Revolution that the first American decorative glass of Henry William "Baron" Stiegel and Frederick Amelung must be credited, as well as most of the decoration on early American pottery.

3. Classic Movement After the Revolution, 1785–1835.—Even after the Revolution English decorative influence predominated in spite of greatly increased contacts with French thought and ideas. Although many leaders like Thomas Jefferson wished to see a complete break with English traditions, the Georgian forms of colonial days persisted in common usage till 1800 or after. By 1785, however, the reaction in Europe against the rather heavy classic style called free Palladianism and its rococo and baroque elaborations began to affect design in the United States.

Jefferson, largely under French influence, became the leader of one aspect of the new movement in the south which combined practical planning with a literal classicism based on the direct study of ancient monuments. While Jefferson's interest in strict classic form was felt particularly in architecture, the decorative phase of the movement both north and south was dominated by the freer and more personal interpretation of classic motifs based on the work of the Adam brothers in England, before and during the Revolution. This was the principal influence in the designs of Charles Bulfinch of Boston and his followers and was popularized about 1800 in the builders' pattern books of William Pain and Asher Benjamin.

The houses of Boston, Salem and Portsmouth built around 1800–10 by or under the influence of Bulfinch and Samuel McIntire of Salem are the best examples of the changes wrought by the fine scale and delicate precision of their Adam-inspired designs, producing what has become known as the early federal style. In the houses of the time the circle, the ellipse and the octagon were introduced as occasional variations in the plan, and the flying or freestanding staircase became a feature of the entrance hall.

In interior decoration wood paneling was practically abandoned or was restricted to the area below the chair rail. Decorative emphasis was concentrated on the mantel and overmantel, the doors and window frames and the cornice, all usually of wood and enriched with delicate repeat ornament either carved or applied. Rich colour in draperies and upholstery was set off by wall surfaces and decoration in light tones, grayed tints or white. Block-printed wallpapers with classical motifs were frequently used, as were stenciled decorations in the simpler homes.

In general, geometric forms and the urn, swag, patera and wreath were employed. The taste for lightness and attenuation which verged on dryness was reflected in the furniture. The designs of George Hepplewhite and Thomas Sheraton influenced by Louis XVI and Directoire forms found American versions around the turn of the century in the work of Samuel McIntire of Salem, John Seymour of Boston, Duncan Phyfe of New York, Henry Connelly of Philadelphia and the cabinet shops of Baltimore and Charleston. At first, light woods and finishes and decorative inlays were preferred, but by 1820 French empire influence substituted dark reddish mahogany, carved and gilded ornament and heavy, often ill-proportioned forms considered more in keeping with classic taste.

The new classicism, particularly in its Adam phase, was echoed also by the silversmiths, among them Paul Revere, whose patriotic activities have given him a prominence somewhat unfair to his able colleagues. This silver is identified by its general use of the urn form, relieved occasionally by the cylinder, and by a simple elegance of silhouette enriched only with surface chasing. After 1820 the early federal style waned and Jeffersonian classicism was modified by the introduction of Greek and even Egyptian detail, constituting the so-called Greek revival. Accompanied by furnishings and draperies in the heavier Sheraton-empire taste, the classic pattern established in the 1820s became the basic style in building and decorative design until about 1850, and constituted for the time a national style without parallel in Europe. In its later decorative aspect the Greek revival became a fashion rather than a style. As such it marks not only the end of the 18th-century classicism but the beginning of the romantic movement.

4. The Romantic Movement and the Battle of the Styles, 1835–1925.—The ordered symbolism of the Roman classic style had been envisaged by Jefferson as a proper expression of the American national ideal; but by 1835 its restraints had grown tedious. Social and economic changes already initiated by the Industrial Revolution encouraged reaction. This found more or less romantic and emotional expression in a series of style revivals ill-adapted to actual conditions.

The Greek revival, stimulated by the Greek struggle for national independence, was diluted almost immediately by the antiquarian romanticism of the "Gothic," "Tuscan" and "country cottage" fashions. These offered opportunity to the undercurrent of practical utilitarianism, repressed or thwarted by the classic formula, and also gave a fertile field for the novel or exotic in decorative taste fostered by a wealth-induced appetite for comfort and display. By the middle of the century the last vestiges of order in early Victorian romanticism had disappeared under a plethora of decorative motifs and objects easily and inexpensively produced by machine. Colour became confusedly drab or brilliant, and generally out of character as a result of the introduction of uncontrolled chemical dyes and the magic of the Jacquard loom. Increased travel and ease of communication made American styles hardly distinguishable from those of Europe.

This decorative salad of classic and medieval motifs was supplanted by the revival of 18th-century forms which temporarily triumphed in the "second rococo" of the 1850s when rosewood and walnut took the place of mahogany. This was succeeded by fashions based on the 17th century and the later Renaissance until the Centennial exhibition of 1876 brought to America the "craft" medievalism, advocated and industrialized by Charles Eastlake, and a new series of more literal style revivals including that of colonial times. These in turn absorbed the oriental influence of the "aesthetic" movement of the later 19th century.

In the first quarter of the 20th century this confusion culminated in antiquarianism for the wealthy and, for most people, period reproductions provided by the wholesale decorator and manufacturer. These 90 years of enormous technical and financial development are too confused and complex for further analysis here. Almost from the beginning, however, a body of criticism and rational experiment was developing both in Europe and America which was to find effective expression in the early 1920s amid the social and economic upheavals following World War I.

VIII. THE MODERN MOVEMENT

The struggle between the desire to cling to tradition and the necessity of accepting a society based on mechanized industry came into the open between World War I and World War II. The aim of the Bauhaus group, established in Dessau, Ger., in the early 1920s, was to adapt industrial techniques to meet the needs of a society impoverished spiritually and materially by war. Their work was the culmination of the numerous reform movements of the late 19th and early 20th centuries; cathartic and analytical in its methods, on one hand it shocked the conservative into immoderate fury and on the other converted its radical adherents into equally uncompromising iconoclasts. Many of the "functionalist" ideas they employed were inspired by the subtle simplicities of the Japanese tradition and by the innovations and writings of the Chicago, Ill., architect, Louis H. Sullivan. Functionalism demanded a complete break with the ornamental motifs of the past and a quickened response to form, proportion, line and texture. It also aimed at a scientific study of human behaviour, correlating psychological responses to physical stimuli of all kinds. The acceptance of its thesis ran parallel to the growth of interest in abstract art and although the uncompromising application of so intellectual a program proved immediately impracticable, its bold challenge to convention resulted in notable changes in interior decoration.

German functionalism was slow to establish itself in Europe and hardly affected American design until its leaders found refuge in the United States from nazi oppression. There the movement was brought to public attention in the mid-1930s by the need for new stimuli in the trough of economic depression, by the educational campaigns of the Museum of Modern Art in New York city, and by the re-establishment of the Bauhaus teachings in the Institute of Design in Chicago.

In the decade following the International Exposition of Decorative Arts held at Paris in 1925 progressive western design was influenced principally by the less radical productions of the French luxury crafts, based on a modified *art nouveau*, and the Swedish success in combining and developing craft traditions in co-operation with industry. These influences were, however, confined to relatively small and semiprofessional coteries while the market as a whole continued to concentrate on traditional forms, producing and adapting them at various levels of quality and taste. By 1935 the functionalist movement, lead by the disciples of the Bauhaus program, had gained a substantial following among the younger architects and designers. During World War II development virtually ceased in most European countries, and subsequently attention turned again to the Scandinavian countries, particularly Sweden, where strict consideration of function led to simple furnishing schemes which relied on natural wood grains, clear colouring and texture for their effect. Pattern was subdued and, where used, uncomplicated in outline.

Meanwhile in the U.S. during and after World War II, the functionalists, still with the help of the museums and the more progressive schools and periodicals, had gained the interest of a considerable proportion of both the wealthier members of society and the manufacturers who catered for them.

The most obvious changes due to the functionalist movement were: firstly, rapid mechanization; secondly, redistribution of interior space; and thirdly, elimination of formal barriers between indoors and outdoors. These developments, most prevalent in the United States but disseminated throughout much of the world, were accompanied by radical changes in decoration and the design and use of furniture and fittings which came to be known as "International" style. Equipment for heating and lighting, sanitation and food preparation, all derived from inventions of the 19th century, were brought to a high degree of mechanized efficiency taking full advantage of advanced production methods. Since convenience and economy became principal considerations, utility units were fitted into living space instead of being hidden in otherwise unused areas, as in the traditional room arrangement. By insisting on simplicity of form, colour and texture they were made to obtrude as little as possible. In particular the appearance of the kitchen was studied carefully, especially in smaller houses.

Under the influence of electric power, liquid fuels, flexible controls of temperature, ventilation and lighting and countless labour-saving devices, the mid-20th century house began to evolve into an efficient "machine for living."

Reconsideration and correlation of the space needed in living areas broke down traditional room divisions. The new interior, with its invitation to movement, both actual and implied, was in harmony with the times. Decoration became concerned with function and because a living area served more than one purpose, it was frequently irregular in plan and impossible to treat as a unit in the traditional formal manner. Changes of colour, texture and materials consequently became the chief resources of decorative design, taking the place of ornament. Earlier attempts at the functional mode suffered from too much anxiety over simplicity and unity, and consequently became monotonous and cold.

The demands of space made it necessary to keep movable pieces of furniture to a minimum and encouraged the use of built-in units. An earlier overemphasis on straight lines and angles was countered by greater use of curved and molded forms in furniture design. As the average house became smaller and more efficient in its use of enclosed space and as the desire for outdoor living grew, there was a tendency to replace at least one of the enclosing walls of both living and bedrooms with glass. With a well-arranged plan this gave each room an ever-changing mural and better light and it also extended the apparent size of the interior. The illusion of bringing the outside indoors gave a feeling of freedom but it also created certain practical and psychological problems.

By the 1960s a certain reaction against plain-coloured surfaces was taking place, particularly in France, England and Italy where popular taste had never accepted the strictly functional approach. Multiplication of synthetic materials for furniture and decorative surfaces allowed a great variety of choice in achieving new effects, not always with happy results. (M. R. Rs.; X.)

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INTERLAKEN, a Swiss town in the canton of Bern, so called from its position on the flat plain (*Bödeli*) 593 m. (1,864 ft.) above sea level between the lakes of Brienz (east) and Thun (west). Interlaken is built on the left bank of the Aare and grew up round the convent of Augustinian canons, founded about 1130 and suppressed in 1528. Pop. (1960) 4,738 (mainly Protestant and German-speaking).

In the surviving buildings of the convent religious services (Anglican, Scottish Presbyterian and French Protestant) are now held, while the castle (1750) is occupied by offices of the cantonal government. The fine, well-shaded avenue called the Höheweg runs through the main portion of the town and is lined on the north side by a succession of hotels and the large Kursaal and on the south side by the Höhe Matte pleasure ground.

Interlaken (with its suburbs Unterseen and Matten) is much frequented in summer, partly because of the glorious view of the Jungfrau which it commands to the south, and partly because it is the best starting point for many excursions, as to Schynige Platte, Lauterbrunnen, Grindelwald, Mürren and Jungfraujoch. The lines serving these places all start from the eastern railway station (that from Thun reaches the western or main railway station), whence steamers depart for the Giessbach falls, Brienz and Meiringen, on the way to Lucerne or to the Grimsel and Susten passes. Opposite Interlaken on the other side of the river is Unterseen (pop. [1960] 3,783) which was built in 1280 by Berthold von Eschenbach.

INTERLOCUTORY DECREE, generally a judicial decision that is not final or that deals with a point other than the principal subject matter of the controversy at hand. An interlocutory decree of divorce or, in England, a decree nisi, is a judicial decree pronouncing the divorce of the parties provisionally but not terminating the marriage until the expiration of a certain period. The purpose of requiring such a period of time after the pronouncement of the divorce is to discourage quick and easy divorce, to encourage reconciliation, to enable the court to supervise the arrangements to be made for the children of the marriage, and also, in England, to give the queen's proctor an opportunity to discover collusive practices by which the parties may have deceived the court.

In England, under the Matrimonial Causes act, 1860, the period required to expire between the decree nisi and the decree absolute was three months; under the act of 1866, six months. In 1946 the period was reduced to six weeks; under the Matrimonial Causes General Order, 1957, it was restored to three months. In the United States about ten states require that a decree of divorce absolute be preceded by an interlocutory decree, the period of delay varying from three months to one year. *See* also DIVORCE.

(M. RN.)

INTERLUDES. Early Tudor dramas, performed indoors and before a select circle by professional minstrels (*lusores*) or amateurs (such as Thomas More in his youth) in the pauses of some other entertainment (banquet). Interlude may also mean simply a "play between persons" (*ludus inter personas*), hence stage play in general. Most interludes were of a nonreligious and even farcical nature. However, in the 15th and 16th centuries some plays were called interludes which are today classed with the morality genre. Allegorical machinery such as associated with the moralities is not absent in *A Goodly Interlude of Nature* by Henry Medwall (*q.v.*) and in his revival of the old *débat, Fulgens and Lucres* (*c.* 1497). Medieval abstractions prevailed in *A New Interlude and a Mery of the Nature of the IIII Elements* (*c.* 1517) attributed to John Rastell (*q.v.*) and in John Redford's *Wyt and Science* (*ante* 1548). Rastell's son-in-law, John Heywood (*q.v.*), brought the interlude genre to perfection in his "newe and very mery interludes" called *The Play of the Wether* (*c.* 1533) and *The Play Called the Foure PP* (*c.* 1544).

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(A. M. N.)

INTERMETALLIC COMPOUNDS. The formation of intermetallic compounds cannot in general be interpreted according to the laws of ordinary chemistry; progress in the theory of the solid state and the structure of crystals, however, enables the main factors involved to be understood. During the period following the application of microscopic techniques to metallurgical problems and the application of phase-rule principles to metallic equilibrium, much research was devoted to systems consisting of two or more metals. The phase rule, which was based on thermodynamics, enabled the number of distinct phases or types of material which could coexist in such systems to be related to the temperature and pressure at which the systems were studied (*see* THERMODYNAMICS). It became possible to construct for these systems "equilibrium diagrams," that is, diagrams summarizing the temperature ranges and composition ranges over which various metallic phases of the systems were stable at atmospheric pressure. It was quickly realized that metals were able to dissolve in each other, not only in the liquid state but also in the solid state, particularly at high temperatures. Further, it was found that many metals formed well-defined solid compounds with each other. For example, magnesium will dissolve tin to a maximum of about 15% by weight in the solid state. Magnesium and tin also form a stable intermetallic compound, which is of substantially fixed composition and has the formula Mg_2Sn. The melting point of this compound is higher than those of either of the component metals, and its properties are very different from those of either magnesium or tin. The data available for this metallic system may be summarized in the form of the equilibrium diagram shown in fig. 1. At temperatures above the curve ABCDE, all

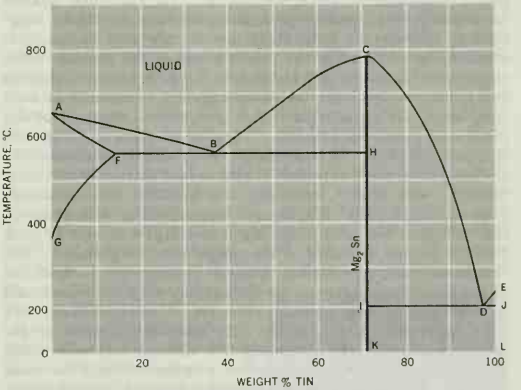

FIG. 1.—EQUILIBRIUM DIAGRAM OF THE MAGNESIUM-TIN SYSTEM

compositions consist of a homogeneous liquid mixture of the two metals. At compositions and temperatures within the area AFG, the system consists of a homogeneous solid solution of tin in magnesium. At temperatures and compositions within the area GFHI, however, the alloys consist of two phases—the solid solution of tin in magnesium and the compound Mg_2Sn. Similarly, alloys in the area KIJL consist of two phases—the compound and the solid solution of magnesium in tin. Only at the precise composition represented by the line CHIK do the alloys consist entirely of the intermetallic compound. The areas ABF and BCH represent compositions and temperatures at which the homogeneous liquid is in equilibrium with the solid solution and the compound respectively, while in areas CDI and DJE the liquid is in equilibrium with the compound and the tin-rich solid solution respectively.

Naturally the attempt was made to interpret compound formation between metals in terms of the valency conceptions of chemistry (*see* VALENCE). This met, however, with only partial success. Although the formation of Mg_2Sn, for example, could be explained in terms of ionic attraction between doubly charged positive magnesium ions and tetravalent negative tin ions, other cases, such as Cu_2Mg and $CuMg_2$, defied such an interpretation. The accumulation of data with respect to intermetallic compounds showed that it is only in a comparatively limited number of cases that the laws of ordinary chemistry can be applied. In the greater number of cases, factors other than chemical bond formation are dominant. Advances in the theory of the solid state, and particularly of the metallic state, have elucidated some of these factors. In addition, the application of X-ray crystal structure determination techniques has revealed the ways in which atoms may be arranged in solid crystals and a satisfactory classification of intermetallic compounds became possible. At the same time, theoretical work tended to emphasize that there is no sharp dividing line between the various types; the problem of fitting unlike atoms together in such a way that the assembly forms a regular three-dimensional framework in space (or space lattice) must be viewed as a whole. The stability of the arrangement will depend on a number of factors. Where these factors oppose each other, classification is difficult, and many cases of behaviour intermediate between those of the well-defined compound types are known.

The discussion of the main types of intermetallic compounds observed may well begin with the compounds in which the normal valencies of the component metals are satisfied. These are only found when the electrochemical characteristics of the metals differ considerably. Just as the electropositive metals of the alkali and alkaline earth groups of the periodic table form stable compounds (salts) with the electronegative elements of the halogen group, they tend to form stable intermetallic compounds with the more electronegative of the metallic elements. There is a general tendency, therefore, for metals of the alkali and alkaline earth groups (*e.g.*, sodium, potassium, rubidium, beryllium, magnesium, calcium) to form stable compounds with silicon, germanium, tin and lead in the fourth group of the periodic table, and arsenic, antimony and bismuth in the fifth group. Selenium and tellurium also form the electronegative component in such compounds. In compounds of this type, normal valencies of the component metals are satisfied. A typical selection of compounds is found in the alloys of magnesium. With silicon, germanium, tin and lead, one stable compound is found in each case. Alternatively, in alloys with arsenic, antimony and bismuth, the compounds Mg_3As_2, Mg_3Sb_2 and Mg_3Bi_2 are formed, while with selenium and tellurium, the compounds MgSe and MgTe occur. In each case the normal valencies of the components are satisfied. The compounds have very limited ranges of homogeneity (a reflection of the high affinity between the metals), are very brittle and tend to have high melting points. They are, if not insulators, very poor conductors of electricity. The stability decreases as the atomic number of the electronegative element increases within any one group of the periodic table, in agreement with the usual tendency for the elements of any one group to become progressively more positive in character as the number of the period to which they belong increases. This is reflected in the progressive decrease in melting point on passing from Mg_2Si (melting point 1,102° C.) to Mg_2Pb (m.p. 553° C.), and from Mg_3Sb_2 (m.p. 1,228° C.) to Mg_3Bi_2 (m.p. 823° C.). These compounds are also characterized by high heats of formation, which are of the order of several kilocalories per gram atom. In general, the greater the stability and the heat of formation, the greater also the electropositive nature of the first metal, and the greater the electronegative nature of the elements of the fourth, fifth or sixth group of the periodic table.

It is significant that compounds of this type have crystal structures which are very closely related to those of true salts. Thus Mg_2Si, Mg_2Ge, Mg_2Sn and Mg_2Pb are anti-isomorphous with calcium fluoride (fluorite, or fluorspar), the arrangement of atoms in the structure of which is shown in fig. 2; the term "anti-isomorphous" means that the crystal structures of the compounds are such that the positive component (Mg) occupies the type of position in the framework or lattice which is occupied by the negative component in the salt. Similarly, the compounds with arsenic, antimony and bismuth are anti-isomorphous with certain of the oxides of the rare-earth elements, while MgS and MgSe and many other tellurides and selenides possess the same type of structure as sodium chloride.

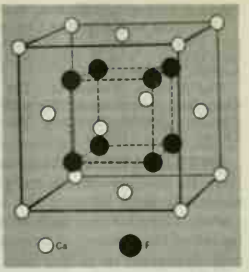

FIG. 2.—FLUORITE STRUCTURE

These compounds may thus be regarded, from one point of view, as the extension of the ordinary ionic structure into the realm of intermetallic structures where one component is electropositive and the other electronegative.

There are examples of a somewhat analogous type of compound to be found among the sulfides, selenides, tellurides and arsenides of metals such as zinc, cadmium and mercury, where the electrochemical differences are less marked than in the systems previously considered. Many of these compounds crystallize in the lattices characteristic of the two naturally occurring forms of zinc sulfide, which are both simply related to the lattice of diamond (fig. 3). Each atom in these compound structures is tetrahedrally surrounded by four atoms of the other component. Diamond takes up this structure by each carbon atom sharing one of its four valency electrons with each of four neighbouring atoms; the bonding force is covalent (electrons shared), and there are four valency electrons per atom in the structure. In the intermetallic compounds which have the zinc sulfide structures, there are again four electrons per atom, as, for example, in CdS, AlP and MgTe. It is very probable that such compounds are not essentially ionic in nature, but are held together by covalent bonds.

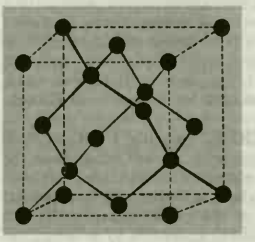
FIG. 3.—DIAMOND STRUCTURE

There is, however, another large class of intermetallic structures which cannot be simply related to ordinary chemistry. These tend to occur in cases where the electrochemical characters of the components do not differ greatly. They often have considerable ranges of homogeneity, are metallic in their general properties and are metallic conductors of electricity. The compositions over which they are stable frequently include compositions corresponding to simple atomic ratios, but these ratios rarely bear any relation to the usually accepted valencies of the components. Thus, intermediate phases occur in the copper-tin alloys at compositions in the region of Cu_5Sn, $Cu_{31}Sn_8$ and Cu_3Sn. At first sight, there appears to be little reason why such peculiar atomic ratios represent stable structures. Systematic work on many alloy systems formed by copper, silver and gold with elements of various valencies, however, enabled phases of this type to be classified, with striking results. In many of these systems, the primary solid solution is followed, as the concentration of the solute is increased, by a phase the structure of which is body-centred cubic (*see* fig. 4); the phase may be stable at room temperature or only at high temperatures. Taking copper as a typical solvent metal, and zinc, aluminum and tin as solutes of valencies 2, 3 and 4 respectively, there are body-centred cubic phases in the regions of the compositions CuZn, Cu_3Al and Cu_5Sn respectively. The common characteristic in each case is a ratio of three valency electrons to two atoms. Both the compositions of the phases and the structure they assume are therefore governed by the valency electron/atom ratio. The same principle holds for many other body-centred cubic phases in this class of alloy. In the alloys of copper and silver with elements of various valen-

cies, homogeneous phases with a complex structure (the "γ" structure) based on a deformed body-centred cube are very frequently found at a ratio of valency electrons to atoms of 21/13. Examples of this type, which tend to be brittle and silvery in colour, are Cu_5Zn_8, Cu_9Al_4 and $Cu_{31}Sn_8$. A further class, all members of which possess a close-packed hexagonal structure, tends to occur at a valency electron to atom ratio of 7/4, as, for instance, in the cases of $CuZn_3$, Cu_3Sn and Ag_5Al_3. It is of interest to note that alloys of transitional metal solvents with similar solute metals also form intermediate phases of the same type. Thus, the phases which occur close to the compositions CoAl, NiAl and FeAl are body-centred cubic in structure, while the phases Co_5Zn_{21}, Fe_5An_{21} and Ni_5Zn_{21} have the "γ" structure. It will be noted that the electron/atom ratios for these phases are the same as in the corresponding copper alloys if the transitional metal atoms are regarded as contributing no valency electrons to the structure, a behaviour which is connected with their peculiar electronic structure. This class of intermediate phase, the formation of which is governed by the number of valency electrons per atom, is usually known as the electron compound class, and occurs in the absence of any marked electrochemical difference between the components and where the atomic sizes of the components do not differ too widely. This class is of great theoretical interest, and its occurrence has been interpreted in terms of the modern electron theory of metals. Broadly speaking, the occurrence of electron compounds is caused by the tendency of a metallic structure to assume such an arrangement that the relatively free (*i.e.*, nonionic) electrons possess the lowest possible energy; this condition is satisfied at electron/atom ratios of 3/2, 21/13 and 7/4 by the body-centred cubic, "γ" and close-packed hexagonal structures respectively. As stated above, these phases frequently have considerable homogeneity ranges, unlike normal valency compounds, and the precise details of the way in which a phase of the fundamental electron/atom ratio can tolerate an excess or deficit of one kind of atom depends on subsidiary factors, such as the atomic size difference involved. It is clear, however, that, in agreement with theoretical expectations, the homogeneity ranges decrease as the valency of the solute increases.

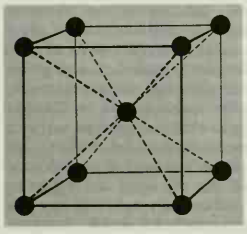

FIG. 4.—BODY-CENTRED CUBIC STRUCTURE

It is important to note that electron compounds are found in ternary alloy systems. Thus the typical "γ" structure is obtained in copper-zinc-aluminum alloys if the composition is so adjusted as to maintain the required electron/atom ratio of 21/13. A further point of interest is that, although the arrangement of the atoms on the lattice points in many electron compounds is entirely at random, in others an ordered arrangement exists. The copper-zinc β phase shows both types of behaviour. At high temperatures, the copper and zinc atoms are distributed at random on the lattice points, and there is no distinction between the atoms at the cube corners and the cube centre of fig. 4. At low temperatures, however, the zinc atoms occupy the cube centres and the copper atoms the cube corners (or vice versa). This behaviour depends on factors, such as atomic size, which are distinct from electronic considerations.

The two types of intermediate phases so far considered indicate that, where size and electrochemical differences are not marked, electronic factors tend to control the occurrence of compounds, while a pronounced electrochemical difference leads to the formation of normal valency compounds. Certain details of the occurrence of the electron compounds, such as the existence of ordered arrangements, show that atomic size differences must be considered as another factor which may become predominant in certain cases. It is known, for instance, that several intermetallic compounds crystallize in the body-centred cubic structure (*e.g.*, NaTl, LiIn, LiZn) without any possibility of an electron/atom ratio of 3/2 being established. In these cases, the effect of size relationship is predominant, and the formation of a large and interesting group of phases is governed primarily by this factor. Among the most interesting are the interstitial compounds, in which it is possible to fit very small atoms into the interstices of a metal lattice, which may be deformed but is left otherwise essentially unchanged. Compounds of this type are met with in the hard, high-melting borides, carbides, nitrides and hydrides of many metals, and the skeleton of the metallic structure accounts for the metallic properties shown by many of these compounds. A large number are based on the face-centred cubic structure (fig. 5). Very small atoms, such as hydrogen, may be inserted into the centres of the small cubes of fig. 5, so that each is surrounded by four symmetrically suited metal atoms; several hydrides possess this structure. The somewhat larger nitrogen and carbon atoms are in general too large to form stable structures of this type with most metals. Such atoms, however, can be inserted into the spaces between metal atoms which occupy the corners of the large cube in fig. 5, and are then symmetrically surrounded by six metal atoms; this type of structure is often observed in carbides and nitrides. Other types of interstitial compounds are known, but in most cases can be understood in terms of the insertion of a small atom into spaces in the metallic lattice which are large enough to accommodate them without too much strain, but not so large that the small atom would be loose in a hole too large for it. The structures are thus determined essentially by the atomic size relationships.

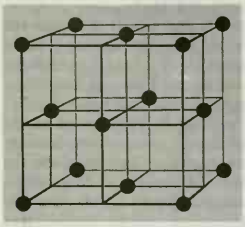

FIG. 5.—FACE-CENTRED CUBIC STRUCTURE

Analogous behaviour is often shown in cases where the atomic size difference is considerable, but not large enough for interstitial compound formation. For instance, the compounds $NaPb_3$, $CaPb_3$, $SrPb_3$, $CaTl_3$, $CaSn_3$ and $CeSn_3$ all crystallize in the structure of fig. 6. In each case the relationship between the sizes of the larger and smaller atoms is similar and the structure appears to be based on geometrical convenience—the structure of fig. 6 is a stable manner in which atoms, the sizes of which differ in a particular way, can be packed together. This clearly suggests that other structures will be found to be characteristic of different size ratios, and this is fully borne out in practice. Thus an approximately constant atomic size ratio is shown in the series of compounds Cu_2Mg, W_2Zr, KBi_2 and Au_2Bi, all of which crystallize in the same type of structure; and it may be noted, in confirmation of the principle that the relative atomic size is the main factor, that the structure of KBi_2, where the bismuth atom is the smaller, is the same as that of Au_2Bi, where the bismuth atom is the larger. The class of body-centred cubic structures quoted above (NaTl, LiIn, LiZn) are also governed primarily by size relationships. Where, in the systems AB and CD, the ratio of the atomic sizes of A and B is closely similar to that of C and D, compounds of the same general type and crystal structure may be expected. Such compounds have narrow ranges of homogeneity because of the difficulty of satisfying the geometrical conditions except at one, particular, simple atomic ratio. For the same reason, ternary compounds of a corresponding type are relatively scarce. Some, however, are known.

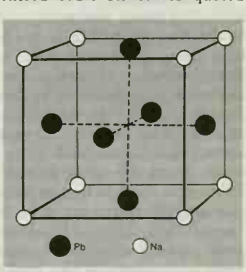

FIG. 6.—$NaPb_3$ STRUCTURE

A particularly interesting group of compounds, in which both size and electronic factors are involved, is illustrated by certain compounds formed between magnesium and zinc, copper or nickel. Thus, in $MgZn_2$, $MgCu_2$ and $MgNi_2$ the ratio of atomic diameters lies between 1.13 and 1.15, and in each case the smaller atoms may be regarded as situated on a close-packed lattice from which

each large Mg atom has replaced two small atoms. There is a close similarity between the three lattices, which are built up from similar atomic planes arranged in a different order. As a consequence of the arrangement of planes, $MgCu_2$ has cubic symmetry, while $MgZn_2$ and $MgNi_2$ are hexagonal, the axial ratio of the latter being twice that of the former. Which of these structures is taken up depends on the number of valency electrons per atom. This is seen most clearly by considering the ternary phases which are isomorphous with these binary structures. Thus, the addition of aluminum to $MgCu_2$ increases the electron/atom ratio and leads to the appearance of a compound with the $MgZn_2$ type of structure, while the addition of silver to $MgZn_2$, which decreases the electron/atom ratio, gives a compound with the $MgCu_2$ type of lattice. These compounds form examples of a type in which the occurrence and general structure are dictated by size considerations, while details depend on number of electrons per atom.

It is possible, therefore, to interpret the formation and nature of intermetallic compounds in terms of three main factors: atomic size relationships, normal valency of components and the ratio of valency electrons to atoms. Although, in this article, only the main types which occur when one or another of these factors predominates have been considered, it will be realized that there must be cases where two or more of the factors are of equal importance. In such cases, more complex compounds may occur, but a discussion of these is beyond the scope of the present article.

Similarly, cases exist where intermetallic compounds of different characteristics crystallize in structures which are essentially the same, or vary only slightly. Thus cobalt sulfide, CoS, crystallizes in a structure in which the metal atoms may be regarded as occupying, in a regular manner, interstices in a close-packed hexagonal arrangement of nonmetal atoms.

The compound AuSn adopts the same type of structure, but with a much smaller axial ratio; it is considered that direct interactions between the gold atoms may be responsible for the difference. The existence of intermediate types, which can be considered from different points of view, does, however, emphasize that the problem of intermetallic compounds must be considered as a whole, without too rigid an insistence on subdivision into types. The classification is a matter of convenience rather than a consequence of the existence of completely different types of compound.

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INTERMEZZO, an Italian musical term (in English, interlude, in French, *intermède*) used originally in the 16th century to describe the madrigals and ballets performed between the acts of a play. These intermezzi, or *intermedii*, were written by the finest composers of the time, an early example of them being those in the comedy *Calandria* by Bernardo Cardinal Bibbiena given at Urbino in 1513. In the 18th century an intermezzo was a scene of comic relief, usually for soprano and bass, introduced into the *opera seria*. Giovanni Battista Pergolesi's famous and influential comic opera, *La serva padrona*, was originally a series of such intermezzi, and was first performed in 1733 to provide comic relief during the performance of his serious opera *Il prigionier superbo*. Operatic intermezzi of this kind were so successful that they were later performed as comic operas complete in themselves. The term intermezzo was also used in the 19th century as the title of character pieces, usually for piano, similar in style to a fantasia, an impromptu or a capriccio, of which there are examples by Schumann and Brahms.

INTERNAL-COMBUSTION ENGINE. In an internal-combustion engine a fuel-air mixture is burned so that the hot gaseous products exert a force on moving parts of the machine, doing useful work and generating power. These engines comprise one group of what are known as heat engines, so named because they derive their power either directly or indirectly from an exothermic reaction, such as combustion.

In the internal-combustion engine the products of combustion act directly on pistons or turbine rotor blades, whereas the external-combustion engine employs a secondary working fluid that is interposed between the combustion chamber and the power-producing elements. All heat engines other than the internal-combustion engine are similar in principle to the steam-engine-and-boiler combination in that the fuel with which they operate is burned in a furnace external to the engine; a portion of the energy liberated is transferred through boiler or heat-exchanger walls to a secondary working fluid, commonly water; and the water is converted into steam under a high pressure created by the vaporization. The steam is then conveyed through pipes to an engine in which the pressure of the steam acts upon pistons or turbine runners whose motion causes a shaft to move and produce power.

Fundamentally, the steam engine operates with a high-pressure working medium produced by utilizing the expansion accompanying the vaporization of a liquid; the internal-combustion engine utilizes the large volume of high-temperature combustion products which, when confined, become a high-pressure gaseous medium.

History.—Attempts to devise heat engines were made in pre-Christian times. The steam engine, however, became the first successful type when James Watt carried the ideas of earlier experimenters to practicability during the 18th century. The internal-combustion engine followed as an improvement over the steam engine.

The internal-combustion engine cannot be attributed to any one inventor. The piston, for example, is thought to have originated about 150 B.C., and was used by metalworkers in pumps for blowing air. The problem of preventing leakage between the piston and cylinder wall led Watt to employ rope yarn impregnated with mutton tallow as a packing in 1764. Brass sealing rings were fitted to steam-engine pistons in Scotland several years later.

The internal-combustion engine of the mid-20th century was made possible by a gradual accumulation of knowledge of thermodynamic principles, mechanical skill, availability of materials and experience. The development was inspired by recognition of the disadvantages of steam power plants—their low thermal efficiency, great weight and bulk and inconvenience of operation—all of which are largely traceable to burning the fuel in a furnace separate from the engine. The greater desirability of a self-contained power unit was evident. A remarkable development resulted from the application of engines to automobiles and airplanes. (This development is even more remarkable in that the gasoline engine is poorly suited for propulsion and must have intricate clutch and transmission devices to adapt it for this purpose. The steam engine can be started under full load, but the internal combustion engine must be set in motion by a cranking device before any load can be applied, and its performance is greatly affected by the speed at which it runs.)

The events leading to the development of a practical internal-combustion engine probably start with the attempt of the Abbé Jean de Hautefeuille in 1677 to pump water by the combustion of gunpowder. The vacuum formed by cooling the hot gaseous products was used to operate the pump. Christiaan Huygens in 1680 and Denis Papin in 1690 experimented unsuccessfully with similar devices. Robert Street obtained a patent in England in 1794 describing an internal-combustion engine employing a piston and a system of levers. In 1801 Philippe Lebon proposed in France that the charge be compressed before burning, but did not build an engine. W. Cecil experimented in England with an engine operated by exploding hydrogen-air mixtures and employing the vacuum acting on a piston as the products of combustion were cooled. Tests of this engine as reported in 1820 provide the first record of operation of a gas engine.

Actual production and sale of the gas engine began in 1823 when Samuel Brown started to build a vacuum-type gas-burning engine. The role of Brown in the development of the internal-combustion engine was similar to that of Thomas Newcomen in the steam-engine field. Their engines were heavy and crude but contained many essential elements of later more successful engines.

The most competent early study of the thermodynamic aspects of the internal-combustion engine was that of Sadi Carnot in France. He published a pamphlet in 1824 in which he outlined not only the fundamental internal-combustion engine theory, but even that of the diesel engine. Although he did not experiment with actual engines, his *Reflections on the Motive Power of Heat* undoubtedly influenced the thinking of many other experimenters.

One of the first engines to use pressure resulting from combustion rather than vacuum from cooling of the products was built by W. L. Wright in 1833. The first engine in which the charge was compressed before burning was built by William Barnett in 1838 and he was granted a patent which included this idea. He also built an engine of the two-stroke-cycle type with an external charging pump, an arrangement that was adopted many years later for diesel engines. The two-stroke cycle is completed in one up- and one downstroke of the piston or one turn of the crankshaft, in contrast with the four-stroke cycle that requires two full turns of the crankshaft. All such machines have operating cycles which, when repeated over and over again, periodically return all of their parts to their original positions.

Barnett also devised an ingenious igniting cock that provided a pilot flame for igniting the charge and a relighter to rekindle the pilot light after it was extinguished when the oxygen in the cylinder was consumed. This method of ignition was applied to many engines before electrical ignition was developed. Another method of ignition, the hot plug, was introduced by Alfred Drake in 1843.

Until 1860 few engines were built, and not many of those ever ran; but practical difficulties were gradually overcome and production facilities improved until it was possible to make a practical engine. In 1860 J. J. E. Lenoir, a Frenchman, marketed an engine that gave reasonably satisfactory service; it operated on illuminating gas. It was essentially a converted double-acting steam engine with slide valves to admit gas and air and to discharge exhaust products. It operated on a two-stroke cycle and, although it developed little power and utilized about 4% of the energy in the gas, several hundred were sold over a period of years.

In 1861 G. Schmidt proposed that the fresh charge be compressed by pumps to a pressure of three atmospheres before introduction to the cylinder. He stated that this would lead to a great expansion of the products of combustion and permit a greater transformation of heat energy. Schmidt was, therefore, one of the early proponents of the theory that compression should precede combustion, although his method of accomplishing the increase in pressure pointed toward the idea of supercharging rather than to the compression-type cycle.

The operating cycle of the modern automobile engine originated with Alphonse Beau de Rochas, who published his theory in Paris in 1862. He stated the conditions necessary for maximum economy as: (1) maximum cylinder volume with a minimum cooling surface; (2) maximum rapidity of expansion; (3) maximum ratio of expansion; and (4) maximum pressure of the ignited charge. He described the sequence of operations whereby this economy could be attained as: (1) suction during an entire outstroke of the piston; (2) compression during the following instroke; (3) ignition of the charge at dead centre and expansion during the next outstroke (the power stroke); and (4) forcing out the burned gases during the next instroke.

Although he never built an engine, Beau de Rochas's statement of factors affecting economy and performance appears as one of the most significant steps in the development of the internal-combustion engine. The four-stroke cycle he described is used in modern automobile engines. Because his work was entirely theoretical, Beau de Rochas has not been given the credit for originating the basic principle of the four-stroke-cycle engine; the name of Nikolaus Otto is commonly associated with that achievement.

The firm of Otto and Langen started production of a free-piston engine in Deutz, Ger., in 1867. Engines of this type had previously been built by Barsanti and Matteucci, but the Otto and Langen engine was superior in design and workmanship. It employed a vertical cylinder, open at the top and fitted with a heavy piston, below which was the combustion chamber. The gas and air charge was drawn into the cylinder during the first half of the upstroke. The charge was then ignited electrically and the piston lifted by the explosion. Although the piston tended to continue upward after the pressure on its underside had been reduced to a partial vacuum, atmospheric pressure acting on the top of the piston and the weight of the piston caused it to descend immediately. The motion was transmitted to a shaft and heavy flywheel by a toothed rack extending downward and meshing with a gear on the shaft. This gear turned freely on the shaft during the upward stroke, but a free-wheeling clutch engaged on the downward stroke and applied torque to the shaft. The engine was very noisy, of small power capacity and the rack-and-pinion mechanism unsound mechanically, but it consumed less than half as much fuel per unit of power as did the Lenoir engine and thus succeeded commercially.

In 1876 Otto and Langen applied the Beau de Rochas principle in the design of the Otto silent engine. This was the first four-stroke-cycle engine employing compression and operating on the principle of the modern automobile engine. In spite of its great weight and low economy, nearly 50,000 engines with a combined capacity of about 200,000 h.p. were reportedly sold in 17 years; this was followed by the rapid development of a wide variety of engines of the same type. Manufacture of the Otto engine in the United States began in 1878, following the granting of a U.S. patent to Otto in 1877.

The four-stroke cycle is illustrated in fig. 1. The piston first

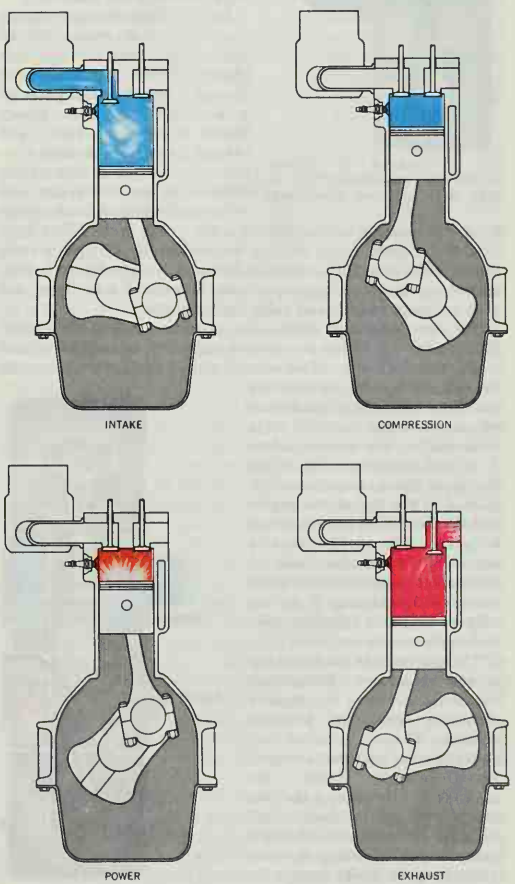

FIG. 1.—THE STROKES OF THE FOUR-STROKE CYCLE

descends on the intake stroke, during which the inlet valve is held open. The valves shown are of the commonly used poppet or mushroom type. The fresh charge is moved into the cylinder by the partial vacuum created by the descent of the piston. The piston then ascends on the compression stroke with both valves closed and the charge is ignited by an electric spark as the end of the stroke is approached. The power stroke follows, with both valves still closed and gas pressure acting on the piston crown because of the expansion of the burned charge. The exhaust stroke then completes the cycle with the ascending piston forcing the spent products of combustion past the exhaust valve, now held open by the valve train. The cycle then repeats itself. Each cycle thus requires four strokes of the piston—intake, compression, power and exhaust—and two revolutions of the crankshaft.

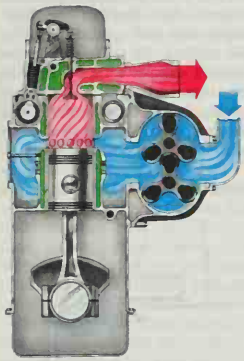

FIG. 2.—DIAGRAM OF BLOWER-SCAVENGED TWO-STROKE-CYCLE ENGINE WITH UNIFLOW SCAVENGING

The disadvantage of the four-stroke cycle is that only half as many power strokes are completed as in the two-stroke cycle and only half as much power would be expected from an engine of a given size at a given operating speed. The four-stroke cycle, however, provides more positive scavenging and charging of the cylinders with less loss of fresh charge to the exhaust.

Fig. 2 illustrates the modern two-stroke-cycle engine of the uniflow type, wherein the fresh charge is forced into the cylinder through circumferential ports by a positive-displacement rotary blower of the Roots type. The exhaust gases pass through poppet valves in the cylinder head, eliminating the return flow and reducing the loss of fresh charge by short circuiting to the exhaust outlet. The cycle differs from that of the simpler type only in the method of placing the fresh charge under pressure to cause its flow into the cylinder. All modern two-stroke diesel engines employ blowers of some type, but with a variety of port and valve combinations.

The opposed-piston engine also provides uniflow scavenging. This engine (fig. 3) has two pistons moving in opposite directions in the same cylinder. Two sets of ports extend entirely around the cylinder bore, so located that one set is covered and uncovered by one piston and the other set is controlled by the second piston. A second crankshaft, to which the upper pistons are attached, is located at the top of the engine and the two shafts are connected by gears. The effect is that of removing the cylinder heads of two similar engines, inverting one engine and attaching it to the other so that their cylinders unite to form a continuous bore.

The opposed-piston design has several advantages. Reciprocating masses move in opposite directions, providing excellent balance. The poppet valves, necessary in other uniflow-scavenged, two-stroke-cycle engines, are eliminated. By placing the two crankshafts several degrees out of phase (the one controlling the exhaust ports leading the one controlling the intake ports), the necessary blow-down period after the exhaust ports open can be provided before the inlet ports open. Intake of charge can continue after the exhaust ports are covered. The stroke of the engine is the combined movement of both pistons, and the combustion chamber formed between the two pistons at their innermost positions is desirably compact.

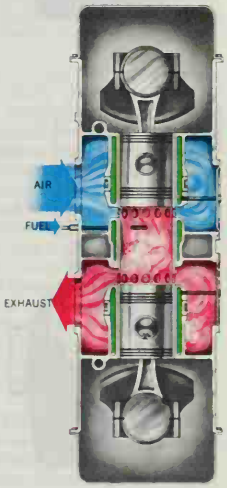

FIG. 3.—OPPOSED-PISTON ENGINE

Carburetor engines operating on the two-stroke cycle lack the fuel economy of four-stroke engines because some of the fuel escapes with the exhaust gases. This loss can be avoided in two-stroke spark-ignition engines only by equipping them with fuel-injection systems instead of carburetors and injecting the fuel directly into the cylinders after scavenging. Such an arrangement is attractive as a means of attaining high power output from a relatively small engine. Development of the turbocharger for this application held promise of further improvement.

Ignition of the charge by the high temperature attained by very high compression, hinted at by Carnot in 1824, became a practical reality in 1897 after five years of effort by Rudolf Diesel and his associates. The diesel engine (*q.v.*) differs from spark-ignition engines in that air alone is inducted into the cylinders, compressed to such an extent that a temperature exceeding the ignition requirement of the fuel is attained, and the fuel is injected into the combustion chamber where it burns. The carburetor and ignition system are eliminated, and improved economy results from the use of lower-grade fuels at higher compression ratios than are attainable with spark ignition.

The Gas Turbine.—Continuous rotation is superior to reciprocating motion, and the imperfections of the reciprocating-piston engine are largely traceable to the noncontinuous motion and the cyclic interruption of combustion. The fundamental principle of the gas turbine was known before that of any other type of heat engine, historians having recorded that a toy gas turbine was built by Hero of Alexandria about the time of Christ. Nevertheless, practical development of the gas turbine did not take place until the 20th century. (*See* TURBINE: GAS.)

The gas turbine is a simple power plant. A compressor supplies air at about three to six times atmospheric pressure to a combustion chamber into which fuel is sprayed, maintaining continuous combustion. The resulting large volume of high-temperature gaseous products then expands through the turbine unit to atmospheric pressure. The compressor and turbine rotors may be on the same shaft. The excess of power developed in the turbine unit over that required to turn the compressor rotor is delivered to a generator, propeller or other load.

The Free-Piston Engine.—In the free-piston engine the pistons are not connected to a crankshaft, as in a conventional engine, but can transmit their power to a turbine instead. Originally built as an air compressor, the engine was first used extensively by the Germans in World War II for launching torpedoes.

The principle of the free-piston engine was known as early as 1857, but no practical engine of this type was built until 1867, when, as mentioned earlier, the German firm of Otto and Langen began production of its first internal-combustion engine. Early in the 20th century Hugo Junkers experimented in Germany with a free-piston apparatus. After World War I Raul de Pateros Pescara started work in France on a free-piston air compressor to serve as the power plant for a helicopter to be operated on the reaction-turbine principle. The application was soon abandoned, but work was continued on the compressor and an experimental unit was built in 1925. Junkers built his first practical free-piston compressor at about the same time. Pescara was granted patents on his ideas, and subsequent work on the free-piston engine was done by licensees under his patents. All early units were built as air compressors, and the possibilities of using the engine in combination with a gas turbine as a gasifier to replace the compressor and combustion chamber were not investigated until about 1937. The useful output of this combined free-piston engine and gas turbine is the power developed by the gas turbine.

The free-piston engine is a two-stroke-cycle opposed-piston engine in which each narrow power piston and its larger air-compressor piston move as a single unit. The combustion cylinder is horizontal and a larger compressor cylinder is located at each end. Diagrammatic sketches of the cylinder and piston arrange-

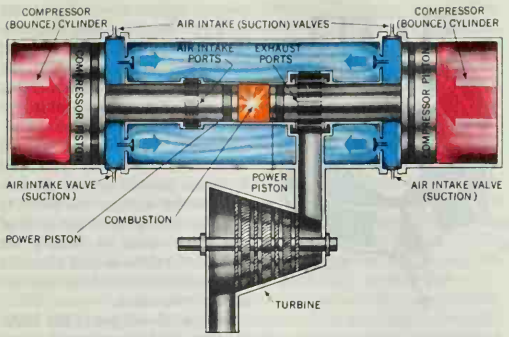

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FIG. 4.—DIAGRAM OF A FREE-PISTON ENGINE

ment are shown in fig. 4. The power cylinder is surrounded by an annular air box that communicates with the two compression cylinders through spring-loaded automatic delivery valves and with the power cylinder through a set of intake ports around the circumference of the cylinder barrel. These intake ports are covered and uncovered by the piston at the left side of the engine in the figure. A second set of exhaust ports is controlled by the movement of the right piston and communicates with the exhaust-gas receiver. The exhaust turbine gets hot gases from this receiver. The pressure maintained in the receiver is usually 45 to 50 lb. per square inch (p.s.i.). Pressures up to 70 p.s.i. are more efficient, but create problems arising from higher temperatures.

The two compressor cylinders receive the air charge from the atmosphere through inwardly opening automatic intake valves, and maintain a high supercharging pressure in the air box. The outer faces of the compressor pistons are in contact with air trapped in the enclosed ends of the cylinder. This air acts as a cushion to bring the pistons to a stop as they are forced apart by the expansion of the combustion products in the power cylinder. The air pressure built up in these bounce cylinders acts to return the pistons after the products of combustion have left the cylinder through the exhaust ports and the fresh charge has been forced in through the intake ports by the pressure in the air box. The fuel injector at the centre delivers fuel to the combustion chamber formed between the two pistons.

The two double pistons are connected mechanically only by a synchronizing mechanism that keeps them in phase and is also used to move them to their outermost positions for starting the engine. The diesel principle functions in ignition. Starting is accomplished by admitting compressed air into the bounce cylinders and the air box from a storage tank. The air pressure on the bounce faces of the compressor pistons forces the pistons inward and compresses the air charge in the combustion chamber so that it attains ignition temperature, and the fuel is then sprayed in. The combustion builds up a high pressure between the two piston faces and forces them outward until their motion is arrested by the pressure in the bounce cylinders. The compressor cylinders are filled with fresh air through the automatic intake valves as the pistons are moved outward, and this air is delivered to the air box through the automatic delivery valves when the pistons are again moved inward by bounce-cylinder pressure.

The strokes of the two pistons are kept equal by the synchronizing mechanism, but the length of the strokes increases with the amount of fuel burned per cycle. At heavy loads the force acting on the faces of the power pistons is greater than at light loads, moving them farther apart and increasing the pressure in the bounce chambers. The greater returning force then pushes the pistons closer to each other at the inner ends of their strokes and thus increases the compression ratio. Higher compression ratios than are practical in conventional engines may be used because there are no bearings to be heavily loaded by the high pressure. The higher compression temperature permits fuels to be used that would not ignite satisfactorily in ordinary diesel engines.

Thus, the free-piston engine operates with a longer total stroke at heavy loads. In fact, there is a minimum load at which the engine can operate because the outward stroke must uncover the cylinder ports to permit exhaust of spent gases and recharge with fresh air. For large power capacity units this is not a problem because several gasifiers supply hot gases to one turbine and light loads are carried by shutting down some of the gasifiers. Twin-cylinder units will probably be commonest in such automotive applications as locomotives and tractors. Twin ("siamesed") gasifiers are controlled by a phasing linkage that keeps the two sets of pistons moving in opposite directions, thus reducing pulsations in the hot gas delivered to the turbine.

Free-piston gas-turbine units are used in electrical generators, ships, locomotives, pumps and compressors; these are units in excess of 1,000 h.p. Smaller units have been found practical in tractor operation. The cost of a free-piston power plant is about the same as that of a conventional diesel power plant and the thermal efficiency is only slightly higher. Perhaps its most attractive feature is its ability to burn a wider range of fuels than other engines. Compared with the conventional gas-turbine power plant, its efficiency is higher and the temperature of the gases leaving the free-piston gasifier is no higher than that at which some steam turbines operate. Blade erosion and other problems of high operating temperature of the gas turbine are thus minimized.

The NSU-Wankel Rotary-Piston Engine.—A rotary-piston internal-combustion engine developed in Germany is structurally so different from conventional reciprocating-piston engines that it has been claimed to be of revolutionary significance. The engine was conceived by Felix Wankel, a specialist in the design of sealing devices. Beginning in 1956, experimental engines were built and tested by the NSU Motorenwerke A. G. Neckarsulm, manufacturers of motorcycles and Prinz automobiles.

Instead of pistons that move up and down in cylinders, this engine has an equilateral triangular orbiting rotor that has the equivalent of three pistons in conventional engines. The rotor turns in a closed chamber and the three apexes of the rotor maintain a continuous sliding contact with the curved inner surface of the casing. Geometrically, the form of the casing is a two-lobed epitrochoid, an epicyclic curve formed by the path of a point on the radius of a circle as it rolls without sliding about the outside of a larger circle. The curved-sided rotor forms three crescent-shaped chambers between its sides and the curved wall of the casing. The volumes of the chambers vary with the rotor motion. Maximum volume is attained in each chamber when the side of the rotor forming it is parallel with the minor diameter of the casing, and the volume is reduced to a minimum when the rotor side is parallel with the major diameter. Shallow pockets recessed in the flanks of the rotor control the shape of the combustion chambers and establish the compression ratio of the engine.

In turning about its central axis, the rotor must follow a circular orbit about the geometric centre of the casing. The necessary orbiting rotation is attained through a central bore in the rotor in which an internal gear is fitted that meshes with a stationary pinion (with two-thirds as many teeth) fixed immovably to the centre of the casing. The rotor is guided by fitting its central bore to an eccentric formed on the output shaft that passes through the centre of the stationary pinion. This eccentric also harnesses the rotor to the shaft so that torque is applied when gas pressure is exerted against the rotor flanks as the fuel and air charges burn. The 3-to-2 gear ratio causes the output shaft to turn three times as fast as the rotor turns about the eccentric. Each quarter turn of the rotor completes an expansion or a compression, permitting intake, compression, expansion, and exhaust to be accomplished during one turn of the rotor. The only moving parts are the rotor and the output shaft.

The charge is supplied by a carburetor and enters the combustion chambers through an intake port in one of the end plates of the casing. An exhaust port is formed in one of the flattened sides of the casing wall and a spark plug is located in a pocket communicating with the chambers through a small throat in the opposite side of the casing wall.

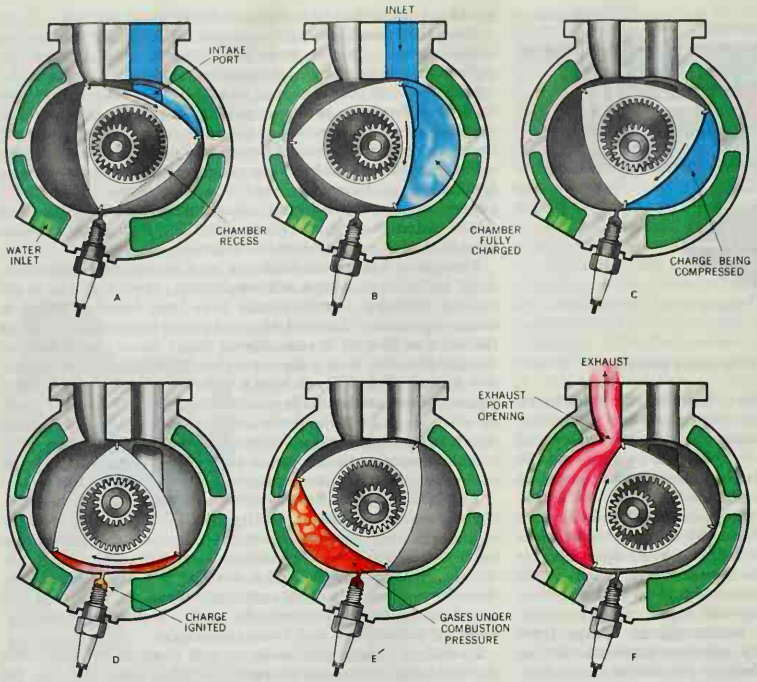

FIG. 5.—OPERATING PRINCIPLE OF NSU-WANKEL ROTARY ENGINE ILLUSTRATED BY FOLLOWING ONE SEGMENT OF THREE-SECTOR ROTOR (DESIGNATED BY HEAVY LINE) THROUGH COMPLETE CYCLE

(A) Intake begins (dotted lines indicate chamber recesses in rotor faces); (B) intake ends, chamber at maximum volume; (C) compression begins, chamber volume decreases; (D) chamber at minimum volume, charge fully compressed and ignited; (E) expanding gases produce clockwise thrust on rotor; (F) exhaust begins as rotor uncovers port

Referring to fig. 5, the cycle starts when the flank of the rotor (indicated by a heavy line in fig. 5[A]) is just uncovering the intake port, and the chamber formed between it and the curved casing wall is about to be cut off from the exhaust port by the adjacent rotor apex. Fig. 5(B) shows the rotor turned clockwise 60°, the crankshaft advanced a half turn, the crescent-shaped chamber at maximum volume, and the intake port about to be covered by the rotor. The charge is undergoing compression in fig. 5(C), and in fig. 5(D) it is fully compressed and is ignited by the spark plug. The expansion or power-producing period is under way in fig. 5(E) and is completed in fig. 5(F) as the shaft completes its second turn with the exhaust port partially uncovered by the rotor apex. An additional turn of the shaft is necessary to push the products of combustion out through the exhaust port, return the rotor to its initial position in fig. 5(A), and complete the cycle. Similar cycles are carried out simultaneously in the chambers adjacent to the other two rotor flanks, thus completing one power impulse for each turn of the shaft and making the unit equivalent to a single-cylinder two-stroke-cycle conventional engine.

The rotor and its gears and bearings are lubricated and cooled by circulating oil through the hollow rotor. The apex vanes are lubricated by a small amount of oil added to the fuel in proportions as low as 1 to 200. Water is circulated through cooling jackets in the casing, the entrance to which is located adjacent to the spark plug where the temperature tends to be highest.

Maintaining pressure-tight joints by suitable seals at the apexes and on the end faces of the rotor appears to be the major design problem. Radial sliding vanes are fitted in slots at the three apex edges and kept in contact with the casing by expander springs. The end faces of the rotor are sealed by arc-shaped segmental rings fitted in grooves close to the curved edges of the rotor and pressed against the casing by flat springs. Adjacent ring segments are fitted into recesses in a small cylindrical member at each end of the apex vanes. Each end is also slotted along one ordinate to receive the inner edge of the radial vane. The horseshoe-shaped outer ends of these six cylindrical plugs are pressed against the casing face by springs and serve to prevent leakage past the ends of the axial vanes by joining the ends of the three sealing elements that meet at each of the six corners of the rotor.

Major advantages of the NSU-Wankel engine are small space requirement and low weight per horsepower, smooth and vibrationless operation, quiet running and low-cost manufacture because of mechanical simplicity. Absence of inertial forces from reciprocating parts and elimination of spring-closed poppet valves permit operation at much higher speed than is practical for reciprocating-piston engines. This is fortunate because shaft speed must be high for optimum performance. Induction of fresh charge and exhaust are more effective because the ports are opened and closed more rapidly than are poppet valves, and gas flow through them is almost continuous. Heat transfer and the resulting cooling requirement are low because the jacketed surface is small. Fuel economy is claimed to be at least as good as that of conventional engines, providing knock-free combustion with a wider range of permissible fuels.

Engine Types.—A wide variety of internal-combustion engines resulted from the requirements of the extensive range of possible applications. Although these various engines differ radically in size, weight per unit of power developed, arrangement of components and details of operation, they are basically similar. The only exception is the gas turbine, which is fundamentally different from the piston engine. The only clearly defined separation into groups having similar design and operating characteristics is consequently the classification as piston types and gas turbines. Classification of reciprocating engines into sharply defined groups is difficult because of overlapping of characteristics.

The greatest differences among engines are those that arise in adapting the engines to various applications; *i.e.*, automotive, aviation, marine and stationary, with a wide range of special types included within each. Of these, the automotive is most important because of the number of engines in use and the total power developed. This group includes all engines used to propel land vehicles ranging from passenger automobiles to railway locomotives, with intermediate truck, tractor and bus types.

Perhaps the most striking of the differences between two types of engines are those that distinguish the locomotive diesel from the airplane engine. The most widely used locomotive diesel engine is a 16-cylinder V type engine weighing approximately 31,000 lb. and having a rating of 1,500 h.p. One of the best of the World War II airplane engines was also a 1,500-h.p. unit, a 12-cylinder V type engine weighing about 1,200 lb. The locomotive engine is two and one-half times as long as the airplane engine and weighs more than 25 times as much—a contrast that seems to indicate inefficiency in the locomotive engine. Such, however, is not the

case; both engines are of excellent design. The locomotive engine is a heavy-duty type designed for millions of miles of operation, much of the time at full throttle, and its crankshaft turns at less than one-third the speed of the airplane engine shaft, whereas the military aviation engine is designed for high specific output with a useful life of perhaps 700 hr.

The stationary power plant engine is usually even heavier than the locomotive type of the same cylinder dimensions and develops less power per unit of size and weight because of its durability and very low crankshaft speed. Falling between these two extreme types, aviation and stationary, are motor-vehicle engines of a wide variety, some of which are designed to operate at very high crankshaft speeds in order to reduce their size, cost and weight. It is evident that the important apparent differences among engines are largely traceable to the use for which they are intended.

Differences in operation of engines also permit grouping certain types that have functional similarities. The most important differences result from: (1) whether the operating cycle is completed in two or four strokes of the piston; (2) whether the charge is ignited by an electric spark or by compression temperature; and (3) whether the fuel burned is gas, gasoline or fuel oil. Such differences are also superimposed on those that adapt the engines to their intended use, thereby multiplying the specification items necessary to define each type. For example, a stationary power plant engine may be a diesel or compression-ignition type, operating on the two-stroke cycle, and burning a heavy fuel oil, or it may be a spark-ignition engine, burning natural gas on the four-stroke cycle. These two engines appear to be very much alike because of the predominant effect of both being stationary power plant engines, but close examination reveals important mechanical and functional differences.

Engine Structure.—The following description of general engine construction is intended to indicate the essential components of an engine and to introduce and clarify the nomenclature of the various parts. The four-stroke-cycle automobile engine is used as the basic type. Fig. 6 shows a cross section of a typical cylinders-in-line automobile engine with the important parts indicated.

The main structural member of all automotive engines is the cylinder block, which usually extends upward from the centre line of the bearings that support the crankshaft to the junction with the cylinder heads. The block serves as the structural framework of the engine and carries the mounting pads by which the engine is supported in the chassis. Large stationary power plant engines and marine engines are built up from a foundation or bedplate and have upper and lower crankcases that are separate from the cylinder assemblies. The cylinder block of the automobile engine is an alloy casting with appropriate machined surfaces and threaded holes for attaching the cylinder head, main bearings, oil pan and other units. The crankcase is formed by the portion of the cylinder block below the cylinder bores and the stamped metal oil pan that forms the lower enclosure of the engine and also serves as the lubricating oil reservoir or sump.

The cylinders are openings of circular cross section that extend through the upper portion of the block with interior walls bored and honed to form smooth, accurate bearing surfaces. The cylinders of heavy-duty engines are usually fitted with removable liners made of metal more wear-resistant than that used in the block casting. Two arrangements of cylinders are in common automotive use—the vertical or in-line type and the V type. The in-line engine has a single row of cylinders extending vertically upward from the crankcase and aligned with the crankshaft main bearings. The V type has two rows of cylinders, usually forming an angle of 60° or 90° between the two banks. V-8 engines are usually of the 90° type. Fig. 7 shows a cross-sectional view of an automobile engine of the high-speed valve-in-head V-8 type. Large stationary-, marine- and locomotive-type engines with 12 cylinders commonly have 60° V's because of their firing interval, whereas 16-cylinder engines similarly have their cylinder banks at 45°. The conventional angle between the planes of the cylinder banks is 360° divided by half the total number of cylinders.

A passage is bored lengthwise in the block for the camshaft which operates the valves, and a gear or chain compartment for the camshaft drive from the crankshaft is formed between the front or rear end of the block and a cover plate. A bell housing is formed at the rear of the cylinder block to enclose the flywheel and provide for attachment of a transmission housing. Water jackets are formed around the cylinders with suitable cored connecting passages for circulation.

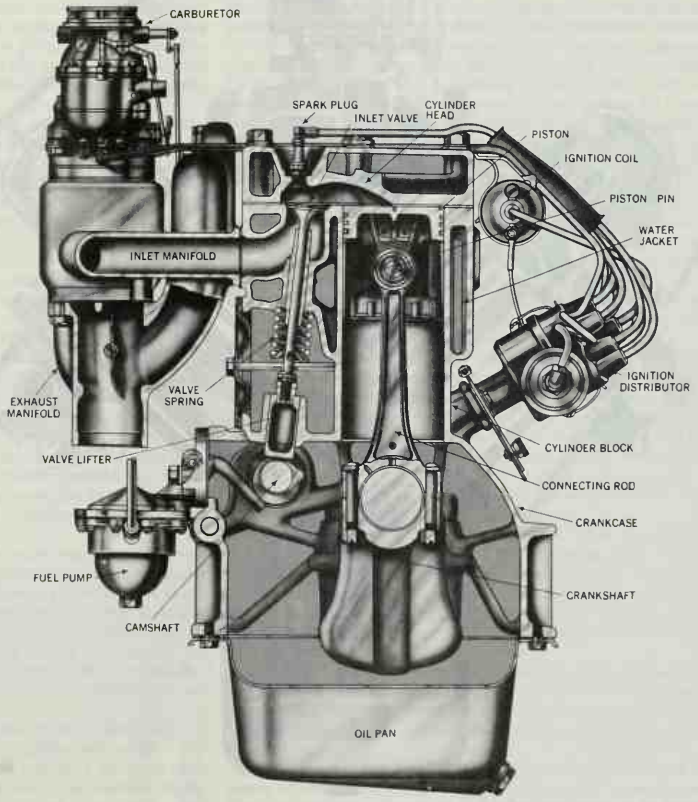

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FIG. 6.—CROSS SECTION OF L-HEAD AUTOMOBILE ENGINE

The design of the cylinder block is affected by the location of the valves of the four-stroke-cycle engine and by the provision of cylinder ports in the two-stroke-cycle type. The overhead-valve engine that largely replaced the L-head type has its valves entirely in the cylinder head, and no portion of the valve system is carried in the cylinder block except the camshaft and the cam followers or valve lifters that bear against the cams. The cylinder block of the L-head engine is extended to one side of the cylinder bores, as shown in fig. 6, with the valve seats and passages for inlet and exhaust, together with the valve guides, formed in this extension of the block. The cylinder head then becomes merely a water-jacketed cover, providing threaded locations for the spark plugs and with its underside so profiled that a combustion chamber of desired size and shape is formed above each cylinder bore. The depth of the combustion chamber in the L-head engine is increased above the valves and the space is thinned out above the piston at the side opposite the valves to permit control of combustion of the last portion of the charge to burn. The shape of the space forming the combustion chamber when the piston is at its closest approach to the cylinder head and the volume contained therein in relation to the piston displacement volume are extremely important in their effects upon performance. The cylinder head of the valve-in-head engine is narrower and deeper, and carries the valve seats, valve guides and valve ports.

The size of the combustion chamber relative to the volume displaced by the piston establishes the compression ratio of the engine. The piston displacement of a cylinder is the volume swept by the piston during one stroke and is equal to the cross-sectional area of the cylinder multiplied by the length of the stroke. The larger volume above the piston at the lowest point in its stroke divided by the combustion-chamber volume when the piston is at its highest point is the compression ratio of the engine. The larger volume is the sum of the piston-displacement volume and the combustion-chamber volume. The compression ratio may thus be expressed as the ratio of the sum of the piston-displacement volume and the combustion-chamber volume to the combustion-chamber volume. This ratio establishes the fraction of the original volume of the charge as inducted that the charge occupies at the end of the compression stroke and also the resulting compression pressure. Compression ratio is the most important factor affecting the theoretical efficiency of the engine cycle. Because increased compression ratio is the most basic way to improve efficiency, the automobile engine has tended toward higher compression ratios.

The pistons are cup-shaped cylindrical castings of steel or aluminum alloy. The upper, closed end, called the crown, forms the lower surface of the combustion chamber and receives the force applied by the combustion gases. The outer surface is machined to fit the cylinder bore closely and is grooved to receive piston rings that seal the gap between the piston and the cylinder wall. The rings are larger in diameter than the cylinders and gaps are provided so that they can be compressed into the bore. In the upper piston grooves are plain compression rings that prevent the combustion gases from blowing past the piston. The lower rings are vented to distribute and limit the amount of lubricant on the cylinder wall. Piston pin bosses are cast in opposite sides of the pistons and hardened steel pins fitted into these bosses pass through the upper ends of the connecting rods. The piston pins are frequently clamped in the eyes of the connecting rods, although floating pins (prevented by spring clips from contacting the cylinder walls) are sometimes used.

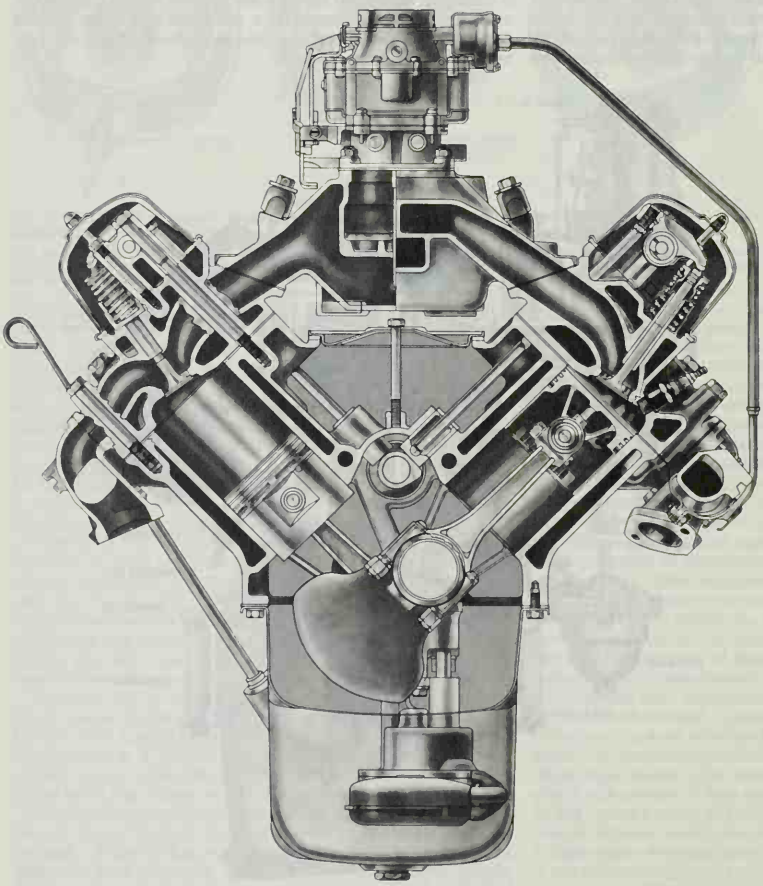

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FIG. 7.—TRANSVERSE SECTION OF A V-8 ENGINE

A forged steel connecting rod of I section connects the piston to a throw (offset portion) of the crankshaft and converts the reciprocating motion of the piston to the rotating motion of the crank. The lower, larger end of the rod is bored to take a precision bearing insert lined with Babbitt or other bearing metal and closely fitted to the crankpin. V type engines usually have opposite cylinders staggered sufficiently to permit the two connecting rods that operate on each crank throw to be side by side. Some larger engines employ fork-and-blade rods with the rods in the same plane and cylinders exactly opposite each other.

Each connecting rod in an in-line engine or each pair of rods in a V type engine is attached to the throw of the crankshaft. Each

throw consists of a crankpin with a bearing surface, on which the connecting rod bearing insert is fitted, and two radial cheeks that connect it to the main journals that turn in the main bearings supported by the cylinder block. Sufficient throws are provided to serve all the cylinders, and the angles between them equal the angular firing intervals between the cylinders. The throws of a six-cylinder, four-stroke-cycle crankshaft are thus spaced 120° apart; those of an eight-cylinder engine are 90° apart because half of the cylinders fire in each turn of the crankshaft. The position of each throw along the shaft depends upon the firing order of the cylinders. Firing sequence is chosen to distribute the power impulses along the length of the engine to minimize vibration. Consideration is also given to the fluid flow pattern in the intake and exhaust manifolds. The standard firing order for a six-cylinder engine is 1–5–3–6–2–4, which illustrates the practice of alternating successive impulses between the front and rear halves of the engine whenever possible. Balancing is further improved by adding counterweights to the crankshaft to offset the eccentric masses of metal in the crank throws.

The crankshaft design also establishes the length of the piston stroke because the radial offset of each throw is equal to half the stroke imparted to the piston. The ratio of the piston stroke to the cylinder bore diameter is an important design consideration. No logical basis for the establishment of this ratio existed in the early years of engine development and a range from unity to one and one-half was used by the different manufacturers. As engine speeds increased, however, and it became apparent that friction horsepower increased with piston speed rather than with crankshaft rotating speed, a trend toward short-stroke engines started. Strokes were shortened to as much as 20% less than the bores.

Other advantages are gained by short strokes, such as providing more cylinder-head surface for valves in proportion to piston displacement and decreasing the height of the engine. Engines with low stroke-bore ratios have slightly greater horsepower, principally because of reduced friction losses.

The arrangement of the throws of the crankshaft for a multicylinder four-stroke-cycle engine is chosen with regard to the firing order of the cylinders and the angular interval between firing impulses. The average number of degrees through which the crankshaft must turn between successive firings is found by dividing 720° (the two turns completed by the crankshaft during a complete cycle) by the number of cylinders. A two-cylinder, four-stroke-cycle engine thus fires at 360° intervals and the second piston must arrive at top dead centre exactly one full turn after the first piston. If the two cylinders are in line, the two throws of the crankshaft must be 360° apart. They will then lie in the same plane with their crankpins exactly in alignment and the two pistons will move up and down in unison. This is just the opposite of the requirement for mechanical balance that one piston rise as the other descends. If that plan were followed, however, the two pistons would arrive at their dead centre points 180° apart and consequently be in firing position 180° apart on the same turn of the crankshaft. The firing intervals would then be 180° and 540° instead of uniformly 360°, and both cylinders would fire during one crankshaft turn with neither firing during the next turn. Under these conditions torque would not be uniform and the engine would not run smoothly.

From the requirements for the two-cylinder engine a general rule for the layout of the throws of four-stroke-cycle multicylinder crankshafts can be expressed. Regardless of the number of cylinders, two pistons must arrive at top dead centre in unison so that a second cylinder is ready to fire exactly 360° after each cylinder fires. Half of the cylinders then will fire during each turn of the crankshaft. To follow this rule, there must be an even number of cylinders in order that there may be pairs of cylinders whose pistons move in unison.

An eight-cylinder engine fires each time its crankshaft makes a quarter turn if the intervals between impulses are equal. The crankshaft for an eight-cylinder in-line engine is designed with each of its eight throws a quarter turn away from another throw. All of the throws then lie in two planes that intersect at right angles. A V-8 engine must have its banks 90° apart so that two pistons can arrive at top dead centre at each quarter turn of the crankshaft.

For best lengthwise balance, the cylinders whose pistons are in phase are the first and last cylinders of an in-line engine, the second and next to the last, continuing in that order with crank throws that are in alignment equidistant from the centre of the engine. This is illustrated in the four-cylinder crankshaft of fig. 8.

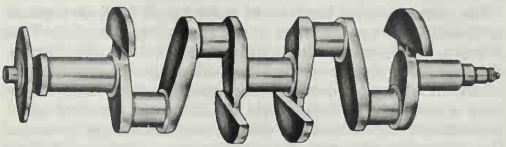

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FIG. 8.—CRANKSHAFT FOR A FOUR-CYLINDER ENGINE

With two pistons reaching their uppermost positions simultaneously, there are two possible firing orders in the four-cylinder in-line engine, four in the six-cylinder engine, and eight in the eight-cylinder engine. The final choice is based on the distribution of the impulses along the length of the engine, which affects intake manifold functioning and the lengthwise rocking tendency of the engine. The firing order selected is then established by designing the camshaft so that the inlet and exhaust valves open in the selected sequence.

Cylinder Charging.—All internal-combustion engines convert heat into mechanical energy or power. First the combustible charge is introduced. One hundred or more cubic feet of air must be pumped into an engine per hour for each horsepower developed in order to supply the oxygen needed for combustion. The engine must function as an air pump as the first step in its operation. Cylinder charging includes ridding the cylinder of the spent products of combustion of the previous cycle to make room for the next charge. This is done by direct pumping on the exhaust stroke of the four-stroke-cycle engine or by pushing out the exhaust gases ahead of the fresh-air charge pumped in by the scavenging pump or blower of the two-stroke-cycle engine.

Pumping in the four-stroke engine involves an exhaust valve held open during the upward stroke that follows the power stroke and an inlet valve that is held open during the next downstroke. The valves remain open for longer periods than the corresponding piston strokes to provide time for opening and closing, and to utilize the inertia effects of the high velocity at which the gases flow. The opening and closing points of both valves are therefore displaced somewhat from dead centre.

The exhaust valve is timed to open at approximately 50° before the piston reaches its bottom dead centre on the power stroke. This occurs well before the power stroke is completed in order to provide a blow-down period to release the gases from the cylinder and reduce the pressure approximately to exhaust-manifold pressure by the end of the power stroke. Some useful work near the end of the power stroke is lost by this early valve opening, but additional negative work during exhaust is avoided by not requiring the piston to ascend against back pressure.

The exhaust valve remains open about 15° after top dead centre, allowing the kinetic energy of the outflowing gases to reduce the pressure within the combustion chamber below atmospheric pressure and decrease the exhaust gases remaining to dilute the next charge. The partial vacuum created is also useful in permitting the inlet valve to be opened early and the flow of fresh charge into the cylinder to be started sooner.

The inlet valve opens about 15° before top dead centre to take advantage of the pulling effect at the end of the exhaust period. About 30° of overlap results from the advanced inlet opening and delayed exhaust closure. The overlap period helps scavenge the chamber.

The inlet valve is not closed until 50° or more after bottom dead centre to utilize the kinetic energy of the rapidly moving charge. The optimum inlet closure point depends upon the speed at which the engine is to operate, low-speed engines having much earlier

closure than high-speed types. The greater the departure of all valve events from the dead centre points, the higher the speed at which the power of the engine will reach its peak. So-called racing cams are designed with all opening events earlier than normal and all closing events, especially inlet closure, later than in conventional timing. This causes the engine to develop higher maximum power at a higher speed, but low-speed performance is impaired.

The extent to which the cylinder is filled with fresh air depends upon such factors as the speed of the engine, the size of the flow passages, valve size, amount of lift and timing. The effectiveness of the charging process of the four-stroke engine is expressed as volumetric efficiency, defined as the weight of fresh air inducted per cycle as compared with the weight required to fill a volume equal to the piston displacement at outside temperature and pressure. The volumetric efficiency of an automotive engine usually rises to a peak of slightly more than 80% at about half the rated speed of the engine and then decreases considerably at higher speed. This change in air charge per cycle with engine speed is reflected in proportionate changes in the torque or turning effort applied to the crankshaft and causes the power the engine can deliver at full throttle to reach a maximum as engine speed increases. At speeds above this peaking speed the air charge inducted per cycle falls off so rapidly that less power is developed than at lower speeds. The inability of the engine to induct a full charge of fresh air at high speeds limits the power output of the engine.

Supercharging is employed to permit the engine to maintain its charging effectiveness at high crankshaft speeds and at high altitudes. Supercharged engines differ from conventional engines in that a pump or blower is provided to raise the pressure of the air supplied to the cylinders, increasing the weight of charge. The approximately 50% loss in power suffered by unsupercharged engines at 20,000 ft. altitude can be largely restored; it is also possible to more than double the power of an engine by supercharging.

Supercharging is more applicable to compression-ignition engines than to spark-ignition types. Increased charge density and temperature, resulting from supercharge, increase the tendency for combustion knock or roughness in the spark-ignition engine and necessitate an undesirable decrease in compression ratio or the use of a fuel of higher antiknock quality. The diesel engine, however, benefits from supercharging because of improved ignition. Four-stroke-cycle diesel engines are commonly supercharged to improve their competitive position with the two-stroke diesel and spark-ignition engines.

The supercharging blower may be geared to the crankshaft, in which case the power consumed in driving it is added to the friction loss of the engine. The turbocharger employs a gas turbine operated by the exhaust gases to drive a centrifugal blower. The turbocharged engine not only gains increased power capacity, but also operates at improved fuel economy. Turbochargers are used extensively to supercharge the larger four-stroke cycle engines and have found some application on two-stroke-cycle diesel engines. Airplane engines are usually supercharged both by geared blowers and by turbochargers to provide the large pumping capacity needed at high altitude.

Performance.—The performance of an engine is expressed in terms of power, speed and fuel economy. The three quantities are evaluated with a dynamometer, a laboratory device that applies a controllable load in the form of resistance to the turning of the crankshaft, and also measures the torque exerted at the shaft coupling. The resistance imposed by the dynamometer may be so adjusted that the desired engine speed is established at any throttle position. It is thus possible to run the engine at various speeds throughout its operating range, to maintain these operating conditions continuously and to measure the precise loads and speeds at which each run is made. Additional test equipment permits measurement of the exact quantity of fuel consumed as well as the duration of the runs. Certain types of dynamometers also make it possible to determine the amount of power consumed by frictional and other losses in the engine. From these data the power-speed-economy relationships can be calculated, performance plotted and much information regarding the suitability of the engine for its purpose derived. More thorough tests are sometimes conducted to determine the durability of the engine, quietness and smoothness of operation, accelerating ability, cooling requirements, fuel limitations, air consumption, etc.

The power produced by an engine is expressed in horsepower, a unit established by James Watt in rating his steam engines. He tested several horses to determine the rate at which they could work and decided that 33,000 foot-pounds (ft.-lb.) per minute was a liberal unit, representing appreciably more work than an ordinary horse could do for a short time. A foot-pound is equivalent to lifting a mass of one pound a distance of one foot. A horsepower therefore represents the work done in one minute by some force (in pounds) acting through some distance (in feet) such that the product is 33,000.

When the power developed is measured by means of a dynamometer or similar braking device, it is called brake horsepower or shaft horsepower. This is the power actually delivered by the engine and is therefore the capacity of the engine. Engineers are also interested in the power developed in the combustion chamber of the engine, which is greater than the delivered power because of friction and other mechanical losses. This power loss, called the friction horsepower, can be evaluated by "motoring" the engine with a suitable dynamometer when no fuel is being burned. The power developed in the cylinders can then be found by adding the friction horsepower to the brake horsepower. This quantity is the indicated horsepower of the engine, so called from an instrument known as the engine indicator, used to measure the pressure on the pistons and thus calculate the power developed in the cylinders. The engine indicator traces curves of pressures acting on the piston versus volume changes in the cylinder caused by piston motion during the strokes that correspond to one cycle.

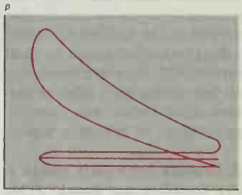
Fig. 9 shows a pressure-volume diagram for an internal-combustion engine. From this diagram it is possible to evaluate the average pressure which, if it acted constantly on the piston for one stroke, would produce a motivating force equal to that produced by the varying pressure during an entire cycle. It is thus possible to find the net force in pounds that would act on the piston during one power stroke if this average pressure is expressed in pounds per square inch and multiplied by the area of the piston in square inches. This pressure is called the mean effective pressure (m.e.p.) of the cylinder and is defined as the constant pressure that would do the same amount of work as the varying pressure in the entire cycle. This quantity can be used to calculate the power developed in the cylinder by substituting in the equation

$$\text{indicated horsepower} = \frac{PLAN}{33{,}000}$$

where P is the mean effective pressure in pounds per square inch, L is the length of the stroke in feet, A is the piston area in square inches and N is the number of cycles completed per minute.

Friction horsepower is caused for the most part by friction between cylinder walls and pistons and by the work done in pumping the charge into and out of the cylinders. In addition to these large mechanical losses, smaller amounts of power are spent in operating the valves, driving the cooling fan, generator, ignition system, and the oil and coolant pumps.

Mechanical efficiency is defined as brake horsepower in per cent of indicated horsepower. Friction horsepower increases rapidly with increased piston speed, but is fairly independent of load. The mechanical efficiency of an engine, therefore, increases with load at constant speed but decreases with increased speed at constant throttle and is usually between 70% and 90% within the normal operating speed range.



BY COURTESY OF O. C. CROMER

FIG. 9.—ENGINE INDICATOR DIAGRAM FOR FOUR-STROKE-CYCLE INTERNAL-COMBUSTION ENGINE (*see* TEXT FOR FURTHER INFORMATION)

A quantity called brake mean effective pressure (b.m.e.p.) is obtained by multiplying the mean effective pressure of an engine

by its mechanical efficiency. This is a commonly used index expressing the ability of the engine, per unit of cylinder bore, to develop useful pressure in the cylinders and deliver power. If the power delivered is increased by any change other than an increase in speed or cylinder dimensions, its b.m.e.p. increases proportionately. The b.m.e.p. reflects any improvement in power output and permits a comparison of effectiveness of engines differing in size that cannot be made from their power outputs alone.

Horsepower is calculated by measuring the torque applied to the dynamometer in restraining the rotation of the crankshaft. Torque is equal to the product of a force and the perpendicular distance from the centre of rotation to the line of action of the force. Torque may be expressed in units of pound-feet, and careful distinction must be made between this unit and the foot-pound used in measuring work. Work may or may not be done by the application of torque. If the torque is insufficient to overcome resistance to turning, then no work is done, but, if the torque causes rotation, work done per turn equals the product of the force acting and the circumstance of the circle to which the force is tangent.

Dynamometer data include the length of the dynamometer arm, which is the torque arm or radius R (in feet) of the torque circle, the reaction of the scales W (in pounds) which is the force acting, and the number of turns n made by the crankshaft of the engine per minute. By Watt's definition, brake horsepower may be calculated as follows:

$$\text{brake horsepower} = \frac{2\pi RWn}{33{,}000}$$

This equation may be simplified by dividing the denominator by 2π and substituting torque, t, for RW, which results in the equation

$$\text{brake horsepower} = \frac{tn}{5{,}252}$$

The brake mean effective pressure may be calculated from the dimensions of the engine and the brake horsepower as determined from dynamometer data. The equation, indicated horsepower = $PLAN/33{,}000$ may be converted to brake horsepower by substituting b.m.e.p. for indicated mean effective pressure. This substitution is possible because b.m.e.p. bears the same relationship to m.e.p. as brake horsepower does to indicated horsepower. If b.m.e.p. is expressed by P_b, the equation becomes

$$\text{brake horsepower} = \frac{P_bLAN}{33{,}000}$$

The power determined by a test of an automobile engine is affected by such test conditions as atmospheric pressure, temperature and humidity, exhaust back pressure, and the number of accessories attached to the engine. Automobile manufacturers in the U.S. adopted a standard code of rating tests for establishing the advertised horsepower of their engines. The conditions specified by this code are favourable to the engine and yield higher horsepower ratings than would be developed in normal operation. This practice establishes another, slightly smaller horsepower unit for engine-rating purposes. In 1906 the Royal Automobile club in Great Britain adopted an approximate horsepower rating based upon an assumed piston speed of 1,000 ft. per minute and a b.m.e.p. of 67 lb. per square inch. The rating is expressed by the equation

$$\text{horsepower} = \frac{B^2N}{2.5}$$

where B is the cylinder bore in inches and N is the number of cylinders. The same formula was adopted in the U.S. by the Association of Licensed Automobile Manufacturers and became known as the ALAM rating. Piston speeds and brake mean effective pressures of modern engines are much higher than assumed in the formula, and it is not unusual for the manufacturer's rating to exceed the horsepower calculated by this formula by a factor as large as five. This formula is widely used as a basis for licences and taxes.

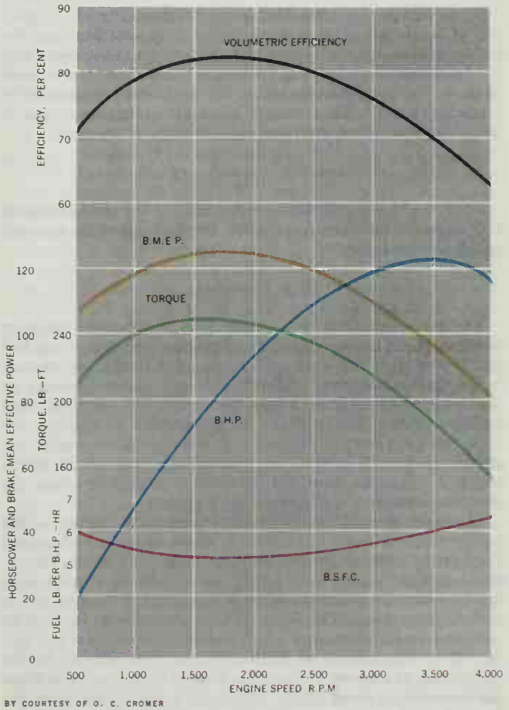
The horsepower unit in Europe, where the metric system is used, is slightly smaller than Watt's unit. It evaluates a horsepower as work done at the rate of 4,500 kilogram-metres per minute and is 98.6% as large as the English and U.S. unit.

To compare engines of differing size, it is customary to divide the horsepower by the piston displacement, arriving at the power per unit of cylinder size. Either the engine speed or m.e.p. must be increased to increase the power per cubic inch of piston displacement. Because it is difficult to maintain effective cylinder charging and low friction losses at high speed, high specific power output as expressed by this unit represents a desirable design achievement. The usual range is from $\frac{1}{2}$ to $\frac{7}{8}$ of a horsepower per cubic inch of displacement for automobile engines and much less for slow-speed engines. Some high-performance automobile engines are available that operate at very high speed and are rated at slightly more than one horsepower per cubic inch. Supercharged engines develop considerably more than this.

The fuel economy of an engine is expressed in pounds of fuel per brake horsepower per hour. This quantity is found by weighing the fuel burned during a test run at constant operating conditions, converting the weight to pounds per hour and dividing by the brake horsepower developed during the test. The rate of fuel consumption evaluated by this unit is called the brake specific fuel consumption (b.s.f.c.). The fuel economy of an automobile engine is usually best at about half its rated speed and at three-quarters or more load.

Performance curves are drawn for a variable-speed engine by plotting power and economy against engine revolutions per minute. Fig. 10 is a set of such performance curves for a typical automobile engine. These curves show that both the torque and the b.m.e.p. curves follow the changes in cylinder-charging effectiveness reflected in the volumetric efficiency curve. The brake horsepower curve is also seen to reach a peak at the speed above which the torque and b.m.e.p. are decreasing more rapidly than the speed is increasing.

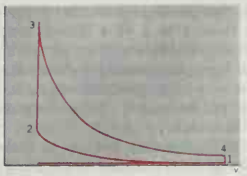
Theoretical Cycles.—Improvements in engine performance were brought about by studying and analyzing the results of tests.



BY COURTESY OF O. C. CROMER

FIG. 10.—PERFORMANCE CURVES FOR TYPICAL AUTOMOBILE ENGINE

The engine indicator diagram permits theoretical analysis when simplified by substituting conventional standard processes of thermodynamics for its irregular and unsystematic curves. The indicator diagram of fig. 9 then appears as a summation of four processes as shown in fig. 11, the diagram of the ideal Otto cycle.



BY COURTESY OF O. C. CROMER

FIG. 11.—THEORETICAL OTTO-CYCLE PRESSURE-VOLUME DIAGRAM (*see* TEXT FOR FURTHER INFORMATION)

The lower loop of the indicator diagram that reflects the intake and exhaust strokes is eliminated by the assumption that these strokes are carried out at atmospheric pressure. Further simplifying assumptions are that air is the working fluid throughout the cycle and its properties are those of atmospheric air. The cycle then starts with atmospheric conditions at the point 1. The processes 1–2 and 3–4 both follow the theoretical paths for isentropic compression and expansion resulting from the assumption that no heat is transferred to or from the working fluid. The pressure at each point along these curves is established by the perfect gas relationship pv^K = a constant, wherein p is the absolute pressure of the air, v is the volume occupied by a unit mass of air and K is the ratio of the specific heat at constant pressure to that at constant volume, which may be taken as 1.4 for atmospheric air. The processes 2–3 and 4–1 are carried out at constant volume, since it is assumed that energy is gained by combustion from 2 to 3 instantaneously and that rejection of energy to the exhaust from 4 to 1 is also instantaneous.

The theoretical or ideal Otto cycle may be analyzed by evaluating the energy quantities in the equation for efficiency, η:

$$\eta = \frac{\text{net work}}{\text{energy supplied}} = \frac{Q_{\text{in}} - Q_{\text{out}}}{Q_{\text{in}}} = \frac{Q_{2-3} - Q_{4-1}}{Q_{2-3}}$$

Thermodynamic relationships permit the evaluation of Q (quantity of heat) between 2 and 3 in terms of specific heat and the temperatures at the two points, and similarly for Q between 4 and 1. An expression in terms of the temperatures at the four corners of the indicator diagram is thus obtained. Further application of thermodynamics yields a simpler and more useful expresssion in terms of the maximum and minimum volumes of the cycle

$$\eta = 1 - \frac{1}{(V_1/V_2)^{K-1}}$$

The ratio V_1/V_2 is the compression ratio of the cycle or engine. Substituting r, the compression ratio, for V_1/V_2 gives the theoretical efficiency equation

$$\eta = 1 - \frac{1}{r^{K-1}}$$

The theoretical Otto-cycle efficiency is the thermal efficiency of the cycle and is equivalent to the fraction of the energy supplied that is converted into work. No losses other than those inherent in the cycle are involved and only a perfect engine operating on that cycle could attain such high efficiency. The practical losses include failure to burn the fuel completely and to duplicate the cycle processes exactly, the heat transferred from the engine, the friction losses and so on. The thermal efficiency of the actual engine is calculated from test data and is much lower than the theoretical efficiency, perhaps only half as large.

The brake thermal efficiency of an engine is the fraction of the energy supplied in the fuel that is available as brake horsepower. The heating value of the fuel must be known to evaluate the energy supplied. Fuel is tested for heating value in a calorimeter that transfers the heat released by burning a known weight of the fuel to a known weight of water. The amount of heat required to raise one pound of water 1° F. is called a British thermal unit (B.T.U.). The number of British thermal units released by the combustion of a pound of fuel is its heating value Q_H. For gasoline this value is about 20,000 B.T.U. per pound. The power developed by the engine can also be expressed in British thermal units because 1 B.T.U. is equivalent to 778 ft.-lb. of work. One horsepower delivered continuously for one hour is thus equivalent to 2,545 B.T.U. Since brake specific fuel consumption is the pounds of fuel burned in one hour to deliver one horsepower, brake thermal efficiency may be expressed as

$$\text{brake thermal efficiency} = \frac{2{,}545}{\text{b.s.f.c.} \times Q_H}$$

The curves of fig. 12 show the theoretical Otto-cycle efficiency and the approximate brake thermal efficiency of an engine operating on the Otto cycle for compression ratios from 2 to 20. The approximate ranges of the compression ratios of spark-ignition engines and diesel engines are also indicated. The upper portion of the spark-ignition engine range is attainable only by engines operating with natural gas or extreme high-octane fuels.

The cycle described by Diesel in his 1893 patent differs from the Otto cycle only in that energy is supplied more slowly, at a rate such that the increase in volume during combustion exactly compensates for the tendency of the pressure to rise. Energy is thus supplied at constant pressure instead of at constant volume as in the Otto cycle. Combustion in an engine following this cycle occurs more gradually during the early part of the power stroke instead of instantaneously at the dead centre point, and the path 2–3 (fig. 11) is horizontal instead of vertical. The efficiency of the Diesel cycle is usually expressed as

$$\eta = 1 - \frac{1}{r^{K-1}}\left[\frac{r_c^K - 1}{K\,(r_c - 1)}\right]$$

where r_c is the cutoff ratio or ratio of expansion during combustion V_3/V_2. The value of the bracketed factor exceeds unity for any practical cutoff ratio and the subtractive term is consequently greater than that of the Otto-cycle expression, $1/(r^{K-1})$. The efficiency of the Diesel cycle is thus lower than that of the Otto cycle for the same compression ratio by an amount that increases with the energy input. An engine operating on this cycle would then be more efficient at a light load than at a heavier load.

The value of K in theoretical efficiency expressions is higher for air than for fuel vapours. It can be shown by calculating K for various air-fuel ratios that the efficiencies of Otto and Diesel cycles are higher when air is considered as the working fluid and become lower as fuel is included in the charge. It is evident that lean mixtures are theoretically more efficient than those containing more fuel.

However, combustion in the spark-ignition engine is slowed down as the mixture is leaned beyond the maximum-economy ratio, causing combustion to depart from the constant-volume Otto cycle and tend toward the less efficient constant-pressure Diesel cycle. On

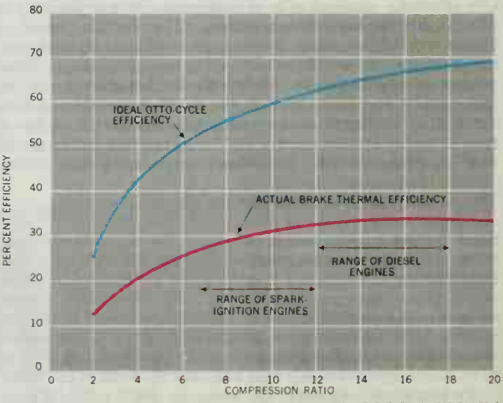


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FIG. 12.—CURVES SHOWING EFFECT OF COMPRESSION RATIO ON THEORETICAL OTTO-CYCLE EFFICIENCY AND APPROXIMATE BRAKE THERMAL EFFICIENCY

the other hand, the compression-ignition engine is inherently a lean-mixture engine, and its combustion is not retarded by excess air. The higher efficiency of the diesel engine arises from its higher compression ratio and its higher air-fuel ratio. High-speed diesel engines follow the Otto cycle.

These theoretical analyses indicate three factors affecting efficiency. First, the compression ratio should be as high as is practical; second, combustion should be as rapid as is practical; and third, the air-fuel ratio should be high. These criteria favour the principle of compression ignition because the compression ratio is not limited by knocking and preignition as it is in the spark-ignition engine, and high air-fuel ratios will not impair combustion. As shown by the curves of fig. 12, the important gains in efficiency from increased compression ratio were made when ratios were increased from about 4 to 7; further increases above 12 result in proportionately less theoretical improvement and very little actual gain in thermal efficiency.

Charge Requirements.—The amount of oxygen necessary to support the combustion of fuel may be readily calculated if the chemical ingredients are known. It is customary to assume that gasoline is a mixture of many hydrocarbons that average approximately the same as octane, C_8H_{18}. With this assumption it is possible to write the combining equation for gasoline and air as

$$C_8H_{18} + 12.5\ O_2 + 47.5\ N_2 \rightarrow 8\ CO_2 + 9\ H_2O + 47.5\ N_2$$

For one pound of fuel, the equation reads

$$1\text{ lb. } C_8H_{18} + 3.51\text{ lb. } O_2 + 11.66\text{ lb. } N_2 \rightarrow 3.09\text{ lb. } CO_2 + 1.42\text{ lb. } H_2O + 11.66\ N_2$$

or

$$1\text{ lb. } C_8H_{18} + 15.17\text{ lb. air} \rightarrow 16.17\text{ lb. products of combustion}$$

These equations represent the proportion for complete combustion. The imperfections of the combustion chamber, incomplete mixing of the fuel and air, insufficient time for the reaction to go to completion and other unfavourable factors prevent perfect combustion.

Empirically, a slightly lean mixture, about 16 to 1, is more economical than the 15.17 to 1 ratio shown in the equation above. The excess air helps complete combustion, but less power is developed because a smaller amount of fuel is contained in the leaner mixture. Further leaning of the mixture is uneconomical because the burning rate of the charge is decreased. A somewhat rich mixture, about 12 to 1, yields more power than the theoretical chemical ratio. This is because the additional fuel introduces more chemical energy to the combustion chamber and, although combustion is slightly less complete, the net energy release is increased. Further enrichment reduces the power output by decreasing the burning rate.

Combustion.—In the spark-ignition engine the high temperature of the electric spark ignites the tiny portion of the charge in the immediate vicinity of the spark-plug gap. This first presents a somewhat spherical surface of flame to the surrounding layer of charge, causing it to ignite and expose the next layer to an igniting flame. As the charge is exposed to this flame front, layer by layer, the sphere grows until it spans the combustion chamber. The flame front then advances radially across the chamber and, if undisturbed, progressively burns the remainder of the charge. Normal combustion, then, depends on the density of the charge, the speed at which the flame front advances and the area of the flame surface. Although the entire process is completed in a fraction of a second, there is no instant during the process when any sizable portion of the charge is burning. Energy is thus released uniformly and without violence.

As each portion of the charge burns, the volume of space occupied by the products increases. This expansion of the burned portion of the charge compresses the unburned portion into a smaller volume than it originally occupied. A compression of this sort is accompanied by an increase in temperature. The temperature and density attained by the last portion of the charge may be so great that the entire remaining charge will self-ignite with explosive violence. Such almost instantaneous combustion sets up a high-frequency pressure wave within the gases. The resulting vibration of the chamber walls produces an audible knock. When knocking occurs, the engine is noisy and the temperature of the combustion chamber rises rapidly, accompanied by a loss in power. Only the last portion of the charge, that farthest from the spark plug, is involved in this irregularity, and knocking will not occur if the fuel can resist self-ignition until it is burned in the normal manner by the arrival of the flame front. This phenomenon is called normal knock and can be avoided by using fuel resistant to self-ignition or by improvements in combustion-chamber design.

Fuels.—To suit the needs of a modern engine a gasoline must have the volatility for which the fuel system of the engine was designed, and antiknock quality, as indicated by its octane number, sufficient to avoid knock under normal operation. Other specifications must also be met, but volatility and octane number are the most important. Starting quality, vapour-locking tendency, rapidity of warm-up, acceleration, crankcase dilution, power and completeness of combustion are some of the performance factors affected by volatility. The octane number of a gasoline determines whether knock-free operation is possible in a given engine. The size and structural arrangement of the molecules principally determine the octane number of a gasoline.

Large straight-chain molecules react most readily, whereas small compact molecules are most resistant to chemical reactions. The size of the molecules and, to a lesser extent, their structure also affect the volatility of the fuel. The smallest hydrocarbon molecule, that of methane, has the lowest boiling point, −259° F., and it is so volatile that it exists as a gas at atmospheric conditions. It is also resistant to self-ignition and therefore has high antiknock quality. Cetane is an example of the opposite extreme. It has a long straight chain with 16 carbon atoms, reacts with oxygen at relatively low temperature and boils at 536° F. Intermediate compounds, of which gasoline is composed, have molecules with from 5 to 12 carbon atoms and a boiling point range from about 100° to 400° F.; the molecules are largely of branched-chain and ring structure that vary considerably in chemical activity.

The octane-number rating of gasoline is based on its knocking tendency and the effect of increased compression ratio on the knocking tendency of an engine. A special single-cylinder test engine with adjustable compression ratio is used to compare the knock intensity of the gasoline under test with that of blends of two reference fuels.

Iso-octane, a branched-chain hydrocarbon of high antiknock quality, is blended with normal heptane, a straight-chain hydrocarbon that knocks severely, in varying proportions by volume. The engine is operated on the gasoline and the compression ratio adjusted until a knock of a standard intensity, as established by the test code, is indicated by a knock meter. Reference blends of octane and heptane are then successively substituted for the gasoline at the same compression ratio until the same knock intensity is again indicated. The per cent of octane in the reference blend that causes the same knock intensity is the octane number of the gasoline.

A 100-octane fuel has the same knocking tendency as iso-octane and one that behaves the same as normal heptane is a 0-octane fuel. An 80-octane fuel has the same antiknock quality as a mixture of 80% iso-octane and 20% normal heptane. It should be noted that no quality other than knocking tendency is indicated by octane number.

The petroleum chemists have devised refining techniques whereby molecules of compact structure and desirable antiknock characteristics are produced in much larger amounts from crude oil. Additives, principally tetraethyl lead, also contribute to knock resistance.

For many years gasoline and other volatile portions of crude oil were thrown away for want of a market, but the advent of the automobile made it desirable to increase the yield of gasoline. Only 20% of the crude could be made into gasoline up to 1914, and its octane number was only 50. By 1922 improved refining processes and the addition of tetraethyl lead had increased the yield to 30% and the octane number to 65. Thermal cracking, whereby large, low-volatility molecules are broken up, came in 1925, increasing the yield to more than 40% and the octane number to 75. In 1935

the cracking process was improved with catalysts to raise the octane number to 85. Higher octane ingredients are made by converting highly volatile constituents into gasoline, making 100-octane fuel and nearly 45% yield possible. (*See* also PETROLEUM.)

Combustion Chambers.—While the petroleum industry was improving gasoline, engine manufacturers were improving combustion and fuel utilization. Modern gasoline engines resulted from the mutual adaptation of fuels and engines. The knowledge that higher compression ratio increases efficiency and output encouraged designers to increase compression ratios as rapidly as the fuel limitations and the engine requirements could be matched.

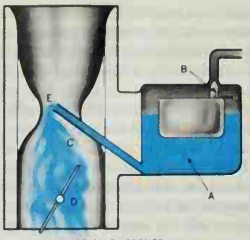
Combustion control in the spark-ignition engine is largely a matter of avoiding preignition and knocking. Self-ignition of the charge before the spark occurs is one of the extreme effects of increased compression ratio. Normal knock is a self-ignition effect, but it occurs after most of the charge has burned normally.

The tendency for a mixture of gasoline vapour and air to self-ignite increases with its temperature, density and the length of time that it is held at self-ignition temperature. In high-compression engines the temperature and density before ignition are much higher than in low-compression engines. The problem in attaining smooth, normal combustion becomes one of burning the charge by the normal flame front before it ignites spontaneously. Much depends upon resistance to self-ignition or octane number, but the severity of the conditions before and during combustion can be lessened by careful design of the combustion chamber and the induction system, as well as by improved cooling of surfaces that are contacted by the charge. The time element in self-ignition is important and can be controlled and shortened in several ways. The more compact the combustion chamber is made the shorter the distance that the flame front must travel to burn all of the charge. Locating the spark plug more centrally shortens flame travel to the boundary of the chamber. Increased engine speed causes more rapid combustion. All of these time-shortening factors are employed in reducing the octane requirements of engines.

The L-head engine was the first to which the principle of turbulence, charge concentration near the spark plug, shortened flame travel and quench area remote from the plug were applied. Sir Harry Ricardo conceived the L-head combustion chamber design shown in fig. 6 shortly after World War I, and it was widely adopted for engines of this type. The "squish turbulence," created by the close approach of the far side of the piston to the cylinder head, feeds most of the charge that would otherwise have been last to burn into the flame front and permits the remainder to be kept cool by proximity to the metal walls. As compression ratios are increased, however, reduced depth of the passage from the valves to the cylinder bore restricts the flow of charge, causing decreased power at high speeds. Manufacturers were forced to adopt the valve-in-head design, in which the charge flows directly into the main cylinder chamber from the valves, for engines with compression ratios higher than eight.

Two types of high-compression combustion chambers were developed for valve-in-head engines, the wedge type and the hemispherical type. All practical designs may be considered as modifications of these two types. The combustion chamber shown in fig. 7 is of the wedge type. The spark plug is located at a deep section, so that as much charge as possible can be burned initially, and tapers away to a region thinned out to gasket thickness designed to act as a quench area and to promote squish turbulence.

Carburetion.—The gasoline carburetor is a device that proportions fuel into the air stream as it flows into the intake manifold. A simple carburetor is shown diagrammatically in fig. 13. Gasoline is maintained in the float chamber A by the float-actuated valve B at a level slightly below the outlet of the jet C. Air flows downward through the throat, past the throttle valve D and into the intake manifold. A venturi throat is formed by the reduced diameter at E, and acceleration of the air through this smaller passage causes a decrease in pressure proportional to the amount of air flowing. This decrease in throat pressure results in fuel flow from jet C into the air stream. Any increase in air flow caused by change in engine speed or throttle position will increase the pressure differential acting on the fuel and cause more fuel to flow.



BY COURTESY OF O. C. CROMER

FIG. 13.—DIAGRAM OF SIMPLE ELEMENTARY CARBURETOR (*see* TEXT FOR FURTHER INFORMATION)

The volume ratio of air to fuel established by the throat and fuel jet sizes will be maintained with increased flow, but the weight of fuel per pound of air increases because the air expands to a lower density as the throat pressure decreases. This enriching tendency necessitates the inclusion of a compensating device in a practical carburetor. Carburetor design is further complicated by the need for an enriching device to provide a maximum-power ratio at full throttle, a choke to facilitate starting a cold engine, an idling system to provide the special needs of light-load operation and an accelerating device to supply additional fuel while the throttle is being opened.

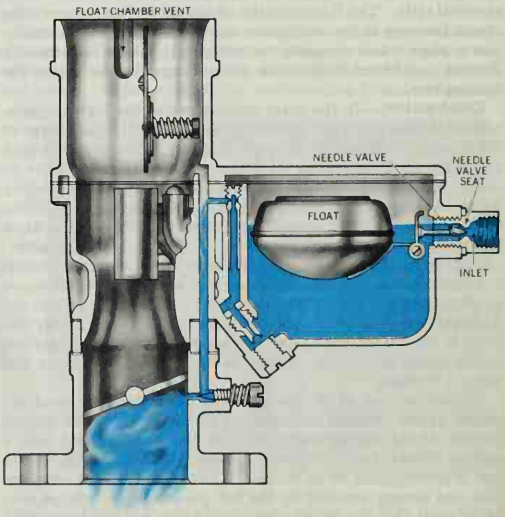
Fig. 14, a sectional view of a typical automobile engine carburetor, shows the throttle in the idling position and indicates the flow of fuel through the idling circuit which draws fuel from the top of the float chamber and delivers it past an idle-adjusting screw to a point in the carburetor outlet just below the throttle valve. When the throttle valve is closed a high vacuum exists on the manifold side of the valve which causes the idling circuit to function.

As the throttle is opened the vacuum at the idle fuel outlet is so reduced that no fuel flows from it and fuel is supplied only by the main jet. The small air flow at the venturi throat when the throttle is closed is insufficient to cause fuel to flow from the main jet, but this jet comes into operation as the throttle is opened.

Fig. 15 shows the carburetor functioning normally with the throttle more fully open and fuel flowing through the main metering jet and into the air stream at the main discharge jet. The high-speed bleeder admits air into the fuel passage as a means of preventing enrichment at increased rates of flow.

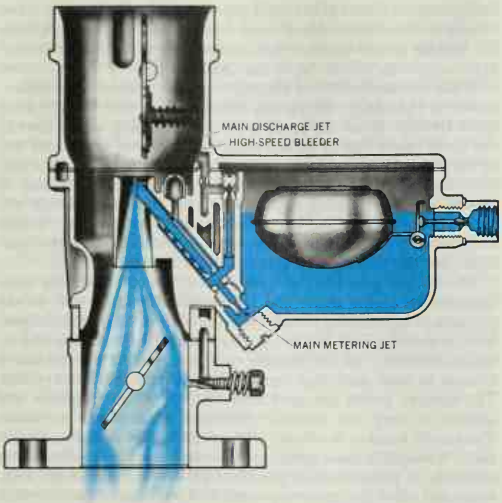
Only the idling and main-fuel circuits are shown in these two views. Accelerating and full-throttle enriching devices and other components are present but not visible.

Modern automobile carburetors are further complicated by the provision of two or four throats, commonly called barrels, as a means of improving charge distribution over the wide range from



BY COURTESY OF BENDIX AVIATION CORP

FIG. 14.—SECTIONAL VIEW OF A CARBURETOR SHOWING FLOAT MECHANISM AND LOW-SPEED CIRCUIT



BY COURTESY OF BENDIX AVIATION CORP.

FIG. 15.—SECTIONAL VIEW OF A CARBURETOR SHOWING MAIN METERING SYSTEM

idling to full throttle. A dual carburetor has two throats, each of which supplies half of the cylinders. A four-barrel carburetor is in effect a small dual carburetor at less than half throttle and a large carburetor when the throttle is more fully opened and the other two barrels are cut in.

Fuel Injection.—Gasoline-injection systems were available for airplane engines before World War II and were extensively used. The performance of engines with this equipment was excellent, but the much greater cost of fuel-injection systems as against carburetors limited their application. Efforts to simplify and cheapen fuel-injection equipment without impairing performance yielded multicylinder pumps that could compete in cost with the four-barrel carburetor. Gasoline-injection equipment has been designed in a variety ranging from distributor systems employing a single pump for all of the cylinders to multipump types.

The principal advantages of gasoline injection over the carburetor are: (1) improved fuel economy because of more accurate fuel and air proportioning; (2) greater power because of elimination of charge heating; (3) elimination of inlet icing; and (4) more uniform and direct delivery of charge to the cylinders.

The SU fuel-injection pump, developed in England, is representative of the direct gasoline-injection systems available. An injection nozzle, located just outside each intake valve, is supplied with fuel at pressures up to 200 p.s.i. in metered quantities while air is entering the cylinder. The basic metering principle is to vary the amount of gasoline delivered to each cylinder in accordance with engine speed, manifold pressure and temperature of the air in the inlet manifold. This is known as speed-density metering and assumes that the rate of air flow to an engine is nearly proportional to its speed and to the density of the air as it enters the cylinders.

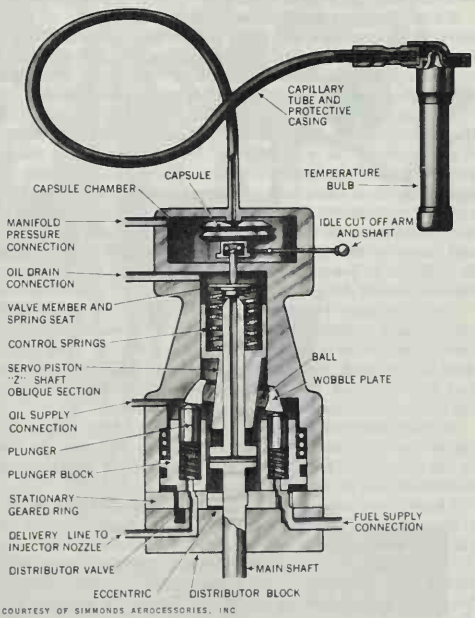
A cross section of the SU fuel-injection pump is shown in fig. 16 with the important parts identified. Pump bores, each with a closely fitted plunger, are spaced in a circle about the central drive shaft with their axes parallel with the shaft. The plungers are held against a wobble plate by springs and receive their reciprocating motion from the angle through which the plate rocks as the main shaft rotates. This angle, in turn, depends upon the axial displacement of the servo piston and its oblique extension through the plate. Upward motion of the piston displaces the plate laterally, causing its ball-section upper surface to assume a more level position, thereby shortening the strokes of the plungers.

The axial location of the servo piston is established by the intake-manifold pressure in the capsule chamber above and the gas pressure within the capsule created by the temperature bulb located in the manifold.

When the throttle at the entrance to the inlet manifold is opened the manifold pressure rises, compressing the capsule, moving the pin shaft upward and opening the oil supply so that pressure is applied under the servo piston. The wobble plate is then tilted at a greater angle and pumping capacity is increased. Higher manifold pressure causes the piston to assume a higher position and higher air temperature lowers it, delivering fuel in proportion to the air density.

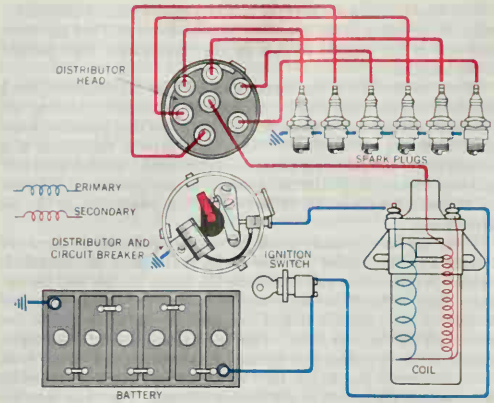
There are half as many pump barrels and plungers as there are cylinders in the engine and the pump shaft turns at crankshaft speed. A distributor valve between the pump barrels and the delivery lines to the injectors is moved so that the fuel is delivered to half of the cylinders during one turn of the shaft and to the other half on the next turn. Thus each pump delivers fuel alternately to two cylinders that fire one crank turn apart. Fuel flows to each injector nozzle for 180° of crankshaft rotation, timed to occur within the period of inlet-valve opening. Fuel flow into the pump chambers on the plunger upstrokes is also controlled by the distributor valve.

Ignition.—Two types of electric ignition systems are used, the magneto and the battery and coil systems. They are similar in principle but the magneto is self-contained and requires only the spark plugs and connecting wires to complete the system, whereas the battery and coil system involves several separate components. Fig. 17 shows a six-cylinder battery, coil and distributor system. The circuit consists of a 6- or 12-v. battery, one terminal of which is grounded while the other leads through a switch to the primary winding of the coil, and then to the circuit breaker where it is again grounded. Current flows through the primary circuit when the switch is closed and the points of the circuit breaker are in contact. Rotation of the circuit-breaker cam opens and closes the primary circuit. The secondary circuit starts with the secondary winding of the coil (several thousand turns of very fine wire), one end of which is connected to the primary winding while the other leads



BY COURTESY OF SIMMONDS AEROCESSORIES, INC

FIG. 16.—SECTIONAL VIEW OF SU GASOLINE-INJECTION PUMP FOR SPARK-IGNITION ENGINES



BY COURTESY OF INTERNATIONAL HARVESTER CO.

FIG. 17.—DIAGRAM OF BATTERY AND COIL IGNITION SYSTEM FOR AUTOMOBILE ENGINES

to the rotor of the distributor which acts as a rotary switch, selecting the spark plugs to be placed in the circuit. Each plug is connected to one of the outer terminals of the distributor to receive an electrical impulse in proper sequence.

When the breaker points are in contact, current flows through the primary winding, creating a magnetic field that crosses the turns of the secondary winding. Separation of the breaker points by the cam breaks the circuit and causes the magnetic field to collapse rapidly, inducing a voltage across each turn of the coil. A total potential as high as 20,000 v. is built up in the secondary winding at the instant that the breaker points open and is applied to the rotor of the distributor. This rotor is in phase with the circuit-breaker cam so that it establishes a circuit to one of the spark plugs just before the breaker points separate, and then moves on to the terminal leading to the next spark plug in firing sequence.

A considerable voltage is also induced in the turns of the primary winding when the breaker points open, causing a spark to occur at the points just as they are separating. This spark tends to burn and pit the breaker points, so a capacitor or condenser is connected across the circuit breaker to protect the points.

A spark plug consists of a threaded steel shell that screws into the cylinder head and an insulator that contains a central electrode. A gap of .02 to .04 in. is provided between the central electrode and the ground electrode attached to the shell of the plug. The central electrode extends through the insulator to receive the secondary wire from the distributor, and the circuit is completed from the ground electrode through the metal of the engine to the battery and thence to the coil. The voltage established at the coil must be sufficient to jump the spark-plug gap against the resistance of the compressed charge.

The spark must be precisely timed in the cycle of the engine; the timing is established by the gear train connecting the breaker cam to the camshaft and thence to the crankshaft. The optimum time for the spark to occur varies both with the load on the engine and with its speed, necessitating an advance mechanism to vary the timing with changes in operating conditions.

A centrifugal flyweight device advances the spark timing as the engine speed increases and a vacuum device advances the timing as the throttle is closed, utilizing the increase in intake manifold vacuum as load decreases.

Ideally, the charge should burn instantaneously while the piston is at top dead centre. Time required for the flame to travel across the combustion chamber permits the crankshaft to turn through 30° to 40° during combustion. Highest thermal efficiency is attained when the pressure rise in the cylinder resulting from combustion is half completed by the end of the compression stroke. The start of the combustion pressure rise is then 15° to 20° before top dead centre on the compression stroke and the peak of firing pressure occurs at the same angle after top dead centre. Any change in operating conditions that slows flame travel and lengthens the burning period requires that the spark be timed earlier to permit combustion still to be at top dead centre.

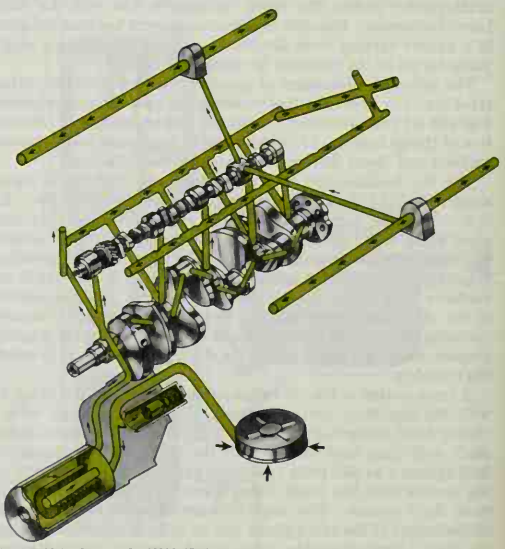
If the octane number of the gasoline fails to meet the requirements of the engine, knock can be minimized with slightly later spark timing. When the spark is retarded, burning occurs later in the cycle (more fuel is burned early in the power stroke and less in the last part of the compression stroke). The piston then will have descended slightly before the last portion of the charge is burned and the resulting expansion of the remaining charge will prevent it from reaching knock temperature and density. Power and efficiency suffer if spark timing is retarded beyond the optimum, but this loss is preferable to knock.

The increased severity of ignition requirements resulting from increases in engine speed and compression ratio as well as the problem of maintaining circuit-breaker points of high-mileage commercial vehicles have led to the development of transistorized ignition systems. In the simpler of these systems the transistor is used to start and stop the current through the primary coil. The breaker points are used only to trigger the transistor and operate at very low current with little maintenance attention. The circuit breaker is entirely eliminated in a more elaborate system. A magnetic pulse generator is incorporated in the distributor assembly to produce timed electrical pulses that trigger the transistor and allow the primary current to flow through the coil when each spark is required.

Lubrication.—The purpose of lubrication is to interpose a film to reduce friction that would quickly destroy rubbing parts. The lubrication system must continuously replace the films that separate the parts.

The lubricant commonly employed is refined from the nonvolatile fractions of crude oil after the fuels are removed. Its viscosity must be appropriate for each engine and the oil must be suitable for the severity of its operating conditions. Oils are improved with additives that reduce oxidation, inhibit corrosion and act as detergents to disperse deposit-forming gums and solid contaminants.

A system of SAE (Society of Automotive Engineers) numbers, from 5 to 50, is used to designate oil viscosity; the lower the number, the lighter the body of the oil. The letter W after the number indicates that the oil is suitable for winter use. W oils are rated



BY COURTESY OF CHRYSLER CORPORATION

FIG. 18.—ENGINE LUBRICATION SYSTEM FOR 1964 CHRYSLER CORPORATION V-8 ENGINES

according to their flow rates at 0° F.; other types are tested at 210° F. Multirated oils, such as 10W–30, contain additives that oppose the tendency to thicken at low temperature, making the same oil satisfy both summer and winter requirements.

Automobile engine lubricants are also classified according to the severity of the operating conditions for which they are suitable by the code letters ML, MM, and MS. The ML grade is recommended for light-duty service, MM for moderately severe conditions, and MS for severe conditions. These oils differ principally in the types and quantities of additives. Diesel engines operate under unusually severe conditions and require special lubricants that are similarly classified as DG, DM and DS. A DG oil is equivalent to an MS oil.

Oil filters, if regularly serviced, can remove solid contaminants from crankcase oil. However, chemical reactions may form liquids that are corrosive and damaging. Depletion of the additives also limits the useful life of lubricating oils.

The lubrication system is fed by the oil sump that forms the lower enclosure of the engine. Oil is taken from the sump by a pump, usually of the gear type, and delivered under pressure to a system of passages or channels drilled through the engine. In some instances a full-flow filter runs the length of the engine between the pump and the main oil passage. In other engines bypass filters continuously bleed off a small quantity of oil and return the filtered oil to the sump.

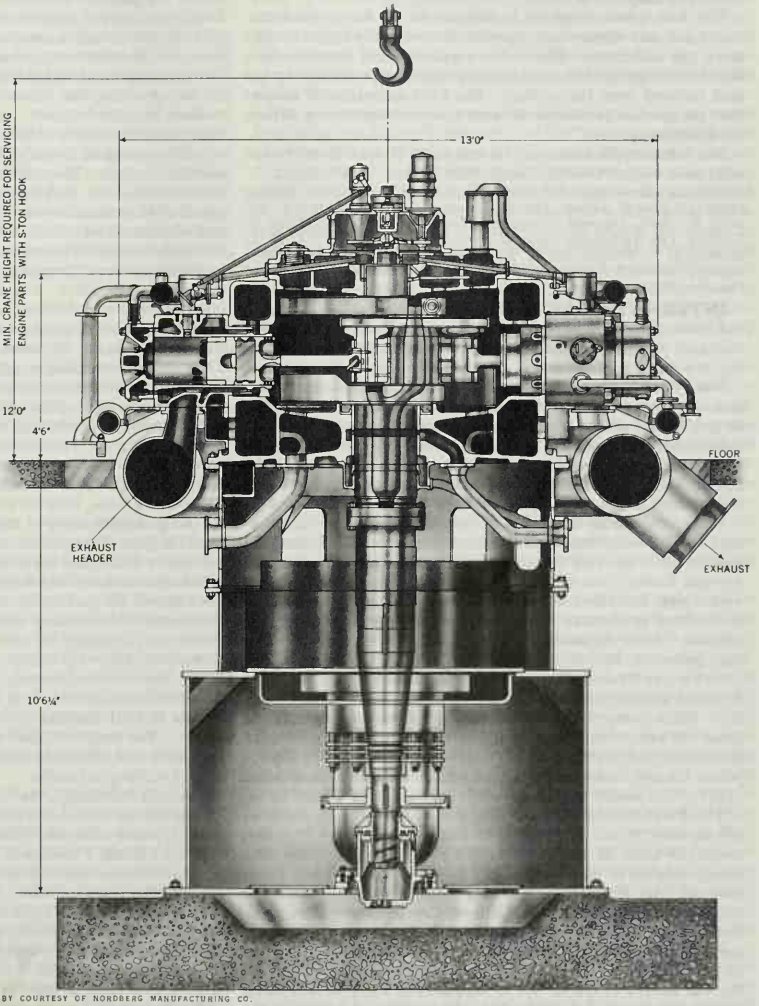
Oil is supplied under pressure to crankshaft and camshaft main bearings. Adjacent crank throws are drilled to enable the oil to flow from the supply at the main bearings to the crankpins. Leaking oil from all of the crankshaft bearings is sprayed on the cylinder walls, cams, and up into the pistons to lubricate the piston pins. Additional passages intersect the cam follower openings and supply oil to hydraulic valve lifters when used. A spring-loaded pressure-relief valve maintains the pressure at the proper level.

Gas Engines.—Gas is burned in some large stationary power plant engines and automotive types used in trucks, buses and tractors. Stationary gas engines are used extensively where natural gas is available at favourable prices. Also, natural gas used with spark-ignition engines is more resistant to self-ignition than other fuels, permitting higher compression ratios to be used with greater efficiency and economy. Low-cost power is important in these engines, and brake thermal efficiency exceeding 40% is reported, more than is claimed for other engines.

Large stationary power plant engines were originally of the cylinders-in-line type, but space requirements and cost considerations led to the development of V type and horizontal radial engines.

Fig. 19 shows a cross section of a radial engine with a vertical crankshaft directly connected to a direct-current generator. This is a two-stroke-cycle engine with 12 cylinders and 14-in. bore and 16-in. stroke, developing up to 2,125 h.p. and 1,500 kw. at 400 r.p.m. Scavenging and charging are through two sets of ports in opposite sides of the cylinder walls and poppet valves are eliminated.

Salient features of the radial engine are high power output per unit of floor space, low weight, high mechanical efficiency because of few bearings, single-throw crankshaft and nearly perfect balance. Operation on natural gas with spark-ignition at a compression pressure of 275 p.s.i. and a maximum cylinder pressure of 650 p.s.i. is possible because of the high antiknock quality of the fuel and the lean mixtures used. Gas is supplied at 20 p.s.i. to mechanically actuated gas inlet valves located above the inlet ports in the top surfaces of the cylinders that admit the fuel into the stream of scavenging air brought in from headers below the floor. Spark plugs at the top and bottom of each cylinder head fire at slightly different angles before top dead centre. A unique feature of this engine is the restraining linkage that prevents rotation of



BY COURTESY OF NORDBERG MANUFACTURING CO.

FIG. 19.—SECTIONAL VIEW OF A RADIAL SPARK-IGNITION GAS-BURNING ENGINE

the single master bearing to which the inner ends of the connecting rods are pinned.

Automotive gas engines cannot operate on natural gas under low pressure because of the large volume of gas that would have to be carried. These engines can use propane-butane mixtures that are liquefied by compression to about 185 p.s.i. These gases are important by-products of petroleum refinery operation and are available as liquefied petroleum gases (LPG). Gases with similar liquefying characteristics also are taken from the ground at petroleum wells. The supply of these gases exceeds demand and, particularly in oil-producing regions, they are priced below the cost of gasoline.

The necessity of storing LPG in steel bottles or cylinders designed to withstand 250 p.s.i. is a serious handicap; nevertheless excellent combustion characteristics for spark-ignition engines make LPG attractive. High antiknock quality, high heating value per pound and high volatility give LPG excellent performance characteristics. The antiknock quality permits compression ratios several units higher than are practical with gasoline, resulting in better efficiency and economy.

The fuel system requires, in addition to the heavy steel container, pressure regulators, a vaporizer heated by the engine coolant and a gas carburetor. The fuel is supplied to the vaporizer as a liquid and is prevented from freezing during vaporization by the heat received from the coolant. The LPG carburetor is simpler than the gasoline carburetor because special compensating devices are unnecessary.

See AIRCRAFT PROPULSION; AUTOMOBILE; DIESEL ENGINE; and references under "Internal-Combustion Engine" in the Index.

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INTERNATIONAL, THE. The International is a federation of working-class parties aiming at the transformation of the capitalist societies into socialist commonwealths and their unification in a world federation.

The Forerunners.—The idea of a democratic, egalitarian International sprang from the ideas of the French Revolution of 1789. In England it inspired the London Corresponding society, the first independent working-class movement, founded by the shoemaker Thomas Hardy in Jan. 1792, and in France the *Conspiration des Égaux*, the first essentially socialist movement, founded by François Noel Babeuf in Nov. 1795.

Suppressed during the period of reaction, the idea of establishing a revolutionary democratic International revived in France and England after the July revolution in 1830. Auguste Blanqui and Armand Barbès founded the secret *Société des Saisons* in 1837, with which the *Bund der Gerechten*, formed with branches in Switzerland by German artisans one year before, was closely associated. After an unsuccessful rising engineered by both these associations in 1839, the leaders of the *Bund der Gerechten* moved from Paris to London where, under the guidance of Karl Marx and Friedrich Engels, they revived it as the Communist League (1847–52). Marx wrote the *Communist Manifesto* as its program. At about the same time there emerged from the Chartist movement the Society of Fraternal Democrats (1846–50), directed by George Julian Harney, and after it expired, the International association (1855–59), founded by the poet and Chartist leader Ernest Jones.

The First International.—The First International, set up at a mass meeting at St. Martin's hall in London on Sept. 28, 1864, under the name of International Workingmen's association, was merely another of the attempts to establish a working-class International. Its founders were Henry Louis Tolain, an influential leader of Paris workers' organizations, George Odger, then president and later secretary of the London Trade council, and a number of the most powerful British trade union leaders. Marx had no part in planning the meeting though he was invited to attend it. He was elected as one of the 32 members of the general council and at once assumed its leadership. In a statement known as the "Inaugural Address" he proclaimed that "the great duty" of the working class was to conquer political power and "to vindicate the simple laws of morals and justice, which ought to govern the relations of private individuals, as the rules paramount to the intercourse of nations." The provisional rules which he drafted declared that the economic emancipation of the workers was the great end to which every political movement should be subordinated, and that the purpose of the association was "the protection, advancement, and complete emancipation of the working classes." Five years later, at its Basel congress in 1869, the International adopted socialist aims: the transformation of the private property of the land and forests into public ownership and the socialization of the mines and railways.

The First International assumed the character of a highly centralized party, based primarily on individual members, organized in local groups, which were integrated in national federations, though some trade unions and associations were affiliated to it collectively. Its supreme body was the congress (held at Geneva in 1866, Lausanne 1867, Brussels 1868, Basel 1869 and The Hague 1872). A general council elected by the congress had its seat in London and served as the executive committee; it met weekly, appointed corresponding secretaries for each of the national federations, issued statements of policy, organized collections for the financial support of strikes in various countries and was instrumental in preventing the importation into Great Britain of foreign workers as strikebreakers.

Its congresses were chiefly concerned with the formulation of principles designed to guide the working classes in their social and political struggle. They discussed the role of trade unions and cooperatives in the working-class struggle for emancipation; the question of nationalization of key industries and of the land; the attitude toward war; and, in particular, the role of the state as an instrument of social transformation and the question of workers' participation in parliamentary elections as a means of conquering the power of the state. The attitude of the International to these questions was laid down in resolutions. It was a unifying force of labour, stimulating the growth of trade unions and infusing into the working classes the sense of international solidarity.

Its renown, spreading rapidly all over Europe and the U.S., was, however, out of proportion to its numerical strength and financial resources. In the public eye, the first International appeared to be a formidable power with millions of members and almost unlimited resources. However, the hard core of its individual members exceeded hardly a score of thousands and its annual income scarcely £100. Yet it was held responsible for the waves of strikes that swept France, Belgium and Switzerland in 1868, and above all, for instigating the rising of the Paris Commune in March 1871. In fact, its general council in an "address" to the French workers, drafted by Marx, had appealed to them to abstain from any revolutionary action, and the Paris section of the International had indeed played no part in the insurrection that brought about the Commune. In Germany and Austria adherence to the International was prosecuted as high treason even before the rise of the Commune; after its fall, it was proscribed also in France and Spain. Jules Favre, French minister of foreign affairs, and the German chancellor Otto von Bismarck proposed to the European powers in 1871 that the International be outlawed by concerted action. The proposal failed only because the British government rejected it and refused to expel the foreign members of the general council residing in London.

From its beginnings, the First International was riven by conflicting schools of socialist thought: Marxism, Proudhonism, Blanquism (whose adherents joined it only in 1871) and, above all, Mikhail Bakunin's version of anarchism which dominated its Italian, Spanish and French-Swiss federations. Over the clash between Marx's centralized socialism and Bakunin's anarchism the first International split at its Hague congress in 1872. In order to prevent the Bakuninists from gaining control of the International, the congress, prompted by Marx, moved its headquarters to New York; there it lingered on until it was formally disbanded at the Philadelphia conference in July 1876.

The Bakuninists, assuming the leadership of the International,

held congresses at Geneva in 1873, Brussels 1874, Berne 1876 and Ghent 1877. At the Ghent congress the Social Democrats broke away because their motion to restore the unity of the International was rejected by the Anarchist majority. The Anarchists failed, however, to keep the International alive. After the London congress in 1881 it ceased to represent an organized movement. Yet the Anarchist ideology retained its hold among the French, Italian and Spanish trade unions until it finally perished as a social force in the Spanish civil war (1936–39).

The Second International.—The formation of Socialist parties on a national scale in various countries started only after the end of the first International. The Social Democratic party of Germany was formed by the unification of Ferdinand Lassalle's and August Bebel's groups in 1875, the French Socialist party in 1879, the Dutch and Danish Social Democratic leagues in 1878. The Spanish Socialist party appeared in 1879, the British Social Democratic federation in 1880, the Belgian Labour party in 1885, the Swiss Social Democratic party in 1888, the Austrian Social Democratic party in 1889, the Norwegian and Swedish Social Democratic parties in 1887 and 1889, and beyond the Atlantic the Socialist Labor party of North America in 1877.

The Second International, founded at a congress in Paris in 1889, was, unlike the first, based on membership of national parties and trade unions only. It was not a centralized organization, like the first, but rather a loose federation which, only 11 years after its foundation set up an executive body: the International Socialist bureau (I.S.B.) with Émile Vandervelde of Belgium as its president and Camille Huysmans, also of Belgium, as its secretary. Its headquarters were in Brussels. The founding congress in Paris in 1889 was followed by congresses in Brussels 1891, Zürich 1893, London 1896, Paris 1900, Amsterdam 1904, Stuttgart 1907, Copenhagen 1910 and Basel 1912. At that time the International represented the Socialist parties of all European countries, the U.S., Canada, Argentina and Japan, with an aggregate voting strength of nearly 9,000,000.

Although the Second International had no mandatory power, it was recognized by its member parties as their highest moral authority. Thus the debates and decisions of the congresses influenced to a great degree the ideology, methods and policy of the European labour movement. The Second International stood for parliamentary democracy and finally expelled the Anarchists (at the London congress in 1896) who opposed it. It rejected, however, the theory of gradual achievement of socialism and co-operation with nonsocialist parties in office, as advocated by Jean Jaurès, and reaffirmed the Marxist doctrine of the class struggle and the inevitability of social revolution.

Its main concern was, however, the prevention of war. It embarked on a powerful campaign against armaments and the danger of war; it demanded the introduction of compulsory courts of arbitration for the settlement of disputes between nations, the reduction of armaments with total disarmament as the ultimate aim, the abolition of secret diplomacy and the establishment of parliamentary responsibility in matters of foreign policy. Yet it rejected the use of the general strike for warding off an imminent danger of war, propagated by Keir Hardie, Édouard Vaillant and Jaurès. However, in a resolution drafted by V. I. Lenin, Rosa Luxemburg and Julius Martov and adopted by its Stuttgart congress in 1907, it pledged its member parties in belligerent countries to utilize the social and economic crisis brought about by war to promote social revolution.

But the power grouping in World War I confronted the Socialist parties in the belligerent countries with a dilemma. Each party felt that its own country was threatened by conquest of a formidable reactionary power: Germany and Austria by tsarist despotism, France, Great Britain and Belgium by autocratic Prussian militarism. Without hesitation all of them (except the Russian and Serbian Socialists) voted for the war credits in their respective parliaments and supported their governments in the war effort. Thus the fundamental principle of international working-class solidarity was superseded by national solidarity.

This attitude was, however, soon opposed by a growing minority within these parties; in Germany there was a split over this issue. In an attempt to restore international working-class solidarity, Italian and Swiss Socialists convened a conference of "Internationalists," held at Zimmerwald, Switz., in Sept. 1915, which, in a manifesto, rebuked the majority Socialists for straying from the principles of the International and appealed to the workers to struggle for the immediate cessation of the war and for peace negotiation based on the principle: "No annexations, no indemnities." Another conference of the same groups met at Kienthal, Switz., in April 1916.

The Socialist minorities opposing the war were divided in their attitude toward the nature of the action to be taken. The "Centre"—led in Germany by Hugo Haase and Karl Kautsky, in France by Jean Longuet, in England by Ramsay MacDonald and in Austria by Friedrich Adler—insisted on the general concept of socialist internationalism and the resumption of the class struggle. The "Left," led by Lenin, who had attended both the Zimmerwald and Kienthal conferences, demanded the launching of revolutionary propaganda among the workers and soldiers and the "transformation of the imperialist war into civil war." He opposed the revival of the Second International, which had ceased to function when war broke out, and suggested the creation of a new International. He failed, however, to carry the conference; it set up an International Socialist commission charged with the task of cooperating with the I.S.B. in galvanizing the Second International into action for a speedy peace.

The outbreak of the Russian Revolution in March 1917, and Pres. Woodrow Wilson's declaration of the "fourteen points" issued when the U.S. entered the war in April 1917, imparted a tremendous impetus to the socialist peace movement. In Aug. 1917, leaders of the Dutch and Scandinavian Socialist parties jointly with the I.S.B. and the Petrograd Soviet issued an invitation for a general international socialist conference to be held in Stockholm in order to consider socialist peace aims and the means to end the war by negotiations. The invitation was accepted by the Socialist parties in Europe and the U.S. and, despite Lenin's appeal to reject it, also by the Zimmerwald groups. Yet the conference never assembled; the governments of Great Britain, the U.S., France and Italy refused to grant passports to the delegates.

Under the impact of the Bolshevik Revolution of Nov. 1917, the left wing of the European labour movement greatly increased its strength. In Germany, Austria and Hungary, there were large-scale strikes in Jan. 1918, followed by a mutiny in the Austrian navy a month later; in Britain, the Labour party for the first time adopted a socialist program; in France the "Internationalists" assumed the leadership of the Socialist party; and in Italy, the Socialist party adopted a Bolshevist program based on the "dictatorship of the proletariat." The rising left-wing tide in the countries of the central powers swelled up in revolutions which swept through Bulgaria, Hungary, Germany and Austria in Oct. and Nov. 1918.

In an attempt to reconstruct the Second International, Socialist leaders of the Allied countries convened a conference, which met at Berne in Feb. 1919, attended by 97 delegates from 26 countries. It set up a commission charged with the task of preparing a congress of the International. However, when it met at Geneva in July 1920 it was revealed that it represented only a small fraction of the prewar members of the Second International. The rift in the international socialist movement, produced by dissensions over the war policy pursued by the majority of the Socialist parties, and their hostility to the Bolshevik Revolution, which had aroused the sympathy of great masses of workers, had destroyed the common ground for the reinstitution of the Second International. Delegates of the "Centre" and "Left" Socialist parties—among them the Socialist parties of France, Austria, Switzerland and the German and British Independent Labour parties—which had refused to join either the Second or the Communist International met in congress in Vienna in Feb. 1921 and formed the International Working Union of Socialist Parties (or Vienna union) with the object of preparing the ground for an all-embracing International.

The Communist International.—The Communist International, known as the Comintern or Third International, was founded at a congress in Moscow in March 1919. It was attended

only by 19 groups chiefly from countries of eastern and central Europe; no major Socialist party outside Russia was represented. It elected a temporary executive committee with Grigori Zinoviev as president and Angelica Balabanoff as secretary. In a manifesto, it denounced the "Centre" Socialist parties even more strongly than the "Right" and called upon the workers to join the Communist International for the immediate overthrow of capitalism.

The second Comintern congress, assembled in July 1920, met under more promising auspices. In Germany, Austria, Czechoslovakia, Bulgaria, Sweden, the Netherlands, Finland and the U.S., sections of the Socialist parties had broken away and had formed Communist parties, and in the Socialist parties of France, Italy, Norway and Spain, the pressure in favour of joining the Comintern had greatly increased. During 1920 there were general strikes in the Balkans, a Communist uprising in the Ruhr, mass strikes and seizures of factories in Italy, and a general strike in France, while at the same time in Russia the Red army had defeated the White armies and had invaded Poland. The "world revolution" appeared to be on the march. In this atmosphere several hundred delegates from 37 countries flocked to the congress—delegates not only from Communist parties but also from the Socialist parties of France, Italy, Norway, Switzerland, the British Independent Labour party and the German Independent Social Democrats.

Lenin was resolved to forge the Comintern into the spearhead of the world revolution, according to the pattern he had devised for the structure of the Bolshevik party. In his "twenty-one points," endorsed by the congress, he laid down the conditions of admission to the Comintern, such as the adoption of a strict Communist program, the removal of all "reformists" from responsible positions in the labour movement, the undertaking to engage in illegal work, to disrupt the armed forces and, above all, to submit to "iron discipline" under the control of the executive committee of the Comintern, which was in turn controlled by the politburo of the Russian Communist party. Over the controversial issue of the acceptance of the "twenty-one points," the German Independent Social Democratic party and the Socialist parties of France, Italy, Norway and Czechoslovakia split.

But the world revolution anticipated by the second Comintern congress failed to materialize; the single Communist rising which occurred in Europe, the rising of the German Communists in March 1921, collapsed ingloriously and accentuated the internal dissensions in Communist ranks. The European Socialist parties on the whole succeeded in repulsing the Communist onslaught. At the same time, the Soviet Union was beset with grave internal troubles: a rapid decline in production; peasant resistance against compulsory delivery of grain; growing discontent of the workers, culminating in the Kronshtadt revolt in March 1921; and the formation of a "Workers' Opposition" inside the Russian Communist party.

To ward off imminent disaster, Lenin introduced the New Economic Policy (N.E.P.), which abolished the requisitioning of grain and restored private trade. He also recognized, at the third Comintern congress in June 1921, the Communist failure to win the masses of the workers by a frontal attack on the Socialist parties alone. He proposed the tactics of the United Front, which, while emphasizing the need of struggle in co-operation with Socialist workers for immediate demands, retained the policy of attacking and splitting the Socialist parties. A conference was held in Berlin in April 1922 to explore the conditions of common actions. It was attended by representatives of the Second, Third and Vienna Internationals but it failed to bridge the gulf between democratic socialism and Communist dictatorship. The United Front tactics accentuated, however, the latent dissensions between the left wing, which opposed it, and the right wing of the Communist parties; it utterly collapsed after the defeat of a Communist uprising in Germany in Oct. 1923. In France, Czechoslovakia, Germany and other countries, the left, supported by Zinoviev, captured the leadership of the Communist parties.

But the failure of the German October uprising finally sealed the fate of the Communist hope for a world revolution which had been regarded by Lenin and Leon Trotsky as a precondition for the ultimate triumph of socialism in Russia. The N.E.P. had been introduced only as a "temporary retreat." In the struggle for power between Trotsky and J. V. Stalin after Lenin's death in Jan. 1924, the left-wing leadership of the main European Communist parties supported Trotsky and Zinoviev in their opposition to Stalin's policy of "socialism in one country." Stalin triumphantly removed Zinoviev as president from the Comintern in 1926, replaced him by the right-wing leader N. I. Bukharin and expelled the left leadership in the Communist parties in 1927. But he soon turned against Bukharin, who opposed the forcible collectivization of the peasants, and crushed him together with the right-wing leadership of the Communist parties. In 1929 Stalin's nominees, V. M. Molotov, Dimitri Manuilski and Otto Kuusinen, assumed control of the Comintern apparatus; after that date the Comintern became exclusively an instrument of the Russian state. At the same time, convinced that the world economic crisis in the early 1930s heralded the final collapse of capitalism, Stalin initiated a period of "left-wing extremism." The Communists concentrated their main efforts on liquidating the Social Democratic parties, and in Germany they co-operated with the Nazis in the destruction of the Weimar republic.

But after Adolf Hitler's rise to power, Stalin, afraid of a German attack, returned to the United Front tactics. In France the Communists supported the alliance of left and centre parties which, under Léon Blum's premiership, formed a Popular Front government in June 1936. But at the same time they harassed it by instigating large-scale strikes. In Spain they supported the republican government against the revolt of Gen. Francisco Franco, yet once they had succeeded in gaining control of the police force, they exterminated the revolutionary anti-Communist wing of the republican movement. After the Nazi occupation of Czechoslovakia in March 1939 the tension between Nazi Germany and the western powers increased and war appeared to be imminent. Stalin then negotiated a pact with Hitler that ensured Communist support for the Nazis' war effort. This pact remained in force until the Nazi invasion of Russia in June 1941. The Communists, infiltrating the underground resistance movement in the countries occupied by the Nazis, emerged from the war with greatly increased strength, particularly in France, Italy and Czechoslovakia.

In the meantime, the Comintern, which had not met in congress since 1935, was officially dissolved in May 1943. But in Sept. 1947 a new centre of international control—the Communist Information bureau or Cominform—was set up and initiated a new phase of revolutionary aggression. The Communists expelled from the government in France organized revolutionary strikes there and in Italy, and seized power in Czechoslovakia by a *coup d'état* in Feb. 1948, thus completing the process of imposing Communist regimes in all countries occupied by the Soviet army. After Tito's defection in June 1948, the Cominform slowly faded out. Thus the last remnant of the Communist International as a formal organization, which at least pretended to grant its member parties the right to participate in shaping its policy, ceased to exist. Moscow reasserted its sole control of international communism, assumed already by Stalin before the war, to be rejected only by the Chinese and Albanian Communists.

The Labour and Socialist International.—After the failure of the Berlin conference (April 1922) of the three Internationals, the Second International and the Vienna union drew closer together and ultimately united at a congress held in Hamburg in May 1923, attended by 620 delegates representing 43 parties in 30 countries with an aggregate membership of 6,700,000 and a voting strength of 25,000,000. It adopted the name "Labour and Socialist International" (L.S.I.). It was, according to its constitution, "a union of such parties as accept the principles of the economic emancipation of the workers from capitalist domination and the establishment of the Socialist Commonwealth as their object." The congress elected Arthur Henderson, leader of the British Labour party, as president, to be followed by Émile Vandervelde, leader of the Belgian Labour party, and Friedrich Adler as secretary. The International Federation of Trade Unions (I.F.T.U.) founded in Amsterdam in Aug. 1919 was also represented at the congress and pledged its co-operation with the L.S.I. The Hamburg congress was followed by congresses in Marseilles (1925), Brussels

(1928), Vienna (1931) and a conference in Paris (1933).

The L.S.I. saw in fascism the gravest menace to freedom and peace and considered the restoration of working-class unity as the most effective means to combat it. Yet the fundamental differences between the L.S.I. and the Comintern frustrated every endeavour to re-establish this unity. The L.S.I. recognized in the economic conditions of the Versailles peace treaty one of the main sources from which both the Communist and Nazi movements in Germany derived their strength, and strove for a fair settlement of the reparations imposed upon the Weimar republic. It called on the western powers to assist Germany when her economic fabric collapsed in the early 1930s. With Hitler's rise to power the L.S.I. became mainly preoccupied with the danger of war. It supported the principle of collective security, pressed for the adoption of a general convention of the League of Nations to strengthen the means of preventing war, and opposed the rearmament of Nazi Germany. In co-operation with the I.F.T.U. it organized financial assistance on a large scale for political refugees from fascist countries, especially for the victims of Franco's war against the Spanish republic.

Hitler's conquests in western Europe destroyed the basis of the International in Europe. Only the British, Swedish and Swiss Socialist parties survived. The International ceased to function.

The Socialist International.—After World War II the International was reinstituted in gradual stages, beginning with establishment of an information and liaison office at the first postwar international conference, held in England in May 1946, to be transformed into a consultative committee a year later and, finally, in 1947, into a more representative body called Committee of the International Socialist Conference, or Comisco. In March 1951 it decided to reconstitute the International.

This took place at a congress held in Frankfurt-on-Main, Ger., in July 1951. It assumed the name "Socialist International" (S.I.), and adopted statutes determining its structure and a declaration of the "Aims and Tasks of Democratic Socialism." It elected Morgan Phillips, secretary of the British Labour party, as president, to be followed by Alsing Anderson, vice-chairman of the Danish Labour party, and Julius Braunthal as secretary, succeeded by Albert E. Carthy. Three of the major member parties of the International are represented in its presidency by Hugh Gaitskell, leader of the British Labour party, Guy Mollet, leader of the French Socialist party, and Erich Ollenhauer, leader of the German Social Democratic party. Its headquarters were set up in London.

Unlike the provisions of the statutes of the L.S.I., according to which its decisions were binding on its affiliated bodies, the S.I. statutes require the consent of all member parties for resolutions. Whereas the L.S.I. statutes gave voting power to the individual parties according to the number of members they represented, the S.I. statutes allocate one vote to each member party regardless of its strength. The L.S.I. was closely associated with the I.F.T.U., but there exist no links or any form of co-operation between the S.I. and the International Confederation of Free Trade Unions (I.C.F.T.U.). Whereas the I.F.T.U. was composed of trade union centres which represented virtually Socialist members, the I.C.F.T.U. includes among its affiliates non-socialist bodies like the American Federation of Labor-Congress of Industrial Organizations (A.F.L.-C.I.O.) in the U.S., and Christian-Democratic trade unions in Italy and other countries.

The structure of the S.I. is, however, similar to that of the L.S.I. Its supreme body is the congress meeting every other year. It proclaims its principles, determines its statutes and decides by a two-thirds majority upon the admission of new members. A smaller body at which, however, each member party is entitled to representation, is the council of the S.I., which assembles at least once a year. Its functions include the formulation of the attitude of the S.I. toward current political issues, the election of the presidency and secretary and the fixing of affiliation fees. Finally, the bureau, composed of delegates from 12 countries and meeting according to requirements, is charged with the supervision of the secretary's activities.

In its declaration of principles the S.I. put the main emphasis upon the political aspects of socialism: democracy and civil liberty. But whereas the L.S.I., while opposing the Communist regime of dictatorship, acknowledged the Soviet Union as a revolutionary Socialist power and pledged the Socialist parties to resist attempts of war against her, the S.I. not only rejects the Communist system as irreconcilable with Socialist principles, but also supports the North Atlantic alliance against Russsia. The L.S.I. was striving for genuine co-operation with the Communists, but Comisco, in 1948, expelled the Socialist Democratic parties of Czechoslovakia, Bulgaria, Hungary and Rumania, because they had merged with the Communist parties, and the Italian Socialist party, because it refused to dissolve its pact of co-operation with the Communists; it admitted a group which had broken away from the Italian party in opposition to the pact and had formed the Social Democratic party of Italy. When the 20th congress of the Russian Communist party, held in Feb. 1956, expressed its desire for some form of co-operation with the Socialist parties, the S.I. in its statement of April 1956 reaffirmed its position, "which firmly rejects any united front or any form of political co-operation with the parties of dictatorship." However, it supports the policy of coexistence and general disarmament under international supervision.

Next to its preoccupation with the defense of democracy against totalitarian communism, the S.I. is mainly concerned with problems of colonialism and assistance to the underdeveloped countries. It declared its support of the colonial and dependent people's struggle for self-determination. Considering the economic plight of the industrially underdeveloped countries as a major humanitarian as well as a political problem, it adopted a detailed "World Plan for Mutual Aid" and pledged its member parties to arouse world opinion to induce the governments to carry it out through the United Nations agencies.

The S.I. stands for the economic unity of Europe, and the relevant European member parties participate in the activities of the European parliamentary assemblies: the Council of Europe, the Western European union and the European Coal and Steel community.

In 1960 the S.I. consisted of 40 Socialist parties in Europe, Asia (India, Israel and Japan) and in the Western hemisphere (Argentina, Canada, Jamaica, U.S. and Uruguay); it included also the New Zealand Labour party. The affiliated parties represented an aggregate of roughly 10,000,000 members and a voting strength of over 64,000,000. Integrated in the S.I. was the International Council of Social Democratic Women, representing 1,700,000 members in 19 countries, and a Latin American secretariat in Montevideo, Uruguay. It was closely associated with the Socialist union of central-east Europe, comprising Socialist parties in exile, the International Union of Socialist Youth, the International Union of Social Democratic Teachers and, in particular, the Asian Socialist conference. The latter was founded at a congress in Rangoon, Burma, in Jan. 1953, and was composed of the Socialist parties of Burma, Ceylon, India, Indonesia, Israel, Japan, Lebanon, Malaya, Nepal and Vietnam.

See also references under "International, The" in the Index.

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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT: *see* BANK FOR RECONSTRUCTION AND DEVELOPMENT, INTERNATIONAL.

INTERNATIONAL CHAMBER OF COMMERCE: *see* TRADE ORGANIZATION.

INTERNATIONAL COURT OF JUSTICE, the principal judicial organ of the United Nations, which succeeded the Permanent Court of International Justice after World War II. For generations eminent statesmen, private persons and various organizations—national and international—have devoted much

time and energy to efforts looking to the peaceful settlement of disputes between nations. Various methods of settlement have been advocated and at times resorted to, such as the use of good offices by other states, commissions of inquiry and conciliation, arbitration and judicial settlement.

Arbitration as a form of judicial settlement has been used by states over a long period of time—not generally but frequently. Many bilateral and a number of multilateral treaties and conventions providing for arbitration have been concluded from time to time, some relating to then-existing disputes and others relating to disputes or categories of disputes which might arise in the future. Of the multilateral conventions providing for arbitration those which stand out are the Conventions for the Pacific Settlement of International Disputes concluded at the first and second peace conferences held at The Hague in 1899 and 1907. The convention of 1899 contains provisions on the use of good offices and mediation, international commissions of inquiry and elaborate provisions designed to regularize arbitral procedure. It also provides for the establishment by the signatories of a panel of jurists called the Permanent Court of Arbitration (although in no sense a court) to which each state, party to the convention, should appoint four members, and from which governments desiring to arbitrate might choose competent arbitrators.

Although many international arbitrations both before and following the Hague conventions constitute landmarks in the process of peaceful settlement of disputes, and the tribunals in such cases made notable contributions to an international jurisprudence, it was recognized that with all its virtues a system in which reliance is placed on *ad hoc* tribunals, as distinguished from an established court of justice, was not all that might be desired. The situation, as visualized by him, was epitomized by Elihu Root, the U.S. secretary of state, who, in instructions to the U.S. delegation to the second Hague conference, observed that the principal objection to arbitration rested not upon the unwillingness of nations to submit their controversies to impartial arbitration, but upon an apprehension that the arbitrators would not be impartial. He instructed the delegates to try to have the Permanent Court of Arbitration developed into a permanent tribunal composed of judges "who are judicial officers and nothing else, who are paid adequate salaries, who have no other occupation and who will devote their entire time to the trial and decision of international causes by judicial methods and under a sense of judicial responsibility."

The 1899 convention was revised, but as revised it fell far short of the pattern outlined by Root. It did not provide for judges "who are judicial officers and nothing else" and who would "devote their entire time to the trial and decision of international causes." Rather it continued the system of a panel of jurists from which arbitrators might or might not be chosen for particular cases.

However, the 1907 conference prepared and recommended to the powers represented at the conference a draft convention to establish a court of arbitral justice composed of judges to be elected for fixed periods of service and on a salary basis. But the project was not adopted by the states and the court was never established. Nevertheless the draft had its influence on subsequent developments.

Permanent Court of International Justice.—The next notable step in the process of developing an international judiciary was taken by the League of Nations in 1920, when, pursuant to article 14 of the covenant of the League, it took steps to establish the Permanent Court of International Justice.

Article 14 provided:

> The Council shall formulate and submit to the Members of the League for adoption plans for the establishment of a Permanent Court of International Justice. The Court shall be competent to hear and determine any dispute of an international character which the Parties thereto submit to it. The Court may also give an advisory opinion upon any dispute or question referred to it by the Council or by the Assembly.

In Feb. 1920, the council appointed a committee of jurists to prepare a plan which it could submit to members of the League for adoption. The members of the committee were: Mineitciro Adatci (Japan), Rafael Altamira y Crevea (Spain), Raoul Fernandes (Brazil), Baron E. E. F. Descamps (Belgium), G. F Hagerup (Norway), Albert Geouffre de la Pradelle (France), B. C. J. Loder (Netherlands), Lord Phillimore (United Kingdom), A. Ricci-Busatti (Italy) and Sen. Elihu Root accompanied by James Brown Scott (United States).

The committee, following meetings at The Hague in June and July of that year, submitted to the council a draft scheme which, with certain modifications, was adopted by the council, and with still further amendments was approved by the assembly on Dec. 13, 1920. The text was attached to a protocol of Dec. 16, 1920, for signature and ratification by the members of the League. By Sept. 1921, the requisite number of states, a majority, had given their approval and the draft became the statute of the Permanent Court of International Justice.

The statute prescribed the qualifications for the judges, the method of election and tenure of office, the court's jurisdiction, its mode of procedure, etc. The first court, consisting of 11 judges and 4 deputy judges, was elected by the council and the assembly on Sept. 14–16, 1921. Later, in 1930, the assembly elected 15 judges and 4 deputy judges. Still later, following the coming into force in 1936 of amendments to the statute, the deputy judges were eliminated and the court was composed of 15 judges elected as theretofore by the council and the assembly.

The court held its first meeting at The Hague, its seat, on Jan. 30, 1922. It held annual meetings thereafter until its work was interrupted by World War II. Its last meeting, an administrative one, was in Oct. 1945.

During its existence it rendered 23 judgments and gave 27 advisory opinions. The court was open to members of the League and also to states mentioned in the annex to the covenant. The conditions under which it should be open to still other states were to be laid down by the council. Acceptance of the jurisdiction of the court was not compulsory. States were free to bring their disputes to the court or not as they might see fit. However, they were privileged, under the optional clause of article 36 of the statute, to declare, either when signing or ratifying the protocol to which the statute was adjoined, or at a later moment, that they recognized as compulsory *ipso facto* and without special agreement, in relation to any other state accepting the same obligation, the jurisdiction of the court in any or all of certain specified categories of disputes. Such declarations might be made unconditionally or on condition of reciprocity on the part of several or certain states or for a certain time. During the existence of the court some 29 states accepted the compulsory jurisdiction in varying forms and for varying periods of time. During this same period 47 states signed the protocol of 1920, to which the statute was annexed, and all but 8 ratified it.

The United States did not become a party to the statute of the Permanent court, although efforts to have it do so were made in turn by Secretaries of State Charles E. Hughes, Frank B. Kellogg and Henry L. Stimson, supported by Presidents Warren G. Harding and Herbert Hoover, as well as by many private citizens who felt that such a tribunal held great potentialities for peaceful settlement of international disputes. A senate resolution for adherence that came to a vote on Jan. 29, 1935, failed to obtain the requisite two-thirds vote, and no further action to have the United States become a party to the statute was taken. Yet throughout the period of the court a U.S. jurist was on the bench.

Judges of the Permanent Court.—During its existence, the court had on the bench the following named judges who served respectively for the periods indicated:

Rafael Altamira (Spain), 1922–45
Dionisio Anzilotti (Italy), 1922–45
Ruy Barbosa (Brazil), 1922–23
A. Sánchez de Bustamante (Cuba), 1922–45
Viscount Finlay (United Kingdom), 1922–29
Hans Max Huber (Switzerland), 1922–30
B. C. J. Loder (Netherlands), 1922–30
Mineitciro Adatci (Japan), 1931–34
D. G. G. Nyholm (Denmark), 1922–30
Yorozu Oda (Japan), 1922–30
C. A. Weiss (France), 1922–28
E. da Silva Pessôa (Brazil), 1923–30
Charles E. Hughes (U.S.), 1928–30
Henri Fromageot (France), 1929–45
Sir Cecil Hurst (U.K.), 1929–45
Frank B. Kellogg (U.S.), 1930–35
F. J. Urrutia (Colombia), 1931–42

W. J. M. van Eysinga (Netherlands), 1931–45
J. G. Guerrero (El Salvador), 1931–45
Demètre Negulescu (Rumania), 1931–45
E. Rolin Jacquemyns (Belgium), 1931–36
Michal Rostworowski (Poland), 1931–40
Walter Schücking (Germany), 1931–35
John B. Moore (United States), 1922–28
Charles de Visscher (Belgium), 1937–45
Wang Chung-hui (China), 1931–36
Åke Hammarskjöld (Sweden), 1936–37
Manley O. Hudson (U.S.), 1936–45
Harukazu Nagaoka (Japan), 1935–42
Cheng Tien-hsi (China), 1936–45
R. W. Erich (Finland), 1938–45

The deputy judges were:

F. V. N. Beichmann (Norway), 1922–30
Demètre Negulescu (Rumania), 1922–30
Wang Chung-hui (China), 1922–30
Mihailo Yovanovich (Yugoslavia), 1922–30
R. W. Erich (Finland), 1930–36
J. Caeiro da Matta (Portugal), 1930–36
Mileta Novakovich (Yugoslavia), 1930–36
Joseph Redlich (Austria), 1930–36

The court was authorized by the statute to elect its president and vice-president for three years. The presidents were: Loder (Netherlands), 1922–24; Huber (Switzerland), 1925–27; Anzilotti (Italy), 1928–30; Adatci (Japan), 1931–33; Sir Cecil Hurst (U.K.), 1934–36; Guerrero (El Salvador), 1937–45. The vice-presidents were: Weiss (France), 1922–28; Huber (Switzerland) 1928–30; Guerrero (El Salvador), 1931–36; Sir Cecil Hurst (U.K.), 1937–45.

Establishment of International Court of Justice.—Following World War II and the advent of the United Nations, the League of Nations was dissolved and with it the Permanent Court of International Justice. But that court was not dissolved until the new one—the International Court of Justice—had been established. By this time the nations, including the United States, were thoroughly convinced that a court of justice must have first rank in any organization for the maintenance of peace. This explains why the court was featured in the charter of the United Nations and why the statute was unanimously approved by the U.S. senate. Article 92 of the charter states:

> The International Court of Justice shall be the principal judicial organ of the United Nations. It shall function in accordance with the annexed Statute, which is based upon the Statute of the Permanent Court of International Justice and forms an integral part of the present Charter.

Article 93 provides that all members of the United Nations are *ipso facto* parties to the statute and states not members may become parties on conditions to be determined in each case by the UN general assembly upon recommendation of the Security council. The court consists of 15 judges, no two of whom may be nationals of the same state, elected by the general assembly and the Security council. They do not have life tenure as do members of the supreme court of the United States, for example, but are elected for periods of nine years and are eligible for re-election.

The seat of the court is at The Hague, but it may hold sessions elsewhere whenever it considers it desirable. Its first session was held at The Hague in April and May 1946.

It is a continuing body. The statute provides that it shall remain permanently in session, except during judicial vacations. It is also an autonomous body. It elects its president and vice-president, appoints its registrar and provides for the appointment of such other officers and clerical staff as may be necessary. The president and the registrar are required to reside at The Hague.

The Judges.—The judges, who must possess certain specified qualifications, do not represent the states from which they are chosen. They represent the entire international community of states. They are not selected by the governments of their states or even nominated by them; they are nominated rather by the national groups in the Permanent Court of Arbitration referred to above, or, in the case of states not represented on the Permanent Court of Arbitration, by national groups appointed for that purpose by their governments, the purpose being to remove the nominations as far as possible from political considerations.

Comparable safeguards were placed around the election of the judges. The statute provides that in such elections the general assembly and the Security council shall proceed independently of each other, and that at every election the electors should bear in mind not only that the persons to be elected shall individually possess the qualifications required "but also that in the body as a whole the representation of the main forms of civilization and of the principal legal systems of the world should be assured." Those candidates who obtain an absolute majority of votes in both the general assembly and the Security council are to be considered as elected. Further procedure is provided for the situation where, after the first meeting for the purpose of the election, one or more seats remain to be filled.

The judges receive annual salaries reasonably commensurate with their status. But they must be prepared to accept certain inhibitions; *i.e.*, they must refrain from all activities incompatible with their judicial functions. Specifically, they are forbidden to exercise any political or administrative function, or to engage in any other occupation of a professional nature; they are not permitted to act as agent, counsel or advocate in any case, and no member may participate in the decision of a case in which he has previously taken part as agent, counsel or advocate for one of the parties, or as a member of a national or international court, or a commission of inquiry, "or in any other capacity."

The purpose of the statute is to have at all times a court that is entirely free from bias or any preconceived notion as to the merits of any case coming before it. Each member is required, before taking up his duties, to "make a solemn declaration in open Court that he will exercise his powers impartially and conscientiously." In order to facilitate the proper exercise of their judicial functions the members, when engaged on the business of the court, enjoy diplomatic privileges and immunities. Members are bound to hold themselves permanently at the disposal of the court.

While nine judges constitute a quorum, the statute requires that the full court shall sit except when it is expressly provided otherwise. The court may dispense with the sitting of one or more judges "according to circumstances and in rotation," provided the number of available judges is not thereby reduced below 11. In practice, the full court sits in all cases except where a judge is disqualified by reason of some previous connection with the case or is prevented by illness or other serious reasons from attending. No judge may be dismissed unless in the opinion of all the others he has ceased to fulfill the required conditions. Vacancies resulting from death or otherwise must be filled by the same method as that laid down for the first election. A member elected to replace a member whose term of office has not expired holds office for the remainder of his predecessor's term.

Obviously, since there are only 15 judges, cases are sometimes presented by states which have no national on the court. While the statute provides that judges of the nationality of each of the parties retain their right to sit in the case before the court, it also provides that, if the court includes upon the bench a judge of the nationality of one of the parties, the other party may choose a person to sit as judge; also that if the court includes upon the bench no judge of the nationality of either party each of the parties may choose a person to sit as judge. This privilege is frequently exercised. *Ad hoc* judges receive compensation for each day on which they exercise their functions.

Competence.—Since the function of the court is to pass judgment upon disputes between states, only states may be parties in cases before the court. It is open to all states parties to the statute and to such other states as comply with conditions laid down by the Security council, which conditions must not, in any case, place the parties in a position of inequality before the court.

At the time that the statute was being drafted, there was strong sentiment on the part of certain states, particularly the smaller ones, for giving the court compulsory jurisdiction; *i.e.*, making it possible for any state to bring an action against any other state without the latter's consent. This, it was argued, was warranted by the more than 20 years of satisfactory experience with the Permanent court. The opponents of this view felt that some states were not yet ready to accept compulsory jurisdiction, and that to try to force it upon them might cause them to decline to accept

the statute at all. They favoured the adoption of the optional provisions in article 36 of the statute of the Permanent court. This was agreed upon, and that article became article 36 of the new statute. Under it parties to the statute may at any time file with the secretary-general of the United Nations a declaration accepting compulsory jurisdiction. A large number of states have done so. The declaration may be made unconditionally or on condition of reciprocity on the part of other states, or for a certain time. It was further provided in article 36 (paragraph 5) that declarations made under the old statute conferring jurisdiction on the Permanent court which were still in force should be deemed, as between the parties to the new statute, to be acceptances of the compulsory jurisdiction of the new court.

In 1946, when the U.S. senate was considering the exact nature of the court's jurisdiction, Sen. Tom Connally introduced a resolution providing that the United States should be free to determine for itself what matters were of an essentially domestic nature and thus outside the jurisdiction of the court. Senator Connally argued that such a self-judging reservation was necessary because the court might take a broad view of what was an international question and thus interfere with U.S. policy on immigration, tariffs and the Panama canal. Several other countries followed the U.S. example and reserved the right to determine what matters fell within their domestic jurisdiction. Criticism of the "Connally resolution" was frequently voiced in the United States and in other countries as being inconsistent with the principle that no one should be a judge in his own cause, and as indicating a lack of confidence in the court. Several countries that originally adopted the self-judging reservation later reconsidered and withdrew it.

The Anglo-Iranian Oil company case (*Great Britain* v. *Iran*) involved a declaration by Iran in 1933 under article 36 of the statute of the Permanent court. Although the court held that it did not have jurisdiction, it was only because it found that the declaration did not cover that particular case (judgment, July 22, 1952; ICJ Reports [1952] p. 93).

The court's jurisdiction was still further extended by article 37 of the statute, which stipulates that whenever a treaty or convention in force "provides for reference of a matter to . . . the Permanent Court of International Justice, the matter shall, as between the parties to the present Statute, be referred to the International Court of Justice."

The advisory opinion given July 11, 1950 (ICJ Reports [1950] p. 128), on the international status of South West Africa, and the judgment rendered July 1, 1952, in the Ambatielos case (*Greece* v. *Great Britain;* ICJ Reports [1952] p. 28) are examples involving article 37 of the statute.

States which have not accepted compulsory jurisdiction may not be sued without their consent. A state may give its consent by entering into an agreement with another state or otherwise indicating its willingness to submit the dispute to the court. *See* the judgment of March 25, 1948, in the Corfu channel case (*Great Britain* v. *Albania;* ICJ Reports [1948] p. 15).

In 1954 the United States filed with the court two applications instituting proceedings against the Soviet Union and Hungary, respectively, and in 1955 like action was taken against Czechoslovakia and the Soviet Union, respectively, each complaint relating to certain aircraft incidents; also in 1955 Great Britain filed two applications instituting proceedings against Argentina and Chile, respectively, concerning sovereign rights in the antarctic. None of the defendant states had accepted compulsory jurisdiction, and on being informed of these actions by the registrar of the court, each in turn specifically declined to submit the dispute to the court. In consequence, the court was under the necessity of issuing orders removing the cases from its list.

In 1959 the court held that it lacked jurisdiction over the claim of Israel for damages from Bulgaria for an airliner shot down over Bulgarian territory. In 1931 Bulgaria had accepted the compulsory jurisdiction of the Permanent Court of International Justice without time limit. The court held that this acceptance did not carry over to the present because Bulgaria had not joined the United Nations until after the statute of the old court had come to an end.

The statute declares it to be the duty of the court to decide disputes in accordance with international law. It applies: (1) international conventions establishing rules recognized by the contesting states; (2) international custom, as evidence of a general practice accepted as law; (3) the general principles of law recognized by civilized nations; and (4) it may look to judicial decisions and the teachings of the most highly qualified publicists of the various nations as subsidiary means for determining rules of law. It may also decide cases *ex aequo et bono* (that is to say, on the basis of equity), if the parties agree. In the absence of such an agreement it must apply rules of law.

Procedure.—The official languages of the court are French and English; either may be used by the parties. Written pleadings and oral arguments presented in one language are translated by the court's staff into the other. The judgments and opinions are in both languages.

Cases are brought before the court either by the notification to it of a special agreement concluded by the parties or by the unilateral action of one of them through a written application addressed to the registrar. The proceedings are in two parts, written and oral. The written proceedings usually consist of two pleadings on each side and supporting documents. Oral arguments by counsel follow the written proceedings.

The court may also hear witnesses and appoint commissions of experts to make investigations and reports when necessary. Both these procedures were followed in the Corfu channel case (*Great Britain* v. *Albania*) decided April 9, 1949.

The deliberations of the court are in private, but the judgments, which are by a majority vote, are read in open court. Any judge may file a separate opinion if he does not agree in whole or in part with the decision. Few decisions represent the unanimous opinion of the judges. The judgment is final and without appeal.

The question is frequently asked as to how decisions of the court are enforced. This also troubled the minds of some of the delegates at the United Nations Conference on International Organization, held at San Francisco, Calif., when the statute was under consideration. To meet their wishes there was incorporated in article 94 of the charter an undertaking on the part of each member of the United Nations "to comply with the decision of the . . . Court . . . in any case to which it is a party," and a further provision that:

> If any party to a case fails to perform the obligations incumbent upon it under a judgment rendered by the Court, the other party may have recourse to the Security Council, which may, if it deems necessary, make recommendations or decide upon measures to be taken to give effect to the judgment.

It should be remarked, however, that by the late 1950s there had been no known instance of the failure of a party to a case before the court, or before its predecessor, the Permanent Court of International Justice, to carry out a decision of either court. In the case of the Anglo-Iranian Oil company (*see* above), Iran declined to observe an order issued by the court, July 5, 1951, under article 41 of the statute, indicating interim measures of protection to be taken by the parties pending final decision. But this is not to be regarded as an exception to what has just been stated since such orders do not amount to judgments. They merely indicate provisional measures which the court considers ought to be taken to preserve the rights of the parties.

Advisory Opinions.—The court is authorized by article 65 of the statute to give advisory opinions on any legal questions at the request of whatever body may be authorized by or in accordance with the charter of the UN to make such a request.

Article 96 of the charter provides that such opinions may be requested by the general assembly or the Security council; also that they may be requested by other organs of the United Nations and specialized agencies, when authorized by the general assembly. Such requests must be laid before the court by means of a written request containing an exact statement of the questions, accompanied by all documents likely to throw light upon them. From this point on, the procedure before the court is somewhat analogous to that followed in contentious cases; that is to say, the registrar gives notice of the request to all states entitled to appear before the court, and the court or the president of the court fixes

time limits within which the states wishing to do so may submit written statements or be heard orally at a public sitting to be held for the purpose. States and organizations presenting written or oral statements are allowed, within a specified time, to comment on those submitted by others. Advisory opinions, like judgments, are delivered in open court.

Membership.—Article 13 of the statute provides that the members of the court shall be elected for nine years and may be re-elected, but in order to avoid the necessity of electing an entirely new court at the end of each nine-year period and to ensure that there shall be on the bench at all times a majority of experienced judges, it was further provided that of the judges elected at the first election, the terms of five should expire at the end of three years and the terms of five more should expire at the end of six years; also that the judges whose terms were to expire at the end of the said periods of three and six years should be chosen by lot to be drawn by the secretary-general of the United Nations immediately after the first election had been completed.

The first election was held on Feb. 6, 1946, at the London meeting of the general assembly and the Security council. Fifteen judges were elected. The procedure provided in article 13 was applied and five judges drew three-year terms and five others drew six-year terms.

In the middle 1960s the court was constituted as follows:

	End of term
Bohdan Winiarski (Poland)	1967
Abd al-Hamid Badawi (United Arab Republic)	1967
V. K. Wellington Koo (China)	1967
Jean Spiropoulos (Greece)	1967
Sir Percy Spender (Australia)	1967
Vladimir M. Koretsky (U.S.S.R.)	1970
Paul Kotaro Tanaka (Japan)	1970
J. L. Bustamente y Rivero (Peru)	1970
Philip C. Jessup (United States)	1970
Gaetano Morelli (Italy)	1970
Sir Gerald Fitzmaurice (United Kingdom)	1973
Luis Padilla Nervo (Mexico)	1973
André Gros (France)	1973
Mohammed Zafrulla Khan (Pakistan)	1973
Isaac Forster (Senegal)	1973

See ARBITRATION, INTERNATIONAL; *see* also references under "International Court of Justice" in the Index. (G. H. H.)

INTERNATIONAL CRIMINAL POLICE ORGANIZATION. This organization, better known as INTERPOL (originally its telegraphic address), is a body which exists to facilitate the co-operation of the criminal police forces of its approximately 90 affiliated countries in their fight against international crime. Its headquarters, the general secretariat, are in Paris and the supreme authority of the organization, the general assembly, meets once annually in a different capital city.

Aims.—The aims of the organization, to which almost all countries of the western world but none of the Communist countries except Yugoslavia belong, are: (1) to ensure and promote the widest possible mutual assistance between all the criminal police authorities of the affiliated nations within the limits of the laws existing in those countries; and (2) to establish and develop all institutions likely to contribute effectively to the prevention and suppression of ordinary crime. Interpol is strictly forbidden to undertake any political, military, religious or racial functions or activities.

Radio, television and motion pictures have presented Interpol as a vast mysterious international criminal investigation force, with agents throughout the world who can wander from country to country and make arrests wherever they please. This impression is quite false and represents an impossibility, since the nations of the world are sovereign states with varying legal systems and their criminal law, practice and procedure differ substantially. No sovereign state would permit any outside body to bypass its police or disregard its laws. The main weapon in the hands of the criminal police is not a universal detective: it is the extradition treaty.

Principally, Interpol's opponent is the international criminal, who falls into one of three main categories. First, criminals who operate in more than one country, crossing national frontiers to commit their crimes. Prominent examples are smugglers, dealing mainly in gold and narcotic drugs. Secondly, criminals who do not travel at all but whose crimes affect other countries. A good example is the forger of bank notes: a man may live in London all his life but make his living by forging U.S. dollar bills. Thirdly, criminals who commit a crime in one country and flee to another in an attempt to evade the consequences of their action. A man may commit a crime in Paris and yet be in London within two hours.

Organization.—The general assembly controls the policy of the organization, approves or rejects applications for membership, elects its executive committee, makes any necessary amendments to its constitution and discusses matters of interest to police of all nations.

The executive committee consists of nine delegates—a president, two vice-presidents and six members. The president holds office for four years and the other executive committee members for three years. The committee's duties consist of supervising the carrying out of the general assembly's decisions, deciding on its agenda for its annual meeting and exercising some control over the general secretariat.

The general secretariat, mainly staffed by officers from the French police and headed by a secretary-general, controls the everyday workings of Interpol. One of its principal functions is the collection, recording, analysis and dissemination of information, a function vital in criminal investigation everywhere. One of the main departments of the general secretariat is an International bureau to deal centrally with this operation. It has a criminal record office of international criminals and others who may later fall into that category, containing particulars of their identities, aliases, associates, method of working, etc., gathered from the police of the affiliated countries. This information is sent out to the countries likely to be interested by radio or by confidential circular.

Interpol has its own radio network, the central control station of which is situated just outside Paris and is linked to the other stations in such widely separated centres as London, Tel Aviv-Jaffa, Stockholm, Swed., and Rio de Janeiro, Braz. It also has an extensive code for enciphering messages.

The confidential circulars are of four types. The first asks for a particular criminal to be detained so that extradition proceedings can be started. The second does not ask for the criminal to be detained but gives full information about him and his methods to the police of countries in which he may temporarily be staying. The third does not deal with persons at all but with valuable property and may describe stolen jewelry or works of art which it is believed may have been smuggled out of the country in which the crime was committed. The fourth deals with unidentified bodies and attempts to discover their identity. A further section of the general secretariat, known as the Forgeries and Counterfeits office, is situated at The Hague.

Each affiliated country has a clearinghouse through which its individual police forces may communicate either with the general secretariat or with the police of other affiliated countries. This clearinghouse is known as the National Central bureau (N.C.B.). The N.C.B. for the United Kingdom and colonies, for example, is situated in the Metropolitan Police headquarters at New Scotland Yard, London, while that for the United States is the treasury department in Washington, D.C.

Development.—Interpol began in 1923 in Europe, which is not surprising since so many countries of Europe have common frontiers and a criminal can, for example, be in one of four other countries within an hour of having committed a crime in Belgium. Air travel greatly increased the means of escape to other countries. After World War I there was a great increase in crime. One of the countries most affected was Austria, and the Viennese police president, Johann Schober, obtained his government's support in 1923 for calling together representatives of the criminal police of other countries. The representatives of 20 nations attended to discuss the problems facing them and the International Criminal Police commission was formed. Vienna was the home of its first headquarters and Schober became its first president. From 1923 until 1938 the commission flourished.

In 1938 the Nazis seized Austria—and Interpol with it. All the records were taken to Berlin. The outbreak of World War II brought its activities to a standstill. After World War II, Florent Louwage, inspector general of police of the Belgian ministry of justice, quickly realized that international crime would once again increase. Austria, under four-power control, could not be considered as a headquarters and Belgium could not take the responsibility, but the French government offered Interpol a headquarters in Paris, together with a staff for the general secretariat consisting of officials of the French police. This offer was gratefully accepted. Interpol was thus revived under the presidency of Louwage assisted by an executive committee of four. Complete reorganization was necessary, since all prewar records had been lost or destroyed.

Interpol flourished and by 1955 the number of affiliated countries had increased from 19 in 1946 to 55. In that year the general assembly decided to draw up a modern and complete constitution, which was ratified in 1956. Under the constitution the name was changed to the International Criminal Police organization. The organization continued to progress and by the early 1960s the number of affiliated countries rose to 90, representing all the continents of the world. In particular the membership increased considerably during 1960–61, when several territories that had recently acquired their independence joined. (R. L. Ja.)

INTERNATIONAL DATE LINE: *see* DATE LINE.

INTERNATIONAL EDUCATION: *see* EDUCATION, INTERNATIONAL.

INTERNATIONAL FINANCE CORPORATION, an affiliate of the International Bank for Reconstruction and Development (*see* BANK FOR RECONSTRUCTION AND DEVELOPMENT, INTERNATIONAL). Its general purpose is to stimulate the economic advancement of underdeveloped member nations by providing venture capital for productive enterprises. It co-operates with private investors and business firms without the safeguard of governmental guarantees of loan repayment.

Background of the Organization.—The origin of the International Finance corporation (IFC) goes back to Pres. Harry S. Truman's request in 1950 that the U.S. International Development Advisory board recommend an appropriate U.S. policy toward economically backward regions. The board found that inefficient employment of locally available capital in the underdeveloped areas and inability of prospective foreign investors to obtain supplementary local venture (risk) capital were serious impediments to economic development. In March 1951 the board proposed the establishment of an International Finance corporation with authority to make nonvoting equity investments in local currencies in participation with private investors and to extend loans in local or foreign currencies to private firms. Unlike loans of the International bank, these investments would not require governmental guarantees of repayment.

Pursuing this recommendation, the United Nations Economic and Social council (ESC) in Aug. 1951 asked the International bank to submit an evaluation of the merits of such an agency. The bank's report of April 1952 concluded that the proposed corporation would "fill an important gap in the existing machinery for financing economic development." Consequently, ESC requested a continuing study of the proposal by the International bank.

During 1953–54 it became apparent to the bank that the needs of the underdeveloped areas for development funds were becoming increasingly acute. It was also obvious that countries that were to be major contributors of funds to the corporation had not yet indicated a willingness to participate in the scheme. In particular, the U.S. government objected, the treasury department being vigorously opposed to the proposal on the ground that a new institution was not needed. It was anticipated that an increased flow of private funds into the underdeveloped areas would render the proposed corporation unnecessary. Additionally, there was deep concern in the United States over the principle of equity participation and over the possible budgetary difficulties that might arise because of the size of the proposed U.S. contribution to the corporation's capital. Since U.S. participation was imperative, the bank searched for a compromise plan.

Late in 1954, Eugene R. Black, president of the International bank, offered a way out of the impasse. The "Black plan" proposed that the corporation should not be given authority to make equity investments but be endowed with the power to make investments yielding a return only if income was earned by the co-operating enterprise. Furthermore, when the co-operating venture became a profitable operation these investments could be sold to private purchasers who would have the option of converting them into capital stock. Thus, Black in effect suggested that the corporation invest in convertible income debentures; it need never acquire an equity position. Additionally, to obviate budgetary problems, the Black plan stipulated that the corporation should begin with an authorized capital of $100,000,000 rather than the $400,000,000 originally proposed by President Truman's advisory board. The compromise scheme thus provided the basis for overcoming the U.S. government's reluctance on budgetary grounds and allayed its fear of mixing government with private enterprise. Still, the basic concept of financing economic development with nonguaranteed venture capital was retained.

Incorporating these features, the articles of agreement of the IFC were approved by the directors of the International bank in April 1955. The articles were then submitted to the governments of the member countries of the bank, since they were the only countries eligible for membership in the corporation. The articles specified that the agreement would enter into force when at least 30 governments whose capital subscriptions totaled the dollar equivalent of at least 75% of the authorized capital had signed the articles and deposited instruments of acceptance with the International bank. The importance of the Black compromise plan becomes clear when it is noted that the U.S. share of the capital subscription was $35,168,000. The corporation could not function until the United States accepted the articles. On Dec. 5, 1955, the United States completed the necessary steps for membership, being the third country, after Canada and Iceland, to do so. When on July 20, 1956, both France and Germany deposited their acceptances, the IFC officially came into being with 31 member nations and a subscribed capital of $78,366,000. Actual operations did not begin until July 24 when the corporation's board of directors appointed Robert L. Garner, formerly vice-president of the International bank, president of the new corporation. Within five years the IFC had more than 60 members.

Investment Principles.—The IFC charter sets forth investment principles that its officers must observe. Since financing is not to be undertaken where sufficient private capital is obtainable on reasonable terms the lending activities of the IFC are largely restricted to the underdeveloped member countries. This implies, further, that prospective borrowers from the IFC must first seek other private capital. The IFC looks upon itself as being the last resort as a source of funds, not the first. Moreover, it is not permitted to assume managerial responsibility in firms in which it has invested except where such action is deemed necessary to protect its investment against default or insolvency. The corporation finances only enterprises that are predominantly private; it is forbidden to invest in government-owned firms or in firms in which the government is a significant participant. Unlike the U.S. Export-Import bank, the corporation cannot stipulate where the proceeds of its loans will be spent. (*See* EXPORT-IMPORT BANK OF WASHINGTON.) A corollary of this is that the funds supplied by the corporation can be used for either foreign or domestic payments, whereas both the International bank and the Export-Import bank normally finance only the direct foreign exchange requirements of a project. The corporation is also prohibited from financing an enterprise in a country if the member government objects to such financing.

An important set of guidelines follows from the corporation's over-all goal of making the greatest possible use of private capital for economic development. Accordingly, the corporation is empowered to undertake its financing on terms that it considers appropriate, taking into consideration the requirements of the borrowing firm, the risks to be assumed by the corporation, and the terms and conditions normally obtained by private investors for

similar financing. In consequence, the rate of return and other terms of the loan are negotiated in each individual case. Negotiation is undertaken, of course, with the view to making the financial burden of the borrowing enterprise as light as is feasible. Most corporation loans carry an interest charge of from 6% to 7% and maturity dates ranging from 5 to 15 years with additional income contingent upon the earning of profits by the enterprise. This is in contrast with the lending operations of the International bank, which has utilized fixed interest-bearing loans exclusively.

If the IFC is to make a substantial contribution to economic development its small subscribed capital must function primarily as a working reserve rather than as fixed capital. To achieve this goal the corporation seeks to revolve its funds by selling its investments to private purchasers whenever it can do so on satisfactory terms. Therefore, its investments must be attractive to investors and, consequently, its loans must earn returns commensurate with the risks assumed. As an added attraction, most IFC investments carry the right to convert into equity shares, although the corporation itself, except in rare circumstances, is prohibited from exercising this option. The corporation is also authorized to guarantee securities in which it has invested in order to expedite their sale. By making useful and profitable loans in the underdeveloped areas the IFC hopes to foster an affirmative attitude toward such investment on the part of private investors everywhere.

Recognizing the possible need for adding funds to the working reserves of the corporation, the charter empowers it to offer its own obligations for public sale. To provide modest protection for the corporation's capital its officers are instructed to seek a reasonable diversification of investments. All productive enterprises, manufacturing, financial, commercial and agricultural, are eligible for loans.

To minimize administrative costs of the corporation its officers provisionally decided that it would not consider investment proposals unless the new investment in the firm was at least $500,000 and the desired contribution of the corporation was to be at least $100,000. The maximum amount of a single corporation commitment is normally about $3,000,000. The desire to reduce operating expenses also explains the corporation's close working relationship with the International bank, whose technical and administrative staff are available to it. *See* also FOREIGN AID PROGRAMS; ECONOMIC DEVELOPMENT; CAPITAL, EXPORT OF.

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For current developments *see* the *Britannica Book of the Year* (U.S. edition). (M. O. CL.)

INTERNATIONAL GEOPHYSICAL YEAR, commonly known as IGY, was the 30-month period July 1, 1957–Dec. 31, 1959, during which a world-wide program of geophysical research was conducted. Initially planned for the first 18 months of this interval, it was extended an additional year. The extension was called International Geophysical Cooperation (IGC-59).

The scope of IGY represented an unparalleled enterprise in international scientific co-operation. It involved co-operation among more than 70 nations, participation by about 30,000 scientists and observers and operation of several thousand scientific stations reaching from pole to pole.

IGY was directed toward a systematic study of the earth and its environment. Even as a single planet the earth is far from static. Earthquakes, large and small, subject it to noticeable stresses and strains; the oceans, seas and the land itself are subject to tidal pulls. Energized by the sun's heat, water passes from the solid state in glaciers and snow fields to a liquid form in seas and rivers and then becomes a vapour in the atmosphere. Great atmospheric and oceanographic circulation systems transport heat energy between the tropics and the high latitudes, equalizing the energy balance of the earth; the tropics receive more energy from the sun than can be reradiated, while the polar regions radiate to space more energy than received directly from the sun.

The sun plays a critical role in weather and climate as the driving engine of winds and currents. Invisible particles and radiations stream to the earth from the sun and outer space, affecting the ionosphere and the earth's magnetic field and causing the brilliant northern and southern lights. These conditions change as events vary in the universe and as the earth rotates about its axis, moves about the sun and is carried with the solar system in a vast trajectory about the centre of our galaxy.

To understand these phenomena better, to obtain thereby better control of man's planetary environment and to gain new insights into the nature of the cosmos, world-wide studies are needed. IGY included 11 fields of geophysics: aurora and airglow, cosmic rays, geomagnetism, glaciology, gravity, ionospheric physics, longitude and latitude determinations, meteorology, oceanography, seismology and solar activity. Each field requires measurement at many points on or above the earth's surface if a relatively complete view of the field is to be obtained. Simultaneous studies permit the establishment of correlations among the many phenomena.

In addition, two novel programs, rocketry and artificial earth satellites, involving all the fields associated with the upper atmosphere and solar-terrestrial relations, were part of the effort. IGY led to a significant expansion of sounding-rocket research and to the initiation of space exploration. Because no one nation could undertake so extensive an effort or overcome problems of national boundaries, IGY was necessarily a co-operative effort among scientists of many nations.

History and Organization.—IGY had two antecedents in the International Polar years of 1882–83 and 1932–33. Both of these were largely concerned with studies of the high northern latitudes. During the first International Polar year 12 stations were established by 11 nations in the arctic for studies of surface weather conditions, geomagnetism and the aurora borealis. Perhaps the most significant result of this effort was the discovery that auroral lights occurred most often and vividly in a circular belt about the north magnetic pole and about 1,200 mi. below it. During the second International Polar year about 20 nations organized expeditions, and the number of observation stations in the northern latitudes was considerably increased. For example, about 90 meteorological stations were active in the arctic and 30 geomagnetic stations in latitudes above 60° N. In addition to the three fields investigated in the first International Polar year, studies of ionospheric physics were included in the second International Polar year. Using a device that transmitted short pulses of radio energy to the ionosphere and received the reflected signals, physicists gained new insight into the electrified layers between 40 and 200 mi. above the earth. Appreciable advances were made, using radiosondes, in the understanding of arctic weather and its relationship to weather in lower latitudes.

Advances in instrumentation during the three decades following the second International Polar year had made possible sensitive and more precise measurements. High-altitude balloons extended the range of radiosondes to about 100,000 ft. and special balloons could carry cosmic ray instruments even higher. Rockets were successfully used in the decade following World War II for direct exploration of the atmosphere up to heights of 250 mi. Automatic high-speed computers capable of analyzing the vast quantities of data were becoming available. These and many similar devices suggested that considerable progress could be made in studying geophysics on a broad basis. As early as 1950 informal discussions were held by geophysicists (led by the American, L. V. Berkner) looking to a third polar year. Proposals to this effect were considered by the International Scientific Radio union and the International Union of Geodesy and Geophysics.

Accordingly, the parent body of international scientific organizations—the International Council of Scientific Unions—sanctioned the broader study of the International Geophysical year and established a special committee (Comité Special de l'Année Géophysique Internationale) for IGY consisting of scientific representation from organizations concerned with radiophysics, astronomy, geodesy and geophysics, physics and geography, and the World Meteorological organization. The officers of this committee were Sydney Chapman (president), L. V. Berkner (vice-president) and

Marcel Nicolet (secretary-general). The first meeting of the special committee took place in Brussels, Belg., in July 1953 and was followed by a series of general assemblies and regional conferences. At the general assemblies, in particular, criteria for the IGY program were established. These criteria specified that: first, fields of geophysics were to be studied where data were needed from many points on or above the surface of the earth in order to get a planetary view; second, projects were to be undertaken that would yield results of value to former studies, such as rocket and satellite exploration of the upper atmosphere and near space; third, advantage would be taken of expeditions to remote places; in large part seismology and gravity measurements were introduced to capitalize upon opportunities opened up by IGY in the antarctic, the arctic basin and at sea; finally, epochal measurements were to be made; such measurements, as of snow and ice in glaciers, repeated at intervals over many years, could indicate long-range trends in climate.

National committees were established by scientific organizations in each country, and these groups solicited support from their governments and private institutions. In Great Britain, for example, the Royal society established a committee of experts. In the United States, the National Academy of Sciences assumed responsibilities for the effort and received contributions from many public and private organizations, including the National Science foundation (through which congress appropriated many millions of dollars) and the department of defense (which contributed extensive logistics and technical support, particularly in arctic, antarctic, rocket and satellite operations).

More than 70 nations co-operated in IGY; the following 66 national groups were formal participants: Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Burma, Canada, Ceylon, Chile, China (Taipei), Colombia, Cuba, Czechoslovakia, Denmark, Dominican Republic, East Africa, Ecuador, Egypt, Ethiopia, Federal Republic of Germany, Finland, France, German Democratic Republic, Ghana, Greece, Guatemala, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, Democratic People's Republic of Korea, Malaya, Mexico, Mongolian People's Republic, Morocco, Netherlands, New Zealand, Norway, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Southern Rhodesia, Rumania, South Africa, Spain, Sweden, Switzerland, Tunisia, Union of Soviet Socialist Republics, United Kingdom, United States, Uruguay, Venezuela, Democratic Republic of Vietnam, Republic of Vietnam, Yugoslavia. These nations were responsible for the operation of more than 2,500 major scientific stations as well as several thousand small or temporary stations and the participation of more than 10,000 scientists and technicians and several thousand amateur and volunteer observers. It is estimated that the IGY research effort cost about $500,000,000.

IGY studies dealt with (1) the physics of the upper atmosphere, which includes solar activity, and particles and radiations from the sun, other stars and the interplanetary medium; (2) the heat and water regimen, which includes meteorology, oceanography and glaciology; and (3) the earth's structure and interior, which includes seismic, gravimetric, and longitude and latitude determinations. In addition to these areas, some work in biology, environmental medicine and geology was conducted in the arctic and antarctic.

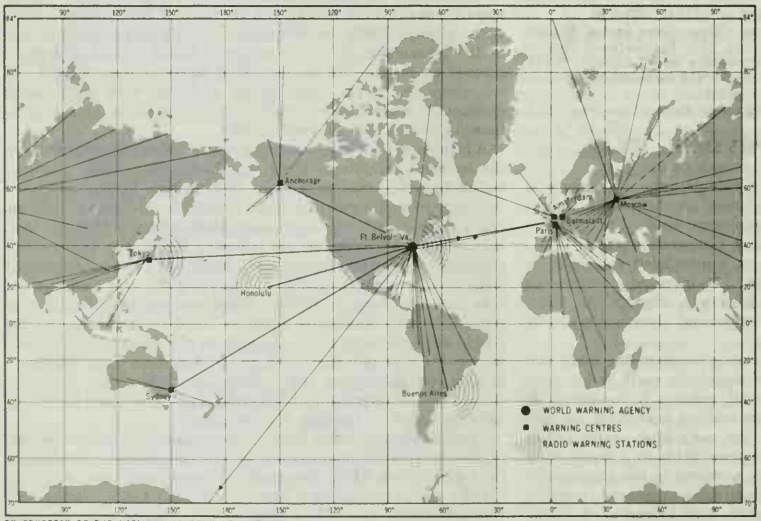
Particularly in the first two categories, measurements and observations were conducted on regular, daily schedules. Because the IGY period was chosen to coincide with the maximum sunspot cycle, when solar flares and disturbances are prevalent, the role of the sun was especially significant. To study these disturbances and their effects, provisions were made for intensifying observations in a program called World Days. Indications of unusual solar activity were flashed from any IGY station to a World Warning agency operated by the national bureau of standards at Ft. Belvoir, Va. There such reports were evaluated; if major disturbances in the upper atmosphere were anticipated, warnings were radioed to all stations in the world-wide network. These stations then increased the frequency of their regular measurements of the earth's magnetic field and of the ionosphere, sent up balloons to detect increases in cosmic ray intensities and auroral activity and launched rockets to intercept the particles and radiations from the sun. The special days or periods for such intensified observation were known as World Meteorological Intervals, Regular World Days and Special World Intervals.

World Meteorological Intervals were periods of ten consecutive days each, in June, September, December and March. They coincided with two pentads (five-day periods) of the World Meteorological organization and always included either a solstice or equinox, periods during which intensified meteorological observations are most desirable.

Regular World Days were three or four days each month that constituted a representative sample of the IGY period. Two were consecutive days at the time of the new moon; the others were at times of unusual meteor showers (Geminid, Perseid, Taurid, etc.) or near one of the lunar quarter phases. They also included the days of solar eclipse, with adjacent days for control purposes.

Periods of Alerts and Special World Intervals were designated on a day-to-day basis. A period of Alert was declared whenever solar activity was unusually high. During the period of Alert, an Interval would be declared whenever the possibility was high that an unusual geomagnetic storm would begin within a few hours. Each period of Alert and Interval continued until terminated by the World Warning agency.

The Upper Atmosphere.— The region of space between about 20 and 600 mi. above the



BY COURTESY OF THE NATIONAL ACADEMY OF SCIENCES

WORLD-WIDE NETWORK OF COMMUNICATIONS STATIONS WHICH CO-OPERATED IN STUDIES OF SOLAR DISTURBANCES AND THEIR EFFECTS DURING THE IGY

Indications of unusual solar activity were flashed to the central warning agency at Ft. Belvoir, Va. (Stations were located near major cities shown on map)

earth is largely dominated by particles and radiations from stars and interplanetary space. The sun emits a broad spectrum of radiations and particles that affects the earth and its atmosphere. Solar disturbances, particularly sunspots and flares, often result in magnetic storms, heightened auroral displays and ionospheric variations that frequently disrupt long-range radio communications, and they sometimes intensify cosmic rays. IGY solar investigations were designed to monitor solar activity so that warnings could be issued of disturbed or unusual conditions, to make measurements of solar phenomena and to relate these observations to the sun itself and to events in the upper atmosphere. Thirty-one nations made solar observations at 120 stations.

A world-wide solar flare patrol network was established. Flares are considered most significant in their terrestrial effects. Solar radio noise, cosmic radio noise and propagation of atmospheric noise were also observed. Variations in the spectral lines of certain major flares were recorded, and an effort was made to map the magnetic-field pattern of the sun on a day-to-day basis.

A variety of instruments were used in the IGY auroral studies. Twenty-nine special cameras photographed the sky, recording spatial distribution and changes of the aurora. Hundreds of amateur observers assisted in plotting the extent of auroral displays. Radar devices were used to scan the skies in cloudy weather and during daylight. Spectrographs and spectrometers analyzed the auroral variations. The objectives of these studies were to map the aurora in the north and south, to learn more about its origin and to correlate auroral events with other atmospheric and solar phenomena and disruptions in radio communication. In addition to hundreds of visual observation sites, over 140 instrumented stations were in operation.

Airglow at its brightest resembles faint aurora, but results from chemical reactions in the upper atmosphere rather than the charged solar particles that generate aurora. Sensitive photometers and high-speed spectrographs were in use at 50 stations to detect airglow. The nature and distribution of airglow were principal interests of IGY scientists in this field.

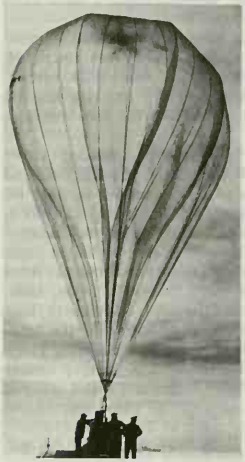
The component of the earth's magnetic field in space was studied during IGY because it is highly variable and interacts with the ionosphere, cosmic rays and the charged particles responsible for aurora. More than 250 magnetic observatories were active in IGY, and rockets and satellites were also used to carry instruments aloft. Particular attention was directed to rapid magnetic-field fluctuations, which are usually accompanied by disturbances in radio-wave propagation and by auroral displays. The fluctuations vary with the number of sunspots, and seem to be caused by three great electrical currents, hundreds of thousands of amperes in strength, flowing through the upper atmosphere, two moving in the high latitudes and one around the equator.

The region between about 50 and 200 mi. above the earth includes the ionosphere, so called because radiations from the sun create charged ions in the atmosphere at that level. The region behaves toward radio waves much like a mirror toward light waves, and accounts for the long-range propagation of radio waves by reflection. The ionosphere consists of several layers of varying ion density. Variations in the electron density of these regions, fluctuations in their heights, relationships to magnetic storms and solar phenomena were topics of study at about 250 stations with ground-based electronic devices and rockets. The chief instrument for ionospheric research is the ionosonde. Radarlike pulses are directed vertically to the ionosphere, and the reflections are recorded. The pulses are varied in frequency so that a broad band of the spectrum can be studied. The travel time of the pulses and their reflections provide virtual ionospheric heights (which are greater than the actual heights because of retardation of the pulses by the ionized medium) while phase shifts and intensities yield information on the state of ionization in the layers. Such studies lead to better knowledge of the ionosphere and provide the basis for selecting desirable frequencies for long-range radio communication.

Cosmic rays, which bombard the earth continuously from every direction, were studied at 130 stations. One of the difficulties in studying cosmic rays is the masking influence of the lower atmosphere. The primary rays fail to reach the earth because they collide with particles in the high atmosphere, creating secondary rays in a kind of chain reaction. In general it is these secondary rays that are observed on earth. More cosmic ray primaries enter at high latitudes where the magnetic field is more or less parallel to particle trajectories and fewer of the lower-energy particles are deflected away. At low latitudes, where the magnetic field is more or less perpendicular to particle trajectories, most of the low-energy particles are deflected, giving rise to the cutoff effect. IGY investigations were concerned with fluctuations in cosmic ray intensity with the sunspot cycle, intensity decreases during some magnetic storms, increases shortly after the onset of solar flares and chromospheric eruptions and mass-energy determinations. These studies employed neutron and meson telescopes, cloud and ionization chambers, photographic emulsions and Geiger counters.

Heat and Water.—Weather and climate are produced by interaction of the sun's energy and the lower atmosphere (below 20 mi. or so), the oceans, and snow and ice fields. These relationships also affect sea levels, ocean currents and the food stocks of the seas.

In meteorology, networks of 650 upper-air, 700 radiation and 100 ozone stations made temperature, pressure, humidity and wind observations and measurements. Circulation of the atmosphere and interchanges between the tropics and polar regions were studied. The objectives were to obtain world-wide data leading to improvements in forecasting, and to provide a sounder approach to climatic trends.



BY COURTESY OF THE U.S. NAVY

LAUNCHING A GIANT IGY WEATHER BALLOON

The purposes of the IGY oceanographic program were to gain an understanding of oceanic circulation and of both short- and long-duration changes in sea level and their relationships to other oceanic and atmospheric phenomena. Thirty-five countries operated 70 research vessels and 225 tide stations in these investigations. Measurement of the movement of deep waters occupied much attention, for these currents are important in the transport of considerable energy. Sea levels provide one key to oceanic circulation and to its meteorological influences. Sea-level changes were recorded at several hundred island stations.

Glaciers exist on all continents except Australia. Fluctuations in their extent provide clues to past and future climatic changes, while polar ice sheets act as sources of cold or sinks of heat from the tropics. Projects were under way to determine the volume of the ice sheets of Antarctica, Greenland and the arctic pack; to study the heat and water exchanges between these ice bodies and the atmosphere; and to examine snow stratigraphy, ice movement, temperature and topography. Eighty-three stations were in operation.

The Earth's Structure and Composition.—Better knowledge of the earth's interior was another objective of IGY. Seismologists of 50 nations gathered earthquake information from almost all regions, particularly from such areas as Antarctica where data were almost completely lacking. Man-made explosions were used to study seismic waves, and to determine ice thickness and the structure of underlying terrain. About 240 stations co-operated in this program of simultaneous land and sea measurements.

The size and shape of the earth remain imperfectly known. Because the earth is not uniform, the pull of gravity varies from place to place. Gravity measurements thus permit better determinations of the configuration of the earth, and almost 200 sta-

tions co-operated in the gravity program. Similar to ocean tides but much smaller, earth tides are created by the moon and sun. Hawaii, for example, rises and falls about four inches daily. Studies of these movements by gravimetry help to determine the rigidity of the earth and its internal structure.

To improve knowledge of distances between points and land masses, 70 stations engaged in longitude and latitude measurements. Twenty stations used a new instrument—the dual-rate moon-position camera, which permits position determinations within a few hundred feet by using the moon as reference. Standard astronomical techniques were also used, where local gravity surveys had provided a precise knowledge of the direction of the vertical, to obtain precisions to better than five feet. Such precision is basic in studying possible motions of the continents and also has applications in the making of maps.

Rockets and Satellites.—Prior to World War II knowledge of the upper atmosphere was restricted to indirect observations from or near the ground. During the decade following, research rockets were developed, largely in the U.S., to carry instruments as high as 250 mi. Several hundred such rockets were fired during IGY by Australia, Canada, France, Great Britain, Japan, the U.S. and the U.S.S.R. Data were telemetered back to earth and provided new knowledge in meteorology and atmospheric structure, ionospheric physics, aurora and airglow, geomagnetism, cosmic rays, and solar ultraviolet light and X-rays.

Rockets are particularly useful in measuring the altitude variation of such phenomena as temperature. They are restricted, however, by their brief lives and by their essentially vertical coverage. To overcome these limitations, IGY included satellite vehicles in the program. Satellites can traverse vast expanses over appreciable periods of time.

The inclusion of satellites in the IGY was recommended (1954) by the IGY general assembly at Rome. Both the U.S.S.R. and the U.S. responded and discussions of IGY plans for satellite research were under way in Washington, D.C., when, on Oct. 4, 1957, Sputnik I was successfully launched by the Soviet Union.

During the 30-month IGY interval the U.S. launched eight satellites and made three space probes. The experiments provided significant data concerning cosmic rays, magnetic fields, radio wave propagation, solar radiations and particles, cloud cover, heat radiation balance, micrometeorites and composition of the ionosphere. In the same period the Soviet Union launched four satellites and made two space probes, instrumented to observe similar phenomena. Two U.S. space probes (Pioneers IV and V) and one Soviet probe (Lunik I) became artificial planetoids of the sun. The U.S.S.R. Lunik II hit the moon on Sept. 13, 1959.

Results.—In several fields, notably meteorology and ionospheric physics, IGY data were immediately applicable and also provided information for future work such as the study of ionospheric storms and atmospheric circulation. Weather observations, for example, were promptly used in forecasting. A significant achievement was the preparation of twice-daily weather maps, providing the first census of antarctic weather. Recording of antarctic temperatures to a low of at least −86.7° C. (−124° F.) as well as studies of temperature, pressure, humidity and winds in both the arctic and antarctic provided data that can reveal the influence of these regions on world weather. In the period following IGY, daily weather maps for the entire globe, prepared by the weather services of the U.S., South Africa and the Federal Republic of Germany (assuming responsibility for the northern hemisphere, southern hemisphere and the equatorial belt, respectively), represented a powerful tool for understanding the forces that affect weather.

Using seismic sounding techniques, traverse parties ranging over thousands of miles in Antarctica measured ice thickness and secured a profile of underlying land masses. One hundred miles east of IGY Byrd station, in the heart of Marie Byrd Land, the ice measured 14,000 ft. thick, resting on bedrock 8,000 ft. below sea level. This is believed to be the thickest ice ever measured. It appeared that the antarctic might be a complex of island and mountain chains, some of which would lie hidden beneath sea level were the ice to melt. There were indications of a major division between east and west Antarctica. Seismic measurements revised the estimate of the amount of snow and ice in the world to about 4,500,000 cu.mi., about 40% higher than earlier estimates.

BY COURTESY OF THE U.S. NAVY

SEISMOLOGIST READING GRAVIMETER WITH WHICH TIDAL MOVEMENT OF ICE SHELF AT LITTLE AMERICA WAS DETECTED DURING THE IGY

In the arctic, gravimetric and seismic measurements uncovered an underwater ridge several thousand feet high. Three major countercurrents in the oceans were found and measured. One in the Atlantic flows beneath and opposite to the Gulf stream at a rate of 8 mi. per day about 9,000 ft. beneath the surface. The second, at depths between 200 and 1,000 ft., flows against the surface equatorial current of the Pacific, transporting 1,000,000,000 cu.ft. of water per second. The third lies beneath the surface 200 mi. north of the Pacific equator, transporting 1,500,000,000 cu.ft. per second. Millions of square miles of the southeast Pacific were found to bear a surface-bottom sludge laden with nodules of manganese and iron with up to 1% of cobalt mixed with copper. The value of these minerals was estimated at about $500,000 per square mile, and the economics of dredging up the sludge appeared promising.

The sounding rocket program of IGY permitted the detection of X-rays and auroral particles high above the earth, penetrated and observed the current sheets of the equatorial ionosphere and provided the first detailed photographs of the solar ultraviolet spectrum taken from above the masking layers of the lower atmosphere.

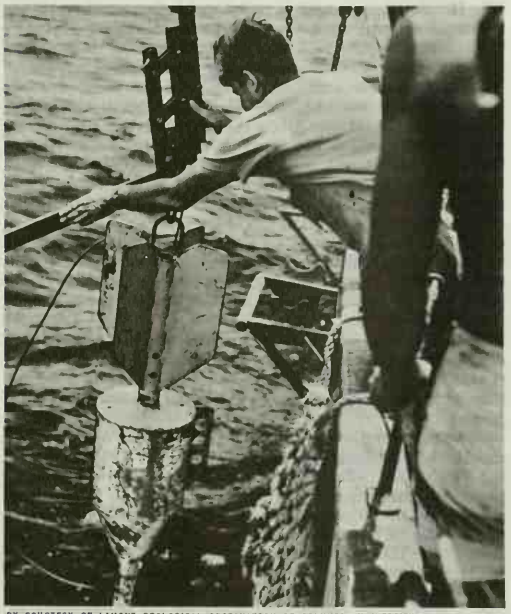
Pressure, temperature, composition and density were recorded to altitudes reaching about 200 mi. from several rocket-launching facilities. Rockets were used to probe active auroras and yielded data that showed, for example, that the soft radiation flux above 25 mi. is many times the flux of primary cosmic rays. Rockets also augmented the study of secondary cosmic rays on the ground, and both rockets and balloons recorded the intensities and composition of the primary radiation. The earth's magnetic field was measured in disturbed auroral regions, and atmospheric electric currents were recorded about the equatorial zone. Within the ionosphere, better electron density data were obtained, and the diffusive separation of atmospheric components below and above its E-region was measured. In astronomy, rockets provided new knowledge of solar radiations and of ultraviolet radiation emanating from other stars. Sodium vapour was ejected from rockets into the high atmosphere, permitting study of its diffusion, of high-altitude winds and effects on the vapour under the impact of particles and radiations from space. In the Argus experiment, electrons released by small atomic devices carried aloft by rockets showed how charged particles are trapped by the earth's magnetic field.

The discovery of the Van Allen radiation belts, in which both satellites and deep space probes were used, provided the basis for a unified description of variations of the earth's magnetic field, the aurora and solar particles. The inner Van Allen belt was first delineated by instruments aboard the early Explorer satellites. The radioactive particles appear at an altitude of 70 mi. in northern latitudes and 250 mi. above the equator and reach a maximum concentration at about 2,400 mi. C. Störmer had postulated that charged particles could be trapped in the earth's field and forced to spiral between northern and southern mirror points. But without experiment, his calculations could not be assessed. Now it appears that over a period of time the number of captured particles can increase appreciably, accounting for the formation of a Van Allen belt. It is probable that at least part of the inner belt arises from beta decay of cosmic rays.

With space probes Pioneers III and IV the second Van Allen belt was discovered to range from 6,000 to 36,000 mi. beyond the earth's surface. This outer zone showed a great increase in radiation intensity between observations of Pioneer III (launched during a relatively quiet period of the sun) and Pioneer IV (launched five days after a period of very high solar activity). The particles in this zone leak out near the magnetic poles and collide with atmospheric atoms, generating auroral displays. The Van Allen belts also explain latitude variations in temperature at high altitudes. IGY rocket experiments showed temperatures of about 2,000° K. over Ft. Churchill, Can., in contrast to 1,100° K. over White Sands, N.M., between altitudes of 90 and 120 mi.

Observations of the earth's shape with the first small Vanguard satellite permitted J. A. O'Keefe and his associates to postulate a pear-shaped model of the earth. The apparent variation from the previous theoretical model was small, but it was important in terms of the earth's structure and surface loading.

Both the U.S.S.R. and the U.S. provided valuable data on satellite drag and such environmental conditions as temperature. For example, L. G. Jacchia established definite relationships linking Vanguard I drag with both solar flux and magnetic activity index. Soviet satellites also permitted ionospheric studies in which the receptions can be coupled with precise positional data.



BY COURTESY OF LAMONT GEOLOGICAL OBSERVATORY OF COLUMBIA UNIVERSITY

OCEANOGRAPHERS DROP A WEIGHTED DEVICE FROM THE IGY SHIP "VEMA" TO COLLECT SEDIMENT FROM THE OCEAN FLOOR

Specific discoveries and findings represent only a part of the technical results of IGY. Most of the effort involved collection of world-wide synoptic data. In one ionospheric physics project (vertical incidence soundings), 10,000,000 frames of film, each containing hundreds of bits of data, were accumulated. An even larger body of data was involved in the meteorology program, and comparable masses of data were collected concerning aurora and airglow, geomagnetism, cosmic rays and oceanography. Valuable analyses of such data were possible with automatic computers and associated techniques.

Thousands of published papers appeared as a result of IGY. Three centres for the interchange of data were established: in the U.S. under the auspices of the National Academy of Sciences, at the Soviet academy in Moscow and in western Europe (with a few discipline branches in Australia and Japan). Each centre gathered, indexed and archived a complete set of all IGY data. The task of interchange was finished on Dec. 1, 1961; final catalogues were published and distributed by each centre within six months. The centres made data available on request to all investigators. As studies of the data lead to new discoveries, these data continue as a unique reservoir for future research. To make the data even more generally accessible, publication of the *Annals of the IGY* was undertaken. These are largely devoted to compilations of significant quantitative as well as qualitative information. About 50 volumes were planned in the first stages of the work.

Politically, IGY is recognized as the basis for the Antarctic treaty, signed by 12 nations active in Antarctica. The treaty consecrates the polar region to peaceful, scientific uses and is the first instance in which such a portion of the earth has been so set aside. The United Nations also noted the value of IGY and recognized post-IGY activities planned by the international scientific community.

IGY itself directly generated new international organizations through the International Council of Scientific Unions. The Special Committee on Oceanic Research (SCOR) launched a major investigation of the seas, concentrating first on the Indian ocean. The Special Committee on Antarctic Research (SCAR) continued antarctic studies begun by IGY. The Special Committee for Space Research (COSPAR) similarly continued and extended cooperative studies of space initiated by IGY. The International Geophysics committee (CIG) succeeded the IGY committee in its responsibilities for data interchange and publication of the *Annals*, and initiated such programs as the World Magnetic survey, the Upper Mantle program and the International Years of the Quiet Sun (IQSY). The fields of IQSY study included magnetic fields, ionospheric physics, aurora and airglow, all radiations and charged particles in the atmosphere and nearby space, and solar activity. IQSY was scheduled for the period of sunspot minimum (1964–65), while IGY occurred during sunspot maximum. *See* SPACE EXPLORATION. (HH. O.)

INTERNATIONAL INSTITUTE OF AGRICULTURE, a clearinghouse of world agricultural information in the international sphere whose functions included the collection, analysis and publication of facts about crop and livestock production, trade, prices and related subjects "for the protection of the common interests of the farmers" of all nations. The institute was founded in Rome in May 1905. It was disbanded and its activities were transferred in 1946 to the Food and Agriculture Organization of the United Nations (*q.v.*), which superseded it.

The idea of the institute was proposed by David Lubin, a merchant of Sacramento, Calif. King Victor Emmanuel III of Italy called the first conference at Rome in 1905. The convention treaty establishing the institute was later ratified by the governments of 77 nations. The convention provided for a staff of experts to be directed by a permanent committee consisting of one delegate of each country. The institute was financed by contributions of the member nations according to the class of membership chosen.

The technical staff eventually grew to about 100 men and women of more than 30 nationalities. They assembled one of the largest

agricultural libraries in the world, housed in the building donated to the institute by the king of Italy; later a special library building was erected, aided by a grant of funds by the International Education board.

The institute published several series of journals, monographs, yearbooks and special reports in both French and English. The first attempt to make a world-wide agricultural census was begun for the years 1930 and 1940. Much of the work of the staff was done in connection with the biennial general assemblies held at Rome as well as hundreds of special meetings throughout Europe. The institute collaborated with the League of Nations, the International Labour organization and the economic conferences of 1927, 1933 and 1939, and participated in the organization of world congresses on forestry, wheat, poultry and dairying.

During World War II the international character of the institute was recognized by the belligerents and its work continued on a reduced scale. When the Food and Agriculture Organization of the United Nations was started in 1943, the member nations of the institute decided to dissolve it and turn its archives and staff over to the new organization, which was planned to cover the same field with more adequate resources. The staff was either retired or employed by the FAO, and the work of the institute terminated on July 31, 1946. The library of the institute, designated as the David Lubin Memorial library, was transferred to the FAO headquarters building in Rome, which had been provided by the Italian government. (J. C. Ms.)

INTERNATIONAL LABOUR ORGANIZATION, an official international institution that was created by the 1919 peace settlement but later became a specialized agency of the United Nations. The ILO is unique among international organizations in that the representation of each state is tripartite, including representatives of the government, workers and employers.

The ILO's chief organs are its conference, which usually meets yearly and at which all members are represented; its governing body; and the permanent secretariat, known as the International Labour office, under the direction of an appointed director-general. The headquarters of the ILO is in Geneva, Switz. Its chief forms of activity include the proposing of international treaties (known as conventions) and recommendations to governments, offering technical assistance and co-operation, making investigations, suggesting policy, compiling statistics and carrying on research and publicity. It has concerned itself with all forms of labour and social legislation and with the administration of labour laws. It has studied hours of work, wages, occupational health and safety, social security, manpower needs and the recruiting and training of workers and supervisors. It has also given attention to co-operative organizations, handicrafts and rural industries, international migration, freedom of association and trade union rights, industrial relations, workers' education, management development, productivity, employment policies, combating unemployment and underemployment, and the labour and social aspects of international competition, of technological change and of economic development.

ORIGINS AND HISTORY

During the 19th century a number of reformers urged international economic agreements by governments to minimize the hardships to workers and the dangers to peace which they saw as inherent in modern industrialization and international economic competition. In 1900 a private organization, the International Association for Labour Legislation, was established, with headquarters, known as the International Labour Office (not to be confused with the later ILO), in Basel, Switz., in 1901. It succeeded in getting a diplomatic conference in 1906 to adopt two conventions, one to limit the hours of night work of women in industry, another to prohibit the use of poisonous phosphorus in the manufacture of matches. The association's pioneering efforts set "useful procedural precedents" for the later ILO.

Labour in the Versailles Peace Treaty.—As World War I increased its demands on workers for effort in the factories and for sacrifice on the battlefields, labour spokesmen in the Allied nations asserted claims for representation at the peace conference and for a peace settlement that would enhance social and economic justice. The Russian Revolution of 1917 increased the restiveness and the demands of labour in Europe. An international trade union conference in Bern, Switz., early in 1919 demanded an "international labour parliament" with lawmaking powers, in which labour would have half the votes.

The Conference of Paris in 1919 set up a commission for international labour legislation headed by Samuel Gompers, president of the American Federation of Labor. The commission put aside the more ambitious dreams of a body with legislative authority and proposed a body with powers of recommendation to national governments for action by them, in composition a tripartite body in which half the representation would be by governments, and one-fourth each by labour and by employers. The peace conference adopted these proposals and, by inserting them in the treaty of Versailles, set up the ILO.

The ILO Between World Wars I and II.—The ILO offered far less than the European or even the U.S. labour movement had asked, but as much as they seemed likely to get. The democratic labour movements of Europe (as distinct from the Communist unions which soon were competing with them, unsuccessfully, in most countries) threw their support behind the ILO, a condition indispensable for its success.

The first International Labour conference met in Oct. 1919 in Washington, D.C. The governing body chose as the ILO's first director-general, Albert Thomas, a moderate and capable French Socialist who had been his nation's wartime minister of armaments. Under his leadership (1920–32) the ILO defined its purposes broadly, strengthened its organization, built up its staff and achieved an almost complete autonomy of policy in the League of Nations system. Upon Thomas' death, his deputy, a former British career civil servant, Harold Butler, succeeded him. When Butler resigned in 1938, John G. Winant, former Republican governor of New Hampshire and first head of the U.S. Social Security board, who had served as assistant director of the ILO in 1937, became director-general.

ILO After World War II.—In 1940 the ILO moved from Geneva, Switz., to Montreal, Que., for the duration of World War II. Actively engaged in postwar planning, it convened one international labour conference at Philadelphia, Pa., in 1944. Its "Philadelphia declaration" was a restatement of ILO aims—"poverty anywhere constitutes a danger to prosperity everywhere"—and a reaffirmation and amplification of the social-economic purposes of the Atlantic Charter. The ILO's hopes of a major role in the postwar world were hardly realized, however. It was somewhat suspect to states not members of the League of Nations because of its ties with the League. The San Francisco United Nations founding conference snubbed the ILO, despite British support, for the United States was lukewarm toward it and the Soviet Union definitely hostile. The UN charter made no mention of it, while giving broad powers to the UN Economic and Social council. The ILO became one of the specialized agencies by its agreement with the UN in 1946. The ILO kept most of its autonomy of policy and received a budgetary autonomy it had not had under the League.

In 1941 Edward J. Phelan, an Irishman who had been Butler's deputy and before that a career British civil servant, had succeeded Winant. On Phelan's retirement in 1948, David A. Morse, United States undersecretary of labour, became director-general.

Changing Emphasis.—In the period between World Wars I and II, the ILO had been primarily concerned with its research and "legislative" efforts, the attempts to define and promote proper minimum standards of labour conditions by international conventions and recommendations. In the post-World War II world, although conventions and recommendations continued important, the ILO shifted its major emphasis to the programs of technical assistance to underdeveloped areas. This emphasis, which predominated after 1949, led it to take on work of an operating character and to focus less upon the economically advanced nations of Europe and more on the underdeveloped countries of Asia, Latin America and Africa.

CONSTITUTION AND STRUCTURE

The ILO brought into official intergovernmental organization the representation of functional groups, a principle which had been applied to economic and social administration within various nations. In the International Labour conference, each member state is represented by two government delegates and (normally) one employer and one worker delegate, the two latter named by the government in consultation with "the most representative organizations of employers and workers" (where such exist) in each country. Not all delegations are complete, however.

To avoid the rule of unanimity, the ILO from the outset required only a two-thirds vote by its conference for the passage of a convention or a recommendation. The government delegates often cast the deciding votes when there were differences of opinion between the employer and worker delegates.

The conference is the supreme authority of the ILO on most policy matters, but the governing body discusses and votes the ILO budget, appoints the director-general and controls the International Labour office. Tripartite, like the conference, the governing body carried out another innovation of international representation. In the conference all nations are equal, with every delegate having a single vote. In the governing body, 10 of the government representatives must come from the 10 member states "of chief industrial importance."

Tripartism, in the 2:1:1 ratio, is firmly established in the conference and governing body. Various proposals to amend the constitution to give workers a larger representation, or to put both worker and employer delegates on a numerical par with those of government, have been rejected. Governments must be persuaded of the practical value of any proposal if it is to begin to receive implementation. The 2:1:1 ratio, however, prevails only in the phases of ILO work requiring binding votes. In conference committees and in the industrial committees (*see* below), representation of the three interests is equal. Thus the organization seeks the maximum contribution of specialized knowledge and the democratic participation of the major parties to industrial life—unions and employers—along with that of governments in its substantive work.

Two problems raised by tripartism have been troublesome because they involve fundamental differences of national political and social structure. One is the right of governments to name as employer representatives the managers of state industries or enterprises. The other is the naming of worker delegates by governments which systematically manipulate or repress labour unions within their borders.

The first issue arose when, in 1954, the U.S.S.R. and a number of Communist states rejoined the ILO. Employer representatives of other countries for the most part held that the Communist countries' employer delegates could not represent the employer interest; therefore they refused to appoint them to committees. In 1959 the conference reached a compromise which thereafter permitted the seating of some of the challenged employer delegates on committees. It satisfied neither private-enterprise employer spokesmen nor the Communist states, but continued in uneasy and experimental operation, in accordance with "equality of treatment for all members attending the conference" and the organization's universality.

Membership.—The ILO's ideal has been universality of membership. It admitted Germany as early as 1919, long before the League of Nations did. Some nations—Brazil and, for a time, Japan—remained in the ILO after quitting the League. Others became members of the ILO without joining the League or the UN. The United States remained aloof from the League but joined the ILO in 1934. After World War II the ILO admitted the German Federal Republic (West Germany). In 1961 its conference condemned the racial policies of the government of the Republic of South Africa and asked it to withdraw from the ILO "until such time as it abandoned apartheid," but South Africa refused to do so.

Post-World War II amendments made it easier to join the ILO. Members of the UN do not have automatic membership in the ILO, as did League members, but they may become members simply by filing a declaration accepting the obligations of the ILO constitution. Nonmembers of the UN must be accepted by a vote of two-thirds of the conference, including that of two-thirds of the government delegates. By 1962 the ILO had 102 members.

OPERATION OF ILO

Conventions and Recommendations.—The standard-setting process of the ILO, the major activity of its first two decades, uses the instruments of conventions (treaties) and recommendations. Member states are obliged to submit either a convention or a recommendation to the national "authority or authorities within whose competence the matter lies, for the enactment of legislation or other action" within a year or, under exceptional circumstances, 18 months. In the case of a federal state, the federal government must submit the convention or recommendation not only to the national legislature but also to the state or provincial authorities whenever it is, in whole or part, within their jurisdictions. A convention ratified by the nation's constitutional process becomes binding upon the nation, which makes periodic reports to the ILO on the measures taken to give it effect. If it is not ratified, the state undertakes to report on its "law and practice" with regard to the subject matter of the convention.

A recommendation makes it possible to offer an international standard higher than that which at a given time may seem the maximum suitable for a convention, or to offer a general principle where a binding obligation by states is not being sought. The same problem may be dealt with by both forms, the convention setting an international minimum, and the recommendation a higher norm for more advanced countries and a level of aspiration for others. By 1961 the ILO had adopted 115 conventions and 114 recommendations, constituting the *International Labour Code*. The conventions had received by mid-1963 a total of 2,730 ratifications, plus 1,339 declarations of application by governments to their nonmetropolitan territories.

Frequently states do not ratify conventions where their practice is as good as, or in most ways better than, the ILO's standards, because (1) governments and labour organizations are against enactment of any standards not so high as existing practices, or (2) in many federal states, national government does not have the constitutional power to ratify, for the conventions deal with matters wholly or partly within state or provincial authority. On the other hand, some states, out of a desire to be or to appear "advanced," have ratified many conventions but have done little to put them into practice. This was, for example, the case between World Wars I and II, with some social security conventions ratified (and codes enacted) without regard for countries' limited economic possibilities or weak administrative structures.

The ILO could not, even if it wished, try to enforce the binding ratifications. Its constitution provided that it could appoint a commission of inquiry and eventually refer complaints to the International Court of Justice, whose decision would be final. But such recourse was impractical in an international society characterized by intense national sovereignty. The only real sanction in practice is that of public opinion, aided by the examination at the conferences of the extent of ratification and implementation of conventions, appeals to governments and public opinion and the education of officials, employers and labour.

Technical Assistance.—The gap between reality and law in relation to conventions was one stimulus to the new stress on technical assistance. Between World Wars I and II, ILO technical assistance took the form chiefly of expert advice on legislative drafting and administrative procedures. With the emphasis of the UN and the United States on technical assistance to economic and social development, beginning in 1949, the ILO amplified its services to include new techniques and operational activities. Working to raise productivity and living standards in underdeveloped countries, it also sought "to ensure that social objectives are not overlooked or sacrificed to purely economic objectives."

Fields of assistance have included vocational guidance, training and rehabilitation for workers, supervisors, teachers and administrators; methods of production—industrial, agricultural and handicrafts; co-operative organization; labour-management relations and management development; workers' education;

aid in the selection, training, movement and reception of workers migrating from one country to another; employment service organization and manpower utilization surveys; as well as such older areas of ILO work as wages and hours, industrial relations, social security, labour inspection and statistical procedures.

Methods have included a heavy reliance on the use of visiting experts drawn from many countries, fellowships, study tours, seminars, the supply of equipment and worker-trainees; *e.g.*, almost 400 Yugoslav skilled workers, foremen and technicians placed for training in factories in a dozen European countries in the 1950s.

In addition to its own programs, out of its regular budget, the ILO undertook many projects under the United Nations expanded program of technical assistance. Some were undertaken together with other UN agencies; *e.g.*, the "Andean highlands" project, for which the ILO had chief responsibility and collaborated with the UN, its Food and Agriculture organization, UNESCO and the World Health organization to help raise the living standards of the Indians of the Bolivian, Ecuadorian and Peruvian Andes, and integrate them into the economic life of each nation.

Trade Union Rights and Forced Labour.—After World War II the ILO adopted its first conventions on trade union rights (1948) and on protection of the right to organize and bargain collectively (1949). This action was overshadowed by the bitter debates over charges of violation of trade union rights, made without regard to the ratification of the conventions. The lead was taken by the Communist-dominated World Federation of Trade Unions (W.F.T.U.); its complaints, laid before the Economic and Social council, were referred to the ILO. The W.F.T.U. showed great concern for union rights in countries outside the Soviet bloc but found no occasion for complaint with conditions in the Soviet Union or its satellites. This deficiency was made up by the American Federation of Labor (A.F. of L.) and (after its formation in 1949) by the International Confederation of Free Trade Unions (I.C.F.T.U.), of which the A.F. of L. was a founding member. Although concentrating its fire on the Soviet bloc governments, the I.C.F.T.U. also complained of violations of labour rights by some non-Communist governments.

In 1951 the governing body established a committee on freedom of association, which made preliminary inquiries into complaints and had the power, if it found complaints warranted, to refer them to an impartial high-level fact-finding and conciliation commission. The ILO committee had to deal largely with complaints patently of a political motivation remote from the issues ostensibly at stake (many W.F.T.U. charges), with issues of suppression of free trade unionism inherent in the whole structure of a state (many complaints against Communist governments), and with complaints against governments in developing countries for sponsoring or directing labour unions.

Even more dramatic were the charges of forced labour leveled at the Soviet Union (and later its satellites), originally by the A.F. of L. before the UN in 1947, and then by the I.C.F.T.U. In 1951 the UN and the ILO set up a joint *ad hoc* committee on forced labour which inquired into about 100 charges against 24 governments, for by then countercharges had been leveled at many states outside the Soviet bloc. Although facilities for inquiry within the Soviet world were denied by the governments involved, the committee made public evidence of forced labour on a vast scale. The world's public opinion, dulled by a generation of horrors, took only slight note. The committee's temperate recommendations for international consideration and action were reminders to a few consciences.

Regional Activities and Industrial Committees.—Two forms of the ILO's adaptation to the enormous differences in problems of different regions and of different industries were the intensification of regional activities and the use of industrial committees. The ILO prior to World War II, for all its official relations with other continents, had been essentially European in outlook and in support. The insistent claims of national self-consciousness and of economic and social development in other continents after World War II caused it to give weight to regional conferences, to establish field offices, to appoint more non-Europeans to responsible positions and to tackle problems (and to offer technical assistance) primarily, though not solely, of interest to the near east, Africa, Asia and Latin America.

From the first (1919), the ILO had had one specialized industry committee, the joint maritime commission. In this field, the ILO achieved some of its most important results. The industry itself was international in operations; its workers and employers were highly organized; governments had long been accustomed to legislating on its problems. The ILO's 25 conventions and 10 recommendations made up a comprehensive and influential international seafarers' code. After 1945 the ILO set up eight new tripartite industrial committees. Although they dealt with a wide variety of problems in major industries, none of them attained the importance of the joint maritime commission.

The International Labour Office.—The office, the secretariat of the organization (and of the conferences and the governing body) consisted in the early 1960s of more than 1,100 international civil servants, from more than 70 nations, and some experts on temporary assignments. Most of them worked in the ILO headquarters at Geneva; a number were, at any given time, in the field, all over the world. Substantial reports on subjects under consideration by conferences and committees, continuing research and statistics, publicity, a large library, technical assistance, legislative and administrative drafting, expert counsel in any field of labour and social policy are among the staff's contributions. In 1961 the ILO inaugurated an ambitious International Institute for Labour Studies at Geneva with its own endowment fund. Something of the ILO's manifold activities may be seen in its publications, whose extent can be gauged from its *Catalogue of Publications.* Among the most widely used are the monthly *International Labour Review* and the *Year Book of Labour Statistics.*

See also references under "International Labour Organization" in the Index.

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(V. R. L.)

INTERNATIONAL LANGUAGE: *see* UNIVERSAL LANGUAGE.

INTERNATIONAL LAW, PRIVATE: *see* CONFLICT OF LAWS.

INTERNATIONAL LAW, PUBLIC. International law, or the law of nations, is a body of rules and principles which states consider legally binding upon them. Its origins may in part be traced to the middle ages and antiquity; but the general body of modern international law dates from the late 16th and the early 17th centuries, when it was called into being to order the relationships and conduct of the newly appearing sovereign independent states of Europe. Clearly, a system of legal precepts binding upon sovereign states needed some prior authority. The writers of the formative period of international law—particularly the greatest of them, Hugo Grotius (Huigh de Groot), whose *De jure belli et pacis* (1625) remains one of the most important books of all time —found that authority both in the much older idea of a system of natural law discoverable by reason, and in that part of Roman law, the *jus gentium* ("law of nations"), which had always been considered to be *ratio scripta* ("written reason"), and to consist in rules both generally accepted and of universal validity.

Writers have always felt the need to explain and justify the legally binding nature of international law; for the notions of state

sovereignty and the subjection of states to law do not easily ride together. When the idea of a system of natural law was unfashionable—particularly in the England of the 19th and early 20th centuries—an alternative basis of legal obligation was found by the so-called positivist school in the supposed consent of states to be bound; a consent, manifested sometimes expressly, as in a treaty, or sometimes tacitly, as in a rule of customary law. The positivists did a great service in emphasizing the importance of the study of actual state practice as a source of positive law; but their attempt to found obligation upon consent—though still echoed in innumerable judgments in English and United States courts—raised as many questions as it appeared to solve. It was never satisfactorily explained why, for example, a state which consented to a treaty and so became bound by it could not withdraw that consent at its discretion. It may well be a mistake to postulate some essential difference between international law and internal law in the matter of the basis of obligation. The notion that international law does not require a particular and special pleading to establish its legal nature has the advantage of being in accord with the factual situation. For while writers have sometimes found it convenient to deny the legal nature of international law, it is easily demonstrable that states do recognize their obligation to observe it.

The major difference between international law and internal law is not, as the layman often supposes, that international law is less consistently obeyed than internal law. It is true that much of the so-called law of war which used to be an important part of the system has in many ways proved both inadequate and irrelevant; this situation obtains for reasons which will be discussed later on. But the main body of the law between states in peacetime is probably more consistently applied and obeyed than many systems of internal law. Nor is the apparent lack of sanctions anything like so serious as the layman is apt to imagine. As J. L. Brierly put it in *The Basis of Obligation in International Law and Other Papers* (p. 54, Oxford University Press, London, 1958), "the regular observance of the international law of peace is explained only too easily; it is generally observed largely because there is little temptation to violate it, because its yoke lies easily—too easily—on the states, and also because to violate it habitually would invite reprisals and would not be in the interest of any state. But all that does not alter the fact that in spite of the vagueness of its sanctions, the law is very rarely broken."

Nevertheless, there are two important ways in which international law has less efficacy than internal laws. First, there are many areas of state activity, and these some of the most important, where the law reaches hardly at all. Thus, questions such as nationality, armament, immigration and fiscal and trade policies—all of which may vitally affect international relations—are traditionally within the untrammeled competence of the state itself to order and determine. It is true that there is a tendency of the law to feel its way gradually into these areas where formerly an anarchic sovereign discretion in each state was sanctioned by the law. Thus, until fairly recently, even the right to wage war was one which the law left to each state to exercise at its complete discretion but this is now no longer so. A serious qualification of the law that still remains, however, is the maxim that a court can exercise jurisdiction over a state only where the state has in some way consented to that jurisdiction; so that, for example, the International Court of Justice at The Hague has a compulsory jurisdiction, in the sense that a defendant state can be compelled to plead and to submit to judgment, only in a very limited sphere.

The second important difference between international and internal law is the comparative lack of international organizations and institutions. A developed system of internal law cannot be imagined without legislature, executive and judiciary. Yet, until about the middle of the 19th century, international law was virtually without institutional organizations, and thus dependent for action upon the separate governments of the states composing the family of nations. After the middle of the 19th century there was increasingly rapid development on the institutional side of international law, but 100 years later the machinery available was still far short of what is required for a mature and adequate system.

The Sources of International Law.—The term source is here used to connote "those agencies by which rules of conduct acquire the character of law by becoming objectively definite, uniform, and, above all, compulsory" (C. K. Allen, *Law in the Making*, 6th ed., p. 1, Oxford University Press, London, 1958). Obviously, every system of law must have criteria by which one can set about discovering the rule of law on a particular matter at a given time. For international law, those tests of validity have been authoritatively stated in art. 38 of the Statute of the International Court of Justice, by which it is provided:

> 1. The Court, whose function is to decide in accordance with international law such disputes as are submitted to it, shall apply:
>
> a. international conventions, whether general or particular, establishing rules expressly recognized by the contesting states;
>
> b. international custom, as evidence of a general practice accepted as law;
>
> c. the general principles of law recognized by civilized nations;
>
> d. . . . , judicial decisions and the teachings of the most highly qualified publicists of the various nations, as subsidiary means for the determination of rules of law.

By conventions is meant what are commonly called treaties. The many thousands of treaties in force now form much the greater part of the fabric of international law. This was not always so. Treaties were formerly mainly political in content: peace treaties, alliances and the like. It was not until the 19th century that the multipartite treaty began to be used for creating law between the parties. Nowadays, the multipartite lawmaking treaty is an indispensable instrument of the society of states. It must be remembered, however, that, with very few exceptions, treaties are contractual in the sense that they are only binding upon states parties to them.

The customary element in international law is prior to treaty law in the sense that the binding force of treaties themselves depends upon rules of customary law. To establish a rule of customary international law it must be shown that there exists not only a practice or habit among states, but also a recognition that the practice follows a rule legally binding on them. Customary law must accordingly be distinguished from mere usage, however well established; and from the rules of international comity, which, however well observed they may be, are recognized by states as being demanded by courtesy rather than by law. Thus, the elements necessary to establish a rule of customary law are, in the words of Judge M. O. Hudson (*Permanent Court of International Justice*, p. 609), "the concordant and recurring action of numerous states in the domain of international relations, the conception in each case that such action was enjoined by law, and the failure of other states to challenge that conception at the time."

There has been some controversy over the precise meaning of the provision in the court's statute requiring it to apply general principles of law; but there can be no doubt about its importance. One general principle common to, and necessary to, all systems of law is that the law is complete in the sense that there must be some legal answer to every legal problem. The positive aspect of this principle is neatly expressed in a well-known international arbitral award: "International law, as well as domestic law, may not contain, and generally does not contain, express rules decisive of particular cases; but the function of jurisprudence is to resolve the conflict of opposing rights and interests by applying, in default of any specific provisions of law, the corollaries of general principles, and so to find . . . the solution of the problem." (*Eastern Extension, Australasia and China Telegraph Co. Ltd., Case*, 1923).

Accordingly, international law, even where relatively lacking in detailed and elaborated rules in some of its aspects, is a complete system when seen against the back cloth of the general principles of law, which are to be collected from a study of the several internal systems and of law in general. Examples of general principles which have been assumed by tribunals to be part of international law are the principle of unjust enrichment, that he who is unjustly enriched to another's damage must make compensation; the rule called by common lawyers estoppel, that a party may not in his assertions be allowed to blow hot and cold in the same case; and the rule of *res judicata*, that a final decision by a proper tribunal disposes of a dispute once and for all.

It should not be supposed that this provision of the court's

statute was an innovation; for general principles of law have necessarily been a source since the beginnings of international law. It should be added that the general principles of law are regarded by some as being nothing more or less than the principles of natural law. At any rate, the inclusion of this source in the statute of the International Court of Justice was a rejection of extreme positivist ideas that international law rests solely upon the consent of sovereign states.

Judicial decisions are, with text writers, recognized as "subsidiary means for the determination of rules of law." Obviously there can be no rigid system of binding precedent of the kind peculiar to the common law; but argument from persuasive precedent is inevitable, for it is a natural tendency of the human mind. The International Court of Justice has shown no reluctance to refer to its own earlier decisions, nor to the awards of other international tribunals. Case law is, of course, dependent on there being a system of reports; as well as the international court's own series, there are the *International Law Reports*, published in the United Kingdom, which report not only the decisions of all international courts and tribunals but also the many decisions involving questions of international law of national courts all over the world. The transformation of international law into a case law system, which has taken place mainly since 1930, is a movement the importance of which it would be difficult to exaggerate; for it provides a resilience and a factor of growth not easily achieved in other ways.

The opinions of writers serve as evidence of what the law is, exactly as they do in other systems. Their function was well described by Justice Horace Gray in a decision of the United States supreme court on an international law question (*Paquete Habana*, 1899, *American Prize Cases*, p. 1938):

> ... where there is no treaty, and no controlling executive or legislative act or judicial decision, resort must be had to the customs and usages of civilized nations; and as evidence of these, to the words of jurists and commentators who by years of labour, research, and experience have made themselves peculiarly well acquainted with the subjects of which they treat. Such works are resorted to by judicial tribunals, not for the speculations of their authors concerning what the law ought to be, but for trustworthy evidence of what the law really is.

Relationship With the Internal Law of States.—To understand international law it is necessary to appreciate its close relationship to the internal law of states, or, as lawyers say, the municipal laws of states; for it is increasingly penetrating that sphere. Even the traditional international law, at a time when it was supposed to be a law only between states, had many rules which required the co-operation of municipal courts for their realization; for example, the very ancient rules whereby foreign sovereigns and their diplomatic representatives enjoy certain immunities from the municipal jurisdiction. But a very large part of modern international law is directly concerned with the activities of individuals which come before municipal courts. So that it is in municipal courts that a large and increasing part of international law is enforced.

One school of thought accepts that international law may be per se a part of the law of the land and that the municipal court therefore, in the appropriate case, applies international law directly. Another insists that a municipal court can only apply and enforce its own municipal law, and that the international law rule is binding only on the state itself, which must by legislation transform the precept into one of municipal law. The two approaches can on occasions lead to different results; *e.g.*, in a case involving a treaty which the government has omitted to transform into a municipal statute. But the second, or dualist, theory can hardly be applied in any case in those many countries (*e.g.*, the Republic of Ireland, France and the German Federal Republic) where it is by the constitution provided that international law is part of the law of the land.

The position before English courts is not so straightforward. There can be no doubt that they regard customary international law as part of the law of the land, for they take "judicial notice" of it; that is to say they assume that the court knows the law and does not require it to be proved by calling expert evidence, as in all cases involving foreign and external systems of law. The courts do in fact regard any relevant rule of customary international law as incorporated into the domestic law.

However, this statement must be understood subject to certain qualifications. First, English courts have tended to apply their doctrine of rigidly binding precedent even in cases involving customary international law. Thus, although the court may initially have applied the pure rule of international law, the rule may in the English jurisprudence have become fossilized just because the original decision has become a binding precedent; while the rule as it exists in the main stock of international law may have changed considerably in the course of its natural development. A notorious example is the rule by which a foreign sovereign state enjoys immunity from the jurisdiction of the municipal courts: in origin a simple and reasonable principle which, in the course of English case law, has become peculiar and technical while retaining an archaic form which some consider inappropriate to modern conditions. Secondly, it must be remembered that in England a statute is paramount law and must therefore be applied even if found to be contrary to international law (*cf. Mortensen* v. *Peters*, 14 S.L.R. 227). In such an impasse it is for parliament to get itself out of difficulties of its own creating by changing the law. The municipal court cannot help.

A treaty, even though binding upon the United Kingdom internationally, will not be applied as such by the courts. If the implementation of the treaty requires a change in the law it is for parliament to make that change by statute. The reason for this rule is said to be that, since the treatymaking power is a prerogative power, it would, if the treaty were binding directly on the courts, amount to a power to legislate without parliament. The position is quite different for example in the United States, where treaties are binding on the courts even if in conflict with state laws or previous federal laws; on the other hand, a subsequent federal statute will overrule a previous treaty.

The Sphere of Operation.—Up to the end of the 19th century and even later, international law was mainly if not entirely a law governing the conduct of sovereign states. Theorists tended to erect this fact into a principle, and it used to be asserted, therefore, that international law could not bind or confer rights upon individuals, or upon entities other than sovereign states. But in truth there never was anything inherent in the law to prevent it applying to individuals. Indeed, as we have already seen, municipal courts have constantly found themselves compelled to take account of rules of international law affecting individuals appearing in cases before them. Developments during the 20th century have long outstripped the old orthodoxies. In 1928, the Permanent Court of International Justice recognized, in the case concerning the *Jurisdiction of the Courts of Danzig* (PCIJ, series B, no. 15) that states may expressly grant rights directly to individuals by treaty if they wish to do so, and that such rights may validly exist and be enforceable even though they have not been incorporated into the municipal law. In 1949, the International Court of Justice, in its opinion on the *Reparation for Injuries Suffered in the Service of the United Nations* (ICJ Reports, 1949, p. 179), expressly rejected the view that only states can be the subjects of international law. And, of course, the laws of war were always based on the assumption that their precepts were binding not only upon sovereign states but also upon the individuals who compose them. In its judgment of Sept. 30, 1946, the Nürnberg International tribunal said this:

> It was submitted that international law is concerned with the actions of sovereign States, and provides no punishment for individuals; and further that where the act in question is an act of State, those who carry it out are not personally responsible, but are protected by the doctrine of the sovereignty of the State. In the opinion of the Tribunal, both these submissions must be rejected. . . . Crimes against international law are committed by men, not by abstract entities, and only by punishing individuals who commit such crimes can the provisions of international law be enforced.

All this is not to say of course that some parts of the law—and particularly those which developed in the 19th century—are not still coloured by the old orthodoxies. For example, the influence of dualist doctrine is still to be seen in the so-called rule of nationality of claims, by which it is assumed that a wrong to

an individual committed in a foreign state is a wrong not to him but to his own state, and that there is no redress unless his own state takes up the claim, and, moreover, is qualified to do so by reason of his having been its national both at the time of the injury and continuously until the claim is brought. This cumbrous and unrealistic procedure is being changed only slowly into something more apt to the doing of justice.

Codification.—Since the middle of the 19th century it has often been suggested that international law would be strengthened by codification, on the grounds that a code would add certainty and precision to the law, besides offering an opportunity for the completion of the system. While there can be no doubt that the movement has been a salutary one, with considerable achievements to its credit, it has only been realized slowly that codification presents peculiar difficulties in the international sphere. A codification in the strict sense—*i.e.*, where existing law is put into written form but the substance remains unchanged—is, except perhaps in a very few restricted fields, practically impossible, because any attempted codification must involve the resolution of differing opinions about what the law is; so that some changes in the law in the course of codification are unavoidable. This process presents no special difficulty in an internal system where there is a legislature competent not only to promulgate the new code with authority but also to abrogate the former sources and understandings of the law. But in international law there is no legislative process as yet available. The nearest approach to it is the multilateral treaty; which, however, is still only binding on the parties to it. Consequently, unless the treaty becomes universally accepted, the former customary sources of the law remain valid for those who are not parties to the treaty. Thus it may be possible to argue that the former customary law remains in existence as the general law, and that the codification is a novel law binding only those who have subscribed. Hence, a codification attempted at the wrong moment may easily complicate rather than clarify the law.

These and other difficulties were demonstrated by the disappointing results of the Hague Codification conference of 1930 when, in spite of preparatory work of unexampled thoroughness, the conference failed to reach any agreement on two major topics of the law and produced only minor, and for the most part still unratified, conventions on a third.

A great step forward, however, was taken in the charter of the United Nations, which required the general assembly to initiate studies and make recommendations for "encouraging the progressive development of international law and its codification" (art. 13), thus recognizing that codification and development of the law are in practice inseparable companions. To carry out this task an International Law commission of experts was established in 1947 and began its studies in 1949. Its method has been to study certain major topics of the law and to report the results of its labours to the general assembly in the form of draft conventions with comment. It is then for the general assembly to decide whether the time is opportune for a diplomatic conference to use the work as a basis for an actual codifying convention. But in any case the reports of the commission and the materials they collect and publish have themselves enriched the law, thus demonstrating the force of Sir Cecil Hurst's plea for codification in the form of restatements by technical experts which might be expected to achieve the inherent authority of accurate and persuasive scholarship (see *Grotius Society Transactions*, 1946). In the first ten years of its working life, the commission produced reports on such important topics as arbitral procedure, diplomatic immunities, state responsibility and offenses against peace and security.

In its final report on the very important question of the various aspects of the law of the sea the commission recommended the calling of a general diplomatic conference. Accordingly, the representatives of 86 countries met at the Geneva Conference on the Law of the Sea in 1958. The conference failed, not unexpectedly, to agree on the crucial question of the width of territorial waters: a question which nicely illustrated the difficulty of maintaining a distinction between the question of what the law is and the question of what it might become. Some countries were doubtless still jockeying for position in the controversy and were not at that moment wishing to reach a final agreement. On other topics of maritime law, however, the conference was a very considerable success, for it achieved very wide agreement on four draft conventions ranging over almost the entire field of maritime law, comprising in all 106 articles, dealing with the territorial sea and contiguous zone, the high seas, fishing and conservation of resources on the high seas and the continental shelf. The draft conventions were of course subject to ratification before becoming binding upon states. The Geneva experiment was a very great advance over earlier attempts at development and codification by treaty and probably showed an increasing awareness in governments of the importance of international law and the urgent need for its development.

International Organizations.—As has been already noticed, there were in quite recent times no international organs of government and administration. International law could only function through the agency of the governments of the separate states. Thus, for example, new states were admitted—and indeed still are admitted—into the international comity of nations by the process of independent recognition by each separate state. It is true, of course, that there are legal rules governing various aspects of recognition; but the act of recognition is still a function of the states and not of an international institution. Again, the claims of individuals or corporations for reparation for international wrongs such as denial of justice have to be adopted and preferred by the government of their national state before they become viable in the international sphere. Until after World War I, the final sanction of the law was accepted as being the rough and ready one of various forms and degrees of self-help by states themselves, including ultimately war.

Some international institutions began to appear, however, in restricted and mainly technical fields in the 19th century. The first was the International Telegraph union of 1865, followed by the Universal Postal union in 1874, the Copyright union in 1886, the International Institute of Agriculture in 1905 and the Radiotelegraph union in 1906.

This development of international institutions was greatly accelerated after World War I by the establishment of the League of Nations with its many associated agencies, including two important ones which have with some changes, survived World War II, namely the International Court and the International Labour organization. The movement gathered pace again at the close of World War II with the establishment of the United Nations and its 12 specialized agencies, and the creation of numerous intergovernmental organizations exercising functions bearing on the development or administration of international law. Thus the middle of the 20th century saw the emergence of a large number of international agencies, some well-nigh universal, some regional and many of them now an indispensable part of the daily working of international society; *e.g.*, the International Civil Aviation organization, the World Health organization, the United Nations Educational, Scientific and Cultural organization, the Food and Agriculture organization, the International Monetary fund and the Bank for International Settlements.

These bodies are creatures not of a particular municipal law but of international law. The International Court has given its opinion that the United Nations itself is a person in the law in the sense that it can even bring certain kinds of claims on behalf of individuals against a state. The legal problems which are common to international organizations in general, such as questions of membership, voting powers and procedures, and relations with other organizations, with states and with individuals, were, by the middle of the 20th century, being welded into a systematic legal discipline comparable with the constitutional law of a state.

Important, however, as this emergence of an international constitutional law undoubtedly is, its significance clearly depends in the long run on the success or failure of that central part of it which is concerned with the problem of war; for a system of law fails in its primary function if it fails to regulate the use of physical force within the society it purports to govern.

International Law and War.—The founding fathers of mod-

ern international law had no doubt that the control of war must be the primary function of the system. Therefore they not only devised rules governing the conduct and methods of warfare—the so-called *temperamenta*—but also attempted to distinguish between wars which were just and lawful and those which were unjust and therefore unlawful. This attempt, however, could be of little practical significance in a society in which there was no international authority to make the determination one way or another. Consequently, from the 18th to the early 19th century, international law abandoned the attempt to distinguish between wars and followed the cynical maxim that "war is no illegality." War, which might therefore be made at the absolute discretion of each sovereign state strong enough to wage it or desperate enough to risk it, suspended the law of peace between the belligerents and brought into operation the rules of war intended in some measure to mitigate its severities and to protect civilian lives and property. Between the belligerents and neutrals there came into operation a highly sophisticated law of neutrality. This traditional law was codified, though not without ambiguity, at the two Hague peace conferences of 1899 and 1907. It is important to remember therefore, that during much of its existence, international law made no practical attempt to control the use of war as an instrument of policy.

World War I demonstrated the need not merely to attempt to control the conduct of war, but to prevent it; both on account of the increasingly devastating scale of modern warfare and also because even the old rules governing its conduct, except for certain fundamental principles stemming from the ordinary rules of humanity, were being rendered constantly obsolete or irrelevant as a result of the application of modern science to the methods of warfare. The rules tended always to be more appropriate to the last war than the present one.

The 20th century has therefore seen a return in a new form to the classical attempt to distinguish between the just and the unjust war: first in the League of Nations covenant, then more generally in the still important and binding general treaty for the renunciation of war of 1928, sometimes known as the Peace Pact of Paris, or the Kellogg-Briand pact. This was a well-nigh universal treaty in which states renounced war as an instrument of national policy and undertook to settle their disputes by pacific means, thus making all wars illegal except those waged in self-defense or against a state that had already violated the treaty by an illegal resort to war. It was this instrument which formed the legal basis for the abandonment of formal neutrality by the United States in the early stages of World War II and for her assistance to the Allies before she herself became belligerent. In 1946 there was added the charter and structure of the United Nations, in which members undertook to "refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any state. . . ." (ch. 1, art. 2, sec. 4).

Conclusions.—The experience of two world wars, the failure of the League of Nations experiment and the unforeseen difficulties and frustrations of the United Nations resulted in a prevailing temper of disillusionment which contrasted strongly with the optimism of the late 19th century. Yet it is true that the 20th century has seen an unprecedented and rapid development of the main body of international law which gathered even increased momentum after the close of World War II. There is a sense in which this development was inevitable. The industrial revolution and then the technological revolution forced states closer together and greatly increased the importance and variety of crossfrontier relationships in trade, communications and culture. Though political theory continued to describe states in terms of sovereign independence, the most important fact about them became their interdependence. All this was bound to produce great changes in the law. For law is not created by the speculations of jurists, or even by the desire of peoples for it, but by their real needs and by the pressures of events. Accordingly, if the international law of the mid-20th century is compared with the international law of the latter part of the 19th century great differences are found. The first and most immediately striking is the increase in the sheer bulk of it. Some idea of this change can be gained by comparing the slim volume of a little more than 200 pages which Sir Henry Maine found sufficient to cover the subject in his Cambridge lectures of the 1880s, with the 2,000 or more pages of a modern basic text book such as L. F. L. Oppenheim's *International Law*, edited by H. Lauterpacht (vol. i, 8th ed., 1955; vol. ii, 7th ed., 1952). But the most important difference is the change in content. At the end of the 19th century and even perhaps after the end of World War I, it was still necessary to define international law in the traditional terms of a law to order the relations of states among themselves and to delimit the territorial spheres within which their respective sovereign and independent authorities might properly be exercised. As Sir Alfred Zimmern said, in a telling criticism of it, "modern international law was developed as a means for regulating external contacts rather than as the expression of the life of a true society" (*The League of Nations and the Rule of Law*, pp. 98–99, The Macmillan Company, New York and London, 1939). And indeed it was to be expected that a law coeval with the emergence of the nation state should have been much influenced by doctrines of the fundamental rights of states, so that much of the traditional law was concerned with aspects of state separateness and independence, rather than with the problems of an international society. But by the middle of the 20th century this was no longer the position. The proliferation of modern treaty law and relationships, the development of international organizations, the increasing concern of the law with the protection of fundamental human rights of the individual even as against his own state, the necessity for detailed international regulation of technological developments such as international civil aviation: all these factors resulted in a profound transformation of the nature and content of the law which is admirably summarized by Wilfred Jenks:

". . . . . the emphasis of the law is increasingly shifting from the formal structure of the relationships between States and the delimitation of their jurisdiction to the development of substantive rules on matters of common concern vital to the growth of an international community and to the individual well-being of the citizens of its member States. We shall also find that as the result of this change of emphasis the subject-matter of the law increasingly includes cross-frontier relationships of individuals, or organizations, and corporate bodies which call for appropriate legal regulation on an international basis, problems of economic and technological interdependence requiring the regulation on the basis of common rules of matters which do not *per se* involve inter-State relations in any real sense, and rights designed to provide the individual, and in some cases organizations, with a measure of protection against the individual member States of the international community. This international community, which is still far from having attained any political or moral unity and is always liable to be torn asunder by disruptive forces, continues to be organized on the basis of States, but its law has long since ceased to be merely, and is rapidly ceasing to be primarily, a law between States." (C. W. Jenks, *The Common Law of Mankind*, p. 17, Stevens and Sons, London, and Frederick A. Praeger, Inc., New York, 1958).

The attention of the reader is especially drawn to the following articles: Arbitration, International; Conflict of Laws; Hague Conferences; International Court of Justice; International Labour Organization; Laws of War; League of Nations; Neutrality; Sanction and Guarantee; Treaty; United Nations. *See* also references under "International Law, Public" in the Index.

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(R. Y. J.)

INTERNATIONAL MONETARY FUND, a specialized agency affiliated with the United Nations, designed to stabilize international monetary exchange rates. Together with the International Bank for Reconstruction and Development (*see* Bank for Reconstruction and Development, International) its articles of agreement were signed, after considerable prior negotiation, at Bretton Woods, N.H., in July 1944. Ratification and appropriation of funds by national governments enabled the fund to be constituted in March 1946. Initial exchange values of member currencies were accepted at the rates then current. The fund

opened in March 1947 and made its first transactions in May.

Organization.—Operating funds are subscribed by member governments. Each member has a quota, of which an amount equal either to 25% of the quota or 10% of the member's holdings of gold and U.S. dollars, whichever is smaller, is subscribed in gold and the remainder in national currency.

The fund was designed to stabilize exchange rates by assisting members over temporary difficulties in their international balances of payments. It does so partly by consultation and technical advice, but also by allowing members to purchase from it with their own national currencies the gold or foreign exchange they need. In principle not more than 25% of the member's quota may be purchased in any one year, but in an emergency this limit may be, and often is, waived. Not more than 125% of the quota may be purchased in all. Charges begin at ½% for the first 25% for the first year, rising by ½% for each additional 25% for each additional year, with a limit of 5%. Members may arrange stand-by credits to use as and if necessary. If demands for any currency outrun the fund's resources it may be declared scarce and rationed. Members may then impose discriminatory exchange controls against it. Members are required to repurchase the excess of their own currencies over their quotas within an agreed period (three to five years) and as their balances improve.

Members agree not to alter the exchange value of their currencies (except once by not more than 10%) without prior agreement by the fund. In 1949 Britain and many other countries secured such agreement, as did France in 1957 and other countries at different periods.

Members are pledged to the ultimate elimination of exchange control and multiple exchange rates. They must consult annually with the fund on both and it works with them toward greater freedom and uniformity of exchange rates. Such consultations offer opportunities for technical advice and assistance toward currency stabilization and the freeing of exchange transactions. Staff members also frequently visit member countries to consult with national monetary agencies.

The fund has no power to dictate national monetary policies. By providing technical assistance when asked and facilities to acquire needed reserves in emergencies, it may moderate exchange crises and minimize currency instability, but it had not by the early 1960s been able to get rid of exchange restrictions.

Policy is determined by a board of governors representing each member government. Governors cast votes weighted according to the quotas subscribed by members, ranging in the late 1950s from 255 votes for Panama to 27,750 for the United States. The executive directors meet frequently. Five, representing the countries with the largest quotas (the United States, United Kingdom, China, France and India), are appointed; the others are elected by the other members. The managing director and his staff are responsible for actual operations.

Transactions.—After years of relative inactivity, the number and amount of the fund's transactions increased sharply during the Suez crisis in 1956–57. In the organization's first ten years, ending April 30, 1957, total purchases amounted to $2,350,000,000 of which $1,114,000,000 were made in 1956–57. Another $1,212,000,000 was earmarked under stand-by arrangements in that year. Most purchases were of U.S. dollars, but there were also small purchases of German marks and Dutch guilders, as in earlier years there had been of sterling, Belgian francs and Canadian dollars. Not all stand-by arrangements were used. Up until 1958 repurchases of their national currencies by members were less than new purchases of dollars. Some national quotas were increased and there was discussion in the late 1950s of the need for a general increase to enlarge the fund's resources. It was widely recognized that the fund's action in making available large amounts of internationally acceptable currencies had eased the strain on national balances in the Suez crisis.

See INTERNATIONAL PAYMENTS; MONETARY AGREEMENT; *see* also references under "International Monetary Fund" in the Index.

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INTERNATIONAL ORGANIZATIONS, institutions drawing their membership from two or more states, and maintaining arrangements and facilities designed to promote periodic or continuous activities by their members.

The 20th-century trend toward the creation of international organizations on a wide scale was essentially a product of circumstances stemming from advances in the technology of communication, transportation and warfare, and from the growth of industrialism. These developments gave rise to a sense of interdependence among the peoples of the world, thereby stimulating recognition of the need for systematic international co-operation to avoid the dangers, curb the evils, solve the problems and exploit the opportunities which confront the society of nations. These same developments also gave an unprecedented air of feasibility to the project of creating and operating organizations on a world-wide scale. Such institutions vary greatly in geographical scope, ranging from regional organizations to universal bodies embracing virtually the whole world. Some are concerned only with single and relatively narrow problems, while others, *e.g.*, the United Nations, deal with a great variety of substantive matters. Finally, international organizations may be designated as either intergovernmental or nongovernmental agencies.

Nongovernmental Organizations.—Typically, international nongovernmental organizations are associations of private groups organized separately within various states, although some are based upon the membership of individuals. The distinction between the intergovernmental and nongovernmental types is not always clear cut. Many organizations are mixed in composition. The International Labour organization, for instance, while fundamentally an intergovernmental body, included in the 20th century spokesmen for national employers' and workers' associations along with official representatives of governments as voting delegates to the sessions of its major organs.

On the nongovernmental level, groups were organized for such purposes as the international exchange of knowledge, the promotion of religious and humanitarian causes and the development of parallel or co-ordinated practices among nations in particular areas of activity. Nongovernmental organizations also in many instances promoted the creation of intergovernmental agencies in the fields of their concern, and advised and assisted the latter bodies in their operations. While most nongovernmental organizations were designed to stimulate co-operative achievement of practical results in rather specialized fields of endeavour, some reflected a desire to cultivate internationalism as a value in itself, promoting friendly contact and habits of international co-operation as a contribution to the creation of an orderly and peaceful world.

Intergovernmental Organizations.—The intergovernmental category includes those established by agreement among governments, and maintained by states, which exercise their membership functions through governmental representatives. Public international organizations, of the mid-20th century, although less numerous than the nongovernmental agencies, generally attracted greater attention and had more adequate financial support. Their creation reflected a disposition to seek new techniques and improved facilities for coping with the tasks of government under the increasingly complex circumstances of the modern era. In particular, the ancient moral ideal of world peace and the urgent practical requirement of avoiding the devastating results of modern war produced an emphasis upon the peace-preserving function of intergovernmental organizations. Although governments formed international institutions to deal with a variety of highly technical problems, there was at mid-century a growing tendency to express the formal purpose of these agencies in terms of their potential service to international peace and security.

Accelerated 20th-Century Development.—The association of the tendency to create international organizations with the development of the complexities of modern interdependence is dramatically illustrated by statistical analysis. According to a 1957 report by the Union of International Associations, *Les 1,978 or-*

ganisations internationales fondées depuis le Congrès de Vienne ("The 1,978 international organizations founded since the Congress of Vienna"), only a handful of international organizations in existence in the late 1930s were formed before 1850; approximately 10% were established before 1900; and about 90% of the organizing activity was concentrated in the period, 1900–56. The accelerating pace of the movement was particularly notable in the decade following World War II, when more than 600 nongovernmental and over 80 official organizations were formed.

In the early 1960s there were more than 1,100 international organizations. This number included more than 130 intergovernmental agencies, of which the most notable were the United Nations, the various specialized agencies affiliated with the United Nations, and such regional organizations as the European Coal and Steel Community, the North Atlantic Treaty organization and the Organization of American States. The variety of subjects with which intergovernmental organizations were concerned was indicated by such names as the Central Commission for the Navigation of the Rhine, the International Tin Study group, the International Patent institute, the European Organization for Nuclear Research and the International Whaling commission. Nongovernmental organizations were listed by the Union of International Associations under 19 headings ranging from "Religion and Moral Improvement" to "Sport and Recreation." The largest concentrations of private international organizations fell under "Labour and Professions, Employers, Trade Unions," "Commerce and Industry" and "Medicine, General and Mental Health."

The first half of the 20th century was marked not only by the rapid multiplication of international organizations, both private and public, but also by efforts to create a pattern of orderly relationships among them. The Union of International Associations, founded at Brussels, Belg., in 1907, was an early co-ordinating body. The League of Nations, created after World War I, provided a focal point for intergovernmental organizations and also for the growing network of nongovernmental agencies. Following World War II, the United Nations became a kind of "roof organization" for the major enterprises in systematic international cooperation. In accordance with art. 57 and 63 of its charter, the UN entered into co-ordinating agreements with intergovernmental agencies operating in economic, social, cultural, educational, health and related fields. In the second half of the 20th century the roster of specialized agencies affiliated with the United Nations included: Inter-Governmental Maritime Consultative organization (IMCO); International Labour organization (ILO); United Nations Educational, Scientific and Cultural organization (UNESCO); Food and Agriculture organization (FAO); International Civil Aviation organization (ICAO); International Monetary fund; International Bank for Reconstruction and Development (World Bank); World Health organization (WHO); International Telecommunication union (ITU); Universal Postal union (UPU); World Meteorological organization (WMO); International Atomic Energy agency; and the International Finance corporation. The Economic and Social council of the United Nations, acting under art. 71 of the charter, also maintained a consultative relationship with nearly 300 nongovernmental organizations, virtually all international in scope.

The United Nations did not, however, become, nor was it intended to become, a central authority with power to control the operations of other international organizations. A great number of international agencies of all types remained outside the institutional family over which the United Nations presided. Nevertheless, the United Nations was responsible for the closest approach made to the development of a system within which the work of the great mass of international organizations might be harmonized and co-ordinated. *See* also AMERICAN STATES, ORGANIZATION OF; BANK FOR RECONSTRUCTION AND DEVELOPMENT, INTERNATIONAL; BENELUX; CENTRAL AMERICAN FEDERATION; FOOD AND AGRICULTURE ORGANIZATION; INTERNATIONAL COURT OF JUSTICE; INTERNATIONAL INSTITUTE OF AGRICULTURE; INTERNATIONAL LABOUR ORGANIZATION; INTERNATIONAL MONETARY FUND; INTERNATIONAL REFUGEE ORGANIZATION; INTERNATIONAL TRADE ASSOCIATIONS AND CONGRESSES; NORTH ATLANTIC TREATY ORGANIZATION; PAN-AMERICAN CONFERENCES; PAN-EUROPEAN MOVEMENT; RED CROSS; SOUTHEAST ASIA TREATY ORGANIZATION; UNITED NATIONS; UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION; UNITED NATIONS RELIEF AND REHABILITATION ADMINISTRATION; POSTAL SERVICES; WARSAW TREATY ORGANIZATION; WORLD GOVERNMENT MOVEMENTS; WORLD HEALTH ORGANIZATION.

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INTERNATIONAL PAYMENTS. The main difference in the settlement of international and domestic transactions is the existence of different currencies. This, however, is not a serious obstacle as long as the currencies are freely convertible into each other, and into gold. When, for example, British importers can buy United States dollars from their banks for sterling and U.S. exporters can sell sterling to their banks for dollars, it is immaterial in what currency the transaction is settled. Banks trading in foreign exchange normally keep balances in the appropriate currencies with their branches, agents or correspondents abroad in order to facilitate the clearing process. But whereas interbank credits or debits outstanding can be settled internally in terms of local currency, they are settled internationally either from accumulated balances of foreign exchange, or by loans from the creditor to the debtor, or by drawings on the International Monetary fund (*q.v.*) or by movements of gold. Whenever this process is multilateral rather than bilateral, it provides an additional advantage. For if, in terms of the total annual turnover of transactions between them, England is in debit to the United States and in surplus with the colonies and the latter in surplus with the United States but in debit to England, there is no net change in the foreign-exchange position of the areas concerned if the various credits and debits exactly cancel out. In practice, however, it does not work out so smoothly; there always have been considerable fluctuations in net credit and debit positions within any given year as well as between years. The way in which a country balances its international accounts is one of the most important problems of its balance of payments.

BALANCE OF PAYMENTS

The balance of payments is a systematic record of all economic transactions during a given period between residents (including the government) of one country and residents (including the governments) of other countries, referred to for convenience as foreigners. The transactions are presented in the form of double-entry bookkeeping with credit entries balanced on the debit side, and vice versa. The balance of payments of a country thus necessarily balances. There can be no surplus or deficit in a country's balance of payments as a whole.

This accounting equality of a country's total credits (receipts) and total debits (payments) may be readily illustrated. The balance of payments of the United States, for example, records the various ways in which dollars are made available to foreigners through U.S. imports, tourists' expenditures, military expenditures, donations, foreign lending activities and so forth. These expenditures are shown on the debit (payments) side of the balance. The credit (receipts) side indicates the various uses to which foreigners put their dollars, such as paying for U.S. exports, servicing of debts to the United States and the like. If foreign countries do not spend all the dollars made available to them during a given period to obtain goods and services from the United States, the balance of payments will show on the credit (receipts) side an increase of foreign-held dollar balances, foreign purchases of U.S. securities, gold exports from the United States or some similar item. If, on the other hand, the dollars made available by the United States are insufficient to pay for the exports of U.S. goods and services, additional dollars can be obtained only by liquidation of foreign holdings in the United States, by gold imports into the

United States and by similar operations which would necessarily be recorded on the payments side. This must mean that for any period the receipts measured in dollars are equal to the payments measured in dollars when all the receipts and payments are included. But this equality of payments and receipts in the formal "balance sheet" conceals the reasons why countries are so concerned with their balances of payments. Hence, not whether the accounts are balanced but how they are balanced is the important question.

Standard Schedule for Reporting Balance of Payments to International Monetary Fund

Current transactions. Reporting country——Period covered——Currency——Unit——Exchange rate: U.S. $ per——	Credit (receipts)	Debit (payments)	Net credit (+) or debit (−)	Movement of capital and monetary gold. Reporting country——Period covered——Currency——Unit——Exchange rate. U.S. $ per——	Net movement, increasing (+) or decreasing (−)		
					Assets	Liabilities	Net assets
Item				Item			
A. Goods and Services				C. Capital and Monetary Gold			
1. Merchandise: exports f.o.b.				Private, excluding banks			
Merchandise: imports f.o.b.				11. Long-term liabilities			
2. Nonmonetary gold				Direct investment (in country)			
3. Foreign travel: credit				Transactions in securities			
Foreign travel: debit				12. Short-term liabilities			
4. Transportation: credit				13. Long-term assets			
Transportation: debit				Direct investment abroad			
5. Insurance: credit				New foreign security issues			
Insurance: debit				Retirement of foreign securities			
6. Investment income: credit				Transactions in outstanding securities			
Investment income: debit				14. Short-term assets			
7. Government, n.i.e.: credit							
Government, n.i.e.: debit				Official and Banking Institutions			
8. Miscellaneous: credit				15. Long-term liabilities			
Miscellaneous: debit				16. Short-term liabilities			
				To foreign officials and banks			
				To other foreigners			
B. Donations				17. Long-term assets			
9. Private				Official loans extended			
10. Official				Official repayments			
Total (1 through 9)				Other			
Total (1 through 10)				18. Short-term assets			
				Government			
				Other			
Net errors and omissions				19. Monetary gold			

Operations Entering Into the Balance.—Countries are greatly concerned about the types of transactions giving rise to the receipts and payments of foreign exchange and how these compare in size with one another. The accompanying table comprises all the items in the standard schedule for reporting a country's balance of payments to the International Monetary fund (IMF). It is divided into two major sections: the current account and the capital account.

The current account records all transactions other than those representing changes in the international creditor-debtor position of the reporting country and in its monetary gold holdings. It includes two distinct types of transactions: items 1 through 8, which refer to transfers of goods and services, and items 9 and 10, which cover private and official donations. The credit entries under items 1 through 8 correspond to goods and services supplied, the debit entries to goods and services received. Credits under items 9 and 10 show donations received by the country; debits show donations made.

The capital account records all transactions representing changes in the international creditor-debtor position of the reporting country and in its holdings of gold and other monetary reserves. It does not include valuation changes (*e.g.*, changes in the market values of securities, or revaluations of assets and liabilities because of exchange-rate adjustments) since these are not transactions. The capital movements shown do not, therefore, necessarily reflect the total change in the creditor-debtor position of the reporting country during the given period. In order to present a maximum of information compactly, the capital account is shown in terms of net changes—increases or decreases—in assets and liabilities. Increases in assets and decreases in liabilities indicate an outflow of capital (a debit); decreases in assets and increases in liabilities indicate an inflow of capital (a credit). The capital account is divided into a private sector (items 11 to 14) and an official sector (items 15 to 19).

Since economic transactions included in the balance of payments involve directly or indirectly two entries—a debit and a credit—errors and omissions apart, any net balance on account of goods, services and donations taken together is matched by an equal balance with opposite sign on capital account. Because some transactions may be inaccurately recorded or not recorded at all, the "errors and omissions" item is included to bring the statement into balance (*see* table).

Various Concepts of Surplus or Deficit.—To speak of a surplus or deficit in the balance of payments would appear to be a contradiction in terms. Yet much of the discussion of international economic problems following World War II concerned certain "deficits" of the war-damaged countries and the underdeveloped areas. These problems, in part, revolved about whether certain segments of a country's balance of payments were in balance or whether they were in surplus or deficit by some amount.

The discussion sometimes ran in terms of the "trade balance"; *i.e.*, the net credit or debit of merchandise trade. While this is an important segment of the balance of payments, it may have very little significance by itself. An import surplus may be matched by net sales of services that are closely similar in their economic implications to sales of goods. There would then be no deficit in goods and services as a whole and this balance is a broader and more significant measure than is trade alone. Similarly, an export surplus may be reinforced by net sales of services, increasing the surplus in goods and services as a whole.

Often the balance of goods and services has been discussed as if it were the balance on current account. The current account as a whole has always had a basic importance since it is the counterpart of the capital account. A nation with a deficit on total current account is *ipso facto* decreasing its capital assets abroad (including gold) or increasing its capital liabilities to foreigners. A nation with a current-account surplus is gaining foreign assets or reducing its foreign liabilities. Manifestly, a deficit or surplus on current account may be of crucial importance to a country. However, in addition to the goods and services that are sold to foreigners, there are many transactions for which no payment is made. Governments that extend grants, individuals who send goods or money to families or friends abroad, and institutions that provide charity are all engaged in such transactions. The goods, services and capital items that pass in these transactions without payment are all entered in the balance of payments as if payment were made for them. They are then simply offset by contra-entries under "donations" (which may be voluntary, automatic or semiforced) to show that, in fact, payment was not required. In many instances, to state that a country financed by foreign grants had no deficit to be met is a patent contradiction. Accordingly, while the full current account (including donations) is useful in revealing the factors that have altered the international capital position of a country, it is a seriously defective measure of balance-of-payments deficit or surplus from the standpoint of exchange problems.

Even if official donations are eliminated from the current account in arriving at a figure for deficit or surplus, the result may still be misleading as an indication of the exchange problem involved. A deficit in the balance of goods and services, for example, is not necessarily an indication of pressure on a country's exchange rate. It may be matched by an inflow of investment capital which strengthens the immediate exchange position and builds up a country's future exporting capacity. Similarly, a surplus in the balance of goods and services may be no indication of a strong exchange position. It may reflect the efforts of a country

to pay reparations or to meet other fixed obligations abroad.

It is regrettable that in public discussions a deficit in the balance of trade is referred to as an "unfavourable trade balance" and a surplus as a "favourable trade balance." The notion that it is vitally important for a country to have an excess of exports over imports was stated as far back as the 14th century. A country that exports more commodities than it imports, so the argument runs, would receive the difference in gold and silver. This was regarded as a "favourable balance" because, for a country with no gold or silver mines, it was the only way to increase its stock of the precious metals. But the grounds on which early writers based their beliefs in the desirability of an indefinite accumulation of the precious metals were for the most part erroneous. The mercantilists of the 16th, 17th and 18th centuries, for example, regarded any gain in the precious metals as a gain in economic power and prosperity. (*See* MERCANTILE SYSTEM.) Clearly, from the welfare point of view, it is goods and services that account for the economic advantages derived from foreign trade. Money is predominantly a mechanism of foreign commerce. Just as it is impossible for a country to maintain indefinitely an excess of exports over imports unless it is willing continuously to accumulate gold, invest abroad or give its goods away, so it is impossible for a country to maintain indefinitely an excess of imports over exports unless it is able continuously to obtain foreign exchange from the export of gold, from grants or investments abroad, or to default.

The terms "favourable" or "unfavourable" trade balance, when not wholly invalid, are subject to such grave limitations that they are rejected in modern treatments of the subject and are replaced by such terms as "active" and "passive," or "positive" and "negative," trade balance. Other terms used for the same phenomena are "export surplus" and "import surplus," or "credit" balance and "debit" balance. The more important item, net total on current account, is often designated by the terms "surplus" or "deficit" in a country's balance of current payments. The value of the net outflow of gold plus net increases in foreign holdings of a country's short-term balances has most frequently been used as a measure of a country's balance-of-payments deficit.

BRITISH BALANCE OF PAYMENTS

Britain has had a deficit in merchandise trade since before the Napoleonic Wars. Before World War II it had been able to pay for its imports of food and raw materials largely with earnings from foreign investments built up over generations, and from services. The postwar balance-of-payments difficulties, however, which in some respects were typical of those of western Europe, were not of late origin. World War II merely hastened a great structural change in Britain's trade relations which had been going on since well before World War I.

Before World War I.—During the nation's great period of expansion—from 1780 to 1913—conditions favoured the import balance appropriate for Britain's creditor status. Its position as a pioneer in industrial development, with no tariffs or quota restrictions from 1860 to 1914, the complementary exchange of its manufactures for food and raw materials, general political stability, the large increase in overseas investment, free or "untied" lending and stable world currencies all contributed to the relatively smooth multilateral adjustment of the British balance of payments. A fortuitous historical circumstance aided this adjustment process: Britain was able to invest much of its excess savings abroad whenever plans to invest at home declined relative to the level of total savings. But even before World War I, as Germany, the United States and Japan industrialized, world trade increased; Britain's export industries, however, were unable to keep pace with the manufactured products of the expanding industrial nations. Between 1870 and the start of World War I, world production of manufactures increased fourfold, but world trade in manufactures was a decreasing fraction of total production. In the 1870s one-third entered into international trade, in 1913 one-fifth. Nevertheless, the absolute volume of world trade in manufactures increased threefold between 1880 and 1913, and that of Britain also increased considerably although Britain's relative share of world trade declined. This trade expansion assisted the equilibration of Britain's external accounts. Even though its leadership in world trade was slowly being transferred to the United States, Britain's international accounts were not weak at the outbreak of World War I. It was the war, together with Britain's unavoidable sale of some foreign assets, that contributed to the deterioration in its balance of payments.

Between the World Wars.—Between World Wars I and II the volume of world trade in manufactures never appreciably exceeded that of 1913; the peak of 1926–30 was hardly above the 1913 level; the average of 1931–35 was only 76% of 1913; and the average of 1936–38 was 92%. The fact that Britain's share was declining rapidly within this reduced total was a significant factor in impeding adjustment of its international accounts. The external strains of the interwar period were in considerable part the result of the need for Europe—and Britain in particular—to adapt itself to this changing situation.

Furthermore, in the 1920s Britain's deficit between direct imports from, and exports to, the United States increased at the very time that invisible income (*i.e.*, shipping, insurance, banking receipts, etc.) from the United States decreased. The United States looked increasingly to the non-European world for imports, and Britain's share in U.S. trade continually declined. This decline was partially the result of a widening gap in productivity between the United States and Britain.

The gold standard, which Britain restored in 1925 following the period of currency disorder and inflation which engulfed Europe, broke down in 1931. The great depression aggravated the external strains; comparatively free multilateral trade proved to be incompatible with mass unemployment. Multinational clearing disintegrated as restrictions on trade became ever more severe. The gains from the devaluation of sterling in 1931 proved short-lived; this action started a chain reaction that included devaluation of the U.S. dollar in 1933–34 and did not end until there had been further devaluations of the French and Belgian francs. Meanwhile, Britain (and many other countries) in the later 1930s had turned toward bilateral trade and direct controls as an effective method of relieving external strains. Despite all its efforts, Britain by 1938 was compelled to liquidate a small portion of its overseas assets to bring its international accounts into balance.

Effect of World War II.—World War II dealt a staggering blow to Britain's balance of payments. Loss of income from overseas investments and from services impaired the nation's ability to meet the long-standing trade deficit with the United States and Canada. The east-west barrier, the position of Germany and chaotic conditions in the far east and middle east increased British dependence on the dollar area. In effect, the prewar pattern of trade between Britain and the rest of Europe, and between Britain and the non-European world, had been practically destroyed.

Britain's postwar recovery in its balance of payments was irregular. Underlying the transitional problems was the long-term conjuncture of the great structural change in Britain's international position and the growing predominance in the world of a relatively self-contained, industrially efficient but highly unstable United States. Over the whole process of British reconstruction loomed the interrelated maladies of domestic inflation and external deficits which led to such events as the British convertibility crisis of 1947. Following that crisis, Britain made remarkable headway with the external problem, largely through a budgetary attack on inflation and, later, the European Recovery program (*q.v.*). Nevertheless, Britain suffered another reserve crisis in 1949 caused partially by a direct increase in Britain's own dollar gap (to some extent a result of "suppressed inflation"), a loss of dollar earnings by other members of the sterling area (occasioned by a recession in the United States) and an acceleration of a slow drain of gold to Belgium and Switzerland. The ominous decline in reserves compelled Britain to devalue the pound in Sept. 1949. Mass devaluations followed. Devaluation of the pound sterling, coupled with increased productivity at home and elsewhere, rapidly improved Britain's reserves. The deficit on current account with the United States and Canada was much reduced, and the surplus with the entire world was increased greatly. The over-all improvement

was partly attributable to the expansion in net invisible earnings and to the continued restriction of the volume of imports. Certainly the latter could not have been accomplished without the most severe austerity in Britain.

Following the devaluations, the balance-of-payments position of the entire sterling area improved even more strikingly than did that of Britain. Actually, the sterling area raw material exporting countries had sold large quantities of wool, tin, rubber and cocoa at high prices, particularly to the United States and continental Europe, and had to a large extent "banked" the proceeds with the United Kingdom. The increase in reserves was therefore quite accidental; for the most part it was the result of the outbreak of war in Korea in 1950. Although this proved to be, with subsequent price decline of important raw materials, a temporary financial improvement, more fundamental forces were operating toward the strengthening of Britain's external accounts.

The continuing growth of British productivity during the 1950s and the more effective anti-inflationary monetary and fiscal policies helped immeasurably to reduce Britain's dollar deficit; indeed, in some years dollar surpluses were recorded. These factors, coupled with the high rates of economic growth in western Europe, Japan and the commonwealth, as well as the improvement in the United Kingdom's terms of trade, enabled it to increase its gold and dollar reserves. In 1958, with the collaboration of other western European countries, Britain consolidated the strength of its economy, which had been steadily built up in the preceding years, by establishing nonresident convertibility. As from Dec. 1958 British pounds earned by residents outside the sterling area were designated freely convertible into gold, dollars or any other currency. In effect, by 1960 the United Kingdom had achieved a workable balance in its international accounts. Despite all the stresses of World Wars I and II and their aftermaths, the pound—the international currency of the sterling area—remained one of the two leading world currencies. An important problem which remained unanswered, however, concerned the ability of the United Kingdom to maintain an appreciable rate of economic growth without rapidly encountering balance-of-payments strains. The complexity of the problems was evidenced by a recurrence of a balance-of-payments crisis in 1961. *See* STERLING AREA.

U.S. BALANCE OF PAYMENTS

For many years the United States had a merchandise export surplus. From 1876 to 1960 there were only three years (none after 1894) when it had a merchandise import surplus. The reasons for this development were many and varied. They included a deliberate national policy of high tariff protection; the continental character and climate of the United States; the abundance, richness and variety of its natural resources; the great distances from most foreign trading and producing centres; the protection given inland producers by high internal transportation costs; the technical skills of its people; the technological efficiency of its mass-scale production and distribution in manufacturing; the generally well-organized and mechanized agriculture; the greater tendency to generate excess capacity than other developed countries; and the nature of its commodity imports. All these factors tended to limit the expansion of American imports without heavy cost either in the production of domestic substitutes or in the deprivation of important products. Thus, compared with other important trading countries, the United States spent through the years an extremely small proportion of any dollar increases in national income on foreign products.

In the period before World War I, the United States export surplus was a sign of healthy economic development. It supplied foreign exchange for payments on foreign debt. In the 1920s, when the United States became a creditor nation, it preserved its export surplus partly by making large loans to foreign countries. Other large debit items, purchases of shipping and insurance services, tourists' expenditures abroad and remittances by immigrants and charitable foundations contributed substantially to the foreign supply of dollars.

Depression and War.—The depression of the 1930s altered these conditions. Domestic investment, particularly during the spurt before the depression, tended to generate a rate of growth in income and an excess of planned saving over planned investment. With the coming of the depression, the disparity between the growth in physical capacity to produce and the growth of current demand became acute. As returns on domestic capital declined and political and economic troubles developed abroad, the excess of planned saving not only failed to be invested abroad but the flow of capital was reversed from a net outflow to a net inflow. The nation maintained a merchandise export surplus by readily importing the precious metals. From 1934 until the outbreak of World War II, rising levels of production and moderate reduction in tariffs contributed materially to a closer approach to balance in the nation's current account. On the whole, U.S. industrial production, exports and imports moved together. During the period of U.S. participation as an active belligerent in World War II, more than 80% of total U.S. merchandise transfers represented lend-lease. In addition, for the three and one-half years following the war (from July 1, 1945, through 1948), net utilized foreign grants and credits of the U.S. government covered more than one-third of the United States total exports of goods and services.

Long-Range Trends.—What is often overlooked, however, is that powerful forces have for long been working toward international equilibration of U.S. external accounts. Thus, abstracting from the abnormal conditions of World War I and reconstruction, there has been a strong tendency since 1909 for the United States to have an excess of imports over exports of crude foodstuffs. From 1923 to 1960 U.S. imports exceeded exports of crude foodstuffs virtually every year, despite depression conditions of the early 1930s. Similarly, since 1915, the U.S. excess of imports over exports of crude materials has been quite general, the only important exceptions being those of the years 1932–33. More noteworthy has been the long-term trend toward balance of U.S. trade in manufactured foodstuffs and in semifinished manufactures. From 1876 until 1932, U.S. exports of manufactured foodstuffs exceeded imports in every year but 1920. However, from 1932 to 1940 the trend was reversed; and this new tendency toward net importation of manufactured foodstuffs was gradually resumed after World War II, although from 1953 to 1956 the structural maladjustments in U.S. agriculture brought about an excess of exports over imports of those products. From 1957 to 1960 imports of manufactured foodstuffs once again exceeded exports. Further, in most years from 1897 to 1921, U.S. exports of semifinished manufactures exceeded imports, but from 1922 until 1936 imports exceeded exports in every year. This trend was also resumed after World War II, although in the recession year of 1957 exports of semifinished manufactures exceeded imports. Lastly, U.S. exports of finished manufactures, the trade balance of which had been active since 1898, did not show a tendency to rise in the postwar period, whereas U.S. imports of finished manufactures continued steadily to expand.

Indeed, with one insignificant exception, throughout the 1950s U.S. total expenditures on imports of goods and services, donations and investment abroad exceeded foreign expenditures in the United States. The excess of total exports over imports in goods and services had in effect become insufficient to cover U.S. capital exports, governmental aid and expenditures. Measured in terms of gold outflow and the increase of foreign short-term balances held in the United States, from 1950 to 1957 the average annual deficit for the United States was about $1,000,000,000. In 1957 there was no such deficit, but it reached the embarrassingly large figure of over $3,000,000,000 in 1958 and 1959. The deficit in 1958 comprised a gold outflow of $2,300,000,000 and an increase of foreign short-term balances of $1,100,000,000; in 1959 it comprised a gold outflow of $770,000,000 and an increase of foreign short-term balances of $2,300,000,000. In the latter year, for the first time in the 20th century, the United States had an excess of commercial imports over exports of goods and services. It also had a deficit on total current account (items 1 through 10) and in goods and services and private donations (items 1 through 9).

During the first decade after World War II, the remarkable economic expansion in the United States and elsewhere, together with

continued foreign assistance and tariff reductions, strengthened the long-term forces operating toward balance in U.S. international accounts. But at the close of the 1950s, events exhibited a "pendular" reaction. Supply conditions in western Europe had greatly improved. The high rates of economic growth at stable prices in the Federal Republic of Germany and at falling ones in Japan enabled them to expand their share of world exports of manufactures while that of the United States declined. The magnitude of the U.S. deficits was aggravated by a sharp rise in U.S. imports relative to that of western Europe, an unusually prolonged steel strike, exceptionally low cotton exports, conversion to the production of commercial jet airplanes and abnormally large imports of small cars. The evidence does not disclose that U.S. prices had been rising appreciably as compared with those of most other industrial countries. With the relative expansion in Europe during 1960 the U.S. balance of payments in goods and services strongly improved. Nevertheless, the continuation of substantial deficits in the early 1960s, measured in terms of the outflow of gold and net increases in foreign holdings of liquid dollar assets, gave concern on both sides of the Atlantic over the long-term equilibrium of the U.S. balance of payments.

Balance-of-Payments Equilibrium.—Balances of payments are seldom in equilibrium in the theoretical sense that a small displacement of exports, imports or capital items would tend to be corrected and the original balance restored. In practice, equilibrium in a nation's balance of payments implies the absence of severe drain, or accumulation, of foreign reserves. Such drains may be the direct result of an excessive amount of domestic money being exchanged into foreign money. This may indicate that either the debtor or the creditor nation's monetary, fiscal and wage policies—and the resulting money incomes and product prices—are incompatible with the foreign-exchange rates. After World War II many countries found themselves in this situation vis-à-vis the United States and, by Sept. 1949, felt compelled to devalue their currencies. A persistent drain of reserves arising from an import balance in one of the selections of accounts (*e.g.*, total goods and services) may indicate that the nation in the past has been able to live partly on its foreign reserves and assets or to secure foreign loans or grants. Mounting international indebtedness may also be the result of unfulfilled or inconsistent plans with respect to domestic production and expenditures on the one hand, and imports and exports on the other. In such instances the gap between imports and exports has often been filled by foreign borrowing. Differential rates of interest may also contribute to international disequilibrium; thus the lower net-interest rates of the United States as compared with those of many other industrial countries have recently compounded the difficulty for U.S. net exports to cover capital outflows, governmental aid and expenditures.

Regardless of the source of disequilibrium, the problem of adjustment in a nation's balance of payments affects the creditor as well as the debtor. In the long term, measures appropriate to the debtor will help solve the problems of the creditor, and measures appropriate to the creditor will help solve the problems of the debtor. But in the short term all policies are not equally acceptable, and creditors as well as debtors are tempted to resort to extreme national measures without regard for their effects on the world economy as a whole.

FOREIGN-EXCHANGE CONTROLS

As a consequence of the great depression, and attendant capital flight, from the 1930s a major complication arose in the international mechanism of adjustment, viz., the development of foreign-exchange controls. These controls restrict operations in all or specific foreign currencies on both current and capital account. They are usually administered by the central bank as the treasury's agent, and are invariably associated with trade controls. They take many forms, ranging from the licensing of all transactions involving foreign exchange to the supervision of transactions involving only specific foreign currencies or those of residents of specified countries. Nonetheless, they always constitute a method of rationing foreign currencies, particularly those which are scarce, and of ensuring that receipts of such foreign exchange are diverted into authorized channels.

The chief function of exchange controls is to prevent or redress an adverse balance of payments by limiting purchases of foreign exchange to an amount not in excess of foreign-exchange receipts. Usually, this entails setting a rate, or rates, at which exchange shall be bought and sold. When a single rate is established, it is normally higher than the rate that would prevail in a free market. Consequently, it tends to curb exports and stimulate imports. When multiple rates are established, they have the effect of differentiating between prices charged at home and abroad for specified exports and imports. The value of the currency is kept uniform for all residents with respect to their purchases of domestic products; but the multiple rates fix different prices for the same goods at home and abroad by stipulating different exchange rates for the various uses to which foreign exchange may be put. Although this practice may strengthen a country's balance of payments, it is a form of monopolistic price discrimination in international trade.

Most noncommunist countries have had occasion to adopt foreign-exchange controls out of necessity rather than preference. In periods of emergency it has often been impossible to achieve balance-of-payments equilibrium through the operation of demand and supply on the foreign-exchange market. Once adopted by some important country or countries, exchange controls have provided a source of special advantage as an instrument of trade bargaining; hence their tendency to spread. They have also been used primarily for domestic reasons, such as to insulate an economy from external inflationary or deflationary pressures, or to assist in national economic planning and development. However, in economies that are not centrally planned, exchange controls have had a tendency to direct trade into uneconomic channels, deteriorate its quality and reduce the extent of its potential contribution to the well-being of the participating countries. These factors are particularly relevant to full-employment conditions, for then exchange controls and their associated practices act as a constraint against further economic expansion. When the emergency that brought about their adoption has been removed, most noncommunist countries have tended to do away with exchange controls on trade account. They have usually been maintained on capital account, however, in order to control the flow of domestic versus foreign investment, and to deal with emergency conditions of capital flight.

Freely Fluctuating Rates.—Under normal circumstances international payments equilibrium might be achieved in a free system in which everyone is permitted to buy and sell foreign exchange in unlimited amounts. Shifts in demand and supply in foreign currencies would bring about changes in exchange rates which, in turn, would equalize the demand and supply for foreign currencies. If a country's demand for foreign exchange were to exceed supply, the value of foreign currencies would tend to rise relative to the value of the domestic currency. Its imports would tend to fall and its exports rise, leading toward the restoration of equilibrium. This process of international equilibration, it will be observed, requires no disinflationary pressures in the country suffering from a balance-of-payments deficit; on the contrary, it tends to raise prices domestically in terms of the national currency but to lower them in terms of foreign currencies.

Despite its simplicity the system of freely fluctuating exchange rates has rarely been recommended. Almost no country for which foreign trade has been of great importance has ever been willing for long to tolerate completely uncushioned, fluctuating exchange rates. The reasons for this have been many and complex; they are grounded in the fact that fluctuating exchange rates are a powerful vehicle for disruptive speculation. A small, well-informed group customarily deals in the exchanges. In these markets there are no storage expenses, no physical deterioration or obsolescence caused by changes in tastes or wants. The asset in question is for practical purposes homogeneous, standardized and without grades. Brokerage charges are minimal, the level of commissions by middlemen being lower than in any other field of speculation except national bond markets. The hedge normally earns

income for the speculator and, be it foreign exchange or gold, it may be the best hedge with respect to expectations of a decline in the general price level. Lastly, there are no physical restraints, such as cost of production, on the possible extent of the swing downward in the value of a single country's currency. Exchange-rate fluctuations are often self-propelling and lead away from, rather than toward, international payments equilibrium.

It is generally recognized that once the brake of reasonably stable exchange rates is removed, the last significant obstacle to irresponsible monetary and fiscal behaviour, for a long period and for many countries, may also be removed. In addition, experience has proved that fluctuating exchange rates result in risks for foreign trade and investment which are economically costly, and for which the development of forward-exchange markets and other facilities for hedging provide only a very limited palliative. Nor is it desirable to let exchange rates fluctuate freely in response to temporary changes in demand and supply. Such fluctuations cause adjustments in production and transfers of resources which also are costly and should be avoided if the disturbance is merely of a short-term character. The crux of the matter is that changes in exchange rates are different from other price changes: they affect, directly, all prices of internationally traded commodities and, indirectly, many prices in the national economy. As a prerequisite for international economic stability, key trading countries must therefore maintain reasonably stable exchange rates.

Stable Rates.—Rigidly stable exchange rates also have their drawbacks, for under certain circumstances they tend to generate deflation. Between 1870 and 1914, when the gold standard was an almost universally accepted institution in the western world, gold-standard countries tied their currencies to each other in terms of gold. Residents of one gold-standard country were permitted to procure money from another gold-standard country at a rate of exchange determined by the gold-weight ratio of the two currency units and by the cost involved in sending the gold from one country to the other. Thus the price of the pound sterling in terms of dollars could not rise beyond the so-called upper or U.S. gold-export point, since at this point it would become cheaper to purchase pounds by exchanging dollars into gold in the United States and to ship the gold to Great Britain. Similarly, the price of the pound sterling could not drop below the lower or U.S. gold-import point, since at this point it would become cheaper to purchase dollars by exchanging pounds into gold in Great Britain and shipping the gold to the United States. Within limits of the gold points, the gold standard therefore directly achieved stable exchange rates. Indirectly, it contributed to the automatic operation of the international mechanism by stimulating the inflow of short-term funds to the country whose exchange rate had fallen to the lower limit and was expected soon to rise.

Should a country's demand for foreign exchange tend greatly to exceed the supply, however, the movement of short-term funds would be insufficient to re-establish equilibrium. Nevertheless, the gold-standard mechanism would still tend to produce an adjustment automatically by an outflow of gold from the country that had developed a deficit, and an inflow of gold into the country that had developed a surplus. As gold constituted the basis of the monetary system under the gold standard, a reduction in the gold base could lead to a contraction of money and credit of a country in amount several times larger than the gold export, and conversely. The outflow of gold would tend to depress prices, and if the wage-price level were not perfectly flexible, this would also tend to depress real incomes. These changes in turn would tend to reduce imports and expand exports of the country losing gold, while the opposite changes would tend to raise imports and lower exports of the country gaining gold. The monetary contraction of the country losing gold relative to the countries gaining it would have the additional effect of raising interest rates in the former and lowering them in the latter. Normally, this would aid the process of equilibration by attracting foreign capital to the country which had developed the deficit. Equilibrium would therefore tend to be restored with a minimum gold outflow, an export surplus and an inflow of foreign capital.

The gold standard clearly was conducive to the interdependent growth of free multilateral trade and large-scale private capital movements. It helped integrate the monetary and credit policies of the gold-standard countries. It also was compatible with the objectives of reasonable price level stability and satisfactory growth rates. But it could not prevent world-wide inflations or deflations. If gold-standard countries were simultaneously to go through an inflation, the gold-flow mechanism would only keep them in line by way of a gold flow from the more to the less inflationary countries. A parallel rise in prices would not set the mechanism in motion; and similarly for the case of simultaneous deflation. Furthermore, even in the 19th century, prices and costs were not flexible enough for a smooth adjustment in the event of a gold outflow. Wages were inflexible downward. Attempts to reduce prices through credit contraction often lowered profits and increased unemployment. In fact, the gold standard failed to accomplish one of the most significant aims of virtually all modern nations, the avoidance of major depressions and mass unemployment. When the gold standard was restored in the latter 1920s, its weaknesses became even more apparent. Not only had the United States replaced Britain as the pivotal country in world trade, and thus transformed the process of international equilibration, but economic rigidities had also increased: the rules, as well as objectives, of the gold standard became increasingly incompatible with the new conditions.

As an international mechanism, the gold standard failed and crumbled with the great depression. Experience and theory had shown that deflationary policies might not improve a country's balance of payments during a world crisis. Moreover, countries suffering from external deficits could not tolerate an international mechanism which intensified unemployment. Hence, after the depressed conditions of the early 1930s, most governments eschewed financial contraction and undertook measures to increase the volume of output and employment.

A good deal of the theoretical literature of the period swept aside the classical assumptions of maintaining stable exchange rates and of relying on internal price adjustments to bear the brunt of the balancing process. Stress was laid, instead, on the equilibrating effects through income changes and on the insensitivity of internal adjustments to external forces. Emphasis was placed on greater exchange-rate variation and on trade controls as a guide to external policy; on internal stability at full employment and on effective demand as a guide to internal policy. Primarily, the equilibration of international accounts was achieved, in fact, through the adjustment of imports and exports to changes in the levels of production and income at home and abroad. When employment and production increased in one country, its imports would rise. The export industries in the countries supplying these goods would expand. Their income and employment would rise in turn, and their imports would increase. This adjustment process could readily cause a deficit in the country initiating the change, for the rise in its imports would not be followed by an immediate rise in its exports. A new balance would nevertheless tend to be established as an expansion of production, income and prices in the countries that had been stimulated would bring about an increase in their imports. On similar reasoning, a recession or depression in an important trading country could cause a contagious economic contraction, for the decline in its production would tend to result in a fall in its imports, and hence a fall in production and income abroad.

MONETARY AGREEMENT

It can readily be understood that when the representatives to the United Nations Monetary and Financial conference met in 1944 at Bretton Woods, N.H., to establish the International Monetary fund (IMF), they did not recommend a document that would have tied the hands of governments to rigidly stable exchange rates. Nor did they recommend freely fluctuating exchange rates or the complete abolition of foreign-exchange controls.

International Monetary Fund.—The main purposes of the IMF were to promote international monetary co-operation; to facilitate the expansion and balanced growth of multilateral trade; to promote exchange stability and avoid competitive exchange

depreciation; to assist in the establishment of free international payments and convertibility on current account without discriminatory trade or exchange restrictions; and to make international currency resources available to the contracting members. To this end, the agreement which came into force in 1945 assigned to each member a quota in the fund on which it could draw to cover a deficit in its balance of payments. The subscription of each member was equal to its quota, 25% of which was paid in gold (or, lacking this amount, 10% of its net official holdings of gold and U.S. dollars) and the balance in its own currency. Although the countries agreed to promote general stability of exchange rates, the par value of a member's currency could be changed by 10%, and the fund merely notified of such action. Changes in excess of 10% would require the concurrence of the fund.

The contracting members thus anticipated that exchange-rate changes would be more flexible in the postwar era than they had been under the gold standard, but that competitive exchange depreciation would be avoided. The new arrangements would give the member countries greater freedom with respect to domestic financial policies than did the gold standard. A country would be able to combat certain kinds of depressions or recessions by expanding effective demand, even though such policies might lead to an adverse balance of payments and a reduction of its exchange rate. On the other hand, if a country should suffer from a balance-of-payments deficit engendered by expansionary financial policies, the fund could withhold aid until the member adopted noninflationary policies.

After the establishment of the fund, the international mechanism of western nations consisted of arrangements lying between that of the gold standard and completely flexible exchange rates, with some measure of direct foreign-exchange controls. These arrangements have been used with a view to achieve external balance without sacrificing prevalent domestic economic objectives: a high average level of employment; avoidance of significant cyclical instability; appreciable long-run rates of growth; improvement in the average level of well-being; equity in the distribution of income; and a reasonably stable general price level. Within the limits of these objectives, most western nations have also endeavoured to keep their exchange rates stable over extended periods of time. There has thus been a general weakening in the emphasis on exchange-rate stability, although key countries have shown resolve to alter their own exchange rates only as a measure of last resort. All western governments have demonstrated greater determination to counteract economic fluctuations by central bank and fiscal policies. They have considered it undesirable to permit the self-regulating forces of the international mechanism to operate whenever such forces threatened the objectives of economic growth or price-level stability. In time of balance-of-payments deficit, some nations have therefore refused to follow contractionary policies; in time of surplus and full employment, others have been reluctant to follow expansionary policies. Consequently, the operation of the international mechanism of adjustment has been seriously curtailed.

In the early postwar years the IMF was unable to deal effectively with the problem of international disequilibrium. Dollar deficits were inextricably interwoven with the gigantic task of European reconstruction; and the fund was never intended, nor did it possess the resources, to cope with these problems. Among other things, western European countries required larger international reserves. From 1946 to 1949 various types of monetary clearing agreements predominated in Europe. They usually involved an arrangement between the central banks of two countries; the importers of each country paid the sums they owed to the exporters of the other into an account of their own central bank. At specified intervals, the two central banks offset their mutual claims. If the imports of the two countries did not balance—as they usually did not—one country would for a considerable time accumulate claims on the other.

European Payments Union.—In 1950 these emergency arrangements were replaced in Europe by a new monetary agreement called the European Payments union (E.P.U.). The E.P.U. was a multilateral clearing agreement which allowed each country to offset a deficit in its balance of payments with any one of the member countries against surpluses with others. The clearing took place at the end of each month. If the country emerged with an over-all deficit vis-à-vis the rest of the group, the E.P.U. automatically extended credit to it either for the whole amount of the deficit or for part of it, depending on its cumulative debtor position. The difference between the deficit and the amount of credit obtained had to be paid in gold. Once the country had exhausted the quota allotted to it, the whole of the deficit had to be paid in gold. Similarly, a country that emerged with a surplus had to give credit to the E.P.U. to the extent of the whole or part of the surplus depending on its cumulative creditor position. Once it had reached the limit of its quota, the country received an agreed-upon proportion of the surplus in gold from the E.P.U. and granted the remaining credit to the E.P.U. The E.P.U. was renewed from year to year, until it was terminated in 1958.

European Monetary Agreement.—By that time western European countries felt able to make a major monetary reform to eliminate the discrimination between dollar and nondollar currencies in their formal exchange arrangements. With their adoption of nonresident convertibility in 1958, the E.P.U. was dissolved and its termination brought into force the European Monetary agreement (E.M.A.). This agreement was signed as early as 1955 by the members of E.P.U. Under E.M.A., the automatic credit arrangement was abolished but member countries were obliged to make available limited amounts of very short-term finance. Credits might be granted to assist in meeting temporary balance-of-payments difficulties, the approval of each application being subject to examination of the merits of the case.

The IMF had increased its quotas in 1958 and expanded its stand-by reserve arrangements. These acts were of importance in reinforcing the confidence of western Europe to establish nonresident convertibility. Even of greater significance were the deficits of the United States in improving the international liquidity position of its trading partners. These latter deficits were of great magnitude and clearly could not be continued. Hence, in 1961, the Organization for European Economic Co-operation (O.E.E.C.) was transformed into the Organization for Economic Co-operation and Development (O.E.C.D.) with the full participation of the United States and Canada. It was established for the express purpose of achieving closer economic collaboration of the noncommunist world; and particularly to obtain larger contributions from western European countries and Japan to the development of newly independent countries. Western institutions were substantially strengthened to deal with moderate and isolated balance-of-payments strains, but they would be inadequate to meet a more severe and general international financial crisis.

In order to contribute to the defense and development of the noncommunist world, the United States is obliged to maintain an excess of exports over imports of goods and services. To achieve these ends, the United States and western Europe were faced in the early 1960s with the need to make serious adjustments. As for the United States, a substantial export surplus at appreciable rates of economic growth required the maintenance of a competitive price level. As for western Europe, it was essential to recognize that the burden of adjustment was as much the responsibility of countries with balance-of-payments surpluses as it was of countries with balance-of-payments deficits.

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Europe of the United Nations. For annual data *see* European Payments Union, *Annual Report of the Managing Board* (1951 *et seq.*); Bank for International Settlements, *Annual Report* (1930–31 *et seq.*); International Monetary Fund, *Annual Report* and *Annual Report on Exchange Restrictions* (1950 *et seq.*); *The Balance of International Payments of the United States* (annually). (Jo. M. L.)

INTERNATIONAL REFUGEE ORGANIZATION, commonly known as the IRO, was a temporary specialized agency of the United Nations, formally established in 1946, which assisted refugees and displaced persons remaining in many countries of Europe and China after World War II who either could not return to their countries of origin or were unwilling to return for political reasons. Between July 1947 and Jan. 1952 IRO cared for over 1,500,000 persons in special camps, particularly in Germany and Austria, pending repatriation or resettlement in other countries.

Functions.—The services supplied by IRO were care and maintenance in the camps, including food and clothing, medical care, vocational training and orientation in preparation for resettlement and transportation to overseas countries of permanent resettlement. IRO also conducted an extensive tracing service in many countries to find lost relatives and to reunite families, and assisted many thousands of unaccompanied children to rejoin their parents or to find new foster homes. The aged and the ill who could not qualify for admission to countries of immigration were placed in institutions for permanent care.

Beginning operations on July 1, 1947, the IRO preparatory commission took over from its principal predecessor organization, the United Nations Relief and Rehabilitation administration (UNRRA) (*q.v.*), the administration of the refugee camps in Germany and Austria and assisted many thousands of refugees resident temporarily in other European countries and in countries of North Africa. UNRRA had previously been engaged in collaboration with the occupying military authorities in Germany and Austria in assisting the repatriation of some 7,500,000 displaced persons to their home countries immediately after the war. IRO assisted the remaining 1,500,000 refugees and displaced persons who exercised their freedom of choice, recognized by the UN, not to return to their countries of origin for political or other reasons. IRO also assumed at that time the responsibilities for the legal protection of refugees and for their resettlement in other countries previously carried out by the Intergovernmental Committee on Refugees, which had been organized in London in 1939 and which terminated its activities upon the organization of IRO.

Participation.—During the five years of IRO operations, member governments contributed $400,000,000 to IRO expenditures which included over $195,000,000 for the transportation overseas of approximately 1,000,000 refugees who were accepted by Australia, Canada, the United States and the Latin-American countries. About 23,000 refugees of European origin in China were assisted to find permanent homes in other countries. When IRO terminated its activities in Jan. 1952, about 500,000 refugees remained in an unsettled state in Europe of whom 200,000 were still living in camps. Eighteen governments participated as members of IRO and contributed to its expenditures: Australia, Belgium, Brazil, Canada, China, Denmark, Dominican Republic, France, Guatemala, Iceland, Italy, Luxembourg, the Netherlands, New Zealand, Norway, the United Kingdom, the United States and Venezuela. *See* also Refugees; United Nations.

See Louise W. Holborn, *The International Refugee Organization: Its History and Work, 1946–1952* (1956). (G. L. W.)

INTERNATIONAL RELATIONS (ARTICLES ON). Attempts to systematize the study of international relations date from antiquity. In the 20th century, however, the subject has acquired a new urgency. Because of the increasing destructiveness of war, the rise of new ideologies, the decline of colonialism, the establishment of universal international organizations and the increasing interdependence of all peoples through modern means of communication and transport, governments and peoples have been forced to pay primary attention to international relations. It has become an accepted field of education and research, and efforts have been made to state its principles in a unified discipline. International Relations gives an introductory survey of this discipline, which has attempted to analyze the conditions, needs and aspirations influencing the foreign policies of nations; the patterns of power, interest and justification that have developed both universally and in regions; and the processes of accommodation, adjustment and change seeking to close the gap between practice and theory.

The evolution of international law, its scope, and the theoretical and practical basis of its authority are treated in International Law, Public. The body of rules governing issues that arise between individuals belonging to different nations or between an individual and a nation other than his own, sometimes known as private international law, is discussed in Conflict of Laws.

Diplomacy deals with the conduct of international relations as a profession; the evolution of its traditions and methods; and the impact on these of World Wars I and II. Ambassador describes the nature of the highest diplomatic rank.

Major controversies of the 20th century have centred around the conditions under which a new regime is to be accepted as the legal representative of a state, or a newly established state is to be accepted in the family of nations. The factors involved in this question are discussed in Recognition, Diplomatic.

The varying degrees of authority exercised by fully and partially sovereign states are discussed in Sovereignty. Articles dealing with the influence of states beyond their national borders include Empire; Hegemony; Imperialism; Mandate; Protectorate; Spheres of Influence; Suzerainty.

Attempts to map a road to peace, and the methods that have been tried and proposed, are discussed in Peace, International. Among the articles dealing with individual phases of the quest for peace are Arbitration, International; Disarmament; International Organizations; Pacifism; and World Government Movements.

The rise and fall of the first global organization for collective security are chronicled in League of Nations. The organization that inherited the League's problems is discussed in United Nations, an article that describes the major executive and administrative units of the UN; its specialized agencies; and its successes and frustrations when its machinery has been called into action. Certain ideals which the UN was intended to realize are discussed in Atlantic Charter; Human Rights; and Self-Determination.

International Court of Justice describes the history, organization and administrative procedures of the chief judicial agency of the UN. Among other articles dealing with UN agencies and activities are Food and Agriculture Organization; International Labour Organization; Trusteeship System; United Nations Educational, Scientific and Cultural Organization; Postal Services; and World Health Organization.

Among many articles dealing with international economics are Bank for Reconstruction and Development, International; Capital, Export of; Cartel; Commercial Treaties; Economic Union; International Payments; International Trade Associations and Congresses; Mercantile System; Shipping, History of; Tariff; Trade, International; Trade Routes; and Waterways, International.

International alignments in general are treated in Alliance; those sponsored by the U.S. include North Atlantic Treaty Organization and Southeast Asia Treaty Organization. Alignments associated with the U.S.S.R. are discussed in Communism; International, The; Mutual Economic Assistance, Council for; and Warsaw Treaty Organization. Economic aid programs of both the U.S. and the U.S.S.R. are discussed in Foreign Aid Programs.

The European common market is discussed in Economic Union.

Articles on other regional groupings in international relations include Monroe Doctrine; American States, Organization of; and Pan-European Movement. Articles on ethnological and religious groupings include Pan-Germanism; Pan-Islamism; Pan-Slavism; Pan-Turanianism; and Zionism.

Since international conferences and treaties made at them are

usually referred to by the name of the city where they were held, articles dealing with them will be found under such headings as BAGHDAD PACT; BANDUNG CONFERENCE; GENEVA SUMMIT CONFERENCE (1955); LOCARNO, PACT OF; SAN FRANCISCO CONFERENCE (1945); YALTA CONFERENCE (1945); and, for earlier conferences, under HAGUE CONFERENCES; WASHINGTON CONFERENCE; etc. Two key articles dealing with groups of conferences are PAN-AMERICAN CONFERENCES; and WORLD WAR II CONFERENCES, ALLIED, which treats all major Allied conferences (for example, those of Casablanca and Potsdam) with the exception of Yalta, which is the subject of the separate article listed above. The procedures usually followed in gatherings for the discussion of international issues are described in CONFERENCE. TREATY deals with methods of negotiation, the various types of treaty and the place of treaties in history and in the context of international law.

FAR EAST: RELATIONS WITH THE WEST surveys the history of these relations, from the Portuguese explorations of the 16th century to the political and military chain reactions that followed the rise of Communist China. EASTERN QUESTION similarly deals with the near east and middle east.

WAR examines military policy as a branch of foreign policy; also, it reviews ancient, medieval and modern types of war, their causes and their impact on civilization. Among other articles concerned with the repercussions of war on the international community are AGGRESSION; BLOCKADE; CONTRABAND; ECONOMIC WARFARE; ESPIONAGE; LAWS OF WAR; NEUTRALITY; PRIZE COURTS AND PRIZE LAW; PSYCHOLOGICAL WARFARE; and REFUGEES. Articles on many aspects of warfare are listed under MILITARY AFFAIRS (ARTICLES ON); NAVAL AFFAIRS (ARTICLES ON); AIR WARFARE.

The foreign policies of specific states are discussed in the general articles on those states.

A sound understanding of international relations calls for knowledge of many allied fields, the most obvious of which is covered in the survey article GEOGRAPHY. The use and misuse of geographical science in international relations are treated in GEOPOLITICS.

Among other important background articles are ANTHROPOLOGY (particularly the section *Applied Anthropology*); ATOMIC ENERGY; FOOD SUPPLY OF THE WORLD; MIGRATION; NATIONALISM; NATURAL RESOURCES; POPULATION; PROPAGANDA; PUBLIC OPINION; PSYCHOLOGY; RACES OF MANKIND; and SOCIAL ANTHROPOLOGY.

Biographical articles summarize the work of leaders in the field, from the classical commentator GROTIUS, HUGO to such modern authorities as ANZILOTTI, DIONISIO and WILSON, GEORGE GRAFTON.

INTERNATIONAL RELATIONS. In its broadest, literal meaning, this term denotes relations among the autonomous political units which today we call nations, or among individual members of such units. On the collective level, such relations can be political, military, economic or cultural; they can comprise all kinds of individual relations involving members of different nations. Yet when we refer to international relations as a distinct object of human action and understanding, we have in mind only those collective or individual relations, transcending national boundaries, which affect the position of nations vis-à-vis each other. International relations in this sense are political relations; they comprise, aside from the foreign policy of nations, all collective and individual relations which impinge upon the political position of a nation vis-à-vis other nations. The term in this sense is a synonym for foreign relations, as used, for instance, in the name "senate foreign relations committee."

International relations are as old as political history itself and have shown throughout the ages constant patterns of relationships and policies, whether entered into by hereditary monarchs or elective governments, cities or nation-states, continental empires or tiny principalities, ecclesiastic or secular rulers. The consistency of patterns beneath the variety of historic manifestations makes both historic understanding and theoretical analysis of international relations possible. Thus we are able to understand the international relations of the Greek city-states that Thucydides describes, the international relations of the Indian states of the 4th century B.C. from which Kautilya derived his philosophy, the international relations of the ancient near east of which the Old Testament tells, as well as those of the more recent past. By detecting in the international relations of different cultures and historic periods identical responses to identical challenges, we are able to develop certain theoretical propositions about international relations that are true regardless of time and place.

Basic Patterns.—The dynamic force that molds international relations is to be found in the aspirations for power of autonomous political units. These aspirations crystallize into three basic patterns: to keep one's power, to increase one's power, to demonstrate one's power. From these patterns three basic types of policy ensue: the policy of the *status quo*, the policy of imperialism and the policy of prestige. The clash of these policies —A trying to maintain the *status quo*, B trying to change it at the expense of A—leads to an unending struggle for power which characterizes all international relations. This struggle for power can be fought by two different means: diplomacy and military force. It leads of necessity to the balance of power through which nation A, either alone or in conjunction with other nations similarly threatened, tries to maintain itself against B. When A and B pursue their goals in conjunction with other nations, they embark upon a policy of alliances. When nations carry on the struggle for power by military means, they engage in an armaments race or war. When they try to justify and rationalize their position in the power struggle by reference to universal values, typically of a moral nature, they develop political ideologies. Continuous peaceful contacts among them lead to the development of an institutionalized diplomacy (*q.v.*).

Throughout the better part of history, several systems of international relations have existed side by side with little or no contact among them. Until the discovery of America, the American system or systems of international relations led a completely separate existence. The Chinese and Indian systems had only intermittent contacts with others.

Three different patterns of international relations can be distinguished according to the distribution of power within them: multiple, bipolar and imperial systems. The multiple system is distinguished by a number of units of approximately equal strength which combine and oppose each other in ever-changing alignments. Its main characteristics are flexibility, uncertainty as to the relative strength and future policies of its members and the propensity for limited, inconclusive wars. The European state system, from the end of the Thirty Years' War in 1648 to the beginning of World War I in 1914, with the exception of the period of the Napoleonic Wars, conformed to this pattern.

The bipolar system is characterized by the predominance of two major powers of approximately equal strength, around which the other members are grouped in different degrees of closeness. This system is rigid and stable as long as the approximately equal distribution of power between its two predominant members persists. Any marked shift in that distribution threatens the system with destruction. The structure of international relations that emerged from World War II exemplifies this pattern.

The imperial system consists of one predominant nation with a number of subordinate members clustered around it. The stability of such a system is great, and conflicts within it tend to be marginal. Its existence can be threatened by the disintegration of the predominant member, the rise of a number of subordinate members to a position from which they can challenge the predominant one, or by a challenge from outside the system. The system of international relations dominated by the Roman empire is the classic example of this pattern.

Changes in Modern Times.—International relations have undergone in modern times four drastic changes: the formerly separate systems of international relations have merged into one world-wide system; the predominance of the European system has disappeared; the possibility and actuality of total war have come to dominate the international scene; the feasibility of universal destruction with nuclear weapons has radically altered the

function of force as a means to the ends of foreign policy. While the first three changes do not affect the dynamics and structure of international relations as we have known them since the beginning of history, the last constitutes a veritable revolution, the only one in recorded history, in the structure of international relations.

The expansion of the European state system into the other continents by means of colonial empires, starting early in the 16th century, broke down the barriers which had separated the different systems of international relations. They were all brought into contact with, and into some form of dependence upon, the European state system, and through it they came into contact with each other. The two world wars of the 20th century, in which most nations of the world participated, point in their very name to the transformation of a number of separate systems of international relations into one world-wide system. That process of political unification was greatly advanced and expanded to the individual sphere through the development of the technology of transportation and communications. This development started with the great voyages at the end of the 15th century and culminated in the drastic reduction of geographic distances for transportation and the virtual obliteration of the limits of time and space for communications.

The last phase of this transformation of international relations into a world-wide system, covering roughly the period from the end of World War I to the aftermath of World War II, coincides with a radical change in the distribution of power within the system. From the beginning of the 16th century to World War I the European system provided the dynamics and the preponderant power for this transformation; now two nations, either completely or predominantly non-European—the United States and the Soviet Union—have taken its place. This decline of Europe as the political centre of the world may be said to have started with the Monroe Doctrine of 1823 declaring the mutual political independence of Europe and the western hemisphere. This declaration foreshadowed the fragmentation of the European empires which was virtually consummated after World War II in the colonial revolutions sweeping Africa and Asia. Most of the colonial possessions of European nations, one after the other, gained their national independence, and many of them either withdrew their political support from the European nations or joined their enemies. The outstanding examples of these two different forms of political emancipation are India and China.

The decline of Europe resulting from the colonial revolutions coincided with the rise to predominance of formerly backward nations such as Russia and China. The technological unification of the world gave these nations the tools to transform their superior potential in geography, population and natural resources into the actuality of national power.

Total War.—The decisive factors in the decline of Europe as the political centre of the world were the two world wars of the 20th century. At the same time that they weakened the main European nations in their human and material resources, these conflicts brought non-European nations to the fore—the United States and Japan in consequence of World War I, the United States and the Soviet Union in consequence of World War II. These two world wars differed not only in their consequences but also in their intrinsic character from other wars fought in the western world in modern times. Most of the latter were limited wars in that only a fraction of the total human and material resources of the belligerents was committed to them. Only a fraction of the total population was morally identified with these wars and suffered from them, and each war was waged only for limited objectives. The two world wars and those for which the most powerful nations continued to prepare were total in all these four respects. The actuality and threat of total war were, indeed, the most important distinctive characteristics of international relations in the mid-20th century. They were due to an unprecedented accumulation of destructive power in the hands of the most powerful nations and to the incentive to use that power for national purposes. The accumulation of power resulted from drastic changes in the distribution of political and technological power in the world; the incentive was presented by the closing of the colonial frontier and the ascendancy of a universalistic nationalism.

Throughout the modern period, with the exception of the wars of religion of the 16th and 17th centuries and of the Napoleonic Wars, wars were limited in every respect. Power was so widely dispersed among a great number of sovereign states that no single state or possible combination of states was strong enough to gain more than limited objectives against its adversaries. The drastic reduction in the number of sovereign states and the resulting concentration of power in the hands of a few nations of the first rank, which occurred between the end of the Thirty Years' War and the end of World War II, created one precondition for total war. The treaty of Westphalia of 1648, for instance, reduced the number of sovereign states of which the German empire was composed from 900 to 355. The diet of Regensburg of 1803 eliminated 200 more. When the German confederation was founded in 1815, only 36 sovereign states were left to join it. The unification of Italy in 1861 and that of Germany in 1871 eliminated 31 additional sovereign states.

At the end of the Napoleonic Wars in 1815, only five nations of the first rank were left—Austria, France, Great Britain, Russia and Prussia. In the 1860s Italy and the United States joined them, followed toward the end of the century by Japan. At the beginning of World War I in 1914, eight nations were of the first rank, with Germany having replaced Prussia. After World War I the trend toward reduction of the number of sovereign states was reversed; their number about doubled because the Ottoman, Austro-Hungarian, British and French empires were broken up. Yet the trend toward concentration of more and more power in the hands of fewer and fewer states continued. At the end of World War II the number of nations of the first rank was reduced to two: the United States and the Soviet Union.

It is not by accident that the two most powerful nations, capable of threatening each other with total war, are also most advanced technologically and industrially. The mechanization of warfare in terms of weapons, supplies, transportation and communications requires, in case of actual hostilities, the virtually total commitment of the industrial productivity of the nation. This total commitment has been made possible by the enormous increase in economic productivity brought about by a series of technological and industrial revolutions, starting in the 18th century. By contrast, in earlier periods of history, economic productivity was so low that after it had barely provided for the needs of the population, little was left for military purposes. Thus premodern technology could support only limited war, while modern industry is productive enough to allow the commitment of the lion's share of its products for military purposes.

One incentive for the great nations to use this enormous productive power for the purposes of mutual destruction was provided by a change in international relations which can be called the disappearance of the colonial frontier. The generally limited character of the means and ends of foreign policy from the end of the middle ages to World War I was in good measure due to the opportunity for the great European nations to seek satisfaction for their aspirations for power not in all-out contests with each other but through competitive expansion into Africa, the Americas and the part of Asia bordering on the eastern oceans. Colonial competition and conflict during that period provided outlets through which the European nations could compete for power without endangering their existence. But by the beginning of the 20th century the colonial frontier was, for all practical purposes, closed. Virtually all politically weak or empty spaces around the globe had been transformed into colonies or spheres of influence by one or another of the European nations. From then on, as the two world wars showed, the great European powers, deprived of the colonial safety valve, fought each other not for limited advantage but for total stakes, and they could do so with the instruments of total war.

These stakes became total not only in that total war threatened the belligerents with total destruction, but also in that the issue over which nations competed and fought had become total. That issue was no longer a limited military or territorial advantage but the universal triumph or defeat of a particular philosophy and

way of life, which was supposed to be incarnate in a particular nation. While traditionally the international relations of the western world were carried on within the framework of common moral principles and of a common way of life, which imposed effective limitations upon the struggle for power, international relations in the mid-20th century were dominated by the conflict between democracy and Communism, each putting forth a universal message of salvation, each trying—with different intensity—to extend its dominion to all mankind, and each identified with one of the two great powers left in the world. Thus international relations came to be characterized not only by the traditional threat and use of military force on behalf of the aspirations of individual nations but also by a struggle for the minds of men. The proponents of the two antagonistic philosophies and ways of life, using the instruments of propaganda, foreign aid and foreign trade, endeavoured to gain the allegiance of uncommitted nations. By the same token, the traditional methods of diplomacy were in eclipse. Nations can negotiate and bargain about their interests and conclude compromises concerning them, but they feel that they cannot yield an inch where their philosophies and ways of life are at stake.

While similar situations have existed before, temporarily and on a limited scale, especially in periods of religious conflicts and wars, international relations after World Wars I and II were marked by a change in structure unprecedented in recorded history. Throughout history, there has existed a rational relationship between the threat and use of military force and the ends of foreign policy. It was rational for a nation to ask itself whether it could achieve its ends vis-à-vis another nation by peaceful means or whether it had to resort to military force to achieve them, for the risks involved in the resort to military force were generally not out of proportion to the ends sought. Great ends justified great risks, since the risks were generally not so great as to obviate the ends. Yet all-out nuclear war, likely to destroy all belligerents and thus to eliminate the very distinction between victor and vanquished, is a completely irrational undertaking. No possible end can justify it; it is an instrument of mass murder and mass suicide.

Two Modern Dilemmas.—International relations, then, were faced with two interconnected dilemmas upon the solution of which depended the survival of western civilization and perhaps of mankind itself. The first dilemma consisted in the contrast between the technological unification of the world and the parochial moral commitments and political institutions of the age. Moral commitments and political institutions, dating from an age which modern technology had left behind, had not kept pace with technological achievements and, hence, were incapable of controlling their destructive potentialities. The second dilemma consisted in the contrast between the need of nations to support their interests by resort to violence and the irrationality of resort to nuclear arms. If a nation cannot resort to nuclear weapons without risking its own destruction, how can it support its interests in a world of sovereign nations which is ruled by violence as the last resort?

These two dilemmas put into question the very survival of the existing system of international relations. The first dilemma suggests a higher principle of international organization, transcending the nation-state, in the form either of a universal organization, such as the United Nations, which would minimize threats to international peace, or of regional organizations, such as the European communities or a projected Atlantic union, which would eliminate local threats to peace and facilitate the rational use of regional resources. The second dilemma suggests the abolition of international relations itself through the merger of all national sovereignties into one world state which would have a monopoly of the most destructive instruments of violence. Both kinds of solutions are supported by the awareness of the unity of mankind, underlying the inevitable fragmentation of international relations. However inarticulate and submerged, this awareness never completely disappeared even in the heyday of nationalism, and it has been sharpened by the threat of nuclear destruction facing all mankind. These solutions are also supported by the longing to give that unity a viable political form, a longing which has time and again endeavoured through theoretical schemes and practical measures to transform international relations into a supranational political order. This longing, in times past mainly a spiritual or humanitarian impulse, was in the nuclear age greatly strengthened by the desire for self-preservation, innate in all men.

See also DIPLOMACY; PEACE, INTERNATIONAL; WAR.

(H. J. MU.)

INTERNATIONAL TRADE: *see* TRADE, INTERNATIONAL; EXPORTS; IMPORTING; INTERNATIONAL PAYMENTS; COMMERCE, HISTORY OF; TARIFF.

INTERNATIONAL TRADE ASSOCIATIONS AND CONGRESSES. The 19th century, though often regarded as the age of nationalism, nevertheless was characterized by the growth of private international organizations covering almost every branch of human activity and expressing the supranational extent of modern interests. These organizations multiplied at an even faster pace in the 20th century, about 1,254 being recognized by the Union of International Associations in 1960, as compared with 185 in the first comprehensive account in 1907.

This article is limited to permanent international associations (those representing nationals of more than one country and having a more or less continuing central office or secretariat) in the fields of commerce, industry, finance, transport, communications, agriculture and ancillary professions. Official organizations founded by intergovernmental agreement are excluded, as are also profit-making international groups, such as Standard Oil and the Havas News agency; it is more appropriate to classify the latter as unified business concerns operating in more than one country than as federal associations of national economic interests.

Growth and General Characteristics.—The 19th-century international fairs beginning with the Great exhibition of 1851 in London provided the occasion for the first international associations. Exhibitors at these meetings not only saw the value of more permanent collaboration, but they were also able to secure such official international agreements to protect their rights when abroad as the International Union for the Protection of Industrial Property of 1883 and the Berne copyright convention and union of 1886. Some impression of the rate of growth of private organizations can be derived from statistics (World Peace Foundation, "Pamphlet Series," vol. vi, no. 6 [1916]), which show that, while there were 18 meetings of these bodies in 1850–59, the number had increased to 139 in 1870–79 and to 985 in 1900–09, and that 458 international assemblies met in 1910–14. Corresponding figures for 1919–39 are lacking, but it was reliably estimated that in the early 1930s between 200 and 250 of these meetings took place annually. The evidence from post-1945 experience suggests that these associations possess a remarkable capacity to survive war and political changes. By 1960, for example, 334 private international organizations had passed the rigorous tests of admission to consultative status with the United Nations Economic and Social council.

As for the interests in which international organization has proved most active and viable, there is a difference between those activities, such as railway transport, which have an obvious international significance, and those, such as agriculture, in which national organization is itself weak or which have a predominantly local area of activity. On the whole, agricultural producers' associations have been ephemeral or regional, or confined to secondary or subsidiary agrarian pursuits. It is notable here that the development of official international institutions influenced the relative growth of various types of private organizations; the International Labour organization (ILO), for example, prompted the formation of the International Organization of Employers for the better co-ordination of the employers' point of view. Another interesting form of nongovernmental organization intermediary between the two extremes just mentioned is that dealing with international standards for industry and commerce; the International Organization for Standardization is conspicuous here. Further, since some of the most typical activities of nongovernmental organizations are joint inquiries into questions of common interest to the membership, it is not surprising that professional organizations among actuaries, accountants, architects and engi-

neers have had an important part to play.

The spontaneous growth of these organizations has naturally meant extreme variety in structure and function. Some have highly complex constitutions, with considerable incomes and authority over their members. Others are little more than annual meetings at an accessible centre for an informal exchange of views about trade prospects, with little in the way of binding understandings being reached. Generally members are not individuals but national associations, though hybrid forms exist. A convenient form of classification is the distinction between organizations which are wholly private and those in which there is some official component. The International Institute of Refrigeration is indisputably an official body; it was founded in 1920 by a convention between governments and is governed by a general conference composed of government representatives. But where an organization, such as the International Federation for Housing and Town Planning, is directed by a council having at one time a majority of delegates from official agencies and at another a majority of nongovernment representatives, the case is more difficult to determine. In the marginal zone between the private and the semi-official. limits of the former can probably be best discovered through scrutiny of the functioning of the organization's services.

The functions and activities of international nongovernmental organizations are not essentially different from those of their national correlatives. They are intended to further the special interests of members by providing permanent machinery for exchanging views and pooling information, for public relations on an international scale, for joint studies and research, for the elaboration of standards and metric systems to facilitate international commerce, and for bringing pressure to bear upon governments. Wherever a national business or calling has something to gain by links with its opposite numbers abroad, the basis for international organization exists. Sometimes the sectional character of these groups has been masked by pacifist or internationalist ideals, but in many instances the fact that technical collaboration between private national groups seemed to be more fruitful than negotiation at the diplomatic level genuinely gave rise to the belief that in this lay the road to ultimate world order.

Business and Commerce.—The colossus among commercial organizations is the International Chamber of Commerce (I.C.C.), with a history as a forum for business interests extending back to 1869, though it was not constituted as a permanent association until 1920. The I.C.C. announced itself as a "confederation of the main economic forces of the countries included in its membership"; these forces are: (a) organization members, that is, national and local associations grouped for this purpose into national committees, which operated in about 40 different countries in the early 1960s, and (b) associate members, consisting of individual businessmen, firms and corporations in countries where no national committee is functioning. A regional group, the Commission on Asian and Far Eastern affairs, serves national committees in southern Asia and Japan. There is a supreme policy-making organ, the biennial congress, a permanent council representing each national committee, and an executive committee elected by the council. Some 40 commissions and committees for technical work handle the four main departments of the I.C.C.'s activities: economic policy, distribution and advertising, transport and communications, law and commercial practice. A court of arbitration adjudicates disputes arising between businessmen of different countries; there is also a council to determine what constitutes unfair practice in international advertising, and a central information bureau. The I.C.C. is commonly recognized as having exercised an appreciable influence on government policy during the period between the two world wars, especially in war debt and reparation issues; it is also said to have contributed much to the establishment of the International Bank for Reconstruction and Development and of the International Monetary fund of the United Nations.

The analogous body for co-operative organizations, the International Co-operative alliance (I.C.A.), sprang from exchanges between the British and French co-operative congresses in the 1880s, though the first international congress that formally created the alliance did not meet until 1895. The I.C.A. has among its aims "to be the universal representative of co-operative organizations of all types" and "to propagate co-operative principles and methods throughout the world." Its members by 1960 included 153,000,000 people grouped in national, regional and local co-operative organizations in 47 countries; 34,000,000 of these lived in the Soviet Union. Its structure closely resembles that of the I.C.C., its chief policy-making organ being a triennial congress. Some indication of the scope of the alliance's interests and activities is provided by the fact that at the Lausanne congress, which met in 1960, there were auxiliary conferences dealing with international co-operative trade, banking, insurance, co-operative agriculture, workers' co-operative production, co-operative press and education, and the role of co-operation in housing. The 1954 development fund for assisting underdeveloped countries is a special I.C.A. enterprise.

In the business field are many organizations much smaller than these two giants. Typical of the wide variety of these groups are, in order of their foundation, the Union of International Fairs, started in 1925 for the improved co-ordination of facilities for international fairs offered by public authorities; the International Association of Department Stores, a European organization that in 1928 became responsible for research on management and distribution; and the International Office for Motor Trades and Repairs, with its headquarters at The Hague and members in more than a score of countries. The advertised objects of the latter organization are to distribute information on the sale, repair and service of motor vehicles and to encourage ethical business codes with a view to their adoption internationally.

Manufacturing Industry.—International organization in the manufacturing trades has generally been stronger in the secondary than in the basic industries and in the production of those commodities that play a large part in international trade. One exception to this is the International Organization of Employers (formerly Industrial Employers), which was founded in 1919 with national federations of employers as its members in order to ensure permanent liaison between employers' representatives at conferences of the ILO. The organization is, however, more of a defensive reaction to international labour pressures than a spontaneous industrial organization.

Among the secondary trades, the food, hotel management, fuel and power, building and light industries are well represented. The International Office of Cocoa and Chocolate, which functions in Brussels, Belg., was founded by cocoa and chocolate manufacturers in 1930 and studies all questions relating to the cultivation of cocoa and subsequent manufacturing processes. The International Federation of Meat Traders' associations met annually in general assembly for similar objects beginning in 1946; it is wholly a west European organization. The European Brewery convention, established in 1947, and the European Coffee bureau, created in 1959 to study and disseminate knowledge of coffee, are other examples of the extent and variety of these associations in the food industries. The International Hotel association in 1946 took over the functions of the International Hotelmen's association and of the International Hotel alliance, which were founded in 1869 and 1921, respectively, with the object of federating all the hotel associations of the world in order to formulate a common policy on international tourist traffic. Finally in this group may be mentioned the extensive and active organizations in the fuel and power industries. The World Power conference, representing national committees in more than 50 countries, normally meets in plenary session once every six years in order to study existing resources of hydroelectric power, coal, oil and other fuels and minerals, and to explore the possibility of their more efficient utilization. It has a permanent central office managed by an executive council and is powerfully supported by such organizations as the International Electrotechnical commission (founded 1906), which facilitates the "co-ordination and unification of national electrotechnical standards not already covered by the statutes of any other recognized international organization" among more than 30 countries of industrial importance; the International Union of Producers and Distributors of Electrical Energy (founded 1925), a

professional organization for the study of the production and transmission of electrical energy; and the International Conference on Large Electric Systems (founded 1921), which also has within its purview the study of all technical questions concerning electrical energy.

Textiles are the foremost internationally organized trade among the group with an important interest in the world market. The International Wool secretariat (1937) originally represented the wool boards of Australia, New Zealand and South Africa with their branches in Europe, India and Pakistan, but in 1949 the Wool Bureau, Inc., representing wool producers in North America, was admitted to associate membership. The International Wool secretariat defines its purposes boldly as the promotion of the interests of the producers and users of wool everywhere. The manufacture of wool and allied fibres is represented by the International Wool Textile organization, which arose in 1929 from arbitration agreements between the chambers of commerce of Bradford, Eng., and Roubaix Tourcoing, France, and gradually extended in membership and scope until by 1960 it covered wool organizations in 14 countries in Europe and 7 elsewhere, including Australia and Japan, and represented the "production, commerce and industry of wool textiles in all branches of international economic activity." Similar organizations have been promoted for cotton and silk: the International Federation of Master Cotton Spinners' and Manufacturers' Associations (1904), renamed the International Federation of Cotton and Allied Textile Industries in 1954, represents producer organizations in Europe, India and Egypt and offers such important services to its members as the arbitration of international disputes and, from 1922, an annual survey of the state of the U.S. cotton crop; and the International Silk association (1949) maintains liaison between representative bodies in all parts of the world. Later stages in clothing manufacture are represented by the International Rainwear council and the International Committee for Dyeing and Cleaning, among others; the former dates from 1959 and covers a number of European countries and the U.S., while the latter, founded in Paris in 1950, is an association of national federations, chiefly in Europe.

Apart from textiles and clothing, motors and railroad rolling stock have formed the most important manufacturing trades for international organization. The International Permanent Bureau of Motor Manufacturers succeeded in 1919 the pre-World War I International Union of Motor Manufacturers; its constituent bodies comprise national associations in several European countries and in the U.S. The International Association of Rolling Stock Builders, founded in Paris in 1930, was originally a cartel for the allocation of the export market; its purpose in 1934 was re-defined more generally as to "defend on the international level the general interests of the rolling stock builders' industry." It has a European membership only.

Finance.—Notwithstanding the essentially international character of modern finance, nongovernmental organizations dealing with financial business are relatively few, since international clearings between the central banks of the different countries are generally officially regulated. The most important private organization in this field is the International Credit Insurance association, with its headquarters in Zürich, Switz.; it was founded in 1946 to carry on a previous organization of the same name founded in Paris in 1928. The association is a clearing centre for leading insurance companies in Europe, Mexico, Venezuela and the Republic of South Africa. Its evidence bureau in Amsterdam, Neth., provides different firms with opportunities for joint consultation if they are approached to insure the same risks. A similar financial organization is the International Thrift institute, an association of savings banks in European, Asian and American countries, which was formed in 1925 and was reorganized in 1948 when its office was moved from Milan, Italy, to Amsterdam. The Thrift institute's aims, which include helping savings banks to "enhance their influence and prestige internationally," suitably introduce another class of organizations having an interest in finance but with some financial doctrine or policy to advertise: the International Centre of Research and Information on Collective Economy, the International Interchange committee and the International Union for Land Value Taxation and Free Trade are interesting specimens of these.

Communications.—The international agreements into which communications have entered have generally been diplomatic instruments, such as the convention of 1874 which created the Universal Postal union. In radio broadcasting, however, it was unofficial effort to eliminate the overlapping use of wave lengths that led to official intervention. The "plan of Geneva" of the unofficial International Broadcasting union, founded in 1925 for the rational allocation of European wave bands, became the basis of the intergovernmental convention adopted at Lucerne, Switz., in 1933. Thereafter the union through its technical observation post at Brussels verified daily the accuracy with which the various stations maintained their assigned wave lengths, and assisted the League of Nations Intellectual Co-operation organization in promoting international exchanges of broadcasting material. In 1950 the union was superseded by the European Broadcasting union (E.B.U.), which in the 1960s consisted of "active" broadcasting organizations and national associations of broadcasting bodies situated in 25 countries and "associates" in 14 countries. Through an annual general assembly and an administrative council, the union works to "safeguard in all fields the interests of broadcasting organizations that have adhered to the statutes, and establish links with others"; its technical centre in Brussels maintains the frequency control of the period before World War II and studies all questions of technical interest.

Amateur radio is represented by the International Amateur Radio union (1925), which seeks to promote and co-ordinate two-way radio communication between the amateurs of various countries. For broadcasting in the Americas the Inter-American Association of Broadcasters, created by a radio conference at Mexico City in 1946, has for its objects the promotion of co-operation between radio stations in the public interest and the effective representation of broadcasting organizations at the national and international level. To improve wireless services at sea, the International Radio-Maritime committee was set up in 1928 at San Sebastian, Spain. After its reconstruction in Brussels in 1947 its effective members became radio organizations in Atlantic and Mediterranean countries. The committee's scientific centre prevents interference between ships' radios much as the E.B.U. technical centre prevents interference between stations on land, and its technical commission looks after the interests of maritime radio at national and international conferences.

Transport.—Among the international associations for transport, as for communications, it is not always easy to distinguish between private and official bodies; this is particularly so in railway transport, since the most important railway systems in Europe are state managed. The organizations cited here are those which nevertheless are open to private companies, provided these be of international importance and have not been established by agreement between governments. The International Union of Railways, with its headquarters in Paris, where it was founded in 1922, is composed of railway administrations with at least 1,000 route km. (621 mi.) of line and having traffic relations with each other within and outside Europe; it seeks to unify and improve the construction and operation of railways engaged in international traffic. Its annual general assembly controls a system of standing committees dealing with the standardization of rolling stock, the modernization of equipment, and international timetables. A somewhat similar organization is the International Railway Congress association, first established in 1884; its membership of state railway administrations and private companies in more than 60 countries is geographically more extensive than the International Union of Railways, and it aims at the more general objective of "promoting railway progress by holding periodical congresses and by publications." Similar work is carried on by the Pan American Railway Congress association, founded in 1906. This body is composed both of public and private companies and works through a system of committees toward the unification and modernization of railway transport and the reform of legislation affecting railways. Efforts to reduce inconvenience caused by transfer from one national railway network to another were made through the

European Passenger Time-Table conference (1923). This is in the main an official body but includes private delegates and works on a consultative basis with the International Union of Railways. The latter is also associated with the International (Railway) Wagon union, founded in 1921 to ensure the application of the *Regolamento Internazionale Veicoli,* which provides for the reciprocal use of railway cars in international traffic by its member railway administrations, most of which are European.

Some international organizations for shipping are more like profit-making concerns, such as the shipping conferences that grew up in the late 19th century to eliminate price cutting. The Baltic and International Maritime conference, however, first founded under another name in 1905, provides for mutual consultation in all matters affecting the shipping industry, for defining and circulating news of "objectionable practices" among its members and for approving documents for the use of shipowners. Its members are in three classes—owners, ship brokers and federations of owners' and protecting associations in all parts of the world. An even more general association of shipowners is the International Chamber of Shipping (I.C.S.), founded in 1921 as the International Shipping conference, a federation of national associations of private owners. Wages and conditions of labour at sea are within the purview of the International Shipping Federation Ltd., having a membership similar to that of the I.C.S.; it was dealing with strikes in the industry before 1914 but was given a permanent form with the establishment of ILO. The important role in shipping of international maritime law and maritime insurance is indicated by the International Maritime committee, a federated law society that began to promote intergovernmental maritime conventions in 1897, and the International Union of Marine Insurance, a federal association of insurance and underwriter groups; this was established in 1874 and reorganized in 1946.

The obvious benefits of international connections for tourists is reflected in the associations that grew up for motor transport, especially in connection with sport and recreation. The International Automobile federation is a post-World War II form of the old International Association of Recognized Automobile clubs, which had existed since before World War I. It serves motoring clubs in almost every country and is closely associated with the International Touring alliance, which was founded in 1893 to bring into touch with each other the various national touring groups. Among organizations for road transport as an industry are the Permanent International Association of Road congresses (1909), a semiofficial body concerned with the general improvement of world road conditions, and the International Union of Public Transport (1885), a mixed public and private body dealing principally with problems of urban transport.

When the official conference met in Chicago, Ill., in 1944 to approve the convention establishing the International Civil Aviation organization (1947), the airline operators attached to the national delegations met to reconstruct the old private International Air Traffic association, founded at the end of World War I. The new body, the International Air Transport association, an agency for consultation between airline companies in many countries, claims to speak for 90% of the world's scheduled air traffic; it acts as a central bank of information on all subjects and supplies technical advice to its members. The International Aeronautical federation, established by seven European governments and the United States in 1905, has for its object the promotion of world aeronautics, including private flying, in all its forms.

Agriculture.—Since organization among sectional interests is usually as strong internationally as it is nationally, agriculture did not produce an abundance of private international associations. While the functions and assets of the official International Institute of Agriculture (1905) were transferred to the Food and Agriculture Organization of the United Nations (FAO) in 1946, the voluntary organization, the International Commission of Agriculture (I.C.A.), though dating from 1889, tended to lack official encouragement; its chief function was to bring together representatives of its constituent organizations in biennial congresses to contribute concertedly to the basic knowledge of every branch of agriculture. The I.C.A. is said to have influenced the principles of agricultural policy adopted by the 1933 World Economic conference in London and the bilateral treaties on exchange of produce concluded by certain European countries in the 1930s. The commission was reorganized in 1948 as the European Confederation of Agriculture; it speaks for agricultural associations in many different countries in Europe and the Mediterranean basin. It claims to protect independent family farming and all forms of mutual aid between people employed in farming.

Representations to official international conferences on behalf of European farming are made by the confederation, the organization speaking for the agricultural world as a whole being the International Federation of Agricultural Producers, which was created at a London conference of farm organizations in 1946. This represents general farm and agricultural co-operative organizations in all parts of the world and meets in council once every two years.

Some farm organizations are specialized by product, such as the World's Poultry Science association (1912), the International Olive Growers federation (1934) and the International Dairy federation (1903). Some are regional: the Liaison Committee of Mediterranean Citrus Fruit Culture (1949); the American Society of Agricultural Sciences (1940); and the European and Mediterranean Plant Protection organization (1951). Certain associations, such as the International Confederation for Agricultural Credit (1932), link farming with other interests.

Professional.—Activities deriving special benefits from international co-operation are those which rely upon research or standardized methods for their efficiency. Thus professions serving trade and industry are relatively well organized internationally. The International Statistical institute (1885), with its highly qualified and geographically well-distributed membership, is devoted to the development and improvement of statistical methods; the International Conference of Agricultural Economists (1929) publishes records of current progress in agricultural economics; among others, the Permanent Committee of International Congresses of Actuaries (1889) links together actuaries' associations in different countries. Similar associations for engineering include the International Association for Bridge and Structural Engineering (1929) and the Union of International Engineering Organizations, which originated in an engineering conference convened by the United Nations Educational, Scientific and Cultural organization (UNESCO) in 1950. One of the most useful of these professional bodies is the International Organization for Standardization, founded in 1946 on the basis of an older organization dating back to 1926: this is a federation of national standardizing bodies seeking through the adoption of universal standards to facilitate the world exchange of goods and services.

Relations With Intergovernmental Organizations.—*The League of Nations.*—Art. XXIV of the covenant excluded international bureaus other than those "already established by general treaties" from the provision placing existing international organizations under the aegis of the League. The private organizations, however, were not without influence on national policies within the League. Representatives of important organizations were sometimes included in national delegations to the assembly, and at international conferences under League auspices nongovernmental groups were often allowed to participate in a consultative capacity: the International Chamber of Commerce played an important part in the World Economic conference of 1927 and in the League conference on international trade restrictions in 1928. These associations were active also in the work of the relevant committees and ancillary organs attached to the League. Eight of them, for example, were invited to send representatives to sessions of the Consultative Technical Commission on Communications and Transit, and not only did the ILO constitution presuppose active unofficial organizations but the organization much depended upon them for the carrying out of ratified conventions.

The United Nations.—The UN Conference on International Organization at San Francisco, Calif., in 1945 decided not to admit representatives of private international organizations in a consultative capacity, though consultants from 50 private national groups served unofficially in the U.S. delegation. The charter issuing from the conference, however, gave the first recognition in any multi-

lateral agreement to these bodies; art. 71 permits the Economic and Social council to make arrangements for consultation with nongovernmental organizations, with which it may negotiate directly. These arrangements were put into effect in June 1946 and reviewed at the council's tenth session (Feb. 1950), which adopted a resolution setting out the present form of consultation.

A nongovernmental organization applying for consultative status with the council must satisfy certain conditions; *inter alia* it must deal with matters within the competence of the council; its aims and purposes should conform with those of the UN, which it must undertake to support and publicize; it must be of recognized standing and represent a substantial proportion of the organized persons in its field. Organizations having "a basic interest in most of the activities of the Council" and "closely linked with the economic or social life of the areas which they represent" are admitted to category A consultative status. Category B includes those which have a special competence or are concerned specifically with only a few of the fields of activity covered by the council. In 1960, 119 organizations were included in category B, as compared with 10 in category A. Other organizations that "have a significant contribution to make to the work of the Council" may be entered by the secretary-general in a register established for the purpose. In general, organizations in all three categories may attend the council as observers and submit written statements relative to the work of the council. Category A organizations may also have items of special interest inserted in the provisional agenda of the council, which they may address on such items. A special committee of the council determines the manner in which consultation in the three categories is to be effected.

These arrangements provided a model for similar relations between the UN specialized agencies and the private organizations. Three of the groups mentioned above, the International Chamber of Commerce, the International Co-operative alliance, and the International Federation of Agricultural Producers, acquired consultative status with the FAO. The International Civil Aviation organization by a resolution of June 1947 authorized its council to make suitable arrangements with private international bodies whose activities affect international civil aviation. Art. XI (4) of the constitution of UNESCO provides for co-operation with international organizations of this type in its field. The treaty of the European Coal and Steel community makes provision in art. XLVI and XLVIII for consultation with private organizations in its field of activity. *See* also INTERNATIONAL ORGANIZATIONS.

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INTERNATIONAL WATERWAYS: *see* WATERWAYS, INTERNATIONAL.

INTERPLANETARY EXPLORATION: *see* SPACE EXPLORATION.

INTERPOL: *see* INTERNATIONAL CRIMINAL POLICE ORGANIZATION.

INTERPOLATION AND EXTRAPOLATION are processes for finding additional terms of sequences on the basis of terms that are already given. For instance, the ordered set of four-place values of the function $u = \log_{10} x$, shown in Table I, may be regarded as terms of a sequence for which the computation of the logarithm of any additional value of x, say $x = c$, may be required.

In such cases, if c lies between the smallest and the largest of the given values of x, the process is called interpolation; if c lies beyond these limits, the term extrapolation is appropriate. Interpolation is often used to include both, and will be so used here when convenient. More general situations, in which u is a function of two or more variables, will not be considered in this discussion.

The term interpolation refers most commonly to polynomial interpolation. In the one-variable case, where the function $u(x)$ is known for a set of $n + 1$ values of x, there is only one polynomial $y(x)$ of degree n, of the form $y(x) = A_0x^n + A_1x^{n-1} + \ldots + A_{n-1}x + A_n$ that agrees with $u(x)$ at those $n + 1$ points. Polynomial interpolation or extrapolation based on such data usually consists of approximating the unknown value of $u(x)$ when $x = c$ by the value of $y(x)$ when $x = c$. Available formulas for this purpose differ with respect to the form in which the approximating polynomial is written, but generally afford identical results from the same data.

Usually the tabular values of u correspond to successive values of x that differ by a constant increment h (as in Table I where $h = .01$) and a value of u is required for a specified value of x. The reverse process, in which a value of x is sought for a given value of u, may be described as inverse interpolation or extrapolation to distinguish it from the usual direct process of finding u from x.

DIRECT INTERPOLATION (EQUAL INTERVALS)

Differences and Difference Tables.—In such cases as Table I, if one of the tabular values of x (not necessarily the first one) is denoted by x_0, it is convenient to write $x_m = x_0 + mh$, so that the tabular values of x are $\ldots, x_{-1}, x_0, x_1, x_2, \ldots$, and to use the notation $\ldots, u_{-1}, u_0, u_1, u_2, \ldots$ for the corresponding values of u. Suppose that the value u_s is required in correspondence with $x_s = x_0 + sh$, where s is the difference between x_s and x_0 in terms of the increment h, then

$$s = \frac{x_s - x_0}{h} \tag{1}$$

One class of methods for polynomial interpolation in such a table involves the formation of a difference table in which the column of

TABLE I

x	$u = \log x$	1st difference
...	.	.
2.70	.4314	16
2.71	.4330	16
2.72	.4346	16
2.73	.4362	16
2.74	.4378	15
2.75	.4393	.
...	...	

u values is followed by columns of successive differences. Differences between adjacent u's are first differences; differences between adjacent first differences are second differences, and so on. Three notations are in common use for distinguishing differences. In the forward-difference (advancing-difference) system, $u_1 - u_0$ is regarded as the first difference of u_0 and is written as Δu_0; in the backward-difference (receding-difference) system, the same difference is associated instead with u_1 and is written as ∇u_1. In the central-difference system, which will be used here, the subscript associated with a difference is the average of the two parent subscripts and the first difference $u_1 - u_0$ is written as $\delta u_{\frac{1}{2}}$. The second difference $(u_2 - u_1) - (u_1 - u_0) = u_2 - 2u_1 + u_0$ is written $\Delta u_1 - \Delta u_0 = \Delta^2 u_0$ (forward), $\nabla u_2 - \nabla u_1 = \nabla^2 u_2$ (backward) and $\delta u_{\frac{1}{2}} - \delta u_{-\frac{1}{2}} = \delta^2 u_1$ (central) and so on.

In the central-difference notation, a portion of a difference table would correspond to the notation of Table II, where each entry in a difference column is the difference between its two left-hand neighbours. Usually the numerical entries in the difference columns are expressed as integers, in units of the last decimal place retained in the u's, as in Tables I, III and IV.

Linear Interpolation.—The simplest and best known method of polynomial interpolation is based upon two successive tabular entries, say $u_0 = u(x_0)$ and $u_1 = u(x_1)$, with $u(x)$ approximated by the linear function (first-degree polynomial) that agrees with $u(x)$ when $x = x_0$ and when $x = x_1$. For a linear function $y(x)$, the change in y is proportional to the change in x and, if $y_s = y(x_s)$, then $y_s - u_0 = s(u_1 - u_0) = s\delta u_{\frac{1}{2}}$. Thus, the result of approxi-

TABLE II

x	u	Differences			
		1st	2nd	3rd	4th
.	.	.	.	.	.
x_{-2}	u_{-2}				
		$\delta u_{-\frac{1}{2}}$			
x_{-1}	u_{-1}		$\delta^2 u_{-1}$		
		$\delta u_{\frac{1}{2}}$	$\delta^2 u_0$	$\delta^3 u_{\frac{1}{2}}$	$\delta^4 u_0$
x_0	u_0			$\delta^3 u_{\frac{1}{2}}$	
		$\delta u_{\frac{1}{2}}$	$\delta^2 u_1$		
x_1	u_1				
		$\delta u_{\frac{3}{2}}$			
x_2	u_2				
.	.	.	.	.	.

mating u_s by y_s is the formula for linear interpolation

$$u_s \approx u_0 + s\delta u_{\frac{1}{2}} \tag{2}$$

It is desirable that x_s fall between x_0 and x_1; otherwise, the process is one of extrapolation, which generally produces larger errors than interpolation does.

In Table I, the fact that the first differences are nearly constant suggests the use of (2), at least for x_s between 2.70 and 2.75. For example, $\log 2.7242 \approx .4346 + .42(.0016) = .4346 + .000672 = .435272$, which is .4353 rounded to four places. If this result were to be used for further calculation, it would be desirable to carry along one or two extra figures (perhaps writing $\log 2.7242 \approx .4352_7$) and to round the final result appropriately instead. Similarly, $\log 2.733 \approx .4362 + .3(.0016) = .4366_8$, $\log 2.754 \approx .4378 + 1.4(.0015) = .4399_0$ and $\log 2.697 \approx .4314 + (-3)\ (.0016) = .4309_2$. Note that the last two calculations are extrapolations.

Possible sources of error in linear interpolation and extrapolation include the inherited error E_I in the calculated value of u_s arising from inaccuracies in the given entries u_0 and u_1; the roundoff error E_R introduced if the calculated value of u_s is rounded; and the truncation error E_T that results from representing $u(x)$ as a linear function when (2) is used. For linear interpolation, where $0 < s < 1$ in (2), the inherited error cannot exceed the larger of the inherent errors in u_0 and u_1; but, for linear extrapolation there is no assurance of this. Clearly, the roundoff error never can exceed five units in the first omitted decimal place. The error E_T is harder to analyze and control. Generally it is assumed that the increment h is small enough to make this truncation error negligible, unless there is a warning to the contrary. Appreciable second differences provide such a warning; but, although small second differences are reassuring, they do not always guarantee the propriety of linear interpolation.

The four values interpolated above correspond, respectively, to the true five-place values .43524, .43664, .43996 and .43088, and their five-place approximations differ from the true values by 3, 4, 6 and 4 units in the fifth place. These deviations resulted almost completely from inherent errors (which could be as large as 5 units in the fifth place in consequence of the given data having been rounded to four places) since it can be proved that the truncation error here could not exceed one unit in the sixth place. The rounded four-place approximations (.4353, .4367, .4399 and .4309) differ from the true rounded four-place values (.4352, .4366, .4400 and .4309) by not more than one unit in the fourth place. Although the extrapolations here were about as accurate as the interpolations, such a result is not generally to be expected.

TABLE III

x	$u = \log x$	δu	$\delta^2 u$
.	.	.	.
2.70	.4313638		
		16055	
2.71	.4329693		−59
		15996	
2.72	.4345689		−59
		15937	
2.73	.4361626		−57
		15880	
2.74	.4377506		−59
		15821	
2.75	.4393327		
.	.	.	.

TABLE IV

x	$u = \log x$	δu	$\delta^2 u$
.	.	.	.
2.5	.3979		
		171	
2.6	.4150		−7
		164	
2.7	.4314		−6
		158	
2.8	.4472		−6
		152	
2.9	.4624		−5
		147	
3.0	.4771		
.	.	.	.

Although the first differences in Table I are nearly constant, this does not mean that the second differences of u are exactly zero. It means only that in working to four decimal places the second differences that would occur in Table I are negligible. That they are not in fact zero can be shown either by taking more nearly correct values, as in Table III, or by taking values of x at a greater interval, as in Table IV. Similarly, differences of higher order could be detected.

Sequences of differences may present irregularities when the tabulated entries are not exact, even though those entries be correctly rounded to the places retained. Thus in Table I the difference 15 arose because the correctly rounded entry for log 2.74 is too large while that for 2.75 is too small, as may be seen from Table III. A similar explanation applies to the entry −57 in Table III.

Interpolation With Higher Differences.—When polynomial interpolation is based on values of $u(x)$ at $n + 1$ equally spaced points, generalizations of formula (2) may be used that involve the first n differences of u. One of these (associated with the names of Newton and Gauss) is of the form

$$u_s \approx u_0 + s\delta u_{\frac{1}{2}} + \frac{s(s-1)}{2!}\delta^2 u_0 + \frac{s(s^2-1^2)}{3!}\delta^3 u_{\frac{1}{2}} + \frac{s(s^2-1^2)(s-2)}{4!}\delta^4 u_0 + \ldots \tag{3}$$

The last term is $s(s^2-1^2)\ldots[s^2-\frac{1}{4}(n-2)^2](s-\frac{1}{2}n)\delta^n u_0/n!$ when n is even, and $s(s^2-1^2)\ldots[s^2-\frac{1}{4}(n-1)^2]\delta^n u_{\frac{1}{2}}/n!$ when n is odd. When $n = 1$, formula (3) reduces to (2); when $n = 2$, formula (3) corresponds to approximating $u(x)$ by the second-degree polynomial $y(x)$ which agrees with $u(x)$ when $x = x_0$, x_1 and x_{-1}. When $n = 3$, the approximation $y(x)$ is the third-degree polynomial that agrees with $u(x)$ when $x = x_0$, x_1, x_{-1} and x_2, and so on.

It is desirable to select an x_0 (from among the x values for which requisite differences are available) that is nearest the value of x for which interpolation is to be effected. Tables of the coefficient functions in such formulas as (3) can be found in the literature.

Using (3) in Table III, the interpolated value is found to be

$$\log 2.7242 \approx .4345689 + .42(.0015937) + \frac{(.42)(-.58)}{2}(-.0000059) = .4352389_7$$

and the extrapolated value

$$\log 2.754 \approx .4377506 + 1.4(.0015821) + \frac{(1.4)(.4)}{2}(-.0000059) = .4399638_9$$

These may be compared with the respective rounded true values .4352390 and .4399639.

Everett's Formula.—Many published tables of functions provide second differences (and perhaps also fourth differences) and guarantee that polynomial interpolation based on Everett's formula, retaining the differences provided, will yield results within specified error tolerances. The formula is of the form

$$u_s \approx (1-s)u_0 - a_1(s)\delta^2 u_0 + a_2(s)\delta^4 u_0 + su_1 - b_1(s)\delta^2 u_1 + b_2(s)\delta^4 u_1 \tag{4}$$

where the coefficient functions are defined by the equations

$$a_1(s) = \frac{1}{6}s(1-s)(2-s)\quad a_2(s) = \frac{1}{120}(1+s)s(1-s)(2-s)(3-s)$$

$$b_1(s) = \frac{1}{6}(1+s)s(1-s)\quad b_2(s) = \frac{1}{120}(2+s)(1+s)s(1-s)(2-s) \tag{5}$$

and are themselves tabulated in many sources. If the two fourth-difference terms are ignored, formula (4) yields the same result as (3) when third differences are retained; if the δ^4 terms are used in (4), the result is equivalent to (3) when fifth differences are retained. However, no differences of odd order are needed in (4). It is desirable for interpolation to number the tabular entries so

that $-\frac{1}{2} \leq s \leq \frac{1}{2}$ when possible, and to make $|s|$ as small as possible in any case.

Table V, for example, yields the interpolated value $\log 2.84 \approx (.6)(.4471580) - (.0640)(-.0005542) + (.0116)(-.0000046) + (.4)(.4623980) - (.0560)(-.0005167) + (.0108)(-.0000037) = .4533183_1$ when fourth differences are retained in (4). The necessary coefficients may be read from a table such as Table VI.

TABLE V

x	$\log x$	δ^2	δ^4
.	.	.	.
2.8	.4471580	−5542	−46
2.9	.4623980	−5167	−37
3.0	4771213	−4829	−30
.	.	.	.

TABLE VI

s	a_1	a_2	b_1	b_2
.	.	.	.	.
.3	.0595	.0104	.0455	.0089
.4	.0640	.0116	.0560	.0108
.5	.0625	.0117	.0625	.0117
.	.	.	.	.

with $s = .4$. The true seven-place value is .4533183. Omitting fourth differences in (4) gives $.453318_{40}$, while linear interpolation gives $.453_{25400}$.

DIRECT INTERPOLATION (UNEQUAL INTERVALS)

Lagrange's Formula.—When consecutive tabular values of x are unequally spaced, formulas for polynomial interpolation can be used that generalize those preceding by introducing so-called divided differences. The relevant definitions and formulas will not be detailed here.

Alternatively, Lagrange's formula, which expresses the approximating polynomial directly in terms of u (in place of differences or divided differences), is applicable whether or not the tabular values of x are equally spaced, and can be written in the form

$$u(x) \approx \frac{(x - x_1)(x - x_2) \dots (x - x_n)}{(x_0 - x_1)(x_0 - x_2) \dots (x_0 - x_n)} u(x_0) + \frac{(x - x_0)(x - x_2) \dots (x - x_n)}{(x_1 - x_0)(x_1 - x_2) \dots (x_1 - x_n)} u(x_1) + \dots + \frac{(x - x_0)(x - x_1) \dots (x - x_{n-1})}{(x_n - x_0)(x_n - x_1) \dots (x_n - x_{n-1})} u(x_n) \quad (6)$$

when the calculation is to be based on values of u which correspond to $n + 1$ values of x.

When the tabular values of x are equally spaced, (6) yields results identical with those of (3) after an appropriate renumbering of the entries. Differencing is avoided in such cases with tables of appropriate Lagrange coefficient functions. On the other hand, without a difference table the possibility of gaining useful information from the size and regularity of the entries in successive columns is lost.

To illustrate the use of (6) with unequal spacings, suppose that only the three four-place values $\log 2.70 = .4314$, $\log 2.72 = .4346$ and $\log 2.73 = .4362$ are available. Here (6) becomes

$$\log x \approx .4314 \frac{(x - 2.72)(x - 2.73)}{(.02)(.03)} - .4346 \frac{(x - 2.70)(x - 2.73)}{(.02)(.01)} + .4362 \frac{(x - 2.70)(x - 2.72)}{(.03)(.01)}$$

the right-hand member being the second-degree polynomial which agrees with $\log x$ (to four places) at the three relevant points. As an example of interpolation, $\log 2.71 \approx \frac{1}{2}(.4314) + 1(.4346) - \frac{1}{2}(.4362) = .4330$. In an extrapolation problem, $\log 2.74 \approx \frac{3}{2}(.4314) - 2(.4346) + \frac{5}{2}(.4362) = .4378$. Both values are correct to the four places given.

INVERSE INTERPOLATION

Reversion of Tables.—When inverse interpolation is to be effected, the roles of x and u are reversed (interchange of the x and u columns) and a method of direct interpolation is used that does not presume equal intervals (perhaps Lagrange's formula or a divided-difference formula). Here, however, even if u can be well approximated by a low-degree polynomial in x, it does not necessarily follow that x can be well approximated by a polynomial in u of comparable degree. Thus the fact that a table has been constructed to permit direct polynomial interpolation should not lead to the assumption, without further investigation, that the reversed table will have the same property.

Reversion of Formulas.—When polynomial interpolation is justifiable for a table that gives u as a function of x, with x at a constant interval, but this table is not known to be dependable when reversed, it may be preferable to start with a formula that expresses u approximately as a polynomial in x and to invert the formula approximately by either numerical or analytical methods.

For example, if fourth differences can be ignored in Everett's formula (4), the result can be transposed as

$$s \approx \{(u_s - u_0) + \tfrac{1}{6} s(1 - s)[(2 - s)\delta^2 u_0 + (1 + s)\delta^2 u_1]\} \div (u_1 - u_0) \quad (7)$$

Here it is supposed that u_s is given and s is to be determined. Although (7) defines s explicitly only if $\delta^2 u_0$ and $\delta^2 u_1$ are negligible, a first approximation to s can be made by ignoring these differences in (7), after which a second approximation can be obtained by substituting this result for s in the right-hand member. This iterative process can be continued if necessary and usually will converge to the appropriate solution of (7), after which the desired approximation is given by $x_s = x_0 + sh$.

To illustrate this process, assume the data of Table III and seek x where $\log x = .4350000$. With $x_0 = 2.72$ and $h = .01$, formula (7) then gives $s \approx \{.0004311 - \frac{1}{6}s(1 - s)[.0000059(2 - s) + .0000057(1 + s)]\} \div (.0015937) = .270503 - (.001830 + .000021s)s(1 - s)$. The result of substituting the first approximation $s^{(1)} = .270503$ into the right-hand member rounds to .270141 and the substitution of $s^{(2)} = .270141$ yields the same result, to six places. Since the difference $u_1 - u_0$, which is the denominator in (7), is known here only to five significant figures (two digits being lost in the subtraction), the sixth digit in $s^{(2)}$ certainly is not reliable. The rounded final approximation $x_s = x_0 + sh \approx 2.7227014$ differs from the rounded true value by one unit in the last place. (F. B. Hi.)

INTERRACIAL RELATIONS. The great importance that has generally been attached to ideas of race, racial identity and racial differences in mentality and culture has in recent times played a major role in determining the relations between the peoples and nations of the world. A striking feature of these ideas is the fact that they have usually been based on a false conception of the meaning of race and on erroneous assumptions regarding its implications. Jacques Barzun, for example, entitled his book on this subject *Race: a Study in Modern Superstition*. Ashley Montagu speaks of *Man's Most Dangerous Myth: the Fallacy of Race*. Gunnar Myrdal, in *An American Dilemma*, expresses the opinion that in no other field is there so wide a gap between popular impressions and the conclusions reached by biological and social scientists. Race, in many of its aspects, exists only "in the minds of men."

The Problem of Definition.—The very term race is difficult to define. There is agreement to the effect that it is correctly applied to a subdivision of mankind which is distinguished by the possession of common characteristics, usually physical in their nature, determined by genetic or hereditary factors. Popularly, it has been confused with nation, although it is obvious that every modern nation is a mixture of inherited physical types; there is no British or Italian or German race. As a matter of fact, there is more physical or racial similarity between northern Italians and southern Germans than between the latter and Germans living in Hanover or Prussia. Similarly, there has been confusion between race and language; there is no Latin or Semitic or Aryan (Indo-European) race, since these languages are spoken by people of widely varying physical type. It follows that many of the phenomena usually included within the field of race relations have nothing to do with race as scientifically defined but rather with race as popularly, and erroneously, understood.

Difficulties of application remain even when care is taken to use race in the manner proposed by scientists. The geneticist Leslie C. Dunn, for example, believes that the word may have a valid biological meaning if applied to a group of related intermarrying

individuals which differs from other groups in the relative commonness of certain hereditary traits. This leaves unresolved the questions of how large the group should be or which traits should be used for purposes of classification. G. Sergi, using head form as a criterion, proposes two races, the Eurasiatic or roundheaded, and the Eurafrican or longheaded; J. Deniker, relying upon a combination of features including head form, skin colour and others, concludes that there are 17 main races and 29 subraces. If the criterion of head form is preferred, this would unite in the same category the blondest Scandinavian and the darkest Negro if both are longheaded. If the more usual category of skin colour is used, differences in head form are ignored or at least relegated to the background. This means essentially that racial classification at the present stage of our knowledge is at least to some extent an arbitrary and subjective process. A group of experts consulted by the United Nations Educational, Scientific and Cultural organization (UNESCO) expressed the view that three major human divisions should be recognized, namely, the Mongoloid, Negroid and Caucasoid, and this is probably as satisfactory a classification as any now available, but it does not include all human groups, nor does it solve all the problems that have been raised. The reliance on blood properties, particularly the four blood types A, B, AB and O, has facilitated significant genetic research, but has not as yet produced a satisfactory racial classification.

In view of these complications, it has been suggested that the term race should not be applied to existing human populations but should be replaced by the term ethnic group, which may be characterized by a particular inherited physical type, or culture, or nationality, or any combination of these. In any case, the geneticists have made it clear that the inherited similarities among all the peoples of the world are much greater and far more common than the differences and that the distinctions that have been drawn among the so-called races of mankind are relatively unimportant.

Racialist Thinking.—This similarity among peoples has not prevented a number of influential writers, political leaders and people generally from regarding alleged racial differences as having paramount importance. It is difficult to establish definitely the origins of what has frequently been described as racialist thinking, but certainly one of the most influential of such thinkers was Comte Joseph Arthur de Gobineau (*q.v.*), who published his four-volume *Essay on the Inequality of Human Races* in the middle of the 19th century. He taught the superiority of the white race over all others, and among the whites, of the Aryans as having reached the heights of civilization. This group was in fact considered to be responsible for civilization wherever it developed. The Teutons were taken to be the purest modern representatives of the Aryans, although Gobineau admitted that really "pure races" could no longer be found. As a matter of fact, he did not unequivocally favour such purity, since it was often at the point of contact and mixture between races that, in his opinion, civilization had a better chance to develop. This last point was conveniently neglected by many of his followers who, in the Gobineau societies which sprang up in Germany and elsewhere, not only glorified the Aryans and the Teutons but also insisted on keeping them "pure."

Gobineau's most important follower was H. S. Chamberlain (*q.v.*), who published *The Foundations of the 19th Century* in German in 1899. An Englishman by birth, he spent most of his life in Germany, where he was active in the Gobineau society, and was so popular with the ruling class that he became known as the kaiser's anthropologist. He, too, insisted on the superiority of the Teutons, whom he characterized physically as being for the most part tall, fair and dolichocephalic (longheaded), that is to say, corresponding to the Nordic type. He regarded the Jews as alien in spirit to the favoured Teutons, although he admitted the difficulty of distinguishing Jews from Germans on the basis of physical characteristics alone.

Although there were many other writers who developed the racialist position, such as Ludwig Woltmann and H. F. K. Günther in Germany, and Lothrop Stoddard and Madison Grant in the United States, Gobineau and Chamberlain may be regarded as the intellectual forerunners of the racial theories of the German Nazis. Hitler himself acknowledged his indebtedness to these theorists, particularly to Chamberlain, for giving him the "scientific" basis for this aspect of his political philosophy. There were, of course, inner contradictions in the racialist approach—the fact that so many Germans did not look like Nordics and so many Jews did, the alliance with the Japanese who had consequently to be exempted from the racial restrictions of the third *Reich*, the difficulty of giving any clear meaning to the concepts of German "blood" or "soul"—so that facts had to be replaced by mysticism. In spite of these and other deficiencies, racialism was used as a technique which helped to unify the Germans by identifying the "enemy," gave the people a strong sense of ego enhancement and self-confidence, justified economic exploitation and slave labour, obtained support for the war and convinced the Germans that they never could be defeated. Racialism thus functioned as one of the most effective techniques of Nazi propaganda for achieving and maintaining power over the German people.

Although colonialism cannot be compared with Naziism in terms of the violence and virulence of the human destruction it involved, it also found in racialism a helpful rationalization for conquest and expansion. When the Spaniards first came to America, several of their apologists, particularly Francisco de Quevedo and Juan Ginés de Sepúlveda, supplied them with the proper excuses for taking the land away from the Indians and for treating them with complete lack of consideration. They developed the theory that the Indians had an entirely different origin from that of the Spaniards, that they were not human in the same sense and that there was therefore no need to accord to them the same treatment as to one's fellow human beings. The familiar refrain of the "white man's burden," which was mainly of British manufacture and which found its literary expression in the writings of Thomas Carlyle, James A. Froude, Charles Kingsley and most strongly and clearly in those of Rudyard Kipling, made of imperialism a noble activity destined to bring civilization to the benighted members of other "races." What the British stood to gain as a result was never mentioned. Similarly, the French justified the maintenance of their colonial empire on the basis of their *mission civilisatrice*, their duty to bring civilization to the backward peoples of the world.

In all of these colonizing empires, there were undoubtedly many individuals honestly convinced of the nobility of their motives and their enterprise; at the same time, the feelings of racial superiority which accompanied colonialism played an important part in developing resentments among the colonized which even the recent trend toward emancipation and independence has not always made it possible to overcome. There has even developed in some parts of the world a sort of racialism in reverse, a degree of hostility of coloured peoples against whites as whites, which has caused considerable worry to the responsible leaders of all the groups concerned.

It remains true that in general, although with certain striking exceptions, the trend has been away from racialism. The rapid emergence of new nations, many of them former colonies, has meant that many more nations composed of "coloured peoples" have an independent voice in international affairs that commands a respectful hearing even from previous colonizers. The latter have, for their part, shown an evident willingness to grant such independence on an increasing scale. The recognition that the treatment of ethnic minorities within a country may have important implications for international relations has focused attention upon the need to improve intergroup relations in general. The work of scientists like Franz Boas in anthropology and Gunnar Myrdal and others in the social sciences has helped to destroy much of the mythological thinking associated with race. The trend has been reversed in the Republic of South Africa, where separation of ethnic groups has increased in recent years. In the United States, on the other hand, the movement has been gradually and progressively in the direction of providing greater equality of opportunity for all ethnic groups. The most dramatic expression of this tendency was furnished by the unanimous decision of the U.S. supreme court on May 17, 1954, based in part on social-science research, that the enforced segregation of Negro school children in certain states and localities was contrary to the principles of the U.S. constitution. (*See* NEGRO, AMERICAN.)

Studies of Racial Attitudes.—Although considerable progress has been made, a great deal of intergroup hostility remains, and much scientific effort has been expended in the attempt to understand its nature and its origin. One view has held that prejudice is inborn and inevitable; the philosopher Josiah Royce, for example, spoke of a "natural antipathy" against those who are different from ourselves. The fact that such antipathy is not found in young children, and the further fact that it does not occur in all individuals or even in all groups, throw considerable doubt upon this variety of explanation. There is, for example, much less prejudice against Negroes in Brazil than in South Africa or certain areas in the United States; there is more prejudice against Orientals in California and British Columbia than in Hawaii. Such variations are difficult if not impossible to reconcile with the theory that antipathy is natural and inevitable.

A variant of this theory is found in the writings of certain psychoanalysts who speak of a native aggressiveness or "death instinct" which may take the form of hostility against other ethnic groups. Others have suggested that aggressive tendencies can be explained as a consequence of the experiences of the individual, particularly the extent of his frustrations; the greater the frustration, other things being equal, the greater the tendency to aggressive action. Since, however, aggression may take many forms and may be directed against many different objects, this explanation does not carry us very far. The frustrated Brazilian does not look for a Negro scapegoat. There must be at least one additional factor; namely, that the individual learns what forms of aggression are permitted in his society, and against whom it may be expressed.

This learning process occurs in a variety of ways, and is facilitated from a number of different directions. In the home and in the school, the growing child learns, sometimes explicitly, sometimes indirectly, that others are "not like us," that they are not "our kind." The mass media often aid the process by developing or disseminating stereotypes of the pugnacious Irishman, the mercenary Jew, the lazy Negro, the dishonest Armenian—stereotypes that may frequently turn out to be untrue but which still affect our perceptions and our treatment of others. Institutions in the culture, sanctioned by law or by custom, which involve segregation, untouchability, occupational or recreational restrictions, may all contribute to feelings of ethnic or racial cleavage. A circular relation is established in which prejudice leads to discrimination, which in turn functions as an environmental support or stimulus for increased prejudice.

It is widely believed that our actual experience with members of other ethnic groups determines our attitudes toward them. This is undoubtedly true in many cases, but by no means always. Research has shown that there may be hostility or "social distance" among American students toward Turks, or among Guatemalans toward Jews, without any previous contact whatsoever. One investigator was able to demonstrate the existence of considerable rejection of even imaginary groups such as the Danerians, Pirenians and Wallonians, with whom there could hardly have been any unpleasant personal experience. This not only demonstrates the frequent irrationality of ethnic attitudes but also throws doubt on a theory described by the psychologist Gordon W. Allport as that of the "well deserved reputation"; namely, that if we dislike a particular group, they must certainly deserve our dislike. It seems more likely, as Eugene Hartley has suggested, that our attitudes toward other ethnic groups are not determined by contact with them but by contact with the attitudes that prevail in our community.

The question as to why such attitudes develop in the first place is not easy to answer, although at least a partial explanation can be found in the practical advantages that prejudice seems to confer on the dominant majority. The economic gain has been illustrated in the earlier reference to colonial expansion, in which a theory of racial superiority helped to rationalize and justify the expropriation of the property of others. This mechanism is easily discernible in the tendency to keep a minority "in its place," which essentially means to prevent it from competing with the dominant majority on equal terms. A second gain is represented by the practice of finding a scapegoat whom one can hold responsible for our ills, thus relieving ourselves of the obligation to blame ourselves for our shortcomings; the Jews served as such a scapegoat in Nazi Germany. A third gain, also illustrated by the Nazis, is in the feeling of superior status, of ego enhancement. A fourth may be described as a sex gain, which occurs when men of the dominant group have access to the women of the weaker but resist violently any effort by the men of the weaker group to obtain reciprocal privileges. The psychologist John Dollard believes that this was an important factor in maintaining the caste situation in the southern United States. This particular gain has evidently been renounced in South Africa, where all sexual contact between the races is strictly forbidden.

It should be added that prejudice and discrimination also involve significant losses. The sociologist Arnold Rose mentions, among others, the economic waste resulting from the failure to make adequate use of available manpower, the aggravation of social problems such as crime and delinquency, the harmful effect on international relations with the coloured peoples of the world, the creation of fears and anxieties and disrespect for the law. These are undoubtedly real losses, but they appear to be less obvious than the gains, which therefore are more likely to make themselves felt.

The gain in feelings of superior status and self-enhancement is related to a large amount of significant research on the part played by personality in the development of prejudice. Attention has been focused on the "authoritarian personality," characterized by generalized ethnocentrism but also by excessive conformity, rigidity, concern with status, a tendency to see the world as harsh and unfriendly and an inclination to favour strong punishment of deviants and offenders. This is only a partial list of traits found in prejudiced persons, who apparently "need" to feel superior to many out-groups and who dislike Jews and Negroes and Japanese and foreigners generally. The emphasis on the relation between prejudice and personality has added an important dimension to the understanding of intergroup relations, but it cannot be regarded as telling the whole story. Residents of South Carolina appear to be no more "authoritarian" than New Yorkers, but they usually have very different attitudes toward Negroes.

There is more than one dimension to prejudice. It may satisfy a number of different motives; it may be acquired in a variety of ways. An understanding of its many aspects, and of the manner in which they influence one another, has gradually replaced the attempts to explain the phenomena of race relations in terms of any one, single cause.

Similarly, programs designed to improve intergroup relations have become increasingly versatile instead of relying on any one method or technique. The debate as to whether one must first reduce prejudice before embarking on legislation to combat discrimination, or whether the approach should be the other way round, has yielded to the conviction that both procedures should be followed simultaneously. As a result, many nations have developed a program of education and information, including the revision of their school textbooks, in order to improve attitudes toward other ethnic groups, at the same time strengthening the laws that make racial discrimination a punishable offense. At the international level, UNESCO has directed its efforts toward giving wide dissemination to scientific facts concerning race; on the other hand, the United Nations has sought to give human rights the sanction of a universal declaration leading to a universal covenant.

The fact that progress has been made cannot obscure the resistances that remain to be overcome. The birth of the new nation-states in Africa and Asia has frequently been accompanied by difficulties of racial adjustment. The international political situation has, on the other hand, paradoxically had a favourable effect on race relations because of the desire on the part of all the great powers to win the friendship of these new nations. There have been other favourable factors also, including a changed climate of public opinion, as well as a general desire to counteract the impressions and heal the wounds that resulted from colonialism and imperialism. There is still a long way to go before race is universally recognized for the myth it really is, but the movement is in that direction.

See SEGREGATION, RACIAL; *see* also references under "Interracial Relations" in the Index.

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INTERSTATE COMMERCE, a term widely used in the United States to denote commerce that crosses state boundaries or involves more than one state; it is distinguished from intrastate commerce that does not involve more than one state. Such a simple definition gives no hint of the complicated legal controversies through which the precise meaning of the term has been spelled out by the courts in more than 170 years under the federal constitution. The general trend in the 20th century has been toward including more and more activities under the heading of interstate commerce, and hence under control by the federal government. Few subjects in U.S. constitutional history have produced a greater harvest of judicial opinion and professional commentary.

Background.—During the 1780s, when the central government of the United States was based on the Articles of Confederation, the young nation went through the trials of its "critical period." One of the chief defects of the government under the articles was the absence of any central control over commerce with foreign nations and among the different states. The separate states, particularly those with large shipping and commercial interests, made their own regulations with little regard for the welfare of the country as a whole. It soon became clear that a new constitution creating a stronger central government was an absolute necessity. The new constitution that replaced the Articles of Confederation in 1789 gave the national congress power "To regulate Commerce with foreign Nations, and among the several States, and with the Indian Tribes." (art. I, sec. 8). In considering this grant of power, it must be recognized that the constitution created a federal system with powers divided between a central or federal government and the individual states that together make up the whole. The central government possesses only those powers delegated to it by the constitution. The remaining powers are "reserved to the States respectively, or to the people." (Amendment X.) If a specific act of congress comes within one of the powers granted to congress it is not only valid but is also the "supreme Law of the land . . . any Thing in the Constitution or Laws of any State to the Contrary notwithstanding." (Art. VI.) If it is not within such a grant it is invalid or, in the language of the U.S. courts, "unconstitutional." Under the established polity of the United States the duty of determining whether an act of congress or of any individual state is valid or invalid rests with the courts and ultimately with the supreme court of the United States. It is therefore in the reported opinions of that tribunal that one must turn to ascertain the nature and effect of the power of congress to regulate interstate commerce.

Federal and State Powers.—The problem divides into two distinct but related issues: (1) the extent of the power granted to congress; and (2) the effect of such grant on the powers of the several states. It would be simple if these issues could be determined by pure syllogistic logic—by defining what it is that constitutes power to regulate commerce among the several states, and by ascertaining whether the particular law in question comes within that definition. In some notable instances, such as *Gibbons* v. *Ogden* (9 Wheat. 1 [1824]) this method has been used. Customarily, however, the court has not confined itself within such mechanistic limits. The power it possesses of determining the validity or nonvalidity of the laws of the federal and state governments necessarily makes it an arbiter between these two elements of the federal system. In such role it recognizes the responsibility of assuring the central government of power sufficient to preserve and advance the welfare of the nation as a whole, and also of according to the individual states the authority necessary to conserve their own legitimate local interests. Such an approach does not lead to an orderly and permanent pattern of law. The course of decisions shifts and varies according to the nature of the issues in individual cases, according to the prevailing opinions of the proper role of the federal and state governments in the affairs of the people, and according to the views of the individual justices on these great underlying issues.

The Commerce Clause.—Consideration of the basic elements in the commerce clause is necessary. "Commerce" includes transportation—the carriage of persons and commodities—and also trade—the buying and selling of goods. Commerce is interstate when the transportation crosses state lines and when the trade contemplates the movement of the subject matter across such lines. The commerce is interstate not only at the moment the state lines are crossed, but it has that quality from the time the transaction is initiated until it reaches its final conclusion, including all the elements thereof, even though within the confines of a single state. The power to regulate is simply the power "to prescribe the rule by which commerce is to be governed." In spite of possible implications, "commerce among the several states" does not require that financial considerations enter into the transaction. A man who transported from California into Nevada a woman there to become his mistress was held engaged in interstate commerce, and subject to the law of congress imposing criminal penalties on anyone transporting a woman across state lines for an "immoral purpose." Interstate commerce is, of course, not confined to the types of transportation and trade that were in existence when the constitution was adopted, but includes transportation by railroad, automobile and airplane, and the transmission of intelligence by telegraph, telephone, radio and television. Also covered by the clause in question are the news-gathering activities of the press services, and education by correspondence schools. Although it was at one time held that the interstate business of insuring against risk was not interstate commerce under the constitution, the decision was later repudiated.

POWERS OF CONGRESS

General Concepts.—Since the constitution confers no general lawmaking power upon congress, it is upon the interstate commerce clause, coupled with the grant of power to make such laws as are "necessary and proper" to carry out a specifically granted power, that the very considerable body of federal regulatory law principally depends. When such commerce is found to exist, then the power of congress over the transactions involved is as positive and complete as that of any state over transactions taking place entirely within its borders. When, in the 1880s, the stock raisers and farmers of the western plains were oppressed by the exorbitant rates and discriminatory practices of the railroads that moved their products to market, congress passed the Interstate Commerce act of 1887. This law required that all interstate rates be just and reasonable, and that no preferences be allowed to any person, place or type of business; it also created an Interstate Commerce commission to administer its provisions. Similar regulations were later enacted for interstate motor carriers, air transport, transmission of electric energy, and for telegraph and telephone lines, radio and television. In 1890 the Sherman Antitrust act

made illegal all combinations in restraint of interstate transportation and trade, and all attempts at its monopolization. In 1914 federal control was further implemented by the Clayton act and the Federal Trade Commission act.

With perhaps some strain of interpretation the power to regulate interstate commerce comprehends the power to prohibit it. The U.S. supreme court has said: "Congress can certainly regulate interstate commerce to the extent of forbidding and punishing the use of such commerce as an agency to promote immorality, dishonesty or the spread of any evil or harm to the people of other states from the state of origin." (*Brooks* v. *United States*, 267 U.S. 432 [1925], sustaining a federal statute making it a crime to transport a stolen automobile in interstate commerce.) Of a similar character are statutes making it a federal crime to transport in interstate commerce lottery tickets, women for immoral purposes and intoxicating liquor into a state whose laws prohibit its use. The far-reaching federal Food, Drug and Cosmetic act (1938) and the Meat Inspection act (1906) rest on a similar foundation. And in order to enforce the prohibition the federal government may proceed against those handling the product whether before the traffic has begun or after it has been completed.

In the case of *Hammer* v. *Dagenhart* (247 U.S. 251 [1918]) a closely divided court held that it was not within the power of congress to prohibit the shipment in interstate commerce of the products of child labour. The cases that had supported similar enactments were distinguished on the ground that in them the use of interstate commerce was necessary to accomplish the evil purpose, whereas in the child labour case the goods themselves were proper and harmless. The purpose of the statute, the court declared, was to control manufacture in the individual states, a matter reserved to the several states and not granted to congress. The decision did not, however, stand the test of time, and was later overruled. (*United States* v. *Darby*, 312 U.S. 100 [1941] upholding the Fair Labor Standards act.)

The national power over interstate commerce is not confined to measures necessary to prevent its employment in harmful ways, but supports as well federal action preserving and protecting it against such acts as would impede, injure or destroy it. In an early case the court held it within congressional power to provide punishment for theft from vessels wrecked on the high seas. Upon this concept rests the power of the courts under the antitrust acts to enjoin combinations designed to prevent interstate transportation or trade. The commerce power thus extends not only to interstate commerce itself but to all other transactions which "affect" it, even though not interstate in scope nor even—as in the cited cases—"commerce" at all. In the case of *United States* v. *Wrightwood Dairy Co.* (315 U.S. 110 [1942]) the supreme court said:

> The commerce power is not confined in its exercise to the regulation of commerce among the states. It extends to those activities intrastate which so affect interstate commerce, or the exertion of the power of congress over it, as to make regulation of them appropriate means to the attainment of a legitimate end, the effective execution of the granted power to regulate interstate commerce. . . .

Under this concept the power that congress may wish to exercise under the commerce clause appears almost limitless.

Transportation.—Congressional regulation of the nation's transportation systems is almost complete; it extends far beyond the bare act of interstate transport and touches many matters that normally would be reserved to the authority of the individual states. In numerous instances it is required that a federal licence be obtained before an interstate commerce enterprise is undertaken. In 1870 the supreme court sustained a statute requiring inspection and licensing of vessels operating on inland waters, where the vessel in question carried goods in interstate commerce, even though it operated solely within the confines of a single state. By the middle of the 20th century the requirement of a federal licence in the crowded fields of interstate motor and air transport and in radio and television transmission had become a matter of transcendent importance.

The purpose of the Interstate Commerce act was to regulate interstate rates of the railroads to the end that they be just, reasonable and without discrimination. This power was later extended to motor-vehicle and airplane rates. The appropriate regulatory body is also empowered to require the establishment of joint rates for traffic moving over several lines, and to provide for the division of the receipts between the participating carriers. Whenever there is a single continuous journey between different states, the rate-fixing power of the United States extends to each portion thereof, even though one portion may be conducted by a separate carrier and be confined within the limits of a single state. The federal rate power is not only regulatory, but may also be employed to maintain an adequate national transportation system and to promote the general economic welfare of the nation. The federal power may extend even to the fixing of purely intrastate rates. When two cities compete for the trade of a particular area, one being located across a state line and shipping goods in interstate commerce, and the other being located within the same state shipping in intrastate commerce under lower rates, the commission may require the railroads involved to increase the intrastate rates to the level of the interstate rates to prevent discrimination. The power was subsequently extended to permit the commission to increase intrastate rates when it was shown that they did not provide a fair share of the expenses incurred in operating the railroad as a whole.

Under the provisions of the Interstate Commerce act that prohibit unreasonable preferences to or discriminations against any particular person, place or type of business the supreme court has held contrary to federal right the imposition by carriers, as applied to interstate travelers, of racial segregation, not only in transportation itself, but also in sleeping-car and dining-car service, and in the accommodations furnished in terminals and waiting rooms.

In order to protect persons (including railroad employees) and property transported in interstate commerce, certain specific requirements as to equipment are imposed on the railroads. Moreover, so intermingled is the interstate and intrastate traffic of the roads that failure of the railroad to comply with terms of the statute even as to cars not then employed in interstate traffic subjects it to the penalties of the statute.

Adequate regulation of interstate transportation can hardly be achieved without control over the corporations that own and manage the interstate transit systems. In the historic case of *Northern Securities Co.* v. *U.S.* (193 U.S. 197 [1904]) the court, acting under the Sherman Antitrust act, sustained an injunction against acquisition by the defendant of the stock of the competing Great Northern and Northern Pacific railroads. It has since become a well-established principle that the Interstate Commerce commission has power to control the merger and consolidation of interstate railroads and of airlines. To assist it in carrying out its functions the commission may require the carriers under its supervision to maintain a uniform system of accounts. To prevent monopoly and to secure efficient management in the gas and electric industry, congress in 1935 enacted the Public Utility Holding Company act, providing for the breakup and reconstitution of the sprawling holding companies in that industry.

Because interstate transportation can be conducted only by the employment of human labour the law governing labour relations falls within the regulatory power of congress. In the first *Employers' Liability* cases (207 U.S. 463 [1908]), however, an act of congress modifying certain of the common-law rules governing the liability of employers for personal injuries to employees was held unconstitutional, since it applied to all employees and not merely to those engaged in interstate commerce. A later act, which applied only when the injured employee was at the time engaged in interstate commerce, was sustained. (Second *Employers' Liability* cases, 223 U.S. 1 [1912]). Following these cases there inevitably arose a multitude of decisions on the difficult question as to which acts of an employee could be deemed to involve interstate commerce. The outcome was that the law covers any employee any part of whose duties are in furtherance of interstate commerce, or closely and substantially affect it.

When disputes between a railroad and its employees lead to work stoppages or strikes, interstate traffic is obviously stopped. To prevent such occurrences, congress in 1934 enacted the Rail-

way Labor act that required employers and employees to settle their differences through conferences, agreements, mediation and finally by voluntary submission to arbitration. Specific sections of the act forbade the interference by either party with the choice of representatives by the other, and conferred on the employees the right, without interference by the employer, of joining unions of their own choice. These latter provisions have been upheld as reasonable measures of securing settlements of disputes and preventing interruption of commerce.

As natural highways for interstate and foreign traffic, the navigable waters of the United States have from the very beginning been recognized as being under the jurisdiction of congress. Congress may either prohibit or permit the erection of piers and bridges on and over navigable waters. Congress has adapted this power over navigable waters to many different activities. The agricultural and industrial development of the Tennessee valley rests upon the power to improve navigation by building dams on the Tennessee river, and, as ancillary to that purpose, the disposal of the power thereby developed. *United States* v. *Appalachian Electric Power Co.* (311 U.S. 377 [1941]) sustained the authority of the Federal Power commission to grant licences for dams on navigable rivers, though the dams were useful only for power purposes, and to impose conditions on such licences, though unrelated to navigation. The power of congress over navigable waters is plenary and the development of navigation thereon but a part. In 1941 the supreme court sustained the construction of a dam—under an act of congress—on an unnavigable portion of the Red river, a tributary of the Mississippi, since the dam would help to prevent floods on the Mississippi, which was, of course, navigable.

Trade.—In the 20th century the sanction of the supreme court has been accorded federal regulation of matters that in earlier times would have been considered local and solely for state control. These holdings were foreshadowed as early as 1905 when the court sustained an injunction under the Antitrust act against a combination of the meat packers to control prices paid for cattle in the stockyards. Even though the purchases took place locally, the transactions involved were in what was described as the "current of commerce," and the court held that strict legal rules should not deprive the government of control over matters that so closely affected interstate commerce. (*Swift and Co.* v. *United States,* 196 U.S. 375 [1905].) Later cases relied on this decision to sustain the constitutionality of federal regulation of the stockyards, of trading in grain futures and of the inspection and grading of tobacco in the tobacco markets. The activities in question were not, taken separately, interstate, but since they affected prices charged in interstate trade, they came under the federal power. The Fair Labor Standards act of 1938 not only prohibited the shipment in interstate commerce of goods produced contrary to the standards of the act but directly prohibited the payment to employees engaged in the "production of goods for interstate commerce" wages lower than those prescribed by the act, or the exaction of longer working hours. The prohibitions were sustained as means of preventing shipment of such goods; the court held that production of goods in one state under substandard labour conditions would through the force of competition prejudice industry in those states where proper standards were maintained, and thus "affect" interstate commerce. The National Labor Relations act of 1935 extended to employees in commerce and industry generally the same rights of organization and collective bargaining as are accorded to employees in transportation, as previously mentioned. In the case of the *National Labor Relations Board* v. *Jones & Laughlin Steel Corporation* (301 U.S. 1 [1937]) the supreme court upheld the act as applied to a manufacturer of steel. The opinion covered familiar ground. Labour disputes lead to strikes, which stop the flow of goods in interstate commerce. Recognition of the right of employees to form unions and to bargain collectively is a means of preventing strikes and is thus within the federal power. The word "affect" has been liberally interpreted. *Consolidated Edison Co.* v. *National Labor Relations Board* (305 U.S. 197 [1938]) held the act applicable to the electric utility serving metropolitan New York city. Although the utility was not itself in interstate commerce, part of its sales were to railroads and other enterprises in interstate commerce, and thus the act was held to be applicable to the utility.

Since the 1920s congress has struggled with the problem of inadequate prices and overproduction in agriculture. The Agricultural Marketing Agreement act of 1937 authorized the secretary of agriculture to fix minimum prices for purchase of specified agricultural commodities "in the current of interstate commerce or which directly burdens, obstructs or affects interstate commerce." In *United States* v. *Rock Royal Co-operative, Inc.* (307 U.S. 533 [1939]) the supreme court upheld under this act an order fixing minimum prices for fluid milk in the metropolitan New York area paid farmers in sales to local plants. Although these sales were by themselves intrastate transactions, the ultimate destination of the product was interstate commerce. Where the interstate and intrastate transactions are inextricably mingled the federal power extends over the whole. *United States* v. *Wrightwood Dairy Co.* (315 U.S. 110 [1942]), involving the same act, went farther and sustained an order of the secretary of agriculture fixing prices in the Chicago market, though the dairy in question purchased only from Illinois producers and distributed only to Illinois consumers. The secretary could not adequately regulate the entire market, the court ruled, if intrastate operators sold at lower rates than did the interstate operators. Federal power moved even more deeply into what appeared to be local affairs in the Agricultural Adjustment act of 1938, which attacked the problem of agricultural overproduction. Under the terms of the act there was allotted to one Filburn, a small Ohio farmer, 11.1 ac. on which he could plant wheat. Filburn planted 20 ac. Although he sold no wheat, but used it solely for his own consumption, the supreme court in the case of *Wickard* v. *Filburn* (317 U.S. 111 [1942]) held him subject to the penalties of the act. Filburn's consumption of wheat that he had grown himself relieved him of the necessity of buying wheat in interstate commerce; interstate commerce was affected; and thus, the court held, the power of the federal government was applicable. After this group of decisions, *Schechter Poultry Corporation* v. *United States* (295 U.S. 495 [1935]), holding the attempt under the National Industrial Recovery act to control the live poultry market in New York city, and *Carter* v. *Carter Coal Co.* (298 U.S. 238 [1936]), holding invalid the regulation of hours and wages in bituminous coal mines, were no longer authoritative.

POWERS OF THE STATES

Regulatory.—In the landmark case of *Gibbons* v. *Ogden,* cited above, Chief Justice John Marshall raised, but did not decide, the question whether the grant to congress of power to regulate commerce among the states did not necessarily exclude the states from exercise of like power. The later case of *Cooley* v. *Board of Wardens* (12 Howard, 299 [1851]) decided the issue in a manner that was thereafter uniformly followed. Some subjects of the power are national in their nature and thus demand a single uniform system of regulation. As to these the power of congress is exclusive. With other subjects, conditions differ from state to state, and as to these, diversity rather than uniformity is desirable; here the states, in absence of a federal statute on the matter, have the power of regulation. On this ground the court sustained the Pennsylvania law requiring ships arriving from or bound to a foreign port to engage a local pilot while in the port of Philadelphia. The test permits no easy or automatic application, since, in essence, it calls for striking a balance between national and state interests.

In one respect, however, the rule was at first positive. Engagement in interstate commerce is a federal and not a local right, and statutes requiring state licences to engage therein are invalid. The rule has its usual application in respect to corporations. Although in general a state may prohibit a corporation that is not incorporated nor licensed by it from doing business within its borders, the prohibition cannot apply when the corporation is engaged in interstate commerce. The main rule does not apply when the corporation involved, though engaged only in interstate commerce, has its principal place of business in the state nor, apparently, when the requirement of permission is a reasonable method of protecting the people of the state from the practices of possible dis-

honest and irresponsible companies. Apart from the incorporation phase of the problem, the former rule was that a state, even to protect its people from fraud or imposition, could not require a state licence nor impose conditions on interstate transactions such as buying grain for interstate shipment. Subsequent cases, however, sustained such enactments on the ground that the activity involved was essentially local.

Clearly, as contrary to the *raison d'être* of the commerce clause, a state may not insulate any portion of its own intrastate commerce from interstate competition. For example, a statute that forbade natural gas producers in one state to pipe their product into adjoining states, until the needs of local consumers had been satisfied, was held invalid.

The regulation of rates for transportation from, to and through several states is obviously a matter requiring single national control. *Wabash, St. Louis and Pacific Railroad Company* v. *Illinois* (118 U.S. 557 [1886]) held such an attempt by the state of Illinois to be invalid and was the occasion for the enactment of the federal Interstate Commerce act in 1887. Since that time there has been considerable litigation on the question whether the particular rates fixed involve interstate or intrastate transactions. State regulations of interstate commerce designed to protect the personal safety of citizens, or to secure adequate service, have been sustained. The courts have also upheld state laws requiring railroads at highway crossings to check the speed of their trains, maintain watchmen or eliminate grade crossings. In all these respects, however, if the regulation in question is found unreasonably to hamper or burden the interstate commerce function of the railroad it becomes invalid.

Where interstate transportation is over public highways, the propriety of regulation by the several states is more apparent. The highways are subject to wear and tear, and there are hazards to life and limb of other users. In the earlier days of automobile traffic the supreme court sustained state laws requiring a licence for the use of its highways, and imposing fees for its issuance to compensate the state for the use of its roads and the cost of the regulation. Where, however, state permission is required, not for these reasons, but in order to prevent undue competition—then, as in other cases, the requirement by a state of a permit to engage in interstate commerce is invalid. The several states may, for safety and other reasons, regulate the weight and equipment of vehicles traveling their highways but when shown that the requirements are unreasonable the rules in question become invalid.

Of a somewhat different character from the laws just discussed are those statutes prohibiting the entry into a state of persons or goods likely to spread disease. Quarantine laws, except where found unnecessarily restrictive, are upheld because in these cases the local interest outweighs the national. In the case of *Edwards* v. *California* (314 U.S. 160 [1941]), however, the court invalidated a statute punishing transportation of indigent persons into the state because the constitutional right of U.S. citizens to move from state to state was involved. When, however, the harmful character of the inhibited goods is not universally recognized, then the law is not so clear. Long before adoption of the 18th or prohibition amendment in 1919, laws of certain "dry" states prohibiting the shipment of intoxicants into the state were held invalid. Intoxicating liquor was a recognized article of trade, and the court ruled that a single state could not prevent the shipment of liquor into its borders. In the 1940s, after repeal of the prohibition amendment, statutes regulating the transportation of liquor through a state were upheld. Laws requiring that before certain commodities may be transported into a state they must be inspected to determine whether they endanger the public safety, are instruments of possible fraud or are otherwise detrimental to the common welfare, are universally sustained.

When congress has legislated on a particular subject the rule of federal supremacy makes state law to the contrary invalid. When no direct conflict exists, but both federal and state law cover the same general subject matter, a different problem arises. One line of cases holds that legislation by congress in a particular field is an implied prohibition of state legislation in the same field. For example, a federal act requiring in considerable detail certain equipment on locomotives was held to preclude the states from making additional requirements. A second line of cases, however, permits state authority to operate in the interstices not covered in the specific provisions of a federal law. The National Labor Relations act occupies a middle ground. In general, the states may regulate labour-management relations in areas over which the federal authority has not been extended. Thus it has been held that the states may, in spite of that act, prohibit mass picketing and forbid periodic unannounced work stoppages by employees. Where, however, the federal law does govern a specific segment of labour-management relations, particularly when it confers positive rights, then state regulation in that field must give way. For solving the problems presented in this paragraph, it would appear that canons of statutory construction and rules of logic may be outweighed by the relative importance of the national and state interests involved, and by the practical aspects of administering the various laws in question. Diversity of decision has been the result.

Taxation.—Taxes have been defined as the price one pays for the benefit of government, and since it is on the governments of the several states that those engaged in interstate commerce depend principally for the protection of their properties, activities and other interests, it follows that they must pay state taxes. Nevertheless, taxes "affect" such commerce, and accordingly the state taxing power is subject to the jurisdiction of the federal courts. Taxes may be levied on privileges and franchises; on gross receipts or net income; on sales of goods or on the privilege of using goods; and, of course, on property. Each of these modes of taxation has its own particular problems, but in each of them runs the necessity of striking a balance between protecting interstate commerce from undue burden and allowing the states sufficient sources for their tax revenues. The resulting fusion of law and policy has led to a great volume of litigation, and the drawing of many fine lines of distinction. One thing is clear, however. The states, in whatever manner they may exercise their power to tax, cannot favour their own internal commerce and discriminate against interstate commerce.

The conduct of interstate commerce is a right conferred by the U.S. constitution, and, as the states cannot require a licence for its exercise, neither can they levy a tax on it. For example, a city ordinance levying an annual tax of $225 on telegraph companies doing business in the city was held invalid when a part of such business was interstate. The imposition of a fee for soliciting the sale of goods by sample was likewise held to be void when the solicitor in question represented a merchant of another state. A state may not levy upon a corporation organized in another state a tax on the privilege of doing business in the corporate form in the state of the levy when such business consists solely of interstate commerce.

A state tax that involves neither interstate commerce nor a subject matter so connected therewith as to be deemed a part thereof is perfectly valid. There are numerous decisions, some upholding and some invalidating the tax, depending on how vitally interstate commerce is deemed to be affected by the levy. It sometimes happens that certain transactions, though held sufficiently related to interstate commerce to be regulated by congress, are nevertheless held subject to tax by the states. Where both interstate and intrastate commerce is conducted, state privilege taxes assessed on the latter business are sustained. *Western Union Telegraph Co.* v. *Kansas* (216 U.S. 1 [1910]) qualified this rule, however, holding that where the intrastate business was but a small fraction of the entire business transacted, a tax on such intrastate business based on a percentage of the corporation's entire capital, most of which was employed out of the state, was in effect a tax on the interstate business and on property located beyond the jurisdiction of the state, and hence invalid. This decision led to a large number of other supreme court cases. The final result seems to be that annual franchise taxes on foreign corporations engaging in both interstate and foreign commerce, when based on the entire capital and business of the corporation, are invalid; where based on the proportion that the capital employed or business conducted in the state bears to the whole, they are valid.

As noted above, automobile licence taxes, reasonable in amount,

apply to all vehicles, including those employed only in interstate commerce. They are regarded as compensation for the use of the state's highways, and it is immaterial whether the exaction be a flat sum, or be computed on some such basis as value, weight, carrying capacity, miles traveled or gross revenue. Also, it is not essential that the revenue obtained be applied directly to the building and maintenance of highways. If, however, under the state statute the exaction cannot be regarded as compensation for use of the highways, then it is an invalid tax on the privilege of engaging in interstate commerce.

Taxes on gross receipts from commerce are, because of their practical effect, held equivalent to taxes on the privilege of engaging in commerce, and are invalid when levied on gross receipts from interstate transactions. They may, however, be levied upon the proceeds from intrastate operations. The court is thus faced with the problem of drawing the line between transactions that are interstate and within the protection of the interstate commerce clause, and those that are local and not within such protection. In the former group are decisions holding invalid gross receipt taxes from transportation between points in a single state but through other states; radio broadcasting; sales of securities on stock exchanges by residents of other states; stevedoring on vessels in foreign and interstate commerce; and from services as agents for fruit growers selling their products in other states. On the other hand, taxes have been upheld on gross receipts from local sales, whether they be of goods destined for shipment to another state for processing by the seller, or whether from sales in the original packages in which the goods were shipped to the seller from another state.

In contrast to taxes on the gross receipts from interstate commerce, nondiscriminatory taxes on the net income from such commerce are upheld. In this case the impact of the tax is not so severe, and the tax, like taxes on the property employed in the commerce, is held "indirect," and not violative of the implied prohibitions of the interstate commerce clause.

Sales taxes, analytically considered, are levied on the privilege of buying and selling goods. Accordingly, where the transaction is interstate, no state tax can be levied on it. Such characterization is, however, sparingly conferred. A sale is not excluded from taxation merely because the seller acquired the subject matter through interstate commerce and is selling it in the original package nor because the buyer is purchasing the goods for transport into another state. A New York city tax on sales to New York residents was upheld even though the goods were shipped from another state, the seller was incorporated in and had its principal place of business in another state, and in such other state the contract of sale was finally effected. The taking of orders for the goods by the sellers' representatives with established businesses in New York, and the delivery there of the purchased goods gave to the sales sufficient local incidence to enable the city to levy the tax. No tax was, however, leviable in the state of the purchaser if the buyer submitted his order directly to the out-of-state seller, or, if to agents of the seller, such agents had no settled place of business in the buyer's state. To prevent escape from state sales taxes by such methods or through journeys to, and purchases in, neighbouring states that had no sales taxes, the sales-tax states resorted to so-called "use taxes." They imposed taxes equal in amount to the sales taxes for the use of property brought into the state on which no sales tax had been levied. Such taxes are valid. They are justifiable attempts to conserve the levying state's sales tax revenues; the property in question has passed out of interstate commerce and come to rest in the state; and from the combination of the sales and use taxes, equality of burden and not discrimination results.

State taxation of the property of the interstate carriers has always been upheld. The property receives state protection and the taxes thereon are the price paid for the protection. Such property has its own particular characteristics. Most of the individual items of the property—the rolling stock of the railroads, the vehicles of the truck and bus lines, the planes of the airlines—are constantly on the move throughout the entire system of the carrier and are in a single state only temporarily. Nevertheless, in each state there is constantly on hand a fairly constant average of such property. The individual items of property are integral parts in the entire system of the carrier and as such have a value that may be greater than the value of the items considered individually. The taxable value of the property of the carrier within a particular state then, is that proportion of the value of the entire property of the carrier devoted to commerce that the property in the taxing state bears to the total value. To determine this proportion several different factors have been utilized: track mileage, car mileage, gross receipts and net income. Taxes levied through such formulas are not taxes on the factors employed, but taxes on property, and if through them a fair approximation of the value of the property within the taxing state is obtained, they are valid. Where, however, the formulas employed result in a valuation greatly in excess of the true value of the property affected, then the tax is invalid. In *Northwest Airlines* v. *Minnesota* (322 U.S. 292 [1944]), the supreme court by a bare majority held that the state of Minnesota, where the company was incorporated and which was the main base of its operations, could tax all the planes of the corporation, even though a determinable fraction thereof was constantly in operation in other states. Continuing litigation resulted, the final conclusion being that the domiciliary state of the carrier may still assess all of its movable property devoted to such business, except as the taxpayer can prove that a determinable portion thereof has acquired a situs in another state or states, subjecting it to taxation therein. (*Central R. Co.* v. *Pennsylvania,* 370 U.S. 607 [1962]).

Property of the shippers while in interstate transit also has peculiar characteristics. It is customarily in the taxing state for but a few days, and the shipper has not, as the carrier has, a constant average of property in the state. Moreover, since the several states often provide different days on which the assessment of property is made, there is great possibility that property in transit might be subject to multiple taxation. The accepted rule, accordingly, has always been that property in transit in interstate commerce is not taxable by the several states. For this purpose interruptions in the actual movement of the goods, when due to the necessities of the interstate movement, as where property is stored awaiting transshipment to another carrier, do not take the property for tax purposes out of the interstate movement. *Champlain Realty Co.* v. *Town of Brattleboro* (260 U.S. 366 [1922]) held that logs being rafted from Vermont into New Hampshire, though detained for several weeks in the former state by conditions of the rivers, were still in interstate transit and not taxable by Vermont. The transit does not begin until the property in question is either started on its journey or delivered to a common carrier for such transport, and the transit comes to an end when the property is delivered to the custody of the consignee. The circumstance that it may be in the original package in which it was shipped is for this purpose immaterial. The so-called "original package" rule of *Brown* v. *Maryland* (12 Wheat. 419 [1827]), which frees from state taxation property of an importer from foreign countries while it is in the original package, does not apply to interstate commerce.

See CONSTITUTION AND CONSTITUTIONAL LAW: *United States;* FEDERAL TRADE COMMISSION; LABOUR LAW; *see* also references under "Interstate Commerce" in the Index.

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INTERSTELLAR MATTER is material of exceedingly low density dispersed in the space between the stars in the form either of gas (detectable from its emission and absorption of light and radio waves, especially in certain spectral lines) or of "dust," which can be detected by its general absorption and reddening of starlight.

DARK MATTER IN THE MILKY WAY

Absorbing Clouds.—Inspection of the Milky Way with a small telescope (or in places with the naked eye) shows that the rich

star fields of which it consists are interrupted by dark patches, such as the Coalsack near the Southern Cross. These dark areas were examined around 1900 by Max Wolf and E. E. Barnard, who found them to be most abundant in Ophiuchus and Sagittarius, toward the centre of the Milky Way system. This fact, together with the appearance among them both of bright patches and of still darker globules, suggests that they are really dark clouds rather than starless "holes," which latter would have to be narrow tubes thousands of light-years in length converging on the solar system —an obvious absurdity. The absorptions, distances and thicknesses of these clouds have been determined by a method originated by Wolf and improved by later workers: the apparent distances of stars (found from their spectral types and apparent brightnesses) are determined both through a cloud and in a neighbouring field outside the cloud. The number of stars at a given distance is then plotted on a graph against this distance for the two cases; the two curves coincide up to the distance of the near side of the cloud and then diverge until, on the far side, they run parallel with a constant horizontal displacement from which the amount of light absorbed by the cloud can be calculated. The results are greatly complicated by the frequent presence of several clouds in one direction, but a typical cloud seems to be about 100 parsecs across (1 parsec = 3.26 light-years) and to diminish the light passing through it by nearly 1 magnitude (equivalent to a factor of 2.512).

A further effect, known as interstellar reddening, arises in the clouds because blue light is absorbed more strongly than red light; hence a given star appears redder through a cloud than when seen through clear space, just as the sun appears red when near the horizon. The colours of stars are measured by their colour index; *i.e.*, the difference between photographic or blue magnitude (measured in a wave length band centred near λ 4250 Å) and visual magnitude (centred near λ 5450 Å in the yellow-green region). The amount by which the colour index of a star exceeds the normal value for its spectral type is known as its colour excess. In most clouds studied, the ratio of total absorption in photographic magnitude to colour excess has nearly the same value, about 3.5, suggesting the presence of the same absorbing material in these various cases. This fact has been applied by W. Becker and by H. L. Johnson and W. W. Morgan in order to obtain the degree of interstellar absorption and reddening for star clusters by comparing the normal colour index with an additional colour index obtained from photometry in the ultraviolet region of the spectrum (λ 3600 Å).

General Absorption.—The possibility that the light of distant stars might be dimmed by absorption even where no dark clouds are actually visible was mentioned in 1720 by Edmund Halley, and discussed during the 19th century by H. W. M. Olbers, F. G. W. von Struve and others as a possible explanation of the fact that the number of stars per unit volume seems to diminish with distance in all directions. The alternative explanation is that we are near the galactic centre.

The 20th-century research on our galactic position has shown that we are close to the central plane of the galaxy, but a long way from the centre, so that the apparent distribution of stars in the Milky Way (though not at right angles to it) is indeed determined by absorption, although the amount of absorption varies greatly with direction and distance. Definite proofs of the presence of general absorption in the Milky Way have been provided by the invisibility of external galaxies in an irregular region roughly bounded by the circles of galactic latitude ± 20° ("zone of avoidance" studied in detail by E. P. Hubble and H. Shapley) and by R. J. Trumpler's extensive investigation in 1930 of galactic open clusters at distances between 600 and 2,200 parsecs.

By measuring the apparent brightnesses of cluster stars whose real brightnesses could be estimated from their spectra, Trumpler estimated the actual diameters of the clusters and showed that these must increase systematically with the distance of the clusters from us if the intervening space were assumed to be entirely transparent. This highly implausible effect is removed if one assumes an average absorption of about 1 photographic magnitude per 1,000 parsecs in the galactic plane.

RADCLIFFE OBSERVATORY (PRETORIA, U. OF S. AF.) PHOTOGRAPH, REPRODUCED BY COURTESY OF A. D. THACKERAY

M 16. A COMPLEX OF BRIGHT AND DARK INTERSTELLAR MATTER IN SERPENS, IN THE SOUTHERN MILKY WAY

A similar result was obtained by A. H. Joy (1939) and R. E. Wilson (1940) from a study of Cepheid variables whose absorptions and true distances were derived from the period–luminosity relation in conjunction with the theory of galactic rotation; but J. H. Oort, H. C. van de Hulst and D. W. N. Stibbs later suggested twice this value. If the absorption is neglected, large distances are greatly overestimated; for example, the distance of the galactic centre—estimated at 16,000 parsecs by Shapley in 1930—turns out to be only 8,200 parsecs when the obscuration is allowed for. W. Baade's photographs of external galaxies suggest that the absorbing clouds are mainly confined to galactic spiral arms.

Scattering Nebulae.—When observed with a spectroscope, certain bright nebulae show a continuous spectrum with dark lines, identical with that of a nearby star, unlike the emission spectra of gaseous nebulae near very hot stars. These bright nebulae are identical with the dark clouds mentioned above, which scatter incident starlight in all directions and thus appear bright when viewed sideways on. As in the case of the sunlit sky, but to a lesser degree, the scattered light is generally more blue than that of the illuminating star and shows a certain degree of polarization (*see* below). True absorption of starlight by obscuring clouds is probably absent, and the term "interstellar absorption" should strictly be interpreted as obscuration resulting from scattering by interstellar material.

Interstellar Polarization.—In 1949 W. A. Hiltner and J. S. Hall showed that the light of distant stars seen through obscuring matter often possesses an appreciable degree of polarization; *i.e.*, the electric vibration of the light is slightly (up to 8%) stronger in one plane than in the plane at right angles to it. The polarization is particularly strong toward Perseus, where we are probably looking along a spiral arm of the galaxy. In this direction, the strongest vibration is parallel to the galactic plane; this suggests the presence of elongated scattering particles with their long axes predominantly at right angles to the plane. According to L. Davis and J. L. Greenstein, this orientation may be caused by paramagnetic relaxation in a galactic magnetic field between 10^{-5} gauss and 10^{-4} gauss, if the particles have a small admixture of magnetic material.

Form of Absorption-Colour Curve and Nature of the Scattering Material.—The variation of the scattering coefficient from the violet to the red end of the spectrum has been studied

by comparing the brightnesses in various spectral regions of pairs of hot stars of identical spectral types seen through different degrees of obscuration. The most extensive measurements have been carried out photoelectrically (with colour filters) by J. Stebbins and A. E. Whitford (1943) and spectrographically by Greenstein (1938), C. Schalen (1952) and L. Divan (1951). The various results agree in showing that, in the limited range of wave lengths between λ 4000 Å and λ 8000 Å (roughly the visible range from violet to red) the scattering coefficient is nearly inversely proportional to wave length, but that the curve flattens off at both the ultraviolet and infrared ends. The absorption is thus neither neutral (as would be expected from large rocklike objects or from free electrons, neither of which could exist in sufficient quantities to explain the observations) nor is it in accordance with Lord Rayleigh's fourth-power law (which applies to atoms and molecules, *e.g.*, in the earth's atmosphere).

The absorption must arise from a fine dust or smoke with particles of dimensions comparable with the wave length of light (about $\frac{1}{20,000}$ cm.). Van de Hulst has shown that the observed data, including the polarization of starlight observed through obscuring matter, are consistent with a distribution of dielectric grains (probably consisting of ice with admixtures of solid hydrogen, methane, ammonia, metallic oxides and metals) having a typical diameter of 0.56μ (μ = micron: 1 micron = 10^{-4} cm.).

INTERSTELLAR GAS CLOUDS

Interstellar Absorption Lines.—Many distant, hot stars show in their spectra certain characteristic absorption lines with a red or violet shift differing from that shown by the remaining lines of the spectrum. This is particularly conspicuous in the case of certain spectroscopic double stars which show "stationary calcium lines," first discovered in the spectrum of δ Orionis by J. Hartmann (1904). Hartmann noted that the H and K lines of ionized calcium in the violet show a constant-velocity shift, while the shift of the remaining lines goes through a cycle of variation every few days because of the orbital motion of the system. Hartmann recalled the behaviour of the exploding star Nova Persei 1901 in which the H and K absorption lines, and also the D lines of sodium in the yellow region, had remained sharp and fixed while the other lines underwent complex changes in position and structure; he concluded that these lines must, in the case of both stars, have been superimposed on the spectrum of the star proper by the passage of its light through a gaseous cloud in which calcium and sodium were present.

Afterward, M. L. Heger showed that the sodium D lines also remain stationary in δ Orionis, and high-dispersion spectra of this and other stars by T. H. Dunham and W. S. Adams revealed in addition stationary lines of potassium, titanium, neutral calcium and the diatomic molecules CH and CN. In cooler stars, these interstellar lines are hard to detect because of their blending with the corresponding lines in the star's own spectrum.

That the clouds which produce the interstellar lines are distributed throughout the galaxy and do not exist primarily in the neighbourhood of individual hot stars was first suggested by A. S. Eddington and confirmed from a study of numerous spectrograms in 1929 by Otto Struve, who showed that, on the whole, the intensity of the interstellar K line increases steadily with distance. In 1935, J. S. Plaskett and J. A. Pearce studied the velocities in the line of sight of numerous hot stars (which are distributed close to the galactic plane). They showed that, in a given direction, the velocities of individual stars increase in proportion to their distances, in accordance with Oort's theory of differential galactic rotation, and that the velocity shift of the interstellar K line generally corresponds to about one-half the velocity (and hence one-half the distance) of the star, as though the gas were uniformly distributed in the intervening space.

Later work with spectrographs of higher dispersion by C. S. Beals (1936), R. F. Sanford, P. W. Merrill and O. C. Wilson (1938) and Adams (1943) showed that the interstellar lines are often split into numerous very narrow components, each being the effect of a separate cloud of gas with its own characteristic motion. According to estimates by A. Blaauw and B. Strömgren, a straight line 1,000 parsecs long in the galactic plane may traverse about 10 clouds with a mean diameter of about 5 parsecs, a mean density of 10 hydrogen atoms (or 2.7×10^{-23} g.) per cubic centimetre and a mean velocity relative to the average of the surrounding stars of about 7 km. per second. The chemical composition of the clouds seems to approximate closely to that of normal stars, but their temperatures are very low (of the order of 100° K., *i.e.*, 100° C. above absolute zero or −173° C.), so that the constituent atoms and molecules are practically all in their state of lowest energy. The absorption spectra therefore consist entirely of resonance lines, only a limited number of which occur in the observable spectral range. In 1953, Guido Münch showed that around Perseus the interstellar lines from hot stars at very great distances (up to 3,000 parsecs) split into two distinct groups of components, arising from gas clouds in the next spiral arm out from the centre of the galaxy as well as in the arm in which we are situated.

In addition to the lines mentioned above, certain highly diffuse absorption bands many ångströms wide are produced, the strongest being centred on λ 4430 Å. Their origin is unknown, but they appear to be associated with the clouds of obscuring dust rather than with the interstellar gas in general.

Radio Emission by Cosmic Gas.—In 1932, K. G. Jansky found that cosmic noise at radio frequencies was received by a directional antenna pointed at the sky; he and G. Reber afterward showed that the radio waves came from the Milky Way, the strongest radiation being received from the direction of the galactic centre in Sagittarius. After 1945, a number of point sources of radio emission were discovered both within and outside the galaxy, but only in certain cases was it possible to identify these visually. One such source within the galaxy is the Crab nebula in Taurus, which is the gaseous remnant of the supernova observed from China and Japan in 1054. An extragalactic source is Cygnus A, which was shown by Baade and R. Minkowski in 1952 to consist of two colliding galaxies. In this case the stars simply pass one another with little interference because of their enormous distances apart, but the clouds of interstellar gas and dust collide with relative velocities of 1,600 km. per second and are in violent turbulent motion.

Weak radio emission has been detected from the sun (enhanced by sudden bursts during solar flares), from the galactic plane, from the galactic corona (a large, spherical, extremely tenuous region roughly embracing the globular clusters and concentric with the Milky Way) and from nearby extragalactic nebulae; but it is significant that the strongest sources always consist of ionized gas with violent internal motions. The evidence suggests that the chief cause of radio emission is the deceleration of electrons moving with velocities approaching that of light in a magnetic field (synchrotron radiation). These ionized, magnetized gas clouds also provide a likely mechanism for the production of some cosmic rays. In the case of the quiet sun and of ionized hydrogen clouds in the galactic plane, however, the radio emission is of thermal origin, as a result of the deceleration of electrons in the electric fields of nearby protons. In 1963, by scanning the frequency spectrum of radio emissions from Cassiopeia A, radio astronomers detected the hydroxyl (OH) ion in interstellar space for the first time. They estimated that interstellar space contains one hydroxyl ion to every 10,000,000 hydrogen atoms.

Interstellar Hydrogen and 21-cm. Radiation.—Although hydrogen is by far the most abundant element in the interstellar gas, as in normal stars, its spectral lines are not detectable optically except as emissions from those clouds (known as H II regions) that are close enough to hot stars to be ionized by their ultraviolet radiation. In this case the capture of electrons by protons leads to the production of energetically excited hydrogen atoms which then lose their energy by emitting radiation, some of which appears in the visible region of the spectrum. At a certain distance from such a star (depending on its size and temperature and on the density of the nearby gas), the ultraviolet radiation is completely broken down into quanta of lower energies and longer wave lengths, so that hydrogen is no longer ionized (this is the H I region).

In accordance with the theory developed by H. Zanstra and Strömgren, the transition takes place quite suddenly, so that the typical H II region is a well-defined sphere surrounding a hot star or a group of hot stars. Such H II emission clouds are prominent in photographs of spiral galaxies, in which they were formerly often mistaken for bright stars. They occupy only about one-tenth the space taken up by the neutral H I clouds which produce the interstellar absorption lines; their physical state resembles that of the diffuse nebulae, such as the great emission nebula in Orion, but they are of a considerably lower density.

The development of radio astronomy has provided an extremely powerful method of detecting neutral hydrogen in interstellar clouds from the transition at 1,420 mc. per second (λ 21.1 cm.), a possibility which was suggested by van de Hulst in 1944. Radio waves of this frequency are respectively emitted or absorbed by a hydrogen atom in its lowest energy state, when the directions of spin of the proton and electron change from parallel to antiparallel or vice versa. This hyperfine structure transition takes place very rarely, the mean life of an atom in its upper state being about 11,000,000 years; but the clouds of interstellar gas are so vast that detectable amounts of radio noise are emitted at this frequency. The 21-cm. radiation from the Milky Way began to be observed in 1951, first by H. I. Ewen and E. M. Purcell (Harvard), then by C. A. Muller and Oort (Leiden, Neth.) and shortly afterward by W. N. Christiansen and J. V. Hindman (Sydney, Austr.). By observing the velocity shift of the 21-cm. line and applying Oort's theory of differential galactic rotation, van de Hulst, Muller and Oort plotted the spiral structure of the galaxy in the range of galactic longitude from 0° to 220°, while further spiral arms were detected in the southern Milky Way by Christiansen and Hindman.

In 1956, the 21-cm. line was detected in absorption from cool hydrogen clouds surrounding the intense radio source in Cygnus by A. E. Lilley and E. F. McClain, who showed that the recession velocity deduced from the Doppler shift of this line was in excellent agreement with the value of 16,700 km. per second measured in the optical spectrum by Minkowski. This result is strong confirmation of the view that the red shift observed in the spectral lines of distant galaxies is a true velocity shift.

Relationship Between Stars and Interstellar Material.—The distribution of interstellar gas and dust clouds is very heterogeneous, but roughly speaking they are confined within a distance of about 100 parsecs from the galactic plane (in the solar neighbourhood) and within the galactic spiral arms, which have a width of the order of 500 parsecs within the plane. While the dust appears to be confined to discrete clouds, which coincide with local concentrations of the gas with a density of about ten hydrogen atoms per cubic centimetre, there appears to be in addition a uniform distribution of gas with a density of about one hydrogen atom per cubic centimetre throughout the galactic disk. The temperature of the interstellar medium depends somewhat on the local intensity of stellar and cosmic radiation, but mainly on the absorbing properties of the medium; in H II regions it is about 10,000° K., in H I regions about 60° K. and the solid particles may be still cooler.

In the H I clouds there may be a statistical equilibrium between the gas and the dust grains, the latter being formed by combination and condensation and evaporated again by collisions between the clouds. The close association between bright, hot stars (which exhaust their nuclear energy sources so rapidly that they can be no more than 10,000,000 years old) and interstellar matter suggests that stars are being continuously formed by condensation from clouds of gas and dust. Possibly we are actually witnessing such a process in the T Tauri variables, stars which show emission spectra and are often accompanied by a visible nebulosity. The explosions of novae and supernovae and the slower ejection of matter from stars with expanding gaseous envelopes tend to replenish the interstellar medium, but only partially, since a certain fraction remains permanently locked up in white dwarfs. Thus the amount of interstellar material may be expected to diminish slowly with time.

At present the mean density of interstellar matter in the solar neighbourhood is about 3×10^{-21} g. per cubic centimetre, which is about equal to the density of material in the form of stars; but in the galaxy as a whole, most of which consists of relatively inconspicuous stars and of globular clusters distributed more or less spherically about the centre, the interstellar medium probably contributes only a small percentage of the total mass.

See COSMIC RAYS; GALAXY; NEBULA; RADIO ASTRONOMY; SPECTROSCOPY, ASTRONOMICAL; STAR; *see* also references under "Interstellar Matter" in the Index.

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INTESTATE SUCCESSION. Upon the death of a person who has made a valid last will or testament, his property passes in accordance with his testamentary disposition. But if he has not made a will, or if his will is legally defective, or insofar as he has not validly disposed in it of all his property, the course of inheritance will be determined by the law of intestate succession. The development and problems of the law of inheritance in general are discussed in the articles INHERITANCE; ESTATES, ADMINISTRATION OF; PROBATE; and those of the law of wills in the article WILL. The present article is concerned with the problems of the law of intestate succession.

History.—Rules of intestate succession became necessary with the development of individual ownership in objects that would not, as in earlier stages of civilization, be destroyed at the death of the owner, or buried with him, or given away. However, the only statement that can be made about intestate succession in general is that it seems to have universally occurred within the kinship group and that its course has thus been determined in any given society by the form of its kinship organization. In most primitive societies the clan appears to have been the basic form of social organization, but there are also societies in which the nuclear family of mother, father and children is not overlaid by a clan organization and thus constitutes the basic social unit, as it does in modern western society. In its structure the clan, which consists of a number of households, can be organized matrilineally or patrilineally. In the former a person is regarded as related to only those persons whose descent is traced through his mother, while in the latter relationship through the father is decisive.

In a clan-organized society succession to status and thus inheritance to property are, on principle, limited to clan members. In reality, affections engendered by close community, especially of the household, have also influenced the course of inheritance. In a matrilineal society a man may have greater affection for the children of his wife than for those of his sister, and will thus be inclined to let them succeed to at least some of his goods. Social tensions resulting from such modifications of unilateral organization have been reported from various societies; for instance, the Ashanti of west Africa and the Trobriand Islanders of Melanesia.

It seems indeed that certain kinds of goods frequently are inherited patrilineally even though the bulk may descend matrilineally, or vice versa. An example typical of many primitive societies is presented by the Herero of South-West Africa, where secular property is inherited within the matrilineal clan while certain sacred cattle are inherited patrilineally. A system of consistently matrilineal inheritance is that of the Nayar caste of southern India, where a woman's husband does not enter her clan, has no rights over her children, and property devolves from a male to his sister's children.

Almost consistently patrilineal, on the other hand, was inheritance in Rome in the early centuries of the republican era, beginning about the 5th century B.C. Roman society at that time consisted of patrilineal clans (*gentes*) and patriarchally ruled "houses," the latter being called *familiae* but with a social role and organization different from those of a modern western-type family. Property was owned not by individuals but by families. In prehistoric times family ownership was probably conceived as ownership by the house as a group, similar to the joint family of Hindu society. In historical times it was conceived as ownership by the family chief, the *paterfamilias*. The paterfamilias was not only

the owner of all of the family's property but also the ruler of the group, which could be quite large. It comprised the wife of the paterfamilias; all his sons, irrespective of age, whose membership in the house had not been terminated by dismissal (emancipation) or adoption into another house; the wives of these sons and all of their male descendants, with their wives, who had not been emancipated or adopted into another house; and finally the unmarried daughters of the paterfamilias and the unmarried female descendants of the other members of the house.

When the paterfamilias died, those who no longer had anyone standing above them now became *sui juris; i.e.*, free of the dominion of another and capable of owning property in their own right. This was so for the widow, the unmarried daughters, those sons who had not been emancipated or adopted into other houses, and those grandchildren, great-grandchildren, etc., who had belonged to the house and whose father or grandfather had died or had been emancipated or adopted into another family. These persons were the "proper heirs" (*sui heredes*) of the deceased paterfamilias. At one time it seems that the house was continued under their joint headship. In historical times the house split up into as many new ones as there were heirs. Of the persons shown in Fig. 1, M, B, E and K became persons *sui juris* at P's death and thus his proper heirs.

If a paterfamilias died without being survived by any members of his house, the succession devolved to the "next agnate"; *i.e.*, the nearest relative related through males, or, more precisely, the person nearest to the decedent among those who would be under the same household power (*patria potestas*) if their common ancestor were alive. As illustrated in Fig. 2, the descendants of F, the father of the decedent, X, do not belong to X's agnates: brother B was emancipated and thus would not be under the power of F if F were still alive; sister S and her child N belong to the house, and are thus under the power, of S's husband B-L. Aunt A and her child are not agnates either, because they are under the power of A's husband, AH. The only agnates are second cousin SC and cousin C_2. Of these C_2 is one grade closer to X than SC; she would thus be the closest agnate, but as a female she was excluded from the succession by a law of 169 B.C. (*lex Voconia*). Therefore, SC would be the sole successor.

If the decedent was survived neither by *sui heredes* nor by any agnates, the succession devolved to the *gentiles; i.e.*, the persons who, as clansmen, could perform certain ancestral rites.

The known history of Roman law extends from the 5th century B.C. to the 6th century A.D. During that long period the importance of the clan declined with the growth of the power of the state; marriage ceased to result in the wife's subjection to the household power of her husband; and the tie of blood relationship came to be felt more vividly beyond the limits of agnatic relationship. The corresponding changes in the order of intestate succession were

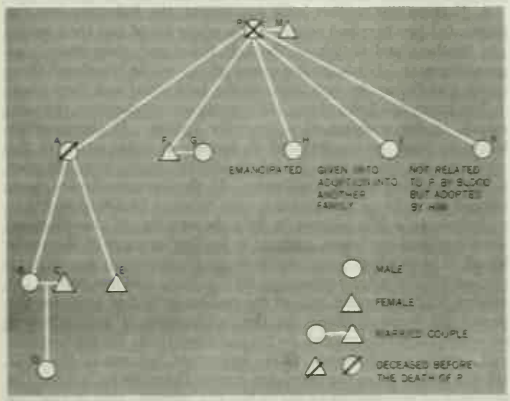

FIG. 1.—EXAMPLE OF SUCCESSION TO DESCENDANTS UNDER EARLY ROMAN LAW

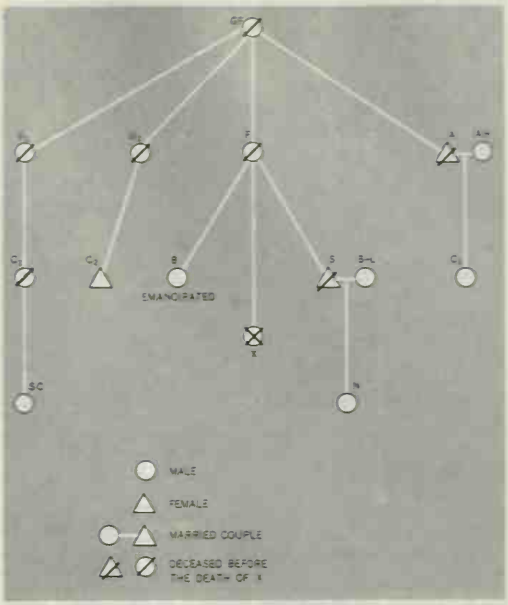

FIG. 2.—EXAMPLE OF SUCCESSION TO AGNATES UNDER EARLY ROMAN LAW

accomplished in a manner characteristic of Roman law. No formal change was made in the cherished rules of the ancient tradition, the *jus civile*, but the magistrate in charge of the administration of justice, the praetor, saw to it that a decedent's estate went to those persons who appeared to be entitled to it under the new order of things. In the time of early principate these persons were, first of all, the descendants of the decedent, including those who had been emancipated but not those who had been adopted into another family. If there were no such descendants, the succession passed, as in earlier days, to the nearest agnate. The more remote clansmen, however, were eliminated and their place taken by the nearest cognates; *i.e.*, the blood relatives in either the male or the female line. Finally, if there were no cognates, the property went to the surviving spouse, who, under the new system of marriage, was no longer a member of the husband's house. New changes were made by imperial legislation, culminating in Justinian I's *Novels* 118 and 127, of A.D. 543 and 548. The order that finally emerged was as follows:

1. Descendants, taking per stirpes; *i.e.*, by families, the children of any one descendant taking only the share that their parent would have taken if alive.

2. Ascendants, and brothers and sisters of whole blood, probably taking per capita; *i.e.*, sharing equally. If, however, the intestate had only paternal grandparents and a maternal grandfather, the latter took half. Nephews or nieces represented the brother and sister from whom they were descended.

3. Brothers and sisters of half blood.

4. In default of any relatives of the first three classes, the next of kin took per capita. Proximity of relationship was determined by counting upward from the decedent to the nearest ancestor common to him and the claimant, and then counting downward from that ancestor to the claimant. In Fig. 3, both A and B stand in the 5th degree of consanguinity to the intestate X, while C stands in the 6th degree. The estate is thus divided equally between A and B.

5. In default of any next of kin the estate devolved to the surviving spouse.

6. In default of all preceding classes the estate went to the imperial treasury, the fisc.

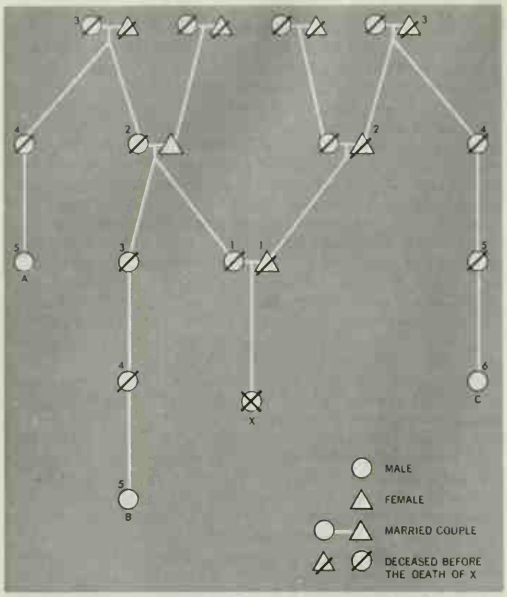

FIG. 3.—EXAMPLE FOR DETERMINING PROXIMITY OF RELATIONSHIP UNDER LATE ROMAN LAW OF SUCCESSION

Except for the position of the surviving spouse and some minor details, this order of intestate succession of the late Roman law is the same that prevails in most states of the United States. It passed into modern U.S. law through the medieval practice of the ecclesiastical courts of England, which was restated in the English Statute of Distribution of 1670. In England itself this system also prevails, but with important changes introduced by the Administration of Estates act, 1925.

While Anglo-American law, a system generally of Teutonic origin, has largely adopted the Roman order of succession, the laws of Germany and other continental countries, although strongly influenced by Roman law, have preserved important Teutonic traditions. Among the various systems that existed among the Teutonic peoples, two are still recognizable; one is that of the French civil code and the laws patterned on its model, the other that of the civil codes of Austria, Germany and Switzerland. In the former, the first order of heirs is constituted by the descendants; the second by the ascendants, the brothers and sisters of the intestate and their descendants; and the third by the collaterals, such as uncles, aunts and cousins, among whom the heirs are determined by counting degrees the same way as in Roman law. The surviving spouse ranks last, but is usually provided for through the system of community property (*q.v.*), by which he is entitled to one-half of what is usually the bulk of the property. The codes of Austria, Germany and Switzerland are based upon the so-called parentelic system. The first parentela or "line" of a person is constituted by his descendants, the second by his parents and their descendants, the third by the grandparents and their descendants, etc. However, under the Austrian code the right to inherit is limited to the first three parentelae and great-grandparents; under the Swiss code to the first three parentelae. No one standing in a more remote line can take if someone exists in a nearer line, and within each line a person standing closer to its head excludes the more remote ones. A varying portion of the estate is granted to the surviving spouse. In a modified form, the parentelic order was generally used in the medieval law of succession to land held in feudal tenure. In England this order was combined with the principle of primogeniture and in this form constituted the canons of descent of real estate held in freehold tenure, until it was abolished by the Administration of Estates act, 1925.

Modern Law.—Uniform rules of intestate succession to both real and personal property prevail in almost all common-law jurisdictions, generally patterned upon the system of the English Statute of Distribution of 1670 but diverging in matters of detail. Differences exist in particular with respect to the position of the surviving spouse, who may be entitled to a portion of the estate, or to a fixed minimum sum as in England and in several U.S. jurisdictions, or to a life estate in all or part of the estate, depending on who else survives the intestate.

United States.—In practically all U.S. jurisdictions the widow, and in some the widower and minor children, are entitled to an award to cover living expenses for the period (usually 9 to 12 months) during which the decedent's estate is wound up by the executor or administrator. In numerous states the surviving spouse is also entitled to a priority over both other heirs and creditors of the decedent with respect to a minimum portion of the land used by the family as its homestead.

In the community property states (Arizona, California, Idaho, Louisiana, Nevada, New Mexico, Texas, Washington) the community property is divided at the death of one spouse so that the surviving spouse has one-half, while the other half, together with the separate estate of the predeceasing spouse, passes under intestacy or under the will, as the case may be (*see* COMMUNITY PROPERTY).

While under the older law an illegitimate child had no rights of succession, modern acts generally provide for rights of intestacy between an illegitimate child and his mother and maternal relatives. A child who has been legitimated by the marriage of his mother and his reputed father or, as is possible in some U.S. jurisdictions, through acknowledgment by his reputed father, has the same position as a legitimate child. As to the intestacy rights between a person adopted, his adoptive parents, his natural parents and the relatives of the adoptive and the natural parents state statutes vary greatly (*see* ADOPTION).

If no relative of a decedent can be found, his estate escheats to the state. (M. RN.)

England.—The plan of distribution provided by the Administration of Estates act, 1925, was as follows:

1. A surviving spouse was to take the personal chattels absolutely and a net sum of £1,000. Of the residue of the estate, the surviving spouse took a life interest in half if the intestate had children or in the whole if he had none.

2. Subject to the rights of a surviving spouse, the estate was taken by the children at 21 or on marriage; the issue of children who had died taking at 21 or marriage their share of what their parent would have taken if alive.

3. If there was no issue, and again subject to the rights of a surviving spouse, the parents of the intestate took equally, or if one parent survived he or she took the whole.

4. If there was neither issue nor parent, the following was the order: (*a*) brothers and sisters of the whole blood and their issue; (*b*) brothers and sisters of the half blood and their issue; (*c*) grandparents; (*d*) uncles and aunts of the whole blood and their issue; and (*e*) uncles and aunts of the half blood and their issue.

The Intestates Estates act, 1952, made some important changes, mainly in the interests of a surviving spouse. If the intestate leaves no issue, no parents and no brother or sister either of the whole or the half blood, the whole of the residuary estate goes to the surviving spouse absolutely. If the intestate leaves issue, instead of £1,000 the surviving spouse receives £5,000 in addition, as before, to a life interest in half the residue; if the deceased leaves no issue but leaves a parent or brother or sister of the whole blood, or issue of such brother or sister, the surviving spouse is to receive £20,000 after payment of all liabilities, and one-half of the residue, while the other half of the residue is held in trust for the parent (or in equal shares for the two parents, if both survive) or, where there is no parent, on the statutory trusts for the brothers and sisters or their issue. Other important features of the 1952 act are that it gives the surviving spouse the right to call for the purchase or redemption of his or her life interest; that it modifies the law as to partial intestacies so that a surviving spouse obtains

a statutory legacy diminished by the value of any bequest; that it enables a surviving spouse, on certain terms, to acquire the deceased's interest in the matrimonial home; and that it applies the provisions of the Inheritance (Family Provision) act, 1938, as amended to an intestacy, so that a spouse, an infant child, an unmarried or incapable daughter or an incapable son may apply to the court for further provision out of the estate of an intestate.

(W. T. Ws.)

Scotland.—In the law of Scotland heritage (real property) descends to the heirs-at-law while the free movable estate (personal property) of the intestate is divided among the heirs *in mobilibus* who are the next of kin and those entitled to share in the succession under the Intestate Moveable Succession acts, 1855 to 1919. The heir of the heritable property, if one of the next of kin, must collate with the next of kin if he wishes to share in the movables. Proximity of kin is reckoned in the same order as in the case of inheritance. The Intestate Moveable Succession acts, among other changes, allow the issue of a predeceasing next of kin, not more remote than brothers and sisters, to come in the place of their parent in succession to an intestate; give the father of an intestate dying without issue one-half of the movable property in preference to brothers or sisters; and if the father and brothers and sisters be dead, a similar preference entitles the mother to succeed to the whole; brothers and sisters uterine are admitted in the absence of both brothers and sisters german or consanguinean and of father and mother. There are also rights of succession in both heritage and movables between a mother and her illegitimate issue under the Legitimacy act, 1926. *See* also SCOTS LAW. (J. WA.; X.)

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Scotland: W. M. Gloag and R. C. Henderson, *Introduction to the Law of Scotland*, 5th ed. by A. D. Gibb and N. M. L. Walker (1952); T. B. Smith, *The United Kingdom: the Development of Its Laws and Constitutions*, ch. 40 (1955).

For a digest of the intestacy laws of the United States, Canada and other countries, *see* Martindale-Hubbell, *Law Directory*, vol. 3 (published annually). (M. RN.)

INTESTINAL OBSTRUCTIONS. The alimentary tract digests and assimilates ingested food and disposes of the refuse. Any obstruction to the continuity of the bowel interrupts these three normal functions. Moreover, a blocked bowel often is accompanied by a chain of events that threatens life seriously. If the obstruction remains unrelieved, death follows.

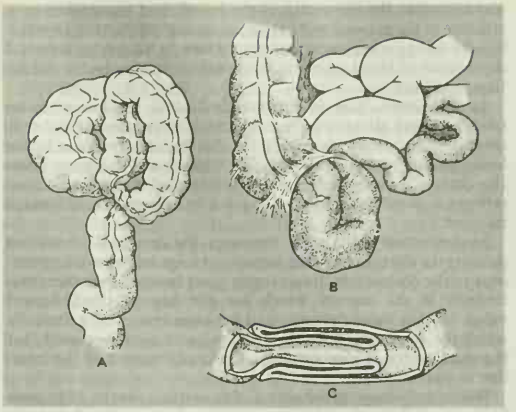
Causes.—The bowel may become obstructed through a number of agencies, of which the following types are recognized:

1. Congenital or acquired strictures of the bowel wall. Atresia and imperforation are types of congenital strictures that result from failure of the bowel to develop its lumen (canal) and are present at birth. Atresia usually concerns segments of the small intestine—duodenum, jejunum or ileum—though the proximal reaches of the colon may occasionally be involved. Ordinarily, the atresic area is a short segment an inch or less in length that looks like a fibrous cord. Imperforation concerns invariably the terminal end of the alimentary canal and involves only the anal canal and distal half of the rectum. Acquired types of stricture of the bowel that may give rise to obstruction are traumatic, inflammatory or neoplastic (cancerous) in origin. The first two are rare; strictures of the bowel caused by malignant growths are rather common, especially in persons past 45 years of age, and not infrequently give rise to obstruction, particularly in the colon.

2. Obstruction by obturation occasioned by the presence of a foreign body within the bowel lumen occurs occasionally. Fecal impaction is the most frequent variety of this type of obstruction. A large gallstone, ulcerating from the gall bladder into the small intestine, now and then causes obstruction by obturation.

3. Occlusions of the bowel may occur through the agency of compression by tumours outside the bowel, especially in areas where the bowel is fixed (*e.g.*, at the retroperitoneal duodenum or terminal ileum).

4. Adhesive bands are a frequent cause of intestinal obstruction.



FROM L. DAVIS, "CHRISTOPHER'S TEXTBOOK OF SURGERY," ED. 7; W. B. SAUNDERS CO., 1960

THREE TYPES OF INTESTINAL OBSTRUCTION: (A) VOLVULUS, OR TWISTING OF AN INTESTINAL LOOP; (B) CONSTRICTION BY ADHESIVE BANDS; (C) INTUSSUSCEPTION, OR THE TELESCOPING OF ONE SEGMENT OF BOWEL INTO ANOTHER SEGMENT

Adhesions are usually inflammatory in origin and follow in the wake of suppuration of the appendix, gall bladder and female generative organs (Fallopian tubes). Adhesions giving rise to obstruction often follow an abdominal operation. Ordinary talcum, with which surgeons formerly powdered their hands to facilitate pulling on of rubber gloves, is known to be a keen stimulus to adhesion formation, occasionally at a remote date after the operation.

5. Hernia (*q.v.*), or protrusion of a loop of bowel through a normal (inguinal, femoral, obturator, mesenteric or diaphragmatic) aperture or through an abnormal orifice (defect in abdominal wound following operation), is a common cause of obstruction.

6. Volvulus, or torsion of the bowel, may occur in the small intestine, caecum or sigmoid—areas in which a segment of bowel is pedicled on a narrow strip of mesentery.

7. Intussusception, or telescoping of one segment of the bowel into another, occurs most frequently in infants from four months of age through the first year of life. The cause is unknown. After two years of age, intussusception is relatively uncommon and a tumour such as a polyp, lipoma or cancer of the bowel is frequently found at the apex of the telescoped segment.

8. A number of miscellaneous congenital factors resulting from errors in development of the intestine may give rise to obstructions, among which the following may be enumerated: (*a*) anomalies of intestinal rotation; (*b*) extrinsic duodenal compression by congenital bands; (*c*) a persistent vitellomesenteric duct (Meckel's diverticulum) and umbilical eventration. In all of these, save the last, the obstruction may occur for the first time in childhood or even later.

9. Physiological imbalance in the nervous tone of the intestine may give rise to obstruction, which in this instance is often referred to as ileus. It may be paralytic (adynamic) in nature or spastic (dynamic). Spastic ileus mimics mechanical obstruction symptomatically. Peritonitis is the commonest cause of adynamic ileus. Deficiencies in the electrolyte (salt) pattern of the blood occasioned by loss of digestive fluids, either by vomiting or from severe diarrhea, may give rise to paralytic ileus. Notably, loss of potassium, chloride or sodium ions may be followed by a paretic state of the intestine, which can only be corrected by replacing the lost electrolytes.

10. Finally, thrombosis or embolism (plugging of the blood vessels of the mesenteric arteries or veins) may give rise to intestinal obstruction.

Consequences.—Whereas a number of different causes may be responsible for the development of bowel obstruction, there are essentially only two pathological types of obstruction: (1) simple

obstruction to the continuity of the bowel, best exemplified by a stricture in the gut wall and (2) strangulating obstruction, in which in addition to mechanical occlusion there is actual or potential deprivation of blood supply to the bowel (hernia, volvulus and intussusception).

In obstructions high in the intestinal canal, the loss of intestinal fluids and electrolytes through vomiting is frequent and constitutes an important element in the disease. Obstructions in the lower reaches of the small intestine (ileum) and the large intestine (colon) are attended regularly by intestinal distension because retrograde peristalsis and vomiting fail to evacuate the distended intestine.

In obstruction of the colon, moreover, the ileocaecal valve often delimits the distention to that segment of large intestine lying proximal to the obstruction, thus causing great hazard of rupture, particularly in the caecum, which lies just beyond the ileocaecal valve. It has been demonstrated by experiments on animals in which the opportunity for the swallowing of air is excluded that the chief source of gaseous distension in obstruction of the intestine is swallowed air.

Whereas students of intestinal obstruction prior to 1930 were likely to attribute the evil consequences of obstruction largely to abnormal permeability with absorption of noxious agents from the obstructed bowel, it later became more generally recognized that the ill effects of obstruction relate themselves essentially to the two items mentioned above: (1) loss of intestinal fluids and electrolytes by vomiting; and (2) the threatened loss of viability of the bowel wall occasioned by long-continued distention. With reference to the latter item, it is apparent that sustained intralumenal pressures maintained for some time above the mesenteric venous pressure (12 to 16 cm. of water) will interfere with the normal nutrition of the bowel wall. Anoxia or poor oxygenation of the bowel wall ensues in consequence of the arrest of venous outflow; as a result of anoxia, the bowel wall becomes devitalized. A bowel wall with impaired viability becomes abnormally permeable to noxious agents within its lumen, which now may migrate across the protective barrier of the damaged intestinal mucosa to the peritoneal cavity; from there, absorption occurs readily.

Recognition.—All mechanical varieties of obstruction (which make up by far the majority of all obstructions) are heralded by the presence of intestinal colic or "gas pains" occurring at the acme of an intestinal contraction or peristaltic wave. These contractions are accompanied by gurgling noises in the presence of a gut distended by both fluid and gas. The intestinal colic of gaseous distension (largely swallowed air) is accompanied by high-pitched sounds that usually have a metallic character. The noises (borborygmi) that accompany such contractions of the bowel are regularly attended by pain that is concurrent with the borborygmus, unlike the noise of the unobstructed gut, which is not accompanied by pain. These noises may be audible to the unaided ear but are elicited more readily on auscultation of the abdomen with a stethoscope.

Recurrent crampy abdominal pain with concurrent intestinal noises is synonymous with intestinal colic. Food indiscretions and the taking of a cathartic may simulate the intestinal colic of intestinal obstruction; however, the conditions they produce can be distinguished from mechanical obstruction by the absence of distension, their history and observation.

Strangulating obstruction, unlike simple obstruction, regularly is attended by abdominal tenderness. Percussion reveals the presence of tympanitic areas caused by the distended intestine, and a scout X-ray film of the abdomen indicates the extent and location of the distended intestinal coils.

An experienced observer summarizing these various findings may therefore determine: (1) whether obstruction is present; (2) whether strangulating or mere interference with the continuity of the intestine is present; and (3) where the obstruction is. He cannot in many instances, without recourse to exploratory operation, determine the exact variety of obstruction present.

Treatment of Intestinal Obstruction.—The object of treatment is to relieve distension and to restore the continuity of the intestinal canal. In obstructions in which vomiting has been an important factor, replacement of lost fluid and electrolyte by the intravenous administration of physiological saline and glucose solutions is important. Sir Frederick Treves of London, who wrote an important monograph upon the subject of intestinal obstructions in 1899, stated: "Those who are enamoured of statistics could, I have little doubt, show that it is less dangerous to leap from the Clifton suspension bridge than to suffer from acute intestinal obstruction and decline operation." Operation is still the mainstay of therapy. Every strangulating obstruction must be operated upon to free the strangulated loop from the agent that threatens its viability. All simple obstructions, such as a stricture, in which the block to intestinal continuity is persistent, must of necessity be subjected to operation. However, in a fairly large number of instances suction applied to an indwelling duodenal or long intestinal tube may succeed in decompressing the distended segment. Obstructions that owe their origin to inflammatory causes, nervous imbalance (paralytic or spastic ileus) or intestinal adhesions not uncommonly may relent when the bowel is decompressed by an indwelling intestinal tube. Attempting to relieve obstruction by such a tube is hazardous in that the obstruction may be strangulating in type or the obstructive mechanism may continue unrelieved. When satisfactory decompression of the distended bowel has not occurred within 12 hours following the employment of suction attached to a long intestinal tube, an operation should be undertaken. Use of a long intestinal tube provided with a stylet and coiled spring in its wall, passed at operation via mouth and stomach into the distended reaches of the obstructed small bowel, often permits decompression without having to open the distended bowel at operation. After the obstruction has been rectified, the stylet is withdrawn and the tube is left *in situ* to drain the bowel until assurances of physiological continuity of the bowel are in evidence.

The necessity of transfusing blood into the veins of patients having strangulating obstructions is apparent; for under the motive force of systolic blood pressure, blood is pumped into the vessels of the bowel wall and becomes imprisoned in the strangulated intestinal loop, thereby causing loss of blood from the circulation with consequent shock.

The inhalation of high concentrations of oxygen has been advised on the assumption that, despite the low coefficient of diffusion of nitrogen, inasmuch as the gas in the distended intestine is largely swallowed air (80% nitrogen), the breathing of pure oxygen by the patient will succeed nevertheless in removing by exhalation small but definite increments of gas from the distended bowel. Whereas this therapeutic procedure is sound in theory, it operates so slowly that it has little merit in practice. Oxygen administered in a hyperbaric pressure chamber has been used both experimentally and clinically to accelerate decrease of gaseous distension. A mechanical block cannot be removed in this manner.

Prognosis.—Recognition of the presence of intestinal obstruction earlier in its course, a better understanding of the ill consequences of obstruction, improvement in surgical technique, the employment of suction applied to indwelling long intestinal tubes and better schemes of intubating the duodenum quickly—all of these agencies combined to reduce materially the hazards of intestinal obstruction. The mortality of the presuction era (1931) was in the neighbourhood of 40% to 60% in the best surgical clinics of the world. By mid-20th century, however, mortality was reduced to the range of 10% to 12% in surgical clinics with a special interest in the problem of intestinal obstruction. Improvement continued to be recorded in the 1960s. When technical improvements permit surgeons to treat intestinal obstruction accompanied by great distension with the same effectiveness with which they now deal with similar conditions in the absence of distension the present mortality of acute intestinal obstruction will again be reduced considerably.

See also GASTROINTESTINAL TRACT, DISEASES OF; INTESTINE, SURGERY OF.

BIBLIOGRAPHY.—Sir Frederick Treves, *Intestinal Obstructions; Their Varieties and the Pathology, Diagnosis and Treatment* (1899); O. H. Wangensteen, *Intestinal Obstructions*, 3rd ed. (1955); Arnold S. Leon-

ard *et al.*, "Intestinal Decompression: Use of a Long Tube With a Coiled Spring Which Achieves Relief of Distension Without Enterotomy or Enterostomy," *Surgery*, 49:440 (April 1961). (O. H. W.)

INTESTINE: *see* DIGESTION; GASTROINTESTINAL TRACT.

INTESTINE, SURGERY OF. The intestine includes the following three anatomic entities of the gut from the stomach downwards: (1) duodenum; (2) small intestine; (3) large intestine. Although similar disease processes affect these three segments of bowel (*e.g.*, obstruction, perforation, infection and cancer), there is a marked difference in incidence, symptoms and surgical treatment. (*See* also GASTROINTESTINAL TRACT; GASTROINTESTINAL TRACT, DISEASES OF.)

Duodenum.—This short segment of intestine, about 9 to 11 in. long, lies between the stomach and the ligament of Treitz. The first portion is frequently involved with ulcer disease. Primary cancer of the duodenum, diverticula (outpouching), cysts, fistulas, inflammation, obstruction or perforation may occur but are uncommon unless related to ulcer disease. (*See* also ABDOMEN, SURGERY OF; GASTRIC AND DUODENAL ULCER.)

Small Intestine.—This portion of the intestinal canal is approximately 21 to 25 ft. long and extends from the ligament of Treitz to the ileocaecal valve. About 40% of the proximal bowel is known as the jejunum; the last 60% is called the ileum.

The commonest disease necessitating operation is obstruction of the normal flow of intestinal content (*see* also INTESTINAL OBSTRUCTIONS). Terms frequently used to describe obstructions include the following: ileus (from the Greek meaning "to twist" or "to roll," connoting colic), a broad term generally used to mean obstruction from any cause; paralytic ileus, failure of peristaltic activity; mechanical ileus, obstruction due to structural block, *e.g.*, adhesive band, hernia or intraluminal foreign body; strangulation obstruction, obstruction that not only occludes but also threatens to completely deprive the bowel of its blood supply; volvulus, a twisting or torsion of a loop of bowel that causes obstruction with or without strangulation; intussusception, the telescoping of one segment of bowel into another.

Approximately 8,000 deaths occur annually from mechanical obstruction of the intestines. Cramping abdominal pain, associated nausea and vomiting represent the classic symptoms. The diagnosis is usually confirmed by typical gas patterns seen on roentgen examination. Treatment consists of surgically relieving the obstructing process. This may be either simple, as severance of one adhesive band, or complicated, as excision of strangulated (dead) bowel with resuturing of the uninvolved ends of intestine.

Miscellaneous diseases of the small intestine that require surgery include regional enteritis (inflammation of bowel segments); traumatic tears of the intestinal wall; Meckel's diverticulum (an outpouching in the ileum); and rarely, benign and malignant tumours.

Large Intestine (Colon).—This portion of the gut is about 5 ft. long and is twice the diameter of the small intestine. Cancer is the most frequent indication for colon surgery. In the United States, about 35,000 persons die of colon cancer annually. The greatest hope for reduction of this problem is earlier diagnosis leading to earlier surgical removal. Less common, but not rare, disorders of the colon leading to operation include ulcerative colitis, diverticulitis and traumatic injury.

See also APPENDICITIS: *Removal of a Diseased Appendix;* DIVERTICULITIS AND DIVERTICULOSIS.

BIBLIOGRAPHY.—H. N. Harkins *et al., Surgery: Principles and Practice*, 2nd ed. (1961); L. S. McKittrick and F. C. Wheelock, Jr., *Carcinoma of the Colon* (1954); O. H. Wangensteen, *Intestinal Obstructions*, 3rd ed. (1955). (L. M. N.)

INTIBUCÁ, small department in southern Honduras, bordering El Salvador. Its area is 1,186 sq.mi., and the population (1961) was 72,981, of which 82% was rural. La Esperanza, the departmental capital and largest town, had only 1,959 people in 1950. Less than 35% of the department area is in farms, and only 18% of this is cultivated.

The principal products of Intibucá are wheat, corn, beans, cattle, hogs and handicraft articles. La Esperanza is famous for its hand-weaving industry. One second-class road connects La Esperanza with the Inter-Ocean highway. (C. F. J.)

INTOXICATION: *see* ALCOHOLISM; LIQUOR LAW.

INTRACOASTAL WATERWAY: *see* ATLANTIC INTRACOASTAL WATERWAY; GULF INTRACOASTAL WATERWAY.

INTROSPECTION, in psychology, is the process of observing the operations of one's own mind with a view to discovering the laws that govern the mind (Lat. *introspicere*, "to look within"). In a dualistic philosophy which divides the stuff of the natural world (matter, including the human body) from the contents of consciousness, introspection is the chief method of psychology. Thus it was the method of primary importance to the English school of philosophy—to Thomas Hobbes, John Locke, George Berkeley, David Hume, James Mill, John Stuart Mill, Alexander Bain and most of their contemporaries—as it was to the pioneers of the new experimental psychology, especially to Wilhelm Wundt, Oswald Külpe and E. B. Titchener.

To all these men the contents of consciousness appeared to be immediate experience: to have an experience was for them also to know that you have it, and in this sense introspection appeared to be self-validating; it could not lie.

Wundt and Titchener, as well as Külpe in his early years (1893), believed that introspection finds in consciousness only sensory materials—sensations proper, images which are centrally excited sensations, and feelings which closely resemble sensations. This view is known as classical introspection.

Many other psychologists, however, found other kinds of content in consciousness. Franz Brentano and Külpe in his later years were the most influential act psychologists who reported consciousness as constituted of both sensory contents and more impalpable acts.

Perpetual controversy about the results of introspection made it quite clear by 1920 that introspection is not infallible and, later, that its fallibility is due to the fact that it is not immediate but is an observational inferential process that takes time and is subject to errors of observation. This discovery came in with the rise of objective psychology and behaviouristics in America.

By 1940 both the concept of dualism and the word introspection had largely disappeared from scientific psychology, especially in the U.S., where behaviourism ruled. Though Gestalt psychology retained a dualistic philosophy, its leaders rejected introspection because the word was so closely identified with the classical form.

Actually the repudiation of dualism by modern experimental psychology led only to the surrender of the word introspection, not to the abandonment of the method. The general method (not classical introspection) is used without the name (1) in phenomenological description as the Gestalt psychologists used it, as the phenomenologists and existentialists—mostly in Europe—use it now, and as it is employed in the description of experience in perception (*see* GESTALT PSYCHOLOGY; PHENOMENOLOGY; EXISTENTIALISM); (2) in psychophysics, where are determined the relations of conscious events, usually of a sensory nature, to magnitudes of the stimulus, especially in the determination of the sensory thresholds and sensory scales (*see* PSYCHOPHYSICAL METHODS); and (3) in the protocols of patients as they describe their consciousnesses to psychiatrists and psychoanalysts, sometimes in free association on the psychoanalytic couch, sometimes in projective tests such as the Rorschach ink blots, where the subject, for diagnostic purposes, reports the train of thought aroused in him by an equivocal stimulus or situation.

See E. G. Boring, "A History of Introspection," *Psychological Bulletin*, vol. 50 (1953). (E. G. BOR.)

INTUITION is the power of obtaining knowledge directly, without recourse to inference or to reasoning. Two senses of the word must be distinguished, one of them ordinary and one technical, the technical differing from the ordinary in the respect that it refers to supposedly primary or self-substantiating and not alternative sources of knowledge. These senses are: (1) the acquisition of knowledge of matters of fact without reliance on the ordinary procedures of inquiry; (2) the acquisition of knowledge of a kind which cannot be obtained by inference (*e.g.*, the knowledge of the axioms and rules of inference employed in logic

and mathematics and of the principles of morals). There are in addition two further technical senses (3 and 4), as mentioned below.

1. In its colloquial sense, as in the phrase, "feminine intuition," the word is used to refer to the capacity for making rapid and accurate assertions about matters of fact in circumstances where reliance on the standard procedure of inquiry is ruled out. It is often, perhaps usually, exercised predictively, on such matters as the outcome of horse races, impending disasters or the behaviour of someone in a yet unrealized state of affairs. For final justification of a claim to knowledge about the future we have to wait for the actual outcome. But before the event one may be quite confident of the truth of one's prediction. This confidence may arise from the strength of the inference leading to the prediction. But it may be that one "just knows," that one is not aware of any inference supporting one's prediction; and in such cases one is making a claim to intuition of the event predicted. This claim is not substantiated by the correctness of the prediction; it may have been a lucky guess. It is only if a man's claims to knowledge in advance about a certain subject matter are regularly correct that a power of intuition can be ascribed to him. For there is then inductive ground for taking his conviction as a reliable index of the truth of what he is convinced about. The existence and unequal distribution of such powers are not difficult to explain. One may be sensitive to significant features of what is currently observable without being aware of the fact (*e.g.*, facial expression as an index of character). This sensitivity will depend in part on natural endowment (*e.g.*, acute hearing) and in part on thorough familiarity with the subject matter in question. In this sense, then, claims to intuition arise either from implicit inference or from lucky guessing. We can only tell which, and thus on which to rely, by waiting to see if the claims are borne out significantly often.

So intuition here is not an independent source of knowledge. It is either inferential knowledge in a disguised form or not knowledge at all but guesswork.

2. In its most familiar philosophical interpretation intuition is the power of obtaining knowledge which cannot be acquired by either inference or observation, reason or experience. As such it is thought of as an original, independent source of knowledge, since it is designed to account for just those kinds of knowledge which other sources of knowledge do not provide. Our knowledge of necessary truths and of moral principles has been explained in this way.

In the first place, some necessary truths, statements of logic and mathematics, can be inferred, logically derived, from others. But not all can: there must be some uninferred statements (*i.e.*, axioms). Furthermore, the interconnected character of the system, the derivability of statements from axioms, presupposes rules of inference. Now the truth of axioms and the validity of basic rules of inference cannot be established by inference, since inference presupposes them, or by observation, which can never establish necessary truths. So they are held to be objects of intuition. Axioms are ordinarily truisms, consequently self-evidence is taken as a mark of intuition. To "see" that one statement follows from another, that a particular inference is valid, enables one, it is said, to make an "intuitive induction" of the validity of all inferences of that kind. Other nonformal necessary truths (*e.g.*, "nothing can be red and green all over") are also explained as intuitive inductions: we are held to "see" a universal and necessary connection through a particular instance of it.

Second, moral philosophers, from Bishop Butler and the Moral Sense school to G. E. Moore and the Oxford moralists, have held that moral assertions record knowledge of a special kind. The rightness of actions (or, in Moore's case, the goodness of states of affairs) is discovered by a special moral faculty, seen as analogous to the power of observation (Moral Sense school, Moore) or the power of intuiting logical principles (Oxford moralists). This theory, like that which holds logical principles to be the outcome of intuition, bases its case on the self-evident and unarguable character of the assertions with which it is concerned.

Against both theories much the same argument can be brought forward. The "axioms" of logic and morality do not require for their interpretation a special source of knowledge, since neither record discoveries: rather they record resolutions or conventions, attitudes that we adopt toward discourse and conduct, not facts about the nature of the world or man. A further argument against the theory of moral intuition depends on the markedly discordant character of the deliverances of the supposed source of knowledge.

3 and 4. Two further technical senses of the word may be briefly mentioned. One, deriving from Kant, is that in which it is understood as referring to the source of all knowledge of matters of fact not based on, or capable of being supported by, observation; that is to say, of matters of fact which observation directly or immediately reveals. The other is the sense attached to the word by Spinoza and by Henri Bergson, in which it refers to supposedly concrete knowledge of the world as an interconnected whole as contrasted with the piecemeal, "abstract" knowledge obtained by science and by common observation.

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INULIN, a polysaccharide that bears to the sugar levulose (D-fructose) a relationship similar to that of starch to glucose. It is used in making bread for diabetics and in diagnostic tests of kidney function. Inulin occurs in many plants of the large family Compositae (*q.v.*) to which the elecampane belongs; it is especially abundant in tuberous roots such as those of dahlia and Jerusalem artichoke. Inulinlike substances from various sources have been given distinctive names such as graminin (from certain grasses), irisin (from iris), etc. Fine inulin forms a white tasteless powder, sparingly soluble in cold water, very soluble in hot water and insoluble in alcohol. Dilute mineral acids or the enzyme inulase convert inulin into levulose (D-fructose). In many plants inulin is detected by the spherocrystals that form on steeping tissue slices in strong alcohol. *See* CARBOHYDRATES. (F. C. SD.)

INVAR, an alloy of 36% nickel, small amounts of manganese, silicon and carbon (less than 1% total), and the balance iron, characterized by an extremely small thermal expansion. The average coefficient is 0.70×10^{-6} per 1° F. (0.8×10^{-6} per 1° C.) for Invar compared with 6.8×10^{-6} per 1° F. (11×10^{-6} per 1° C.) for steel (0° to 200° F.) (about −18° to 96° C.). In applying these alloys it is important to recognize that their expansivity is dependent upon the temperature involved. The range for lowest coefficient is −60° F. to 175° F. (about −50° to 80° C.). Invar is used where it is advantageous to avoid temperature compensation; *i.e.*, for absolute standards of length, thermostatic strip, rods and tapes for surveying, horological instruments, glass-to-metal seals and in radio, electronic and jet-engine components. The name Invar was selected by its inventor Charles Édouard Guillaume (*q.v.*) to express the invariability of its dimensions with heat. (R. A. LR.)

INVARIABLE PLANE, the plane through the centre of gravity of the whole solar system for which the total angular momentum of the system about any axis in the plane is zero. Although the positions of the orbital planes of individual planets are affected by the motions of the other bodies in the solar system, Pierre Laplace demonstrated that no motions within the system can alter the total angular momentum. Thus, aside from minute effects due to the attractions of distant stars, the orientation of the invariable plane is fixed in space. A fundamental reference plane for the solar system, it lies between the orbital planes of the two massive planets, Jupiter and Saturn, at an inclination of roughly 1° 35′–1° 39′ to the ecliptic (*q.v.*). (D. L. H.)

INVARIANTS. The notion of invariant arises as soon as a mathematical construct is subjected to any one of a given group of transformations; and a search is made for properties of the construct (inner geometric properties) that are independent of the transformations (frameworks, co-ordinate systems) used to survey the structure. Necessarily this general definition is only partially satisfactory, since the idea of invariant in the history of mathematics has not been static. This discussion will first give some

illustrative examples of invariants, then show how the idea developed during the 19th century and finally will survey some modern developments.

Examples of Invariants.—Consider the quadratic polynomial $f = ax^2 + bx + c$. The equation $f = 0$ defines two points on the x-axis, the roots of the equation, and although the values of the roots depend on the origin chosen for the co-ordinate system, the difference between the roots must be independent of the origin. If a new origin of co-ordinates is defined by means of the transformation $x = X + \alpha$, the quadratic form becomes $f' = a'X^2 + b'X + c'$, where $a' = a$, $b' = 2a\alpha + b$, and $c' = a\alpha^2 + b\alpha + c$. The difference of the roots of the quadratic equation $f = 0$ is given as

$$\text{difference} = \frac{(b^2 - 4ac)^{\frac{1}{2}}}{a}$$

In the transformed equation $f' = 0$ it is found that $b'^2 - 4a'c' = (b + 2a\alpha)^2 - 4a(a\alpha^2 + b\alpha + c) = b^2 - 4ac$, and therefore

$$\frac{(b^2 - 4ac)^{\frac{1}{2}}}{a} = \frac{(b'^2 - 4a'c')^{\frac{1}{2}}}{a'}$$

Clearly, this is an example of an invariant associated with a quadratic polynomial, under the group of translations along the x-axis.

With a binary quadratic form $ax^2 + bxy + cy^2$ the orthogonal transformation

$$x = X\cos\theta - Y\sin\theta$$
$$y = X\sin\theta + Y\cos\theta$$

(corresponding to a rotation of the (x, y)-axes about the origin) produces the form $a'X^2 + b'XY + c'Y^2$, where

$$a' = a\cos^2\theta + b\cos\theta\sin\theta + c\sin^2\theta$$
$$b' = -2a\cos\theta\sin\theta + b(\cos^2\theta - \sin^2\theta) + 2c\sin\theta\cos\theta$$
$$c' = a\sin^2\theta + b(-\sin\theta\cos\theta) + c\cos^2\theta$$

It is apparent that $a' + c' = a + c$; and it is also found that $b'^2 - 4a'c' = b^2 - 4ac$. Therefore, two invariants have been found associated with this binary quadratic form under orthogonal transformation. If one of these invariants is zero in one co-ordinate system, it will be zero in any other of the co-ordinate systems considered, and thus the vanishing of any one of these invariants expresses an inner geometric property of the construct. In fact, if $a + c = 0$, the pair of lines through the origin represented by the vanishing of the binary quadratic form are at right angles, and this property is preserved under rotation of orthogonal axes. If $b^2 - 4ac = 0$, the pair of lines are coincident in the given co-ordinate system, and also in any other. The question of whether there are any other invariants attached to this form will be discussed in a more general context later.

The idea of an invariant already appears in C. F. Gauss' *Disquisitiones Arithmeticae* (1801), in which the binary quadratic forms $f = ax^2 + bxy + cy^2$ are studied under the linear transformations $x = \alpha x' + \beta y'$ and $y = \gamma x' + \delta y'$ where $\alpha\delta - \beta\gamma = r$. The resulting forms are $f' = a'x'^2 + b'x'y' + c'y'^2$, and it is easily verified that the discriminant (or determinant, as Gauss called it) $D' = b'^2 - 4a'c' = r^2(b^2 - 4ac) = r^2D$. In number theory the case for which a, b, c, d, α, β, γ, δ are all integers, with $r = 1$ (unimodular transformation) is of special interest. Conditions satisfied by the coefficients of the forms are sought that will permit one form to be transformed into another; this is the problem of the equivalence of forms. The condition $D' = D$ is a necessary, but by no means sufficient, condition. The discriminant is a relative invariant under the general linear transformation, and an absolute invariant under the unimodular transformation (*see* NUMBERS, THEORY OF: *Representation by Forms*).

Nineteenth-Century Developments.—The classification of binary quadratic forms just mentioned has a considerable background in geometry, and the subsequent development of invariant theory was influenced even more by geometrical considerations, induced by the study of projective geometry. The great British triumvirate of A. Cayley, G. Salmon and J. J. Sylvester, the Germans A. Clebsch and P. Gordan among others and the Italians F. Brioschi, L. Cremona and E. Beltrami all helped in this development. The founding of *Mathematische Annalen* in 1868, and the many papers published therein from numerous countries, reflected the improvement of communications among mathematicians; invariant theory especially flourished in this epoch.

The notion of determinant (*q.v.*), first mentioned by G. W. Leibnitz, developed by A. Vandermonde in the 18th century and A. L. Cauchy in the 19th century as an effective mathematical instrument, and brought to its full fruition by K. G. J. Jacobi is fundamental in classical invariant theory. The major properties of determinants were commonly taught in mathematics courses above the elementary level in the 1960s. The determinant

$$\begin{vmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ \cdot & \cdot & \dots & \cdot \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{vmatrix} = |a_{ik}|$$

is a simultaneous invariant of the n linear forms $\Sigma a_{1i}x_i$, $\Sigma a_{2i}x_i$, . . . , $\Sigma a_{ni}x_i$. This means that if the substitution $x_k = \Sigma\alpha_{kl}y_l$ is made so that the n linear forms transform into $\Sigma a'_{1l}y_l$, $\Sigma a'_{2l}y_l$, . . . , $\Sigma a'_{nl}y_l$, then the new determinant $D' = |a'_{ik}|$ is connected with the old $D = |a_{ik}|$ by the equation $D' = rD$, where $r = |\alpha_{ik}|$ is the determinant of the substitution. This follows immediately from the law of multiplication for determinants. The determinant is a relative invariant under the general linear transformation.

Generalizing the notion of linear transformation used so far results in what are called functional determinants. Here, n differentiable functions $f, g, h, \dots$ of $x_1, x_2, \dots, x_n$ are considered in forming the determinant

$$\begin{vmatrix} f_1 & f_2 & \dots & f_n \\ g_1 & g_2 & \dots & g_n \\ h_1 & h_2 & \dots & h_n \\ \cdot & \cdot & \dots & \cdot \end{vmatrix}$$

of partial differential coefficients where $f_i = \partial f/\partial x_i$. The relations $\partial f/\partial y_i = f_1\partial x_1/\partial y_i + f_2\partial x_2/\partial y_i + \dots + f_n\partial x_n/\partial y_i$, with similar relations for $g, h, \dots$, together with the multiplication law for determinants, show that this determinant of partial derivatives is invariant under the assumed set of transformations. The vanishing of this invariant expresses a more complicated inner geometrical structure: that of functional dependence of the set of functions $f, g, h, \dots$. The necessity is easily established since, if there exists a functional relationship $\phi(f, g, h, \dots) = 0$, it yields the n linear equations $f_i\partial\phi/\partial f + g_i\partial\phi/\partial g + h_i\partial\phi/\partial h + \dots = 0$, and the determinant of the coefficients of these n linear equations is 0.

If a form $f(x_1, x_2, x_3)$, homogeneous of degree n in the variables x_1, x_2, x_3 is considered, then $f = 0$ is the equation of a plane curve. Associated with this curve is the Hessian (functional determinant)

$$H = \begin{vmatrix} f_{11} & f_{12} & f_{13} \\ f_{21} & f_{22} & f_{23} \\ f_{31} & f_{32} & f_{33} \end{vmatrix}$$

(named after L. O. Hesse), where $f_{ij} = \partial^2 f/\partial x_i\partial x_j$. This curve is invariantly associated with the original curve, and since this Hessian determinant contains the variables x_1, x_2, x_3, it is called a covariant of the form f. The curve $H = 0$ can be shown to cut $f = 0$ in the inflexions of the latter curve. Hesse made a detailed study of the plane cubic and quartic curves, his aim being to express geometric properties of the curves by means of invariants and covariants.

The study of the invariants of curves and algebraic varieties of higher dimension under the group of birational transformations arose naturally in Italy and Germany in the later 19th and early 20th centuries. Mention need only be made here of M. Noether, and the three Italians C. Segre, G. Castelnuovo and F. Enriques; the subject of algebraic geometry (*q.v.*) that they initiated was taking on new life in the 1960s.

Consider now the invariants of quadratic forms under the group of regular linear transformations. A quadratic form $\sum_{i,k=1}^{n} a_{ik}x_ix_k$ ($a_{ik} = a_{ki}$) is a natural generalization of the ternary quadratic forms $ax^2 + by^2 + cz^2 + 2fyz + 2gzx + 2hxy$ studied in the theory of conic sections, the consequential changes in notation deriving from the growth of matrix theory (*see* MATRIX) and the double-suffix notation for the position of an element in a given row and

column. Associated with any quadratic form $\Sigma a_{ik}x_ix_k$ there is the symmetric matrix $[a_{ik}]$. The problem of the equivalence of quadratic forms is bound up with the rank of their representative matrices. If two quadratic forms have matrices of the same rank, then a suitable linear transformation will take one form into the other. This assumes that the underlying field of numbers is such that the square root of any given number in the field also lies in the field.

For linear transformations over such a field, the rank is the only invariant of a quadratic form, and this integer describes the geometric complexity of the algebraic variety $\Sigma a_{ik}x_ix_k = 0$. For example, if $n = 3$, and the rank is 3, the curve represented is an irreducible conic. If the rank is 2, the curve is a pair of straight lines, and if the rank drops to 1, the curve is a pair of coincident lines.

For linear transformations over a real field, the situation changes. The given quadratic form can be transformed into $z_1^2 + z_2^2 + \ldots + z_s^2 - t_{\overline{1}}^2 - t_{\overline{2}}^2 - \ldots - t_{\overline{r-s}}^2$. The total number of squares r = rank $[a_{ij}]$, but now the total number s of positive squares (or $r - s$ of negative squares) is an invariant also, and under real linear transformations real quadratic forms have two numerical invariants; this is called Sylvester's law of inertia. Once again the inner geometric properties of quadratic varieties over a real field depend on their two invariants.

Now consider invariants from a slightly more general point of view. This discussion has been dealing with quantities with n components $x = (x_1, x_2, \ldots, x_n)$. These are called vectors, and their ambience is an n-dimensional vector space. Let there be given a group Γ of linear transformations A in an n-dimensional vector space P. A function $f(x, y, \ldots)$ depending on a number of argument vectors $x = (x_1, x_2, \ldots, x_n)$, $y = (y_1, y_2, \ldots, y_n), \ldots$ in P will change into a transform $f' = Af$ if $x, y, \ldots$ are sent by the linear transformation A into $x' = Ax$, $y' = Ay, \ldots$; this gives $f'(x', y', \ldots) = f(x, y, \ldots)$. If $Af = f$ for all substitutions A of the group Γ, the function f is called an invariant of Γ.

This concept may be illustrated by considering the symmetric group of linear transformations (*see* GROUPS; GROUPS, TRANSFORMATION). Symmetric functions $f(x_1, x_2, \ldots, x_n)$ of n arguments $x_1, x_2, \ldots, x_n$, that is, functions invariant under the group π_n of all $n!$ possible permutations of the n arguments, occur frequently in the theory of algebraic equations. These permutations are obviously linear transformations of the n-dimensional vector $x = (x_1, x_2, \ldots, x_n)$. The so-called elementary symmetric functions $\phi_1, \phi_2, \ldots, \phi_n$ are the coefficients of the polynomial $\phi(t)$ where $\phi(t) = (t - x_1)(t - x_2)\ldots(t - x_n) = t^n - \phi_1(x)t^{n-1} + \phi_2(x)t^{n-2} - \ldots \pm \phi_n(x)$ has the roots $x_1, x_2, \ldots, x_n$. Here, the following relations obtain:

$$\begin{aligned}
\phi_1(x) &= \Sigma x_i \\
\phi_2(x) &= \Sigma x_i x_k \text{ where } i < k \\
\phi_3(x) &= \Sigma x_i x_k x_l \text{ where } i < k < l \\
&\vdots \quad\quad \vdots \\
\phi_n(x) &= x_1 x_2 x_3 \ldots x_n
\end{aligned}$$

Any symmetric function of the vector x is, by our definition, an invariant of the symmetric group. The main theorem concerning symmetric functions is that they can be expressed in terms of the elementary symmetric functions $\phi_i(x)$. More explicitly, if $f(x_1, x_2, \ldots, x_n)$ is any symmetric function of the arguments $x_1, \ldots, x_n$, then there exists a function $F(\zeta_1, \ldots, \zeta_n)$ of the n arguments $\zeta_1, \ldots, \zeta_n$ such that $f(x) = F(\phi_1(x), \phi_2(x), \ldots, \phi_n(x))$. The functions $\phi_i(x)$ (where $i = 1, 2, \ldots, n$) are said to form a functional basis for the symmetric functions.

This is not a deep theorem if a function is being considered in the general sense. If the values of the $\phi_i(x)$ are given, the values of $x_1, x_2, \ldots, x_n$ are determined, except for their order, as the roots of $\phi(t) = 0$, and since the order does not affect the value of $f(x_1, \ldots, x_n)$, then $f(x)$ is determined by hypothesis, or is a function of the $\phi_i(x)$. But if $f(x)$ is a polynomial in $x_1, x_2, \ldots, x_n$, it is asked whether F is also a polynomial in $\zeta_1, \ldots, \zeta_n$. The main theorem for symmetric functions gives an affirmative answer.

Main Theorems.—The so-called first main theorem of general invariant theory is suggested by this example. This theorem says that all invariants are expressible in terms of a finite number among them. This is not true for all groups, but holds in the most important cases. The algebraic, as distinct from the functional, formulation of the dependence is, in all cases, the difficult part of the proof.

Another important group $\Gamma = O(n)$ of orthogonal transformations that is fundamental in Euclidean geometry provides a further illustration. Consider functions of two arbitrary vectors x,y that are invariant under all orthogonal transformations. The first fundamental theorem asserts that the scalar products that may be constructed for these two vectors, that is, the three products (xx), $(xy) = (yx)$ and (yy) form a basis. If $x = (x_1, x_2, \ldots, x_n)$ and $y = (y_1, y_2, \ldots, y_n)$, the scalar product $(xy) = \sum_1^n x_i y_i$.

Now the functional part of this statement is merely the fundamental proposition about the congruence of triangles that says: the triangles ABC and A′B′C′ are congruent when two sides and the included angle of one triangle coincide with the corresponding elements of the other. In our notation, if two figures, each consisting of a pair of vectors x,y and x',y', are congruent, that is, transformable into each other by an appropriate orthogonal transformation, then it must be that

$$\begin{aligned}
(xx) &= \text{AB}^2 = \text{A}'\text{B}'^2 = (x'x') \\
(xy) &= \text{AB}\cdot\text{AC}\cos\theta = \text{A}'\text{B}'\cdot\text{A}'\text{C}'\cos\theta' = (x'y') \\
(yy) &= \text{AC}^2 = \text{A}'\text{C}'^2 = (y'y')
\end{aligned}$$

where θ is the angle between AB and AC, and θ' is the angle between A′B′ and A′C′. The algebraic proposition that every orthogonally invariant form $f(x,y)$ is expressible as a polynomial in the three scalar products is also true, but is a much deeper theorem.

To give more details of the first fundamental theorem for the orthogonal group, the result for the orthogonal invariants of an arbitrary number of argument vectors $x, y, \ldots, z$ is easily stated. A complete table of basic invariants is given by the symmetric matrix of all the scalar products

$$\begin{bmatrix}
(xx) & (xy) & \ldots & (xz) \\
(yx) & (yy) & \ldots & (yz) \\
\cdot & \cdot & \cdots & \cdot \\
(zx) & (zy) & \ldots & (zz)
\end{bmatrix}$$

If there are only the two vectors x and y, then the basic invariants (xx), (xy) and (yy), at least if the number of dimensions $n \geq 2$, are capable of all numerical values satisfying the inequality $(xy)^2 \geq (xx)\cdot(yy)$, corresponding to $\cos^2\theta \leq 1$, but otherwise the lengths of two sides of the triangle and the angle included may be assigned arbitrarily. From the algebraic standpoint, however, the quantities (xx), (xy) and (yy) are independent, since they are not bound by any algebraic relation.

The situation changes if the number h of independent vectors $x, y, \ldots, z$ exceeds the dimension n of the vector space. If there are $n + 1$ vectors $x, y, \ldots, z$, for example, they must be linearly dependent, and there is a relation $ax + by + \ldots + cz = 0$ among them. Forming the scalar product with $x, y, \ldots, z$ gives the $n + 1$ equations

$$\begin{aligned}
a(xx) + b(xy) + \ldots + c(xz) &= 0 \\
a(yx) + b(yy) + \ldots + c(yz) &= 0 \\
\cdot \quad\quad \cdot \quad\quad \cdots \quad\quad \cdot & \\
a(zx) + b(zy) + \ldots + c(zz) &= 0
\end{aligned}$$

and therefore the determinant

$$\begin{vmatrix}
(xx) & (xy) & \ldots & (xz) \\
(yx) & (yy) & \ldots & (yz) \\
\cdot & \cdot & \cdots & \cdot \\
(zx) & (zy) & \ldots & (zz)
\end{vmatrix} = 0$$

and the basic invariants are algebraically dependent.

The first major problem in the theory of vector invariants of a given group Γ is the determination of a set of basic invariants, and the first main theorem (that cannot, however, be asserted for all groups Γ) states the finiteness of such a basis. The second main problem consists in determining the totality of algebraic relations that hold among the basic invariants $\phi_1(x, y, \ldots)$, $\phi_2(x, y, \ldots)$, $\ldots, \phi_r(x, y, \ldots)$, or rather in finding a number of such relations of which all others are algebraic consequences. The finiteness of this number is the statement of the second main theorem. It holds for any group for which the first main theorem is true. This theorem, now to be considered, proves the existence of a finite num-

ber of relations, but in any given case the basis for the invariant relations still must be constructed.

The proof of the second main theorem is a special case of David Hilbert's famous basis theorem. Gordan, who had spent years in finding the bases for the invariant relations for various geometrical constructs, remarked of this very general proof: "This is not mathematics; this is theology." In fact, so general is Hilbert's work, inspired by invariant theory, that it nearly put an end to the theory of invariants.

Hilbert's theorem deals with polynomial ideals and proves that if k is any field, then every ideal in the ring of polynomials $k[\zeta_1, \ldots, \zeta_r]$ has a finite basis. Now, returning to invariants, all polynomials $R(\zeta_1, \ldots, \zeta_r)$ (relations) of r independent variables $\zeta_1, \ldots, \zeta_r$ that vanish after the substitution $\zeta_i = \phi_i(x, y, \ldots)$ identically in $x, y, \ldots$ form an ideal $\mathfrak{J}$ within the ring of the polynomials of the indeterminates $\zeta_1, \ldots, \zeta_r$. According to Hilbert's theorem, the ideal $\mathfrak{J}$ has a finite basis $R_1, \ldots, R_t$. All relations $R = 0$ that hold among the r basic invariants $\phi_i(x, y, \ldots)$ are thus consequences of the t relations $R_1 = 0, \ldots, R_t = 0$.

The General Concept of Invariant.—Finally, mention should be made of the general notion of invariant. The classical notion is usually concerned with a given group Γ of linear transformations A. The general notion is relative to a given abstract group $\gamma = \{s\}$ and a number of representations of γ of degrees $m, n, \ldots$, respectively: $\mathfrak{A} : s \rightarrow A(s)$, $\mathfrak{B} : s \rightarrow B(s), \ldots$. A function $\phi(x, y, \ldots)$ depending on an arbitrary quantity x of type $\mathfrak{A}$, another quantity y of type $\mathfrak{B}$ will be a certain function f of the numerical vectors $x = (x_1, \ldots, x_m)$, $y = (y_1, \ldots, y_n), \ldots$ in terms of a given frame of reference, and will be a certain function f' in another frame of reference in which the same elements have the components $x' = (x_1', \ldots, x_m')$, $y' = (y_1', \ldots, y_n'), \ldots$, and $\phi = f(x, y, \ldots) = f'(x', y', \ldots)$. If s is the transition from the first to the second frame, then $x' = A(s)x$, $y' = B(s)y, \ldots$, and the transform f' is denoted by sf. The function ϕ is an invariant if its algebraic expression f does not depend on the frame, so that $sf = f$ for all elements s of the group γ.

The generalization is on two fronts: the group considered is not necessarily the general linear group, or one of its subgroups, and the theory of group representations is the tool for the introduction of abstract groups, and the linking of the general theory to the elementary theory. Projective geometry (*q.v.*) so dominated the geometers of the first half of the 19th century that they tried to fit all geometrical considerations into the projective scheme. The emphasis on the group of transformations as the ruling principle in any kind of geometry came with F. Klein's Erlangen program (1872), presented in the paper *Vergleichende Betrachtungen über neuere geometrische Forschungen.* It is now clear that the study of the groups themselves and of their representations must necessarily precede the study of their invariants.

The theory of the representation of groups by linear transformations was created by G. Frobenius during the years 1896–1903. W. Burnside, independently, and I. Schur, in continuation of his work, found an essentially simpler approach by laying stress on the representing matrix itself rather than on its trace, the Frobenius character. Fundamental work in the modern development was carried out by J. H. M. Wedderburn and Schur soon after the turn of the century, and more recently by L. E. Dickson and A. A. Albert in the U.S. and E. Noether, H. Weyl and R. Brauer in Germany, and then in the U.S.

In summary, this has been a discussion of the classical theory of invariants. Additional coverage of the topic, including more recent developments relating in part to topology, may be found in ELASTICITY: *Theory of Strain;* GROUPS, CONTINUOUS: *Invariants of an Exterior Differential System;* TOPOLOGY, GENERAL: *Topological Properties.*

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INVENTIONS AND DISCOVERIES. It is impossible to define "invention" with the breadth demanded by literary, scientific and legal usage. A poem, a musical composition, a theory which explains how light is transmitted from a source to the eye is as much of an invention as an electronic computer that solves in minutes problems that would ordinarily engage a mathematician for weeks. So is the universe of any cosmologist, ancient or modern. In this article technological inventions are the principal subject of discussion.

No sharp distinction can be drawn between invention and discovery. Gunpowder, a mixture of potassium nitrate, carbon and sulfur, certainly had to be discovered; yet it was also an invention. There are hundreds of such examples not only in chemistry but in engineering.

Discoveries often lead to invention. Thus the discovery that liquids expand and contract with variations in temperature led to the invention of the thermometer. Michael Faraday's discovery of electromagnetic induction was the basis of the telegraph, the telephone, the electric generator and motor, in fact of electric engineering. Conversely inventions often lead to discovery. Out of the steam engine came important theories that led to the development of thermodynamics and thus to more efficient steam engines. Out of Thomas A. Edison's electric lamp came the discovery that a feeble current could pass from the hot filament through empty space to a metal plate sealed in the bulb—the basis of the vacuum tube.

If the term "invention" is to be broadly defined as an act of the creative imagination, it is easy to understand why the French patent act of 1791, based on the Declaration of the Rights of Man and of the Citizen (1789), placed economic or social inventions on the same footing as mechanical and scientific inventions. Patents were therefore granted for tontine life annuities, tariff systems, credit plans, types of mortgages, banking systems, exchange controls and methods for guaranteeing the value of assignats. When it became apparent that there would be an avalanche of such schemes the national assembly on Sept. 20, 1792 decreed that the executive power should not only cease to grant patents for financial inventions but also to counteract the effect of those already granted.

The Inevitability of Invention.—Given a technical heritage and the right social environment, invention is inevitable. The phenomenon of simultaneous invention and discovery illustrates this. Alexander Graham Bell and Elisha Gray filed applications for telephones on the same day. Charles Martin Hall and Paul L. T. Héroult (1863–1914) discovered or invented the process of making aluminum independently and almost simultaneously. (*See* TELEPHONE; ALUMINUM.) Tessie du Motay (French) and Thaddeus Lowe (American) independently devised the process for making water gas by passing steam over red-hot coal; William Kelly and Sir Henry Bessemer, the one in the United States, the other in England, made steel by blowing air through molten iron to burn out the carbon (*see* CONVERTER STEEL). The history of invention and of the patent law is full of such examples and every year there are "interferences" in the United States patent office—judicial processes to settle rights of inventors who apply for patents on identical machines or processes. Since so many important inventions are conceived simultaneously and independently it is evident that inventive genius is not unique. In any community of 100,000 there are bound to be a certain number of ingenious mechanics, exceptional painters and fine musicians.

From this it almost follows that there are very few "first" inventions, in the sense that they owe nothing to earlier technical knowledge. Most of these must be credited to primitive man. Among them are the wheel, the bow and arrow, the fire drill, the boat, pottery, agriculture, domestication of animals, basketmaking. The melting of metals (gold, copper), the use of the lever, saw, wedge, pulley and rope are very old. Modern inventions as a whole are combinations of well-known elements that produce new results and serve new and useful purposes. Without a heritage technology could not advance. It was largely lack of a technical heritage that made it impossible for Leonardo da Vinci to invent a practical flying machine. For lack of a technical heritage Edison as a caveman would not have invented the phonograph, electric lamp and other devices with which his name is coupled.

How difficult it is to credit any inventor with having been the first in his field is shown by the history of the steamboat. About 30 steam-powered craft, more or less successful, had been built before Robert Fulton went up the Hudson river in his "Clermont" (1807). There was John Fitch who had a steamboat that ran on the Delaware river in 1787; Oliver Evans who built for Philadelphia in 1803 a combined scow and dredge which ran as a steam automobile on land and as a steamboat on the Schuylkill river; James Rumsey who began his experiments in the presence of George Washington; John Stevens who built a screw-propelled steamer in 1802; and William Symington, an Englishman whose "Charlotte Dundas" was a notable success (1802). The histories of the telegraph, the reaper, the motion picture, the filament electric lamp, the sewing machine and the elevator also shatter the pretensions of "first" inventors as a class.

Much, though not all, industrial progress followed discoveries made in the laboratory. Thus the discovery of the benzene ring by Friedrich August Kekulé emphasized the importance of molecular structure in organic chemistry and made it possible literally to design organic molecules with valuable properties. Similarly the mathematical development of the theory of the electromagnetic field by James Clerk Maxwell left it to be inferred that there is a broad spectrum of electromagnetic waves at one end of which lie light waves and at the other what were first called Hertzian waves after Heinrich Rudolf Hertz and later radio waves. Inventors of mechanical and electrical machinery apply such broad generalizations and theories, but the original discoveries or theories are not patentable.

Patent Legislation.—The Statute of Monopolies of James I of England, enacted in 1624, was designed to abolish privileges and monopolies which had become a public scandal. An exception was made of letters patent for the invention of new products. This dislike of monopolies as a whole and the exception made in the case of patents granted to inventions are part and parcel of the legal policy of the United States, Great Britain and other countries.

Patent legislation in the modern sense made its appearance toward the end of the 18th century. The constitution of the United States provided for the granting of patents somewhat after the British system but with the important stipulation that an application for a patent could be filed only by the inventor. In France, as noted above, patent legislation goes back to 1791. Before that the granting of patents was a royal prerogative. Some of the German states passed patent laws as early as 1815, but an over-all German patent law was not enacted until 1842. Most European countries followed the example set by the United States, Britain and Germany, some applying the British system, some the German.

Though Anglo-Saxon countries encouraged invention by the granting of patents it became apparent in the first half of the 20th century that there were as many objections to patent monopolies as to the trade and manufacturing monopolies that led to the promulgation of the Statute of Monopolies. In the United States large corporations may acquire literally several thousand patents to dominate an entire industry. This domination of a whole "art," as it is called in legal parlance, is opposed to Anglo-Saxon thinking on monopolies of any kind. Even in countries such as the United States, which are not socialistically inclined, the government is undermining the patent monopoly sometimes in direct violation of the patent law. The interests of the inventor are subordinated to those of society, with the result that in both Britain and the United States great corporations have been compelled to grant licences to those who want them, sometimes without the payment of royalties. Thus the United Shoe Machinery company was forced to grant licences under its hundreds of patents to all its competitors. Similarly the Aluminum Company of America had to relinquish monopolistic control of its many patents. Imperial Chemical Industries and du Pont de Nemours had to dissolve an agreement that was regarded as a cartel and to throw about 2,000 patents into the public domain.

By the second half of the 20th century, about 2,000,000 inventions had been patented in the United States. Prior to 1900 about 600,000 patents covering the first 110 years of the United States patent system had been granted. Most of these patents described inventions which lacked novelty or which were commercially impractical. (*See* PATENT.)

Encouragement of Invention.—Patent laws in general and those of the United States in particular were formulated on the theory that inventors should be encouraged, that inventive genius was rare, that society must await the coming of a Morse, Bell, Marconi or Edison before it could receive a new technological impetus, and that privileges in the form of limited monopolies should be granted to such men to make, sell and use their inventions as they saw fit in return for complete disclosure. The principle seems sound, yet the hundreds of thousands of patents granted in advanced countries leave no doubt that inventive ability is commoner than was generally supposed. Moreover, physicians, surgeons, engineers and professors of science invent many ingenious instruments and procedures that are never patented.

Some leaders of industry have attributed the remarkable rise of industry in the United States to the patent laws. There is no doubt that the patent laws have had a beneficent economic effect in exploiting rich natural resources, but after the earlier years of the 20th century sociologists and economists as a class discounted the encouragement-of-invention theory. Creative art stands on the same footing as creative mechanical invention. It can hardly be maintained that painters and poets need the spur of copyright laws to create, and copyrights, like patents, are intended to protect intellectual property rights. Frank William Taussig (1859–1940) in his lectures on *Inventors and Money-Makers* showed that inventors are much like artists and that the urge to create is so strong within them that they fly off at half a dozen tangents and too often fail to finish what they have begun.

Social and Economic Factors.—No doubt professional inventors are encouraged to invent by rewards in the form of profits. Yet a study of the lives of such inventors as James Watt, Samuel F. B. Morse and Alexander Graham Bell fails to reveal any convincing evidence that they derived the slightest encouragement from the patent system, though all patented their inventions. The profit motive is as strong as it ever was; yet for some reason the rate at which applications for patents have been filed has not kept pace with the rate of population growth. This decline has been international. The trend was the same in the United States, Great Britain, France, Germany, Canada and Japan; it indicated that something was happening to invention itself. That something could have been the increasing complexity of technology. An electronic computer which can solve a dozen simultaneous equations in a minute or two is hardly the type of invention that can be evolved by an ordinary mechanic who might design an improved reaping machine. The release of atomic energy by fission and the application of that release to the making of an atomic bomb could be expected only of highly trained theoretical physicists.

Whether or not a country is distinguished for its contribution to scientific discovery and invention depends on the social environment. Oriental countries played no important part in the development of modern technology, and yet the Arabs at one time were the most cultured and scientific people. In the Renaissance Italy led the world in science. In the early 18th century industrial supremacy passed to the northern countries, with Great Britain, Germany and the United States in the lead. It can hardly be maintained that one nation is naturally more inventive than another. The British, Germans, Swiss and Scandinavians have made quite as good a record in invention as citizens of the United States so far as quality is concerned, and in some branches of science they excel. The social environment is all-important because it determines what will be discovered and invented. This does not mean that society can dispense with men of exceptional ability or so-called geniuses, but it does mean that only when the social environment is favourable has ability the opportunity to express itself, whether or not there is a patent system.

That social pressure accounts for many important inventions and discoveries is proved by the events that brought about the Industrial Revolution (*q.v.*). After the introduction of the earliest steam engines and the substitution of coke for charcoal in the smelting of iron ore, coal was regarded as potential energy as well as a fuel. This brought about a profound change in outlook. Coal

ceased to be merely a fuel; it symbolized industrial might. With the invention of the gin by Eli Whitney, cotton became the most important of all textile fibres. Because of its leadership in metallurgy and in spinning and weaving, England was overwhelmed by the demand for yarns and cloths. The consequence was a further development of coke production and metallurgy to meet the demand for more and better textile machinery (chiefly power looms) and more steam engines to work mines and drive factory wheels. In the United States the introduction of Whitney's gin made it necessary to revivify the moribund institution of slavery because of the increasing demand for cotton pickers. Slavery became one of the issues of the American Civil War. The need of cloth woven in England from cotton exported by the southern states inspired the high-tariff policy of the Republican party as a protection for the spinners and weavers of New England.

In the later stages of the Industrial Revolution steam engines became more and more efficient, and the energy in coal was therefore more rationally applied. An invention that gave industry an impetus second only to that of the steam engine of Watt was the unpatentable system of interchangeable parts introduced in the United States by Whitney and Simeon North in the 1790s. The principle was old, but its application was the forerunner of standardization and hence of mass production by machine of countless articles ranging from automobiles to tins of vegetables, from bathtubs to electric lamps.

With the discovery in 1856 by William Henry Perkin of mauve, the first aniline dye, the rise of the coal-tar chemical industry began. It was the Germans who realized that Perkin's achievement meant as much for synthetic chemistry as did Watt's condensing steam engine for mining and manufacturing. Germany rapidly assumed leadership in synthetic chemistry and maintained it up to the outbreak of World War I. Out of German laboratories came thousands of chemicals derived from coal tar—dyes, photographic developers, explosives, drugs.

The history of the Industrial Revolution is an illustration of the effect of social and economic pressure on the inventor. Moreover, the Industrial Revolution also changed the character of invention. By 1900 the professional inventor appeared in the person of the scientist hired by an industrial corporation to improve old processes and machines and to invent new ones. For this innovation the Germans deserve a large measure of credit; the laboratories of their chemical industries demonstrated what could be accomplished by trained scientists and engineers, many of them former university professors, in transforming invention and discovery from a haphazard activity to an enterprise as systematic as manufacturing and selling. Germany's example was ultimately followed by the industrial nations of the west.

Revolutionary inventions have been usually conceived not within but outside an industry. Here and there are found a few spinners and weavers such as James Hargreaves (d. 1778) and Samuel Crompton who patented daringly new types of labour-saving spinning machines, but as a rule the inventors whose devices made it possible to spin and weave on a wholesale scale and to transfer yarn and clothmaking from the home to the factory were "outsiders," who neither made nor traded in textiles. Richard Arkwright, an illiterate barber and hairdresser, invented the spinning frame; Edmund Cartwright was a clergyman and poet when chance turned his mind to the invention of the power loom; Watt never concerned himself with steam engines until a model of a Newcomen pump was given him to repair; Whitney was not a cotton grower when he invented the gin but a young teacher who thought of becoming a lawyer; both Fulton and Morse were artists; neither Ottmar Mergenthaler nor Tolbert Lanston (1844–1913) were professional compositors when they patented the Linotype and Monotype.

Usually about 20 years has elapsed before an epoch-making invention has been successfully introduced commercially, partly because time and money must be spent in its perfection, partly because of the inertia of the institutions or individuals to whom the invention was offered. Hence the many tales, most of them untrue, of inventors who have all but starved to death before they succeeded in selling their inventions or finding financial backers as Watt did in Matthew Boulton or Bell in Gardner Hubbard. Too often the offered invention has been rejected, partly because its potentialities were not recognized, partly because of lack of energy and money to found a new industry. So patents in related fields accumulated until a venturesome promoter saw that they represented enormous wealth. Such is the history of inventing and patenting in the older industries.

Research.—No matter how it is conducted invention implies experimentation, hence research. The "heroic" theory of invention, the notion that an idea flashes from a brain and gives the world a sudden, fresh impulse must be dismissed. Watt's engine did not leap from his brain to the drafting board. New machine tools had to be devised by others to bore cylinders with the requisite accuracy; studies had to be made of heat losses; model after model had to be built in order to proportion moving parts and to determine the precise point at which steam might be cut off and used expansively. So it was with the Linotype, the typewriter, the phonograph, the incandescent lamp and many other devices and processes. Crude as was the experimentation that culminated in commercial perfection, it nevertheless deserved the name of research.

The laissez-faire policy of letting invention take care of itself gave way to organized industrial research. An important invention is an assemblage of known elements that produces a new result. Organized research hastens the process of accumulation, aggregation and combination; the salaried engineers, chemists or physicists of industry work contemporaneously in single establishments rather than separately decades or generations apart; correlation occurs simply, speedily and directly; time is telescoped. The "outside" inventor finds it more and more difficult to upset established manufacturing methods because he is likely to have been anticipated by industrial research scientists who know the technical literature of the field that they are exploring and who have at their disposal ample facilities for experimentation. By the second half of the 20th century about half the applications for patents in the United States were being filed by individual inventors; the other half were filed by research scientists and engineers in corporation laboratories or connected with such corporations. The acceleration in research was accompanied by an acceleration in the introduction of new inventions and discoveries. It took more than a century for the steam engine to establish itself, fewer than 50 years for electric energy, fewer than 30 years for the internal-combustion engine and fewer than 15 years for the vacuum tube; many applications of the transistor (*q.v.*), which was produced in the course of a modern industrial laboratory research program, were established within five years of its announcement. *See* also RESEARCH, INDUSTRIAL. (W. KT.; X.)

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INVENTORY, a term used to designate items of property held in stock by a business firm. It includes items that are held for sale in the ordinary course of business, that are in the process of production preparatory to such sale, or that will be consumed in the process of producing goods to be sold. The term is also used in a more general sense to denote any list of property, such as that presented to a court by an executor, administrator or trustee, or that attached to a bill of sale. "Stocktaking" is the British equivalent of the U.S. term "taking inventory."

Inventories appear on a company's balance sheet (statement of financial position) as an asset and are of importance in determining the financial condition of a business. The money value of the inventory also appears on the income statement (sometimes known

as the operating statement or profit-and-loss statement) to determine the cost of the goods sold. To the inventory on hand at the beginning of the period is added the cost of purchasing and producing goods during the period; from this total is subtracted the inventory on hand at the end of the period to determine the cost of the goods sold during the period. As a rule, the larger the inventory at the end of the period, the greater the assets at the end of the year and the greater will be the income for the year.

Cost Methods.—For financial statements, inventories are usually priced (1) at cost; or (2) at cost or market value, whichever is lower. Both methods are considered acceptable by accountants providing consistent use is made of the method selected. Traditionally, financial statements are expected to be conservative in the sense that they understate rather than overstate the resources of a firm, and hence the lower valuation is more commonly used. For merchandise, materials and supplies, cost includes the amount paid or to be paid to the supplier plus cost of transportation and other payments necessary to bring goods to the place of business of the buyer. The cost of work in process and finished goods ordinarily includes the cost of the materials used in their production, the labour cost of production and other manufacturing costs (such as depreciation and insurance) which are associated with the goods in the inventory.

Determination of the cost of work in process and finished goods is the task of the cost accountant. Some cost accountants maintain that financial statements are more useful if only "direct costs," *i.e.*, material and labour, are included. Market value is generally calculated as the cost of replacement by purchase or production; sometimes market value is the selling price less the estimated costs of completing the manufacturing process and selling the goods.

The cost of the merchandise and materials purchased will ordinarily fluctuate during the year and it is therefore necessary to determine which cost is to be used for inventory purposes. Three methods are in general use: (1) average cost; (2) first in-first out (FIFO), which assigns the cost of the last units purchased to the inventory and the cost of the first units purchased ("first in") to the goods that were sold ("first out"); and (3) last in-first out (LIFO), where the reverse pattern is followed. The second of these probably describes the usual physical flow of goods because the old merchandise is usually sold first; the first describes it under some circumstances. Advocates of LIFO argue that this approach eliminates from reported income gains that have resulted from price changes; advocates of FIFO maintain that such gains should be reported.

Application of these procedures can be illustrated by the simple, though unrealistic, case of a merchant who bought one pair of shoes at $5 and later a second identical pair of shoes at $6. He sold one pair for $5.75. FIFO inventory cost would be $6; income (before deducting other costs of operation) would be 75 cents ($5.75 less $5 costs). LIFO inventory cost would be $5 and the loss (before deducting other costs of operation) would be 25 cents. The FIFO inventory cost may be said to represent the market value of the inventory; this will rarely be true of a LIFO cost. During a period of rising prices a firm using FIFO will show a higher income and larger assets; its financial statements are not directly comparable with a firm using LIFO. During such a period, the LIFO inventory firm will pay lower income taxes as a result of its lower income.

Turnover.—The "inventory turnover" of a firm is useful in appraising its financial position. An inventory turnover of six means that the goods are sold and replaced six times during the year, or that, on the average, each item remained in the inventory for two months. The inventory turnover for a retailer or wholesaler is calculated by dividing the cost of the goods sold during the year by the inventory. Calculation of the turnover of the inventory of a manufacturing firm is impossible; the ratio of sales (the total selling price of the goods sold) to inventory is usually substituted as a basis of comparison between firms. A high turnover indicates that goods are in stock a shorter period of time and hence that it will take less time to convert them into cash; the firm with a high turnover is therefore in a better position to pay its debts than one with a low turnover.

Managing the Inventory.—The physical quantity of goods on hand can be determined by a physical count by the employees of the firm or by maintaining a record of all increases (due to purchase or production) and decreases (due to sale or use in production). The former process is called a physical inventory; the latter a perpetual inventory. Even if perpetual inventory records are maintained, a physical count is usually made to determine that the goods are actually on hand; this verification process need not be done at one time—partial counts may be made all through the year.

The inventory is a valuable property of the firm and therefore needs to be safeguarded. To prevent diversion of the property from the business involves keeping a record of what should be on hand, the charging of an individual with the responsibility of seeing that the goods are used only for business purposes, and a physical count to see that the responsibility is discharged. The three functions—record keeping, safeguarding and physical counting—should be performed by different individuals. How much is spent on the physical control of inventories should depend on the type of goods in the inventory. Gold, for instance, requires many more safeguards than does coal. Perpetual inventory records, in addition to providing for the protection of company property, aid the management of the firm by making continuously available information as to the quantity of goods on hand. Some firms have adopted computer methods of stock control and verify their stocks every week.

The cost of carrying an inventory includes storage costs, insurance, possible deterioration and obsolescence and interest on the funds invested in the inventory; in addition the owner runs the risk of price declines. On the other hand, failure to have an adequate stock may result in loss of sales, inefficient use of manufacturing facilities and the cost of idle labour. Ordering or manufacturing in large quantities usually results in lower costs than ordering or manufacturing in small quantities. Decisions must therefore be made as to how large an inventory to maintain, when to order or to produce, and how much to purchase or produce. A firm ordinarily attempts to follow a procedure that will make the costs and losses connected with inventory as low as possible. This involves forecasts of the quantity that will be sold, the length of time for delivery and other factors. The inability to make perfect forecasts under changing conditions results in risks that every business must assume. (C. L. N.)

INVERARAY, a royal and small burgh and the county town of Argyll, Scot., stands near the mouth of the Aray, 9 mi. from the head of Loch Fyne and 58 mi. N.W. of Glasgow by road. Pop. (1961) 501. Created a burgh of barony in 1474, it became a royal burgh in 1648. As the ancestral seat of the Argyll family (*see* ARGYLL, EARLS AND DUKES OF), the town has figured largely in Highland history. When the 3rd duke built the modern castle in 1744–46 he transferred the town to its present site. Since 1957 the Historic Buildings Council for Scotland has modernized the houses internally, preserving externally the 18th-century architectural features. Notable buildings are the parish church, designed by Robert Mylne in 1794; Crombie's land, the birthplace of the novelist Neil Munro (1864–1930); the Town house, the traditional scene of the Appin murder trial (1753); and the Great tower with its peal of ten bells. A medieval Celtic cross stands near the pier. There is a tourist trade, forestry and farming. (DD. MACK.)

INVERCARGILL, the southernmost city of the Commonwealth of Nations, is the capital of Southland land district in South Island, New Zealand. It lies on the Southland plain on the Waihopai river near its confluence with the New river estuary, 139 mi. S.W. of Dunedin by rail. Pop. (1961) 35,605. The city is laid out on a rectangular plan with wide streets, those in the centre being named after Scottish rivers. Attractive public gardens and reserves include a central 200-ac. park. Invercargill is the centre of an important sheep and farming area and also serves as the base for the power generation project at Deep Cove. Most of the trade passes through the modern deepwater port of Bluff, 17 mi. S. Invercargill airport just south of the city is the terminus of the national trunk airline and is linked by amphibian services

with Stewart Island, 40 mi. S. The settlement was named after Capt. William Cargill, the Otago pioneer who founded it in 1856. It became a city in 1930. (L. A. Be.)

INVERCLYDE, BARON: *see* Burns, Sir George.

INVERELL, a town of northern New South Wales, Austr., lies on the Macintyre river 407 mi. N. of Sydney by road and 509 mi. by rail. Pop. (1961) 8,209. It lies at an elevation of 1,912 ft. in the west of the New England plateau. The district produces chiefly wheat and wool; cattle are raised and silver, tin, sapphires and diamonds are worked nearby. Inverell became a municipality in 1872. It is linked by air with Sydney and with Brisbane, Queensland. (R. A. Pa.)

INVERNESS, a royal and large burgh, seaport and county town of Inverness-shire, Scot., lies in the haughlands of the river Ness, which drains Loch Ness, at the eastern end of the great fault line known as Glen More. Pop. (1961) 29,773. The town is surrounded by hills on three sides and to the east the low lying shores of the Moray firth. Astride the river and the Caledonian canal (*q.v.*), it commands the route between the central Highlands and northern Scotland. The river estuary forms a good harbour with piers, breakwater and a slipway. From the quadrangle formed by the town centre, on the eastern bank of the river, the town climbs to the south to the Crown (residential) district and sweeps northward and eastward to the business and working quarters. Overlooking the river is the castle (1835), built on part of the site of a fortress blown up by Jacobites in 1746 and now housing the county law courts and other county offices. Beneath this stand the town hall (1882) and the fine old town cross (1685) let into the foot of which is the ancient Clach-na-Cudainn ("stone of the tubs"), once the resting place for women who carried water from the river. The town steeple (1791), near the town hall, was formerly a prison but now carries the town clock and bells. The Old High (parish) church (1769–72) has in its tower one of the bells removed by Oliver Cromwell from Fortrose cathedral. On the river's western bank, the residential area, is St. Andrew's Episcopal cathedral (1866–71) for the see of Moray, Ross and Caithness. The museum, in the Castle Wynd, houses a fine collection of Jacobite relics. A new bridge, replacing the suspension bridge, was opened in 1961. The picturesque Ness Islands about a mile above the town attract many visitors.

Since World War II light industries such as printing, picture post card printing, food canning and confectionery have been successfully introduced into Inverness. There is also highly specialized electrical and mechanical construction of heavy plant, steel mills and automobile components with a world-wide distribution. The herring industry occupies about 20 boats for five months of the year. The main imports are spirits and oils, coal, timber and cement. A small quantity of timber is exported.

The town serves as a railway and road centre; the airport at Dalcross, 8 mi. S.E., provides services to the Western Isles and to the south.

Inverness was one of the chief strongholds of the Picts and was visited by St. Columba (*c.* 565) with the intention of converting the Pictish king Brude, who is supposed to have resided in the vitrified fort of Craig Phadrick (Patrick's rock) 1½ mi. W. of the town. The castle is thought to have been built by Malcolm III (Canmore), after he had razed the one in which his father, Duncan, is said to have been murdered by Macbeth. It was a royal residence and fortress for centuries and saw a great deal of fighting. William the Lion (d. 1214) granted the town four charters, by one of which it was created a royal burgh. Hardly a trace remains of the Dominican abbey founded by Alexander II in 1233. On his way to the battle of Harlaw in 1411 Donald, lord of the Isles, burned the town, and 16 years later James I held a parliament in the castle to which the highland chiefs were summoned. The house, occupied in 1562 by Mary, queen of Scots, after she was denied admission to the castle, stands in Bridge street. At the northern end of the town Cromwell built a large fort, known as the Sconce, but it was practically demolished at the Restoration. (D. A. An.)

INVERNESS-SHIRE, the largest county in Scotland (4,211 sq.mi.), contains about a quarter of the Highlands and a quarter of the Western Isles. Between the Moray firth on the east and the indented Atlantic shore on the west lies the massive mainland portion bounded on the north by Ross and Cromarty and on the south and east by the shires of Argyll, Perth, Aberdeen, Banff, Moray and Nairn. More than one-third of the area consists of islands, including Skye, Raasay, the Small Isles (Rum, Eigg, Canna and Muck) in the Inner Hebrides, Harris, North and South Uist, Benbecula, Eriskay, Barra, etc., in the Outer Hebrides (*see* Hebrides, The), and the St. Kilda group.

NOEL HABGOOD

LOCH LAGGAN IN SOUTHERN INVERNESS-SHIRE, SOURCE OF THE SPEAN RIVER

Physical Geography.—The mainland portion is almost bisected by the fault-directed Great Glen (Glen More nan Albin), running northeast from Fort William to Inverness. In the narrower part, reaching the west coast between Glenelg and Glenshiel, a main erosion surface at 3,100–3,500 ft. has been deeply dissected by water and ice. Block mountains yield many conical peaks, while the structurally directed main glens running northeast, east and southeast contain many glaciated rock-basin lakes. West coast fjords are linked by low passes with easterly glens giving access to the Great Glen. The almost fjordlike Loch Morar actually contains fresh water and is the deepest lake in Britain, reaching 1,032 ft. below mean sea level. Postglacial raised beaches, preserved in sheltered places up to 100 ft., give level, well-drained, easily tilled fields in limited, narrow belts.

South and east of Fort William somewhat similar country in Lochaber is dominated by the massive lava-crowned granite boss of Ben Nevis (4,406 ft.). The "parallel roads" of Glen Roy in northern Lochaber are shoreline terraces marking successive levels of a glacially dammed lake. Eastward the block mountains are less dissected; gently sloping massive schistose hills alternate with broad glens or straths. To the northeast stands the high Cairngorm plateau, a major granite batholith with a considerable area over 4,000 ft. partly in Aberdeenshire and Banffshire. On the southern border is the main Grampian watershed, glacial breaching of which has chiselled Loch Ericht (14½ mi. long and at 1,153 ft.). From the Grampians the moorlands of Badenoch slope gently to the broad corridor of Strathspey or Speyside. North again the schistose Monadhliath mountains, reaching a summit plane of 3,000 ft., also follow the Caledonian northeasterly trend, as do the broad glens of the Spey Findhorn and the Nairn rivers. Northwest of the Monadhliath mountains a heavily glaciated plateau at 1,000–1,200 ft. gives way in a steep faultline scarp to the Great Glen, there occupied by Loch Ness, the biggest of the three glacial ribbon lakes in the Great Glen; its floor exceeds 600 ft. below sea level for over 17 mi. of its length of 22½ mi. North of the Great Glen are more broad glens trending east or northeast: Glen Moriston and Glen Urquhart, both among broad moorland plateaus of 1,500–2,000 ft.; Glen Affric, Glen Cannich and Strathfarrar, amid conical schistose hills reaching 3,000–3,300 ft. All these glens drain to the Strath Glass-Beauly lowlands, which merge with the raised beaches by the Beauly firth and Inverness firth.

The county's many Atlantic islands include the now uninhabited St. Kilda group about 40 mi. W. of North Uist, with their great

storm-swept cliffs and schist and granite hills; also the Outer Hebrides from Berneray in the south to the county boundary in the "long island" between Harris and Lewis, with their low hills of ice-scoured Archaean gneiss, innumerable glacial lakelets and hollows of boulder clay overlain with peat, and fertile western fringe of shellsand, the *machair*. Skye is the "winged isle" of peninsulas and varied scenery, from the jagged Black Cuillins of Tertiary gabbro to the lighter-coloured massive granite Red Cuillins. There are contrasts again in Rum, with its Torridonian sandstones and peridotites flanked by granites; while nearby Eigg, Muck and Canna are largely of Tertiary basalt.

Mild but windy winters prevail in lowlands in the western fringe and islands (January mean monthly temperatures 40–42° F.), with mean annual rainfall about 40 in., though higher near mountains. The mountains of the western mainland have 100–200 in. mean annual rainfall, while the hilly centre has harsh winters (30–100 mornings a year with snow lying). The eastern lowlands are sunny and dry (mean annual rainfall 20–24 in.), and particularly so, though cool, in the spring and early summer. Typical moorland vegetation in the wetter west is wet grass moor (purple moorgrass, sedges, etc.), with acid grasslands (fescue-purple moorgrass, with mat grass, heather and bracken) on drier sites there and in parts of the drier eastern plateaus. The dominant type in the latter is, however, heather moor. The highest hills have a zone of subalpine moor above which is arctic-alpine vegetation. There are residuals of the once widespread Caledonian forest, *e.g.*, in Rothiemurchus where there is a beautiful association of Scots pine, juniper and heather. (A. T. A. L.)

Red deer abound on the mountains of the mainland and islands, and a small herd of reindeer from Sweden was established in Rothiemurchus in 1952. The wild cat has re-established itself as the result of relaxed game preservation during two world wars. The eagle, gray lag goose, capercaillie and crested tit breed in some areas. After an absence of many years ospreys nested successfully in the Loch Garten bird sanctuary set up for that purpose in 1959. In the Cairngorms, Glen More national forest park (12,500 ac.) was established in 1948 and an area of 36,689 ac. (partly in Aberdeenshire) was in 1954 declared a national nature reserve. National nature reserves have been established in the Isle of Rum (1957), 26,400 ac.; St. Kilda (1957), 2,107 ac.; Loch Druidibeg, South Uist (1958), 2,577 ac.; and Craigellachie, Aviemore (1960), 642 ac.

History.—Stone axes and other weapons or tools dug up in the peat, and carvings such as the incised boar on a shale slab at Knocknagael near Inverness are evidence of early inhabitants. The Clava cairns and stone circles are among the best preserved of this type of burial place. Hill forts are widely scattered, with signs of vitrifaction at Craig Phadrick (Inverness), in Glen Nevis, Glen Garry, Arisaig and Kilmorack; the foundations of round huts mark the sites of early settlement; there are two fine specimens of brochs (dry stone towers) in Glenelg, and crannogs (lake dwellings) occur in some of the lochs.

When the country north of the Grampians emerged into history the Picts were in possession, and it was to Inverness, as the capital of their king, Brude, that Columba went on his Christianizing mission about 565. As Scotland gradually became united, the great province of Moray was formed, including a large part of the modern Inverness-shire as well as the counties to the east and north of it. Dynastic quarrels resulted in two waves of immigrant landowners, the first in the 12th century, the second in the early 14th. The first brought in the Mackintoshes and Bissets, and the second the Frasers, Chisholms and Grants. (The Chisholms, who have owned Strath Glass since the 14th century and whose seat was Erchless castle, gave their name to a pass in Glen Affric. Urquhart castle was the home of the Grants for 400 years from 1509.) In the west the Macdonalds, Camerons and Macleods remained under the sway of the Lords of the Isles, whose influence spread right across the mainland when the earldom of Ross was joined to the lordship. The 15th and 16th centuries, however, saw the Stewart kings attempting to exert their control over the whole country, and using the growing clan system as a means of bringing order to the north through the influence of the chiefs. In the 17th century the clans were divided by religion and politics: the duke of Montrose won a brilliant victory for the royalists at Inverlochy (1645) and Oliver Cromwell planted a garrison at Inverness. The Jacobite risings again set clan against clan: the revolution of 1688 was followed by the building of Forts George, Augustus and William (at Inverness, Kilchumin and Inverlochy); one of the steps toward pacification after 1715 was the building of military roads by Gen. George Wade (*q.v.*) and his successors; and the brief campaign of Prince Charles Edward (*q.v.*) in 1745–46 (begun at Glenfinnan and ended at Culloden, both within the county) was followed by the forfeiture of the Jacobites' estates, the abolition of the power of the chiefs and the proscription of the Highland dress. Economic factors put an end to the system of patriarchal rule, many of the chiefs had to sell out to strangers, sheep-farming was introduced on a large scale, and by the mid-19th century eviction and voluntary emigration had cleared many of the glens. The granting of security of tenure to crofters and other measures of relief has not, however, stemmed the drift from the rural areas.

Population and Administration.—At the first official census in 1801 the population of Inverness-shire was 72,672; it increased regularly until a peak population of 97,799 was recorded in 1841. At the 1961 census the population was 83,425, a decrease of 1,505 since 1951. Of the total, 65,004 were on the mainland, the highest number ever recorded, and 781 more than in 1951; while the island portion in the same period suffered a loss of 2,286. The density, three persons to every 100 ac., was about the same as in 1931 and 1951. Gaelic and English were spoken by 19,848 people (3,816 fewer than in 1951), and Gaelic only by 538 (470 fewer). The rural areas have lost population to the local burghs of Inverness, Fort William and Kingussie, as well as to other parts of Scotland.

With Ross and Cromarty, Inverness-shire returns three members to parliament—for Inverness, Ross and Cromarty, and the Western Isles. With Moray, Nairn and Ross and Cromarty, it forms a sheriffdom with resident sheriffs-substitute at Inverness, Fort William, Portree and Lochmaddy. The county council, with headquarters in Inverness, has 65 members representing nine districts (Inverness, Aird, Badenoch, Lochaber, Skye, North Uist, Harris, South Uist and Barra), each of which also has its own district council. For certain functions the county council also includes representatives of the burghs. For ecclesiastical purposes the county is divided into the presbyteries of Abernethy and Inverness (part of the synod of Moray), Skye and Uist (synod of Ross, Sutherland and Caithness) and Lochaber (synod of Argyll). Senior secondary education is provided in Inverness (whose Royal academy was founded in 1792), Fort William, Kingussie and Portree; a technical college was opened in 1960 at Inverness, where there is a branch of the North of Scotland College of Agriculture. The Royal Northern infirmary (1804) and Raigmore hospital are in Inverness, and there are others in Fort William, Skye and Uist. Two regiments having their depots in the county, the Seaforth Highlanders and the Queen's Own Cameron Highlanders, amalgamated as the Queen's Own Highlanders in 1961. Commando units were trained in Lochaber during World War II, and a monument to those who fell was unveiled near Spean Bridge in 1952. A guided-missile range has been established on South Uist.

The Economy.—Agriculture, forestry and fishing are the basic industries. With a small proportion of arable land, stock raising is important, store cattle raised on the higher land being fattened on the lower and more fertile ground, while sheep are the principal stock on the higher hills. Livestock also includes pigs, horses, goats and poultry. A single unit cattle breeding ranch established in 1947 at the southwestern end of the Great Glen, comprising about 100,000 ac., and large-scale hill farming at the northern end demonstrated the possibility of reclaiming unproductive land and providing winter feed for stock. The main crops are oats, barley and wheat; turnips and potatoes are the chief root crops.

Part of the old Caledonian forest extends for several miles near the Perthshire boundary and in Glenmore. Many famous forests were cut down during the two world wars, but natural woods are extensive, and considerable re-afforestation has taken place, partic-

ularly in Badenoch and the Great Glen. Private and state woodlands between them cover about one-tenth of the land area. More than 800,000 ac. are devoted to deer forest.

Mallaig and Fort William are the main centres of the herring and lobster fisheries, and fishing is also carried on in the Inverness firth and among the Outer Hebrides. There was a whaling station in Harris, and basking sharks were hunted commercially off the west coast and among the islands for some years after World War II.

Inverness is not an industrial county, but as the centre of large hydroelectric projects it is the source of power for others, and a number of small local industries have been established. The first major hydroelectric development in the United Kingdom was the Foyers station (near Loch Ness) of the British Aluminum company, opened in 1896 and followed by the Kinlochleven and Lochaber generating stations. Under the North of Scotland Hydro-Electric board, established in 1943, the county has projects at Morar (opened in 1948), Glen Garry and Glen Moriston, Glen Affric, and Strathfarrar and Kilmorack, besides smaller projects in Skye and Harris. Resistance welding machine construction is carried on at Inverness by the firm which made "Pluto" pipe lines in World War II, carrying oil across the English channel to Allied armies in Europe. There are distilleries at Inverness, Tomatin, Dalwhinnie, Fort William, Inverlochy and Carbost (Skye). Seaweed is processed in South Uist, and diatomite has been exported from Skye. Harris, Skye and other islands produce tweed. There is a deepfreeze food-preserving plant near Inverness. The tourist industry is of growing importance. Ben Nevis, with its diversity of rock conformations and panoramic prospects, attracts the climber (a race to the summit was first recorded in 1895); facilities for skiing in the Cairngorms have been developed; and pony-trekking was first introduced at Newtonmore in 1952. Deerstalking and grouse shooting attract visitors, and rivers and lochs abounding in salmon and trout provide sport to many anglers.

Communications.—Military roads were built in the Highlands under the supervision of General Wade between 1726 and 1732, those in the county forming three sides of a triangle—Fort George (Inverness) to Fort William, Dunkeld to Inverness over Drumochter, and Dalwhinnie to Fort Augustus over Corrieyarrick. Except for the last, which has been supplanted by the easier route by Loch Laggan to Spean Bridge, these are still the main lines of road communication in the county; improvements were made on the main north road in 1763, again by Thomas Telford (*q.v.*) in 1806–09 and also in the 1930s, when a new through road was also built on the west side of Loch Ness to improve communication through the Great Glen. Improvements have also been made in more remote areas, including the connection of Benbecula with South and North Uist by bridge and causeway.

The main railway line between Inverness and the south (via Edinburgh and Perth) enters the county through the Pass of Drumochter, 1,484 ft. above sea level and the highest main-line summit in Great Britain. This route was opened from Perth to Forres (with which Inverness had been connected since 1855) via Aviemore in 1863, the direct line by Carrbridge and Daviot following in 1898. The West Highland railway was opened to Fort William in 1894, to Banavie in 1895 and to Mallaig in 1901. There was a branch line to Fort Augustus from 1903 to 1946.

The Caledonian canal, built by Telford in 1804–12, includes 40 mi. of navigable loch in its total length of 60 mi., and there are 28 locks to carry it up to the level of Loch Oich, exactly 100 ft. above high-water mark at Inverness and Fort William.

There are regular steamer services between Kyle of Lochalsh (Ross), Mallaig, Skye and the Outer Hebrides.

There are airports at Inverness and Benbecula and a landing field at Barra.

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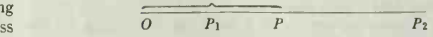
INVERSION, in geometry, may describe the process of finding two points (on the diameter of a sphere or circle) the product of whose distances from the centre equals the square of the radius. In a more general case, suppose in the figure



that $OP = 1$, $OP_1 = \frac{1}{2}$ and $OP_2 = 2$. Then $OP_1 \times OP_2 = OP$. Let $OP = k$; then it is evident that there is an infinite number of points P_1, P_2 on the line such that $OP_1 \times OP_2 = k$. A geometric transformation which replaces each point P_1 by a point P_2 such that $OP_1 \times OP_2 = k$ is called an inversion. In such case O is the centre of inversion and k is the radius of inversion. As P_1 moves nearer to O, P_2 moves farther away. As P_1 approaches P, P_2 approaches P. In general, when $xy = k$, x and y are inversely proportional, one decreasing as the other increases. Also, if $y = f(x)$, x may be considered inversely as a function (implicit) of y.

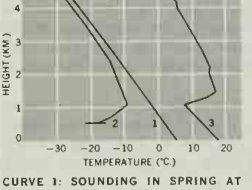
INVERSION OF TEMPERATURE. Over much of the earth the air temperature usually decreases with increasing elevation up to a height of 8 to 18 km. (5 to 11 mi.) above the surface. Frequently, however, layers of air are present through which the temperature increases with height instead of decreasing. Such layers are called inversions of temperature or, briefly, inversions. The rate of decrease of temperature with height is called the lapse rate. When the temperature increases with height, as in an inversion, the lapse rate is negative. Occasionally in meteorological articles the term inversion is applied loosely to any layer in which the lapse rate, though positive, is smaller than the lapse rates below and above it. In the following it will be used only in its strict sense.

Inversions are measured by (1) the thickness of the layer, (2) the rate at which the temperature increases and (3) the total rise in temperature through the layer. The last is called the magnitude of the inversion. Inversions with rapid rates of temperature increase are termed sharp, those which have large total temperature increase are called large and those which are sharp and large are called strong.

The lowest layer of the atmosphere, where the lapse rate is usually positive, is called the troposphere. As has been stated, however, even in the troposphere inversions are frequent, and in some regions they are invariably present at small or moderate heights. An examination of aerological soundings made in Sweden, for example, showed that inversions occurred in 44% of them and in 69% of those made in winter.

In the stratosphere, above the troposphere, the temperature normally is constant or increases slowly with height, and at higher levels it increases at a greater rate. The stratosphere is sometimes called the upper inversion, because the inverted state in this region is normal.

An inversion starting at the earth's surface is called a ground inversion, while one with normal temperature decrease in the layer of air below it is sometimes called a high inversion. In the accompanying figure, curve 1 shows the variation of temperature with height in a case of normal lapse rate at all levels; curve 2 shows a ground inversion, surmounted by a layer with normal lapse rate; and curve 3 shows a high inversion with normal lapse below and above.



CURVE 1: SOUNDING IN SPRING AT HAMBURG, GER., SHOWING NORMAL DECREASE OF TEMPERATURE WITH HEIGHT. CURVE 2: SOUNDING IN LATE FALL AT BISMARCK, N.D., U.S., SHOWING GROUND INVERSION. CURVE 3: SOUNDING IN SUMMER OVER PACIFIC OCEAN AT 30° N., 125° W., SHOWING TRADE-WIND INVERSION

Relation of Inversions to Weather.—Inversions play an important role in determining cloud forms, precipitation and visibility. The ease with which vertical motions of air parcels, and in particular vertical mixing, take place depends on the lapse rate. This can be understood readily when it is remembered that an ascending air parcel cools by expansion at the adiabatic rate of 1° C. per 102 m. rise if it is unsaturated, or a somewhat smaller rate if saturated. (*See* ADIABATIC PROCESSES IN ATMOS-

PHERE.) An inversion acts as a lid on vertical motions in layers below. The consequence is that convection produced by heating the air from below is limited to levels below the inversion, and diffusion of dust and smoke is likewise limited. In regions where a pronounced inversion is present at a low level, convective clouds cannot grow high enough to result in showers, and at the same time the visibility may be greatly reduced below the inversion, even in the absence of cloud, by the accumulation of dust and smoke particles. Because the air near the base of the inversion is cool, cloud or fog is frequently present there (*see* FOG).

The suppression of vertical turbulence allows inversions to act as slip surfaces across which the upper layers slide freely, unimpeded by the exchange of momentum with the lower layers. The resulting wind shear, together with the abrupt density change, may produce bumpiness in an airplane flight through the inversion, even though the actual atmospheric motion is smooth. This is caused by the sudden change in dynamic lift on a plane passing from air moving slowly to less dense air moving rapidly or from a different direction. Furthermore, if the inversion slopes (frontal inversion), the air above it may be carried upward along the slope because of its motion relative to the air below, and layer clouds and precipitation may result from the adiabatic cooling of the ascending air.

Except in the last-named case, of air being carried upward above a sloping inversion, the base of the inversion forms a quite sharp boundary between air with low visibility below and extremely clear air above. Because the inversion likewise limits water vapour diffusion it also usually represents a boundary between humid air below and very low humidity above.

Another important influence of inversions on the weather is the effect upon the diurnal range in temperature. The principal heating of the air during the day is produced by contact with the ground, the temperature of which is raised by solar radiation to which the air is transparent. The sun's radiation is absorbed by the ground, and the heat is communicated to the air by conduction and convection. Since the inversion base represents the upper limit to which heat is carried by convection, only a shallow layer of air will be heated if the inversion is low and large, and the temperature rise will be great. On the other hand, if the inversion is high or no inversion is present a deeper layer of air must be heated, and the temperature will rise less.

Ground Inversions.—These inversions are produced by cooling of the air by contact with a colder surface. The most general cause is cooling of the ground by radiation on clear nights, and for this reason they are also called nocturnal or radiation inversions. The radiation downward from the atmosphere is much less than that upward from the ground, resulting in a net loss of heat by the latter when the sun is not shining. The air in contact with the ground is cooled by conduction, and if the air is in motion, the cooling effect is transmitted upward by mixing of the air at the ground with that a little higher, as well as by radiation.

The effect of this turbulent mixing and radiational exchange is to increase the thickness and decrease the magnitude of the inversion. If the air is cooled below its dew point by this process, fog may result. When the wind is sufficiently strong, the turbulent mixing may wipe out the inversion at the ground, establishing an adiabatic lapse rate there and sharpening the upper part of the inversion. In this case if condensation occurs the fog is also raised from the surface to form "high fog" or stratus cloud in the coldest air just below the inversion.

Topography greatly affects the magnitude of ground inversions. If the land is rolling or hilly, the cold air formed on the higher land surfaces tends to drain into the hollows, producing a larger and thicker inversion above low ground, and little or none above the higher points.

Ground inversions are usually removed during the day by heating from below. The ground is warmed by solar radiation, and the air above it by conduction and convection. In middle latitudes in winter, however, the insolation during the day is often insufficient to offset the cooling which has occurred the previous night, and ground inversions are augmented day after day during periods of light winds. In these cases fog may persist both day and night. The great valleys of California and the valleys of central Europe are characterized by persistent fog of this type in winter.

Farther poleward, where little or no sunlight is received in winter, stagnating air is subjected to long periods of cooling at the ground. An inversion of great magnitude, considerable thickness and tremendous areal extent develops, blanketing the entire interior of high latitude continental areas, and also (in the northern hemisphere) the Arctic ocean. This inversion is known as the arctic (or, over the antarctic continent, the antarctic) inversion. It is strongest and most persistent in the central portion of continents at high latitudes.

Inversions beginning at the earth's surface are also formed when warm air flows over a colder surface. In this case also the air undergoes contact cooling which is carried upward by mixing, and if the mixing is intense the inversion may be dissolved at the ground and sharpened higher up. Among the places where inversions produced in this fashion are dominant, the Grand Banks of Newfoundland are outstanding. In one case, for example, the air temperature increased from 4° C. immediately above the sea surface to 21.5° C. at an elevation of 1,150 m. The persistent sea fogs of this region are caused by the cooling of the warmer air flowing over the cold sea surface. Similar inversions are produced over continents by the flow of warm air from subtropical regions over snow-covered areas in middle latitudes, particularly in spring when the latent heat of melting or evaporation of the snow is withdrawn from the air, increasing the cooling effect.

Turbulence Inversions.—Turbulent mixing in strong winds would establish an inversion even in the absence of a pre-existing one. The effect of vertical mixing in case of a normal lapse rate is to carry heat downward, cooling the upper part of the mixed layer, and heating the lower, until an adiabatic lapse rate is established. If the mixed layer had an abrupt top, the cooling would be a maximum there, and there would be an abrupt increase in temperature at that level. Instead, the mixing tapers off gradually, and above the thoroughly mixed adiabatic layer there is a finite layer of transition to the unmixed and therefore uncooled air above; *i.e.*, a turbulence inversion is established above the thoroughly mixed layer.

If an inversion is already present, stronger winds than otherwise are required to mix the surface air and establish an adiabatic layer, but if they occur, the inversion is raised to a higher level and sharpened. The cooling in the upper part of the mixed layer may produce stratus or stratocumulus cloud there, while the heating in the lower part may dissolve fog at the ground.

The formation of stratus or stratocumulus clouds by turbulence is very general. The stratiform sky is typical of anticyclonic weather over the British Isles and western Europe in winter. The cloudiness may persist for several days, but no rain, or at most a slight drizzle, falls from it. While turbulence is the principal cause of the cloud in this type of anticyclonic weather, another factor contributes considerably to the formation or strengthening of the inversion. This factor is called subsidence.

Subsidence Inversions.—By subsidence is meant the sinking and vertical shrinking of a layer of air. When a layer of air descends bodily, the increase in pressure compresses it, so that the upper portion descends farther than the lower. The heat of compression will be greater for the upper part than the lower, consequently, and the lapse rate of temperature will thus be reduced. If at the same time as it sinks the air layer spreads out horizontally, the upper portion will descend still more, and the compression may be sufficient to heat it to a higher temperature than the lower part, producing an inversion.

Near the ground the air, because of the influence of friction, tends to flow outward from anticyclones (areas of high atmospheric pressure), and the air above must sink to take its place. In addition, because of the dynamics of atmospheric motion, the air moving around anticyclones and in equatorward currents must spread horizontally and shrink vertically (*see* WIND). Subsidence thus occurs in anticyclones at all levels, and especially in their eastern portions, where the air flows toward the equator.

The areas which are dominated by anticyclones are: (1) the

northern portions of continents in winter; and (2) the subtropical oceans throughout the year. These regions, then, are the ones where subsidence inversions prevail.

The inversions associated with continental anticyclones frequently are dome-shaped. The base of the inversion layer may be from three to five kilometres high somewhat to the east of the centre of highest pressure and slope gently downward in all directions to a level of one kilometre or lower. Where the subsidence inversion is low, it may merge with the ground inversion to produce an extremely large and thick inversion. Whether or not they merge with ground inversions, low subsidence inversions in winter are usually associated with persistent fog or stratus cloudiness, with the valleys covered with cloud and the mountains which penetrate into the inversion enjoying clear mild weather.

Associated with anticyclones over the subtropical oceans there occur strong inversions with bases from 300 to 2,000 m. above sea level. Curve 3 in the figure shows a typical sounding taken through such an inversion. These inversions persist throughout the year in tropical regions, and follow the seasonal migration of the subtropical high-pressure belt, extending into middle latitudes in summer.

When the inversions over subtropical oceans were first observed they were called trade-wind inversions and were attributed to the difference in source of air between the trade winds, originating on the poleward side of the subtropical anticyclones at low levels, and the antitrades flowing over them from equatorial regions at greater heights. This name was retained, although it was established as additional data became available that the change in wind direction does not coincide in position with the inversion layer.

Another theory suggested for the formation of the trade-wind inversion was that it is produced by vertical turbulence. This theory, however, was belied by observations which showed that the inversion is too large to be formed that way, with temperatures aloft frequently higher than at sea level, and that it is highest in the region of equatorial calms and lowest in the regions of strongest trade winds. Turbulence would produce the highest inversion where the winds are strongest. Study of the increased number of observations available enabled the demonstration, in 1945, that the explanation of the trade-wind inversion lay in the subsidence associated with the subtropical anticyclones. Analysis of the winds in these regions showed that there is sufficient divergence in them to produce the extremely large sinking motion needed to create the pronounced inversion. Over most of the tropical regions the lapse rate below the inversion is kept nearly adiabatic by heating from below by warmer water, by radiation from cloud tops and by turbulence. Along the west coasts of North America and Africa, however, the air passes over a belt of cold water which rises from considerable depths. In these regions the air is cooled by the surface and the inversion sometimes starts at sea level. On the California coast an inversion at the surface may be produced also at times by winds from the continent subsiding down the high coastal mountain ranges.

The Weather Associated With Trade-Wind Inversions.—The air structure resulting from the processes described above consists of a cool humid layer next to the sea surface and a much warmer dry layer above it. Stratus or stratocumulus clouds are usually present from a few hundred feet above the sea to the base of the inversion. If the inversion starts at sea level, fog will occur if the air is cool enough, or the air may be cloudless. The slope of the inversion upward to the west and equatorward permits more active convection to take place and the clouds to grow higher in those directions. Where convective activity takes place the clouds tend to be broken, but their greater thickness makes showers possible.

While the stratus associated with the trade-wind inversion is characteristic of the eastern portions of subtropical and equatorial oceans, it is commonly referred to as west coast stratus because it is at the shore that it affects aviation and other human activities.

Since a large proportion of the earth's surface is covered by the trade-wind circulation, the trade-wind inversion is one of the major features in the structure of the atmosphere. The principal weather changes in low latitudes have been attributed to long waves in the inversion, convective showers occurring when the wave motion raises the inversion sufficiently high. The relationship of these waves to the genesis of tropical cyclones was studied, but no conclusive results were obtained. It appears to be definite that the formation of hurricanes or typhoons is associated with convergence which would lift the inversion and, offsetting the effect of earlier divergence and subsidence, wipe it out.

Frontal Inversions.—When a cold mass of air and a warm mass of air are side by side the cold one extends like a wedge below the warm one. The sloping boundary between the two air masses is called a front (*q.v.*). Because of mixing at the boundary, the front is not an abrupt discontinuity, but a transition zone. The warm air overlies the cold, and the transition zone represents a region where, in passing upward, the temperature increases from that characteristic of the cold air to the temperature of the warm air. Thus the frontal zone is an inversion.

The frontal inversion differs from the other inversions discussed in two respects: (1) it has considerable slope, while the others are nearly horizontal; (2) the humidity may be high and clouds may be present immediately above it. Frequently fronts, instead of being real inversions, have smaller positive lapse rates than the air masses below and above. In these cases the air above the front would be warmer than that below if brought to the same pressure. Because it is at a lower pressure, it actually has a lower temperature than the (potentially) colder air mass below. Because the warm air frequently is ascending over the cold-air wedge, and being cooled by expansion, actual inversions at fronts are rarely found at heights greater than two kilometres; at greater heights a slower rate of decrease of temperature almost always characterizes the transition zone, rather than an increase. On the other hand, there is frequently an inversion at the top of the cloud produced by the ascent of the warm air. Fronts and frontal inversions play a principal role in the modern theory of extratropical cyclones or depressions (*see* CYCLONE). Most of the precipitation in middle and polar latitudes in winter is associated with fronts.

Discussions of inversions in meteorological literature are spread through the treatments of the various associated phenomena: fog, clouds, haze, radiation, turbulence, and maximum and minimum temperature forecasting. The reader wishing further information on this topic cannot be directed to any single article or small number of articles. By looking at the index of any standard meteorological textbook he will be provided with additional material and with references to journal articles which enlarge upon the treatment given here. (Ms. N.)

INVERTEBRATE, any animal not possessing a backbone or vertebral column (*e.g.*, worms, snails, insects, sea stars). Invertebrates are distinguished from vertebrates (*q.v.*), all of which possess some kind of cartilaginous or bony axial skeleton. In modern systematic zoology, some invertebrate forms (amphioxus, tunicates, etc.) are included with the vertebrates in the phylum Chordata (*see* CHORDATE); thus the invertebrates do not constitute a homogeneous or natural taxonomic grouping, but the distinction between vertebrates and invertebrates remains a convenient one. It is estimated that more than 90% of all known species of animals are invertebrates. *See* INVERTEBRATE EMBRYOLOGY; ZOOLOGICAL NOMENCLATURE; ZOOLOGY; and references under "Invertebrate" in the Index. (J. M. A.)

INVERTEBRATE EMBRYOLOGY is the study of the development of a backboneless or invertebrate animal from the activated egg. Embryonic development is a phenomenon encountered only in multicellular animals (*see* EMBRYOLOGY). Protozoa (*q.v.*), the one-celled or acellular animals, are therefore disregarded; the Mesozoa (*q.v.*), a group of multicellular parasites of simple structure, are considered elsewhere.

Many lower invertebrates can reproduce more of their kind by asexual methods, but more commonly reproduction involves sexual methods. All animals composed of more than one cell reproduce sexually by means of eggs. In most cases the egg is activated to develop by union with a sperm cell; in other cases the egg may start to develop spontaneously without fertilization or may be

caused to develop by agents other than sperm cells (*i.e.*, parthenogenetically). Sex cells of various marine invertebrates have been used extensively for many studies concerned with details of the fertilization process, including the nature and roles of interacting substances produced by eggs and sperm and the nature and mode of action of parthenogenetic agents (*see* EMBRYOLOGY, CHEMICAL).

The study of comparative anatomy reveals that all vertebrates, or backboned animals, possess essentially the same basic body plan (*see* VERTEBRATE). The study of paleontology reveals the relatedness of all vertebrate classes because the fossil record is sufficiently complete to demonstrate the time course and nature of their evolution. Moreover, the study of comparative embryology demonstrates that the events of embryonic development are basically very similar in the eggs of all vertebrates except for those modifications that are primarily the consequence of differences in the amount of food stored in eggs as yolk (*see* VERTEBRATE EMBRYOLOGY), or that are the consequence of adaptations for development on land or inside the mother's uterus (*see* EMBRYOLOGY, HUMAN).

By contrast, the study of comparative anatomy of those animals lumped together as invertebrates reveals a number of basic body plans that differ considerably from one another and that often appear to be completely unrelated. Each group of animals characterized by one of these basic body plans constitutes a phylum. The phyla whose development will be discussed here are those recognized by Libbie H. Hyman. It is not possible in most instances to deduce any evolutionary relationships between any two phyla on the basis of comparative anatomy alone. The only invertebrate phyla shown to be closely related by comparison of adult structure are the Annelida (*q.v.*; earthworms, leeches, etc.) and Arthropoda (*q.v.*; insects, crustaceans, etc.). Moreover, the study of paleontology reveals little about the evolution of invertebrate phyla. By the Cambrian period, *i.e.*, by the end of the first two-thirds of the earth's history, all the major phyla were already present and readily distinguished from one another with the exception of the Chordata, comprising the vertebrates and allies. Unfortunately the bodies of many invertebrates are so delicate, and the rocks of the early periods have been so altered by heating, crushing and other processes, that it is impossible to obtain a fossil record sufficiently complete to demonstrate the time course and nature of the evolutionary changes that led to the origin of invertebrate phyla.

Since comparative anatomy and paleontology provide so little information about the descent of invertebrate phyla, a great deal of attention has been focused on detailed comparisons of embryonic development in different invertebrate phyla in the hope that these would provide some clues concerning the relationships among the phyla. The fundamental postulate on which this work was based was the belief that embryos of related organisms are more nearly alike than are the adults; *i.e.*, that evolutionary changes affect the early developmental stages less markedly than the later stages.

In general it is believed that the embryonic development of marine representatives of the various invertebrate phyla has been modified less during the course of evolution than the development of representatives adapted to life in fresh water, on land or as parasites. Consequently the study of descriptive and comparative embryology has deliberately stressed the marine forms. Since the middle of the 20th century, however, the emphasis in invertebrate embryology has been on the study of the mechanisms of cellular differentiation (*see* EMBRYOLOGY, EXPERIMENTAL). Eggs of many marine invertebrates have proved to be ideal material for many studies in experimental embryology because of their transparency, the ease with which fertilization can be controlled, the ease of culturing and observing them, their availability in large numbers, etc. For these reasons much more is known about the development of marine invertebrates than of invertebrates adapted to other habitats.

Embryonic Development.—For convenience, certain stages are distinguished in the development of all animal eggs, although they frequently merge into one another almost imperceptibly. During a given stage one kind of developmental change predominates. The major stages, in order of their appearance, are as follows:

Cleavage.—Division of the activated egg into smaller and smaller cells called blastomeres; the spatial arrangement assumed by the first few blastomeres constitutes the cleavage pattern.

Blastulation.—The special arrangement assumed by blastomeres at the end of the cleavage period and prior to the onset of gastrulation, often around some sort of fluid- or jelly-filled cavity called the blastocoel.

Gastrulation (Germ-Layer Formation).—Individual or mass movements of blastomeres to form localized groups or layers called germ layers. The outermost cells constitute the ectoderm and the innermost ones the endoderm. A primitive digestive cavity, the archenteron, usually forms within the latter. In animals above a certain level of structural organization, a third germ layer, the mesoderm, forms between ectoderm and endoderm. If a cavity arises within the mesoderm, it is called a coelom.

Organogenesis.—Establishment of organ rudiments through interaction and co-operation of germ layers.

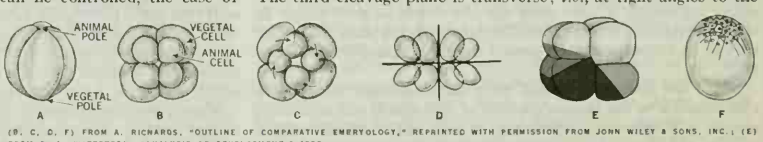
Histogenesis.—Cellular differentiation within those germ layers involved in organ formation.

Development is said to be direct when the new individual at the time of hatching or birth requires only growth and further differentiation to attain the adult form. It is said to be indirect when the new individual at the time of hatching or birth differs markedly from the adult and is called a larva, which is a stage in the life history especially adapted for feeding and/or dispersal of the species. (*See* DEVELOPMENT, ANIMAL.) Adaptation of the larva to some way of life different from that of the adult necessarily means specialization of organs along lines that will not lead directly to the structure of adult organs. In this case attainment of the adult form requires complex and often sudden changes in structure (*see* METAMORPHOSIS) as well as growth and further differentiation. Sometimes several larval stages are encountered before the adult form is attained.

THE DEVELOPING EGG

Types of Eggs.—All eggs are alike in possessing a main axis of symmetry called the polar axis, the ends of which are named the animal and vegetal poles. This axis originates while the eggs are developing in the ovaries. The two poles often differ visibly in the amount of pigment, yolk or other inert materials concentrated near them. If the yolk is slight in amount and is more or less evenly distributed, the eggs are said to be isolecithal, alecithal or homolecithal. Large amounts of yolk tend to accumulate in one region of the egg, either in the vegetal half or the centre, leaving most of the protoplasm in the animal half or the periphery, respectively. Eggs with yolk concentrated vegetally are called telolecithal, those with central yolk centrolecithal. The latter term applies in the strict sense only after the nucleated masses of protoplasm arising within the egg during cleavage subsequently migrate to the periphery.

Cleavage Patterns.—The cleavage pattern depends in part upon the distribution of yolk in the egg, but also upon other cytoplasmic factors independent of the yolk. When cleavage involves the entire egg, it is said to be total or holoblastic. The most common patterns resulting from holoblastic cleavage are called radial and spiral cleavage. In either case the first two cleavage planes are meridional; *i.e.*, they pass through the animal and vegetal poles of the eggs and stand at right angles to each other. Thus, at the four-cell stage the egg is divided into four quarters (fig. 1[A]). The third cleavage plane is transverse; *i.e.*, at right angles to the



(B, C, D, F) FROM A. RICHARDS, "OUTLINE OF COMPARATIVE EMBRYOLOGY," REPRINTED WITH PERMISSION FROM JOHN WILEY & SONS, INC.; (E) FROM R. L. WATTERSON, "ANALYSIS OF DEVELOPMENT," 1955

FIG. 1.—CLEAVAGE OF VARIOUS TYPES OF INVERTEBRATE EGGS: (A) FOUR-CELL STAGE; (B) RADIAL CLEAVAGE; (C) SPIRAL CLEAVAGE; (D) DISYMMETRICAL CLEAVAGE; (E) BILATERAL CLEAVAGE, EIGHT-CELL STAGE VIEWED FROM LEFT SIDE (SHADING SHOWS BILATERAL DISTRIBUTION OF PRESUMPTIVE GERM LAYERS); (F) DISCOIDAL CLEAVAGE. B, C AND D, EIGHT-CELL STAGES VIEWED FROM ANIMAL POLE

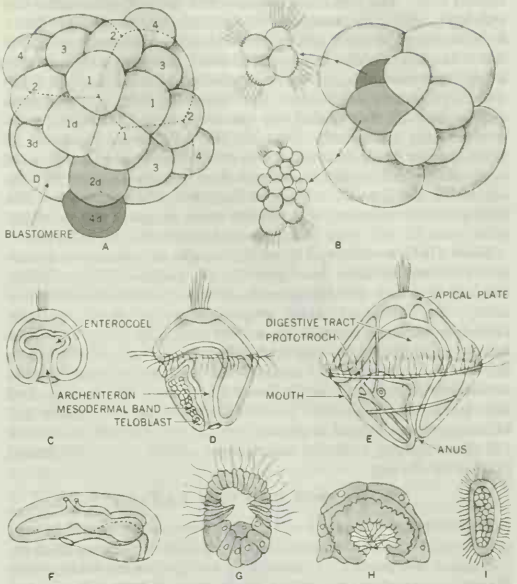
other two. In isolecithal eggs this transverse cleavage is usually equatorial, but in telolecithal eggs it tends to be latitudinal, shifted toward the animal pole, separating four smaller animal cells from four larger vegetal cells. In radial cleavage the four animal cells of the eight-cell stage lie directly above the four vegetal cells (fig. 1[B]), whereas in spiral cleavage the third cleavage planes form in such a way that the animal cells appear to have rotated relative to the vegetal ones, with the result that each of the blastomeres at the animal pole lies directly above the cleavage plane separating two of the cells at the vegetal pole (fig. 1[C]). Holoblastic cleavage results in three other cleavage patterns in invertebrates, although less frequently. One of these, known as biradial or disymmetrical cleavage, occurs only among the comb jellies (phylum Ctenophora) (fig. 1[D]). Another, called bilateral cleavage, is especially striking because of the bilaterally symmetrical arrangement of the blastomeres (fig. 1[E]). The third is called irregular cleavage because the exact cleavage pattern in any given egg is unpredictable.

When cleavage involves only part of the egg, it is said to be partial or meroblastic. If the yolk is markedly concentrated at the vegetal pole, cleavage may be restricted to a cytoplasmic cap at the animal pole (fig. 1[F]); such a cleavage pattern is called discoidal cleavage. In the case of centrolecithal eggs cleavage is said to be superficial, since the blastomeres are located on the surface of the yolk.

Regulative *v.* Mosaic Development (Indeterminate *v.* Determinate Eggs).—It is possible to separate the individual blastomeres of invertebrate eggs from one another to determine their individual developmental capacities. When Hans Driesch carried out this simple experiment in the two- and four-cell stages of sea urchin eggs, he made the momentous discovery that each half or each quarter of the original egg is capable of developing into a normal, but small, sea urchin larva (*see* EMBRYOLOGY, EXPERIMENTAL). This type of development, in which a part can regulate or modify its developmental course to form the whole, is called regulative, and the eggs capable of such development are called indeterminate. This term implies that the developmental fate of the blastomeres has not been determined or decided in early cleavage stages. In indeterminate eggs the ultimate developmental fates of the blastomeres apparently depend to a considerable extent on their positions relative to other blastomeres and upon cellular interactions among blastomeres.

When similar experiments are performed on the eggs of certain other invertebrates, for example on those of tunicates (ascidians), exactly the opposite result is obtained. Isolation of one blastomere of the two-cell stage results in formation of exactly half a larva, and isolation of one blastomere of the four-cell stage leads to formation of exactly one-fourth a larva. This type of development, in which a part of an egg, when isolated, can form only the part of the animal that normally would have been derived from it, is called mosaic development, and the eggs that undergo such development are called determinate. This term implies that the developmental fate of the blastomeres has been determined in early cleavage stages.

In mosaic development the fate of a particular blastomere appears to depend upon the specific portion of the cytoplasm segregated into it at the time of cleavage. This would imply that different localized areas of the cytoplasm of uncleaved eggs possess different morphogenetic capacities; *i.e.*, the existence of a cytoplasmic localization of organ-forming areas in the uncleaved egg. This, indeed, appears to be the mechanism of cellular differentiation in mosaic eggs. For example, in the eggs of certain annelids and mollusks a special portion of the cytoplasm becomes localized and constricted off partially into the so-called first polar lobe. Subsequently this portion of the cytoplasm becomes incorporated into one of the first two blastomeres. If this polar lobe is cut off before the first cleavage occurs, so that its contents cannot be added to one of the first two blastomeres, a defective larva results. It is incapable of forming the special apical tuft of cilia as well as the entire body region posterior to the prototroch (swimming organ). Thus the portion of the cytoplasm that enters the first polar lobe contains factors of some sort that are essential to formation of



(A, B) FROM R. L. WATTERSON, "ANALYSIS OF DEVELOPMENT," 1955; (D, F, I) FROM A. RICHARDS, "OUTLINE OF COMPARATIVE EMBRYOLOGY," REPRINTED WITH PERMISSION FROM JOHN WILEY & SONS, INC.; (E, G, H) FROM L. H. HYMAN, "THE INVERTEBRATES," REPRODUCED BY PERMISSION OF MCGRAW-HILL BOOK CO., INC.

FIG. 2.—CLEAVAGE AND DEVELOPMENT IN ANNELIDS AND MOLLUSKS

(A) Individual cells of first four quartets of micromeres are numbered; cell 2d, shown in light tone, and cell 4d, in dark tone, are two micromeres derived from the D blastomere; (B) developmental fates of progeny of first two daughter cells of a first quartet micromere; (C) enterocoelous method of coelom formation; (D) proliferation of mesodermal band by teloblast cell. Schizocoel forms subsequently within the mesodermal band; (E) trochophore larva; (F) dipleurula larva; (G) amphiblastula; (H) gastrulation of amphiblastula; (I) planula larva

the apical tuft and posttrochal region. It is known that definite substances (enzymes, vitamins) tend to be localized in definite regions of mosaic eggs, but whether these particular substances play a role in determination of morphogenetic potencies of localized areas is unknown. (*See* EMBRYOLOGY, CHEMICAL; EMBRYOLOGY, EXPERIMENTAL.)

Eggs that undergo spiral cleavage are characterized by mosaic development, but this type of development also occurs in a few eggs that do not undergo spiral cleavage. Actually, the distinction between indeterminate and determinate eggs is not as rigid as is suggested by these examples. Isolated animal and vegetal halves of sea urchin eggs cannot develop into normal larvae, so not all regions of so-called indeterminate eggs are capable of regulation into completely normal individuals. Moreover, fragments of uncleaved determinate eggs of certain species are capable of regulation into normal larvae. But for practical purposes the distinction between indeterminate and determinate eggs is a useful one.

Cell-Lineage Studies.—In the case of determinate eggs it is possible to follow the developmental fates of individual blastomeres and their progeny with great accuracy by direct observation and thus to determine the exact parts of the body of the larva that form from each blastomere and its derivatives. Such studies are called cell-lineage studies. They have been pursued with remarkable success by many famous American embryologists.

For example, the spiral cleavage pattern of the eggs of many annelids and mollusks is remarkably similar (fig. 2[A]). It is characterized by the formation from the first four blastomeres (conventionally designated as A, B, C and D) of four quartets of smaller cells (micromeres, labeled and numbered according to their origin and time of appearance as, for example, 1d, 2d, 3d and 4d, the four micromeres derived from blastomere D) toward the animal pole and one quartet of larger cells (macromeres) toward the

vegetal pole. The first three quartets and their offspring form the ectoderm, with the exception of cell 2d, which also produces ectomesoderm in some species (*see* below). Micromere 4d gives rise to the two teloblast cells, each of which produces a mesodermal band, the entire source of the endomesoderm (*see* below), in addition to producing endoderm. The remaining cells of the fourth quartet and all four underlying macromeres at the vegetal pole produce only endoderm. Actually, the cell lineage is known in much greater detail than this. For example, it is known that four large ciliated cells of the prototroch arise in each quadrant by two successive divisions of one of the daughter cells arising from the first quartet micromere, whereas the other daughter cell produces other specific cell types in appropriate numbers (fig. 2[B]).

Blastulation.—Several types of blastulae are encountered commonly in invertebrate development: (1) coeloblastula, a hollow blastula in which the blastomeres arrange themselves around a cavity, the blastocoel, which may be large or small, centrally placed or displaced towards the animal pole; (2) stereoblastula, a type of solid blastula in which all cells extend from the surface to the centre of the egg; (3) morula, another type of solid blastula containing cells in the centre that do not reach the surface, and vice versa; (4) superficial blastula (periblastula), in which the blastomeres are located at the surface of a central yolk mass; and (5) discoblastula, a disc of blastomeres resting on the uncleaved portion of the egg.

FORMATION OF GERM LAYERS

Endoderm Formation.—Endoderm formation occurs in several ways in eggs of invertebrates. By embolic gastrulation or invagination one portion of the wall of a coeloblastula folds within the rest, thus forming a blind sac lined with endoderm; the external opening from this sac is the blastopore. By epibolic gastrulation or epiboly the small blastomeres of the animal hemisphere overgrow the large cells of the vegetal hemisphere; the uncovered area at the vegetal pole represents the blastopore, but it eventually disappears when overgrowth is complete. In involution the cells turn under and extend beneath the ectoderm to form endoderm, usually in meroblastic eggs; a modification of epiboly. In unipolar ingression the cells at the vegetal pole withdraw into the interior singly or en masse. Multipolar ingression occurs when the cells over the entire surface of the blastula withdraw singly into the interior. In delamination the inner ends of the cells of the coeloblastula are cut off by cleavage planes to become endoderm. A blastopore is lacking in those cases where endoderm formation is by ingression or delamination.

Blastopore: Mouth *v.* Anus.—In most of the invertebrate phyla the blastopore persists as the mouth opening of the digestive tube, or the mouth forms approximately where the blastopore closed. In other invertebrate phyla the blastopore persists as the anal opening, or the anus forms approximately where the blastopore closed.

Formation of Mesoderm and Coelom.—There are two kinds of mesoderm, which appear to be phylogenetically distinct: ectomesoderm and endomesoderm. Ectomesoderm is always mesenchymal and typically consists of ectodermal cells that wander into the interior. It is present in the Radiata and in the Protostomia (*see* below). Where cleavage is spiral, ectomesoderm arises from one or more cells of the second and/or third quartets. Endomesoderm arises from or with endoderm; it is referred to as true mesoderm. The coelom always arises as a cavity within endomesoderm.

Endomesoderm originates by several methods: (1) teloblastic method—the 4d cell of eggs exhibiting spiral cleavage divides to form two teloblast cells, which move into the blastocoel, each proliferating a mesodermal band; (2) derived mesodermal band method—endomesoderm comes from paired bands that arise from a mass of cells around the blastopore; once formed, these bands behave much the same way as those originating from teloblast cells; (3) enterocoelous method—the mesoderm is formed in whole or in part by the outpouching of the archenteron wall; (4) lamellar method—the mesoderm grows out as a flattened layer of cells around the blastopore; it is commonly regarded as a modified enterocoelous method; and (5) mesenchymal method—formation of endomesoderm by inwandering of endoderm cells en masse or more or less singly; it may be combined with other methods of mesoderm formation.

The coelom is spoken of as an enterocoel or as a schizocoel, depending on its method of formation. An enterocoel (fig. 2[C]) is the cavity of the pouch or pouches arising from the wall of the archenteron and is thus continuous initially with the archenteron. It and the enterocoelous mesoderm therefore originate simultaneously during embryonic development. A schizocoel originates as a cavity within the endomesoderm that arises as solid masses from teloblasts, derived mesodermal bands, lamellae or mesenchyme (fig. 2[D]). It is never continuous with the cavity of the archenteron and originates later in embryonic development than the mesoderm surrounding it.

PHYLOGENETIC SIGNIFICANCE OF EMBRYOS AND LARVAE

Embryonic Basis for the Diphyletic Theory of Origin of Phyla.—The so-called higher phyla, *i.e.*, those whose structural complexity exceeds that of the Protozoa, Mesozoa, Porifera, Coelenterata and Ctenophora, appear to fall quite naturally into two major groups on the basis of four features of embryonic development discussed thus far, namely: (1) the fate of the blastopore or blastopore region; (2) the cleavage pattern; (3) the time of determination of the fates of the blastomeres; and (4) the method of coelom formation.

Those phyla whose blastopore or blastopore region becomes the anus are grouped together as the Deuterostomia: Chaetognatha, Pogonophora, Echinodermata, Hemichordata and Chordata. Members of these phyla are usually characterized by radial cleavage, indeterminate eggs (regulative development) and the enterocoelous method of coelom formation. Those phyla whose blastopore or blastopore region becomes the mouth are grouped together as the Protostomia. Members of these phyla are characterized in general by spiral cleavage, determinate eggs (mosaic development), and usually by the schizocoelous method of coelom formation. The Protostomia include the following phyla that possess a coelom: Ectoprocta (Bryozoa), Phoronida, Brachiopoda, Mollusca, Sipunculida, Echiurida, Annelida and Arthropoda. Moreover, even though they fail to form a coelom, the acoelomate phyla—Platyhelminthes and Nemertina—as well as the pseudocoelomate phyla—Acanthocephala, Aschelminthes and Entoprocta—are lumped together with the Protostomia because their development is similar to that of the Protostomia in other aspects.

Thus the study of comparative embryology of the invertebrates suggests that there have been two major lines of evolution of the higher phyla. This concept is known as the diphyletic theory of origin of phyla. It is believed that the features of embryonic development used to set the Deuterostomia apart from the Protostomia are so fundamental that there is little likelihood that they would vary readily in adaptation to different habits and habitats. Hence they are reliable indicators of the relationships of invertebrate phyla.

General Larval Types.—Although marine annelids and mollusks differ greatly in their basic adult morphology, they produce so-called trochophore larvae that are almost identical. Larvae very similar in their basic structure to the trochophore larva also develop in other phyla among the Protostomia. Similarly, although echinoderms and hemichordates differ so very strikingly in their adult morphology, their embryonic development results in a larval stage that is almost identical in the two phyla; this larva has been called the dipleurula. Consequently it is often stated that another way in which the Deuterostomia differ from the Protostomia is their ability to form a dipleurula larva, which is distinctly different from the trochophore. Because of the phylogenetic significance attached to these two larval types, some attention should be paid to their basic structure.

Trochophore.—The trochophore larva (fig. 2[E]) is somewhat biconical in shape. Around the equator there is a ciliated swimming structure termed the prototroch; other ciliated bands may be present as well. At the apical pole is a sensory apical plate

bearing a tuft of enlarged cilia; various other sensory structures may be present also. A ciliated digestive tract leads from the mouth at the equator through the elongated stomodaeum and enlarged stomach to the narrow intestine and finally to the anus at the lower pole. The prominent blastocoel is more or less occupied by mesenchyme cells and well-developed larval muscle cells, all formed from ectomesoderm. Within the loop formed by the digestive tube are the paired mesodermal bands. Near each of these is a nephridium (excretory structure) consisting of a tubule whose inner end is closed by one or more solenocytes or flame cells (a long tubular cell having a flagellum moving in the tube).

Dipleurula.—In contrast to the trochophore larva, the dipleurula larva (fig. 2[F]) is actually a hypothetical organism combining the features common to all echinoderm and hemichordate larvae. It is bilaterally symmetrical and in different groups gives rise to more advanced variant forms such as the pluteus, bipinnaria, brachiolaria and other larval types. The locomotor organ is a ciliated band surrounding the mouth and is thrown into preoral and anal loops. The ciliated digestive tube possesses the same subdivisions as that of the trochophore larva. No derivatives of ectomesodermal origin are present in the blastocoel. Instead, the latter is occupied by the paired enterocoelic coeloms, each of which is partially divided into anterior, middle and posterior portions. The left coelom, and sometimes the right as well, establishes a connection to the outside by way of the stone canal and madreporic pore. No nephridium of any kind is present.

Thus the two general larval types, the trochophore and the dipleurula, are so different in certain basic features that they would seem to be as reliable indicators of two different lines of evolution as those aspects of embryonic development used to distinguish the Protostomia from the Deuterostomia. *See* also ANIMALS, PHYLOGENY OF.

SURVEY OF PHYLA

As mentioned in the opening paragraph the Protozoa are excluded from this discussion. Among the metazoans only the Mesozoa are excluded; the Parazoa, comprising only the phylum Porifera, or the sponges, and the Eumetazoa, including Radiata and Bilateria, contain all the remaining phyla.

PARAZOA

Porifera.—Embryonic development of sponges differs so markedly from that of all true Metazoa that we can only conclude that the phylum Porifera diverged from the evolutionary lines of higher organisms at a very early stage in metazoan evolution. The peculiar feature of embryonic development of calcareous and siliceous, or horny, sponges is the fact that the cells of the animal hemisphere appear to form structures typically formed by the vegetal hemisphere of other Metazoa, and vice versa. Thus the cells of the animal hemisphere become flagellated and eventually line the internal cavity (spongocoel) as a layer of collar cells (choanocytes), whereas the cells of the vegetal hemisphere eventually form the outer epidermal covering and ectomesenchyme. The future choanocytes of calcareous sponges at first develop flagella at their inner ends facing the blastocoel. A mouth forms within the group of nonflagellated cells, and the blastula turns itself inside out to form the characteristic larval type of this group, the amphiblastula (fig. 2[G]). Embolic gastrulation then occurs, bringing the future choanocytes inside the future epidermal cells (fig. 2[H]). In other sponges flagella arise on the outside of all cells of the blastula except the most posterior (vegetal) ones. The latter wander into the interior, resulting in formation of a stereogastrula. Later the internal cells migrate to the surface, thus enclosing the flagellated cells that develop into choanocytes.

EUMETAZOA

Two phyla among the remaining Metazoa are characterized by radial symmetry and are hence spoken of collectively as the Radiata, namely the Coelenterata and the Ctenophora. All other metazoan phyla are characterized by bilateral symmetry. For this reason the Radiata, as well as the Porifera, are considered to be offshoots of the main evolutionary line leading to the Bilateria or to be descendants of different protozoan ancestors.

Coelenterata.—The phylum Coelenterata contains the hydroids, jellyfishes, sea anemones and corals. These animals exhibit two basic morphological patterns, the polyp and the medusa. Only the medusoid form is capable of sexual reproduction, except in those species that lack a medusa, in which case the polypoid form can reproduce sexually. Cleavage is typically indeterminate, holoblastic and either radial or irregular. The blastomeres often adhere loosely to one another. The capacity for complete regulation is retained by portions of coelenterate eggs until surprisingly advanced cleavage and blastula stages. Endoderm formation typically involves unipolar or multipolar ingression or delamination, resulting in formation of a stereogastrula that soon develops into the characteristic planula larva (fig. 2[I]). However, in certain more complex coelenterates cleavage may result in formation of a coeloblastula, which then undergoes gastrulation by invagination. The planula typically attaches by its blunt anterior end; the endoderm rearranges itself into an epithelium bounding a gastrovascular cavity, a mouth breaks through at the free end, tentacles arise around the mouth and stolons around the base, thus resulting in formation of a typical polyp. Budding (an asexual method of reproduction) results in formation of other polyps (in colonial forms) or of medusae. Thus in coelenterates that possess a medusoid form there is said to take place an alternation of generations: embryonic development of the egg produces a planula larva that develops into a polyp, which produces medusae by asexual methods; the medusa, in turn, reproduces sexually by means of eggs and sperm. An asexual generation (the polyp) alternates with a sexual generation (the medusa). In the case of jellyfish the polyp is called a scyphistoma. By transverse fission (strobilation) it buds off miniature jellyfishes called ephyrae larvae, which in turn develop into adult jellyfishes. In some coelenterates the planula larva develops into an unattached polypoid form called the actinula larva, which then becomes attached to complete its development into a polyp.

Ctenophora.—Development of the ctenophores (comb jellies) differs markedly from development of the coelenterates. Cleavage is typically determinate, holoblastic and biradial (disymmetric). The basic feature of this cleavage pattern is evident at the eight-cell stage (fig. 1[D]). The eight blastomeres are arranged in two rows of four each, with the central cells larger than the end ones. There are two planes that can divide the egg into halves that are mirror images of one another. These eight cells produce two generations of micromeres that overgrow the macromeres to form the entire epidermis including the eight rows of swimming plates characteristic of ctenophores. Thus gastrulation is mainly by epiboly, although the macromeres invaginate somewhat into the interior so that the gastrula arises by the combined processes of epiboly and emboly. Although the exact origin of the mesoderm is not certain, it is believed to be ectomesoderm, as in some of the coelenterates. A planula larva is not formed. Suitable experiments have demonstrated that the fates of the blastomeres, at least of certain of the micromeres, are as rigidly determined at an early stage as are the fates of the micromeres in eggs that undergo spiral cleavage.

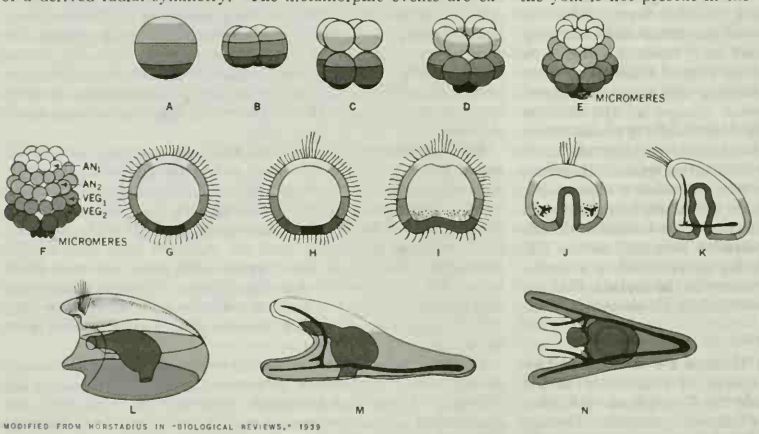
Echinodermata.—Among the Bilateria, attention will be directed first to the Deuterostomia and to the embryonic development of representatives of the phylum Echinodermata. Development is best known in the case of eggs of sea urchins and sand dollars (class Echinoidea). Cleavage progresses rapidly and is of the holoblastic equal type until the eight-cell stage (fig. 3[C]), whereupon each of the four vegetal cells gives rise to a small micromere at the vegetal pole (fig. 3[D]). Subsequent cleavages lead to formation of four tiers of cells above the micromeres (fig. 3[E, F]), referred to in order from the animal to the vegetal poles as an_1, an_2, veg_1 and veg_2.

The structures contributed to the resulting larva by derivatives of each tier of cells can be determined readily by examining fig. 3(G–N). A typical coeloblastula is formed (fig. 3[G, H]) and gastrulation occurs by classical embolic invagination of the veg_2 cells to form the archenteron (fig. 3[J]). Paired coelomic pouches arise from the blind end of the archenteron (fig. 2[C]), and sub-

sequently constrict free from the archenteron. Later these each constrict partially into three antero-posterior subdivisions (fig. 2[F]). Thus the endomesoderm and coelom form by the enterocoelous method. A stomodaeum arises from the ventral ectoderm (fig. 3[K]) and establishes connection with the blind end of the archenteron, which subsequently differentiates into esophagus, stomach and intestine. The original blastopore persists as the larval anus. A ciliated band develops around the ventral surface (fig. 3[L], left). Projections arise and form various larval arms. The ciliated band extends along these arms. The resulting larva (fig. 3[M, N]) is the pluteus larva. Development of certain brittle stars (class Ophiuroidea) likewise results in formation of a pluteus larva, in this case called ophiopluteus.

S. Hörstadius has been able to separate the individual tiers of cells and to recombine them at will. By such delicate operations he has been able to demonstrate that normal development depends upon the proper balance between certain forces concentrated in the animal half (animalizing tendencies) and other forces concentrated in the vegetal half (vegetalizing tendencies). For example, an isolated animal half will not develop normally, and neither will an isolated vegetal half. But if the an_1 and an_2 tiers are combined with micromeres, thereby balancing strong animalizing against strong vegetalizing tendencies, a normal larva results. Current research is seeking to find a chemical or physical basis for these animalizing and vegetalizing influences, and considerable progress has been made.

Development of starfish (class Asteroidea) likewise involves total and approximately equal cleavage. Micromeres do not form and the tiers of cells characteristic of sea urchins are not distinguishable. Gastrulation, formation of the digestive tract and coelom formation occur essentially as in sea urchins. Similarly the previously uniform ciliation becomes concentrated into the usual locomotor band. The larva rapidly puts out projections bordered by the ciliated band; these correspond to the arms of echinoid larvae. The larva is then called a bipinnaria (fig. 4[A]). It typically transforms later into a brachiolaria larva (fig. 4[B]), characterized by the possession of three additional brachiolar arms. Some asteroids develop more directly by omitting one or more larval stages. Development of sea cucumbers (class Holothuroidea) is essentially the same, but the resulting larva is called the auricularia. It may transform into another larva called the doliolaria, or the latter may arise directly from the egg without formation of an auricularia stage. Crinoids or sea lilies similarly develop a doliolaria larva. In all classes the bilaterality of the larval stages bears witness to the origin of the echinoderms from bilateral ancestors. Metamorphosis of echinoderms typically involves the loss of bilateral symmetry and the secondary formation of a derived radial symmetry. The metamorphic events are extremely complex, especially as regards the history of the subdivisions of the coelom.



MODIFIED FROM HÖRSTADIUS IN "BIOLOGICAL REVIEWS," 1939

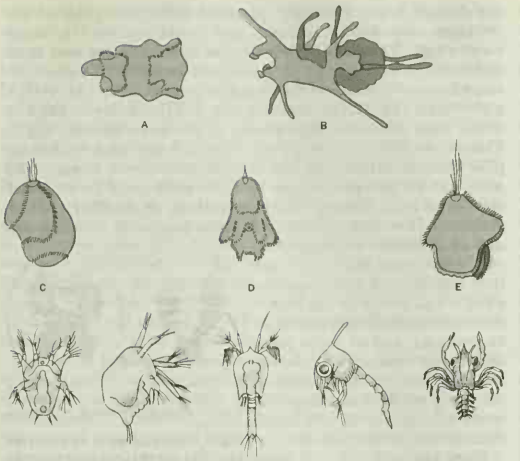
FIG. 3.—DEVELOPMENTAL SEQUENCE OF SEA URCHIN EGG LEADING TO FORMATION OF PLUTEUS LARVA. THE KEY TO THE PRESUMPTIVE GERM LAYERS IS INDICATED AT F; *see* TEXT

Hemichordata.—Members of the wormlike phylum Hemichordata (sometimes considered a subphylum of Chordata) differ so completely from adult echinoderms that there is no obvious relationship between them on the basis of comparative anatomy. And yet, when the details of their embryonic development and larval structure are compared, the conclusion seems inescapable that hemichordates and echinoderms stem from a common ancestor. Cleavage is holoblastic, approximately equal and mostly of the radial type. Formation of a coeloblastula is followed by gastrulation by embolic invagination. The blastopore, which marks the posterior end, is the site of the future anus. The inner end of the archenteron is cut off as a coelomic vesicle that establishes continuity with the outside by a pore located on the left side. Development of the digestive tract is strikingly similar to that of echinoderm larvae. A distinct ciliated swimming band forms in much the same way as in the asteroid bipinnaria larva. The resulting larva is called the tornaria (fig. 4[C]), and was originally mistaken for an asteroid larva. There appears to be little doubt that the hemichordates stand close to the evolutionary line leading to the cephalochordates and urochordates; *i.e.*, to the invertebrate members of the phylum Chordata.

Pogonophora.—The Pogonophora, considered a phylum by some, appears to be closely related to the Hemichordata on anatomical grounds. Cleavage and blastulation differ markedly from these processes in other deuterostomes, but coelom formation is by the enterocoelous method.

Chaetognatha.—Although comparative anatomy suggests that the phylum Chaetognatha is closely related to the phylum Aschelminthes, the embryology of chaetognaths suggests an affinity with other members of the Deuterostomia. Cleavage is of the equal holoblastic type, is radial and indeterminate. A spherical blastula forms and undergoes typical embolic gastrulation. The blastopore marks the future posterior end and the site of the future anus. Paired coelomic pouches arise from the archenteron by an enterocoelous method that differs in detail from the method encountered in echinoderms. A ciliated larval stage is lacking, the animal hatching as a small replica of the adult.

Platyhelminthes.—The first phylum among the Protostomia to receive attention here is that containing the flatworms, Platyhelminthes. All members of two classes of this phylum are exclusively parasitic; *i.e.*, the trematodes or flukes and the cestodes or tapeworms. The structure and life histories of these parasites are highly modified for the parasitic way of life. Moreover, the embryonic development of the majority of the free-living flatworms (class Turbellaria) is likewise greatly modified by the fact that the yolk is not present in the eggs themselves, as in most other phyla, but is contained within special yolk cells that nourish the developing embryos. Only the Acoela and the Polycladida in this class lack these yolk cells, and their development alone appears to be relatively unmodified from its original pattern. Cleavage in the eggs of polyclads is holoblastic and spirally determinate. The cleavage pattern and cell lineage are strikingly similar to those of annelids and mollusks, indicating the phylogenetic relationship of the polyclads to these phyla. Gastrulation occurs chiefly by epiboly, resulting in formation of a stereogastrula. Ectomesoderm arises from cells of the second and possibly the third quartet of micromeres. One cell of the fourth quartet (4d) provides all of the endomesoderm as well as the en-



(A, C) FROM E. MACBRIDE, "TEXTBOOK OF EMBRYOLOGY," 1914; (B, D) FROM L. H. HYMAN, "THE INVERTEBRATES," REPRODUCED BY PERMISSION OF MCGRAW-HILL BOOK CO., INC.; (E) A. RICHARDS, "OUTLINE OF COMPARATIVE EMBRYOLOGY," REPRINTED WITH PERMISSION FROM JOHN WILEY & SONS, INC.; (F, G, H, I) FROM KORSCHELT AND HEIDER, "TEXTBOOK OF THE EMBRYOLOGY OF INVERTEBRATES," 1899; (J) FROM T. J. PARKER AND W. A. HASWELL, "A TEXTBOOK OF ZOOLOGY," 1940

FIG. 4.—TYPES OF INVERTEBRATE LARVAE: (A) BIPINNARIA; (B) BRACHIOLARIA, LARGE BRACHIOLAR ARMS WITH SUCKERS ARE AT LEFT; (C) TORNARIA; (D) MÜLLER'S LARVA; (E) PILIDIUM; (F) NAUPLIUS; (G) METANAUPLIUS; (H) PROTOZOEA; (I) ZOEA; (J) MEGALOPS STAGE. (F–J ARE CRUSTACEAN LARVAE EXCLUSIVELY)

tire endoderm. The gastrula stage may develop directly into a small worm, which then escapes from the egg capsule, or it may develop into a larval form known as Müller's larva, whose chief characteristic is the development of eight posteriorly directed lobes or lappets (fig. 4[D]); these lobes disappear as the larva develops into a small worm. In some species the larva has only four lobes and is called Götte's larva. Development of the eggs of Acoela is interesting in that they undergo only one meridional cleavage instead of the usual two; accordingly, these two cells produce successive duets of micromeres rather than the usual quartets. Moreover, there is no separation of the interior cells of the stereogastrula into endoderm and endomesoderm, and no digestive cavity forms.

Nemertina.—The nemertine worms (phylum Nemertina) are grouped with the flatworms as the acoelomate Bilateria, *i.e.*, the bilateral animals without a coelom; there seems to be little doubt that nemertines are derived from the flatworms. Cleavage follows the spiral determinate pattern. There are four quartets of so-called micromeres, although they are actually larger than the so-called macromeres. A ciliated coeloblastula usually results. Gastrulation is typically by epiboly, sometimes by invagination of macromeres, occasionally by unipolar ingression. Ectomesoderm forms from micromeres, probably most commonly from the second quartet, and endomesoderm arises from teloblast cells that usually arise from the 4d cell. There is no definite formation of mesodermal bands from teloblasts. Although spaces sometimes appear within the endomesoderm, they are not sufficiently constant or definite to warrant the designation of coelom. Development is often direct but in some cases leads to formation of a pilidium larva (fig. 4[E]) or of Desor's larva, which is a pilidium modified for creeping. The pilidium is provided with an apical sense organ, atop of which is a long spike of cilia. Except for this tuft and the marginal locomotor cilia called the prototroch, the cilia are of uniform size and distribution. The two lobes that hang from the sides suggest the corresponding ones of Müller's larva. The gut cavity opens by a wide blastopore and curves posteriorly to form the stomach. This larva appears to be a preliminary step in the direction of formation of a trochophore larva. Eggs of one of the nemertine worms, *Cerebratulus*, have been used extensively for classical experiments on mechanisms of differentiation. From at least the eight-cell stage on, development appears to be clearly of the determinate type, since experiments provide no evidence of cellular interaction at these stages. However, isolation of animal and vegetal halves of the egg prior to fertilization, as well as other experiments, demonstrate that any fragment of the unfertilized egg can develop into a normal pilidium larva, indicating a high degree of regulative capacity in early stages. Certain other experiments demonstrate that the change from a regulative to a determinate type of development occurs progressively during the period extending from the time of dissolution of the germinal vesicle (egg nucleus) to the time of fusion of the egg and sperm pronuclei; *i.e.*, in stages immediately prior to the first cleavage.

Aschelminthes, Acanthocephala and Entoprocta.—Three phyla are spoken of as the pseudocoelomates, namely the Aschelminthes, Acanthocephala and Entoprocta. In these groups the body cavity that appears superficially to be a coelom actually proves to be a persisting blastocoel. The phylum Aschelminthes contains the Rotifera, Gastrotricha, Kinorhyncha, Priapulida, Nematoda and Nematomorpha. In general the embryology of these forms is incompletely known and, where known, provides few clues concerning relationships with other phyla. However, there is some indication that this group is closely related to flatworms and may be derived from some primitive turbellarian.

Development has been studied in detail only in the nematodes. They exhibit rigid mosaic development, but the most interesting feature of their development is the early segregation of a germ-cell line from a somatic-cell line. During cleavage stages chromosomes remain intact only in cells of the germ-cell line; in cells of the somatic-cell line they undergo a process of "chromatin diminution," surviving in a broken and reduced state.

Cleavage in the phylum Acanthocephala seems to be of the spiral type, thus relating the group to other Protostomia, and the embryology presents a number of points of resemblance with that of the Platyhelminthes. However, embryonic development of this phylum presents so many peculiarities that it has been of little value in establishing phylogenetic relationships. Cleavage in the phylum Entoprocta is spiral and determinate in its broad aspects, although the details differ in marked ways when compared with the development of other Protostomia.

Annelida, Mollusca and Others.—In spite of marked differences in adult anatomy, development of certain marine members of the phyla Annelida and Mollusca, and of the phyla Sipunculida and Echiurida, is so similar up to the trochophore stage that these groups can be considered together. Among classical papers written by American embryologists are those of E. B. Wilson on cleavage pattern and cell lineage of the marine worm *Nereis*, and of E. G. Conklin on cleavage pattern and cell lineage of the marine mollusk *Crepidula*. There are striking similarities of development in these two distinct phyla even down to the most minute details.

Cleavage is clearly of the spiral, determinate type. Four quartets of micromeres are formed (fig. 2[A]), with the ectomesoderm being produced by the second quartet and the endomesoderm from the 4d cell by way of teloblast cells that in turn proliferate the two mesodermal bands (fig. 2[D]). The coelom forms within these bands by a schizocoelous method. In annelids the mesodermal bands become segmented and their primary segmentation is imposed upon the rest of the body, whereas in mollusks such segmentation is lacking. Gastrulation is typically by epiboly and results in formation of the classical type of trochophore larva. The trochophore of annelids metamorphoses directly into the adult form, whereas the trochophore of mollusks often assumes another larval form, the veliger, before metamorphosing into the adult. This larva is characterized by a great overdevelopment of the swimming structure, the prototroch, to form the velum. The original bilateral symmetry of the molluscan larva is secondarily lost during the complex metamorphosis.

Many classical experiments have been made on the eggs of marine annelids and mollusks that establish beyond doubt that development is of the rigidly determinate type once cleavage gets under way. However, if some of these eggs are treated appropriately prior to the first cleavage, each of the first two blastomeres can, if isolated, develop into a normal larva. Thus, as in the case

of the nemertine worm *Cerebratulus*, development of the egg is regulative in its earliest stages, becoming determinate by the time the first cleavage is completed.

Phoronida, Ectoprocta and Brachiopoda.—Three other metazoan phyla are spoken of collectively as the lophophorate coelomates, namely the Phoronida, Ectoprocta (Bryozoa) and Brachiopoda. Certain aspects of their embryonic development suggest close affinities with the Protostomia; among them are the following: (1) traces of spiral cleavage in phoronids; (2) gastrulation commonly by epiboly (phoronids and brachiopods); (3) formation of the mouth from the blastopore region; (4) trochophorelike larvae with apical organ (actinotroch of phoronids, cyphonautes of ectoprocts); (5) solenocytic protonephridia (phoronids); and (6) swimming organ a ciliated band near or below the equatorial plane (phoronids, ectoprocts). But in their type of cleavage (often radial or irregular) and in the type of blastula they form (coeloblastula), they resemble the Deuterostomia. Moreover, some brachiopods appear to form the coelom by an enterocoelous method as in the Deuterostomia. Thus the lophophorate coelomates seem to constitute somewhat of a connecting link between Protostomia and Deutèrostomia, although in general they seem to be more closely related to the former.

Arthropoda.—The major phylum remaining for consideration is the Arthropoda. On the basis of comparative anatomy there appears to be little doubt that this phylum originated from the Annelida. Nevertheless, most arthropods differ strikingly from members of all other phyla both in their embryonic development and in their larval types. Their eggs are typically of the centrolecithal type and characteristically undergo superficial cleavage, thus producing a periblastula, which consists of a layer of blastomeres (the blastoderm) enclosing a central mass of yolk (fig. 5[A]). The blastoderm soon thickens ventrally to form the ventral plate or germ band. Endoderm forms from this ventral plate by invagination from a localized area or from a less restricted area, but sometimes it originates in more obscure ways involving immigration and delamination. In general, the endoderm appears to form the mid-gut. The fore-gut arises from the ectodermal stomodaeum and the hind-gut from the ectodermal proctodaeum. The three subdivisions of the digestive tract eventually become confluent. A mass of mesoderm also forms from the ventral plate, usually in close relation with the endoderm, sometimes seemingly proliferated by the latter. It frequently extends anteriorly as two distinct mesodermal bands (so-called derived mesodermal bands). These typically divide into segments or somites within each of which a coelomic cavity appears (schizocoelous method). Fusion of these separate coelomic cavities soon follows, but coelom development in arthropods remains rudimentary. Paired rudiments of appendages begin to take form on the ventral plate and distinct body segments become evident externally (figs. 5[B]–6[B]). In the cases of insects and arachnids the developing embryo encloses itself in two protective embryonic membranes, the amnion and serosa (fig. 5[D]). Arthropod eggs are not very satisfactory for experimental purposes; therefore, with the exception of insect eggs, not much is known about the physiology of their development.

Crustaceans hatch in a variety of larval forms. The most typical crustacean larva is the nauplius (fig. 4[F]), a minute creature, egg shaped, broad anteriorly, provided with three pairs of appendages—antennules, antennae and mandibles—and a single median eye. This level of development may be passed over as an embryonic stage (fig. 6[A]), the animal hatching in a more advanced stage of development such as a metanauplius (fig. 4[G]), a protozoea (fig. 4[H]) or a zoea (fig. 4[I]). Lobsters hatch in a still more advanced stage known as the megalops (fig. 4[J]). Crustaceans that hatch in a simpler larval form (such as the nauplius) may transform into one or more other larval forms in this series before metamorphosing into the adult body form. Each new larval form emerges only after molting or shedding the exoskeleton. In several instances it has been possible to recognize certain adult animals as crustaceans only when it was discovered that their eggs hatched into a nauplius larva. This is true of the barnacles, which superficially appear to be mollusks, and of some parasitic crustaceans such as *Sacculina*, which in the adult stage is extremely modified in adaptation to its special way of life, being reduced to a tumourlike sac.

FROM E. MACBRIDE, "TEXTBOOK OF EMBRYOLOGY," 1914

FIG. 6.—DEVELOPMENT OF CRAYFISH EGG: (A) VENTRAL VIEW OF VENTRAL PLATE SHOWING RUDIMENTS OF APPENDAGES; (B) SAME VIEW SHOWING FURTHER DEVELOPMENT

Some insects hatch in a form essentially like that of the adult. These are known as ametabolous insects. Most insects, however, hatch in a larval form differing from the adult in lesser or greater degree. If the segments and appendages of the larva later become directly converted into those of the adult, the insect is said to be heterometabolous (or hemimetabolous) and the larval stages are spoken of as nymphs. A heterometabolous insect is said to undergo incomplete metamorphosis. In striking contrast is the holometabolous insect, which hatches as a larva completely different from the adult in external form, nature of appendages and internal organization. Such a larva is usually active and very voracious. It subsequently enters a quiescent or pupal stage during which a more or less complete reconstruction of the organs takes place. Many larval tissues are broken down by phagocytic or other action. New adult structures are built up from certain patches of cells present in the larva as the imaginal discs. Thus a holometabolous insect is characterized by complete metamorphosis.

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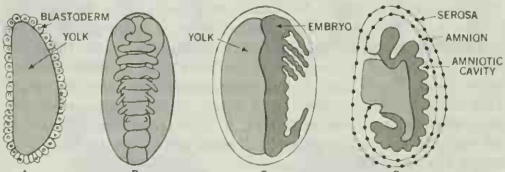


FROM O. A. JOHANNSEN & F. BUTT, "EMBRYOLOGY OF INSECTS AND MYRIAPODS," REPRODUCED BY PERMISSION OF MCGRAW-HILL BOOK CO., INC.

FIG. 5.—DEVELOPMENT OF INSECT EGG: (A) PERIBLASTULA. BLASTODERM COVERS YOLK; (B) VENTRAL VIEW OF VENTRAL PLATE SHOWING RUDIMENTS OF PAIREO APPENDAGES AND SEGMENTATION OF BODY; (C) LATERAL VIEW WITH RUDIMENTS OF APPENDAGES AT RIGHT; (D) LATERAL VIEW SHOWING SEROSA, AMNION AND AMNIOTIC CAVITY

INVESTIGATION, CRIMINAL. The principal purpose of criminal investigation is to provide answers to certain questions relating to crime. These include: the identity of the victim; the exact place at which the offense occurred; how the crime was committed and the means employed in its commission; the time of attack; the motive or object of attack; and the identity of the offender or offenders. Criminal investigation is employed also in the search for and interrogation of material witnesses who are able and willing to give competent and relevant testimony against the suspect or offender, and in the reconstruction of all facts connected with the crime in order that, at the trial of a defendant, a true picture of what occurred may be presented so as to leave no doubt in the minds of the jurors or judge regarding the guilt or innocence of the accused.

HISTORY

Although the beginning of criminal investigation is unknown, there is reason to believe that it came into existence in a very

rudimentary form with the origin of legal trials. It is clearly laid down in the code of Hammurabi (*c.* 18th century B.C.) that suspicion does not give ground for condemnation; receiving of testimony and even elaborate examination of sites or circumstances by the court itself were established rules of procedure.

In Athens, by about 500 B.C., the examination of facts had become meticulous; a defendant, having lost his case, might bring suit against a witness for bearing false testimony and, if successful, would be freed of his earlier condemnation. In the Justinian legislation (6th century A.D.) evidence was so construed as to imply the co-operation of experts in certain cases. In the middle ages, whether in civil or in ecclesiastical courts, and generally in the commercial and customary tribunals, the weighing of evidence was as careful as it has ever been. The introduction, in that period, of courts of inquest whose object was avowedly to procure condemnations, such as those of heretics, and the survival of certain ancient uses of the ordeal have obscured the prevalence then of careful taking of evidence.

In 1507 a penal code containing exact instructions relating to evidence was issued by a bishop of Bamberg, and in 1532 the Caroline code of the German states contained provisions for the examination of criminals. In 1575 a French physician described the form in which judicial reports should be made in medico-legal cases, and at the close of the 16th century outlines of the method of testifying in such cases were numerous, especially in Italy. Toward the end of the 18th century legal medicine was recognized as a science. Mathieu Orfila, who occupied the chair of chemistry and medical jurisprudence in the University of Paris, was employed as an expert in judicial proceedings; in 1813 he published a *Traité des poisons.* In 1689 Johannes Bohn, of Leipzig, published a work on the examination of wounds, the distinction between ante-mortem and post-mortem wounds, and the different effects of death by injury, strangulation and drowning. In another work, published in 1704, he gives rules for the conduct of physicians during court testimony. During the latter part of the 18th century German scientists published numerous books on the subject. Lectures in medical jurisprudence were given at the University of Edinburgh in 1792, and in 1806 the university gave the title of "professor of medical jurisprudence" to A. Duncan, Jr. Thomas Percival, with *Medical Ethics* (1803), made himself one of the first noteworthy English contributors to medical jurisprudence, and was followed by John Gordon Smith. In 1823 J. A. Paris and J. S. Fonblanque published the first English work which associated the medical and legal professions. In 1836 Alfred Swaine Taylor published *Elements of Medical Jurisprudence,* an authoritative work. The first Spanish treatise on legal medicine (1796–97) was written by Juan Fernández de Valles. In 1844 Pedro Mata of Madrid published a work on legal medicine and toxicology which, in subsequent editions, became the most important Spanish treatise on the subject. The fathers of the modern school of scientific investigation were Hans Gross, a professor of criminology; R. A. Reiss, of the University of Lausanne; and Alfred Niceforo.

The old trial-and-error method in criminal investigation was rapidly displaced in the 19th and 20th centuries by scientific methods, including the use of very highly specialized instruments. Philip VI of France had initiated the modern police system of criminal investigation. In Paris, as early as 1327, he appointed *commissaires,* or royal officers, who were not part of the judicial system and who conducted preliminary examinations in the enforcement of police regulations. The *maréchaussée,* a military police, was organized in 1356, becoming the *gendarmerie* in 1720. The first modern police organization, however, was founded in London in 1829. Twenty-five years later the Paris civil police were reorganized on the London model. In 1830 all ungarrisoned Prussian cities were authorized to establish a police force.

Large police departments usually divide their detective forces into two major parts. First, there are groups of detectives assigned to definite geographical areas and responsible for the investigation of crimes committed therein. Second are the specialized "squads" or "details," formed for the purpose of dealing with specific types of crime such as homicide, safe burglary, forgery and confidence games. These investigators are expected to possess special sources of information and an intimate knowledge of the special types of crime together with an acquaintanceship with the physical appearance, haunts and practices of known criminals.

With the development of rapid means of transportation the scope of an individual criminal's activity became greatly enlarged, and jurisdictional boundaries of police forces often hindered the success of an investigation. To combat this trend local police forces maintain close liaison with their neighbours by means of such methods of communication as teletype, telephone, radio and television. Photographs and fingerprint records can be transmitted coast to coast by wirephoto. In this manner the pursuit of a fugitive can be pressed by broadcasting his description together with information concerning his haunts and personal habits.

The complex organization of the modern state led to the establishment of large investigative forces within the various departments of the government. Thus, the military, post office, state and other departments maintain their own, independent investigative units to conduct inquiries into crimes affecting these departments. Since these investigations are often nationwide in scope, an elaborate system of report writing, mutual co-operation and centralized control has been developed. These agencies are also better equipped to cope with such crimes as espionage and sedition, which are directed against the nation as a whole and which, consequently, assume the form of a widespread conspiracy. In addition, the character of modern organized crime has tended to become increasingly complex. A key group of criminals, centrally located, may have representatives in every large city. Local police forces can deal with the problem only in a fragmentary way. A national investigative agency can form a coherent and unified picture of the crime situation and take necessary remedial measures with the co-operation of local police departments.

(A. Vo.; C. E. O'H.)

METHODS OF INVESTIGATION

Identification.—The major concern of criminal investigation is the professional criminal—the recidivist, whose name will appear periodically on the arrest record. If his identity can be conclusively established, his later efforts at concealment can usually be thwarted. A system whereby the identity of the criminal can be positively determined at each arrest is an invaluable aid to the investigator. The qualities of an effective identification medium are the following: (1) it should be fixed and unalterable by deformation or replacement; (2) it should be found on every person; (3) it should be unique for each person; (4) it should be susceptible of being recorded in a simple manner; (5) the records should be classifiable so that each person has a unique position in the files.

The search for a valid identification medium has been a constantly recurring quest in the history of investigation. Tattooing, branding, physical description, measuring and photography have had their successive vogues. The latter three methods, still in common use at mid-20th century, were established as techniques of identification by Alphonse Bertillon, chief of the identification bureau of Paris. He is best known for his development of the science of anthropometry in which an individual is identified by means of his bodily measurements. In the Bertillon system of identification, which he introduced in 1882, identification is completely accomplished by a series of refined bodily measurements, peculiar markings such as scars, and personality characteristics. Bertillon's system was later discarded by most police departments in favour of fingerprint systems, but his descriptive methods are used by investigators as an excellent means of furnishing a minutely descriptive verbal portrait of an individual.

Almost all large police departments possess an identification division where experts compile information which will assist the investigator in his work. The duties of an identification expert are as follows:

1. To ascertain identification of the perpetrator of the crime prior to his apprehension (*a*) by the use of the alphabetical index when the name of the offender is known; (*b*) by photograph when the criminal has been seen by his victim or by witnesses; (*c*) by the *modus operandi* of the criminal; (*d*) by the handwriting of

the criminal; (*e*) by finger impressions left at the scene of the crime.

2. To ascertain identification of offenders after arrest (*a*) by the alphabetical index; (*b*) by a photograph, where no fingerprints have been taken; (*c*) by the *modus operandi* system connecting the arrested criminal with numerous other crimes; (*d*) by comparison of the criminal's handwriting with documents connected with criminal offenses; (*e*) by finger impressions of the criminal found at scenes of crimes committed by him, of which he was not suspected by the investigator; (*f*) by the ten-digit fingerprint system when the offender has been previously recorded in the bureau.

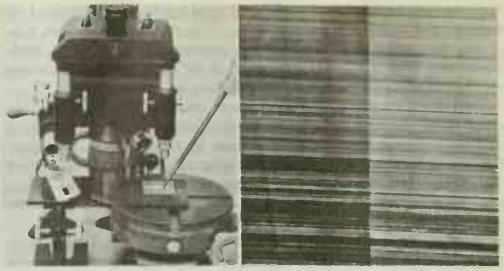
Fingerprints.—At the scene of the crime the investigator endeavours to discover the criminal's latent fingerprints, which he can "develop" or make visible for photography. The latent print is a thin layer of perspiration or grease deposited in the pattern of the friction ridges. Hard, glossy objects such as glass and enamel paint present ideal surfaces for the development of latent fingerprints. Dirty objects and absorbent materials do not readily bear prints. On smooth surfaces the print is made visible by carefully applying a fine powder of suitable colour with a brush. The powder adheres to the small amount of fat present in the perspiration or to the grease which frequently lies on the fingers. Chemical treatment such as iodine fuming or a 5% silver nitrate bath is used to develop fingerprints on paper, wood or other surfaces. The silver nitrate reacts with the sodium chloride present in the perspiration to give silver chloride, a light-sensitive substance that darkens on exposure to a bright light source to reveal the fingerprint pattern. The developed print is preserved by photography, by lifting or by retaining the object itself on which the print appears, and is filed for subsequent comparison with the prints of suspects. It is difficult, however, to discover the identity of a person from a single finger impression left at the scene of the crime, even though the criminal's fingerprints are filed in the identification bureau, unless the subject's prints are also classified in a single-fingerprint file or unless the person's name is known.

Frequently the victim of a crime or a disaster cannot be identified readily by common means of recognition. In such cases special techniques are required in order to obtain classifiable fingerprints. In addition to fingerprints, a person may be identified by X-ray studies, tattoos, anatomical data, occupational marks or dentures. (*See* FINGERPRINT.)

Modus Operandi.—If successful, criminals have a tendency to use the same techniques in their operations. Often the procedure is highly characteristic and will serve to identify the criminal and enable the police to attribute a series of crimes to one offender. Classification of criminals by their methods of operation thus became a permanent and invaluable feature of investigation. Some departments use the Atcherley *modus operandi* system for this purpose. L. W. Atcherley, originator of this system, utilizes the following classes:

1. *Classword*—kind of property attacked, whether dwelling house, lodging house, hotel, etc.
2. *Entry*—the actual point of entry, front window, back window, etc.
3. *Means*—whether implements or tools used, such as a ladder, jimmy, etc.
4. *Object*—kind of property taken.
5. *Time*—not only time of day or night, but whether church time, market day, during meal hours, etc.
6. *Style*—whether criminal describes himself as mechanic, canvasser, agent, etc., to obtain entrance.
7. *Tale*—any disclosure as to his alleged business or errand which the criminal may make.
8. *Pals*—whether crime was committed with confederates, etc.
9. *Transport*—whether bicycle or other vehicle was used in connection with the crime.
10. *Trade-Mark*—whether criminal committed any unusual act in connection with the crime, such as poisoning a dog, changing his clothes, leaving a note for the owner, etc.

Investigation and Reference Files.—Informational files are maintained by police departments to assist the investigator in his efforts to trace the fugitive from justice. The primary purpose of these records is to indicate the source of evidence discovered in connection with a crime. For example, a file of automobile tire patterns will assist in identifying a tire impression found at the scene of a crime. Automobile registrations and records of firearms will assist in establishing ownership. In addition to their own files the police have recourse to the records of the many governmental agencies that record titles, contracts, significant events and official acts in general. Among other files maintained by the police the following prove exceptionally useful:



BY COURTESY OF THE CHICAGO POLICE DEPARTMENT

MATCHING TOOL MARKS: (LEFT) TOOL IMPRESSED ON PLATE LEAVES STRIAE CAUSED BY MANUFACTURING IMPERFECTIONS; (RIGHT) TEST STRIAE MATCHED UNDER MICROSCOPE WITH STRIAE TAKEN FROM SCENE OF BURGLARY IDENTIFIES TOOL AS ONE USED IN CRIME

Missing Persons.—Each year thousands of persons are reported missing to the police. In addition, the police must investigate cases of unidentified persons, living and dead. Descriptive files are maintained of missing persons under the age of 21, unidentified dead, and unidentified persons who are physically and mentally afflicted.

Laundry and Dry Cleaner's Marks.—One of the best clues to the identity of an unknown person is the mark in his clothing placed there by the laundry, dry cleaner or tailor. The dry cleaner, for example, identifies each article of clothing received by means of a set of numbers and letters. These marks are kept in a systematic file by larger police departments for the purpose of tracing a lost, dead or wanted person by means of clothing, whether found on his person or at the scene of a crime. Each mark is associated with an individual laundry, dry cleaner's or tailor's establishment, which can often give the investigator the address of the wanted person. In some cities more crimes are solved by means of this file than through the medium of latent fingerprints.

Lost or Stolen Property.—Many burglaries are solved merely by tracing stolen property to the possession of the criminal. For this purpose police maintain a central cross-indexed file of property lost and articles of value pledged at pawnbrokers or sold to secondhand dealers. The common objects of larceny—automobiles, watches, jewelry, furs and cameras—usually bear identifying serial numbers or marks.

If the criminal disposes of the stolen article through a pawnbroker or a secondhand dealer, the police may trace him through the record of sale which is forwarded to them by the dealer, as required by law in some cities.

BY COURTESY OF THE CHICAGO POLICE DEPARTMENT

COMMUNICATIONS CENTRE: SYSTEM OF RADIO CONSOLES PROVIDES DIRECT COMMUNICATION WITH POLICE VEHICLES. INTEGRATED WITH CITY TELEPHONE NETWORK, EMERGENCY CALLS ARE TRANSMITTED TO CONSOLE SERVING THAT ZONE

Informants and Surveillance.—In combating crime the police require an effective system of positive intelligence. Owners of licensed premises, cab drivers, bartenders and others whose business involves contact with the public at late hours are excellent sources of information. Their co-operation can be enlisted without any difficulty because of the nature of their occupations. In some countries criminals, prostitutes, gamblers and other underworld characters are employed as undercover

agents and report regularly to one or more contact officials. A safe burglar lavishly spending money; a bandit suffering from gunshot wounds; an automobile thief with stolen licence plates; a pawnbroker buying "hot stuff"—all these are types of instances reported to contact officials by undercover agents. Apart from the regularly employed undercover agents, individual investigators obtain information from criminals and other persons whom they have befriended.

It is customary in some courts for the judge to instruct the jury to weigh with extreme care the testimony of informers and accomplices, since their credibility is particularly vulnerable to attack on the grounds of character as well as motivation. In general, a conviction cannot be had upon the testimony of an accomplice unless corroborated by other evidence. A confession of the accomplice cannot be used against another offender unless it is made in court or unless the confession was made in the presence of the accused and he made no reply or otherwise failed to deny it.

Where the services of an informant cannot be obtained, the investigator can initiate a surveillance of criminal activities. This may be done by covert observation or by arranging to have a police agent work within the criminal group, ostensibly as one of them. When this method is successfully employed, it is extraordinarily effective since it provides the direct testimony of a reliable witness. Past crimes can be solved and projected illegal ventures anticipated. Another form of surveillance is the "planting" of microphones and "tapping" of telephone lines. Radio communication can also be employed.

Legal difficulties are encountered with evidence obtained through tapping telephones or planting microphones. The United States code prohibits the use of information acquired by tapping a telephone as evidence against an accused, if he is being tried in a United States district court. State courts are less rigorous in the limitations they place on evidence of this nature, some permitting the interception of telephone messages if a court warrant is first obtained. In regard to information acquired by means of concealed microphones, federal courts have ruled that such evidence is permitted if the microphone is installed without committing a trespass. For example, placing a contact microphone on the opposite side of the wall of the hotel room of a subject would not constitute a trespass.

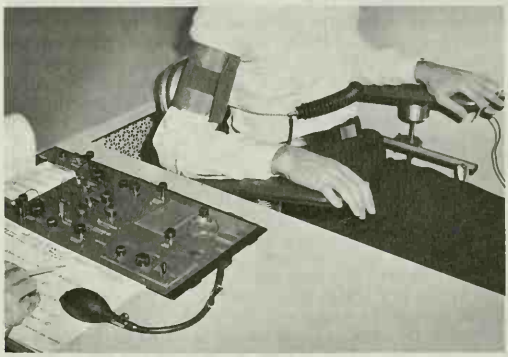
Interrogation.—Since the purpose of a criminal investigation is to discover the truth of the facts surrounding a crime, obviously the shortest road to this goal is to obtain a confession from the guilty person and to elicit significant information from witnesses and informants. The skilful interrogation of a suspect is often the key to a successful investigation. Experience, shrewdness, patience and imagination are required for effective questioning. Guile, forcefulness of character and practical psychology must be employed without resorting to duress or other violation of the suspect's rights. The interrogation is, therefore, a delicate proceeding, since a confession obtained in violation of the suspect's rights can be repudiated in court.

The skilful interrogator briefly analyzes the character of the subject and estimates his weaknesses. Experimentally he assumes different attitudes and employs various procedures to determine the most effective technique of questioning the subject. If he can enlist the subject's co-operation, a confession will be forthcoming. In the case of a reluctant or obstinate subject, he will endeavour to lead him into contradictions, inconsistencies and improbable statements, thus showing him the futility of continued deception.

The most difficult of all subjects is one who flatly refuses to talk about the case. In these situations, the investigator, who must respect the rights of the subject, is usually forced to abandon the interrogation and rely on other types of evidence.

Detection of Deception.—The act of lying is ordinarily accompanied by a bodily reaction such as flushing, increased heart beat, swallowing or other evidence of emotional reaction. Some understanding of the practical psychology of lie detection has always been part of man's knowledge. The 20th century saw the introduction of a number of efforts to apply instrumentation to the art of detecting deception. These instruments are called "polygraphs," "deception indicators" or "lie detectors." Their function is to produce a record of physiological phenomena which may be used as the basis of applying a technique for diagnosing deception. The success of a deception indicator depends on the sensitivity of the mechanism, the phenomena chosen for record and the ability of the operator. It cannot be stressed too greatly that the greatest single factor in the success of a lie-detection technique is the professional capacity of the operator.

The phenomena which should be chosen for recording are those that are not subject in any great degree to voluntary control and which, moreover, are such that the subject is not usually aware of them. Experts in the field consider blood pressure, pulse and respiration as the most dependable criteria. The electrodermal response or current flow between two different areas of the body is also considered useful. To these was added the unobserved muscular activity which has been found to affect the blood pressure. None of these phenomena is a sufficient indicator in itself, but taken together their recording offers an effective means of determining deception. The blood pressure-pulse-respiration recorder employs pens to record impulses on moving graph paper driven by a small synchronous electric motor. A pneumograph tube is adjusted around the subject's chest and a blood pressure-pulse cuff is strapped around the arm. The examiner first acquaints himself with the details of the case. He establishes norms of reaction by asking preliminary questions of an irrelevant nature and then injecting questions pertaining to the investigation. Three or four lie-detector records are ordinarily required for a diagnosis.



BY COURTESY OF JOHN E. REID AND ASSOCIATES

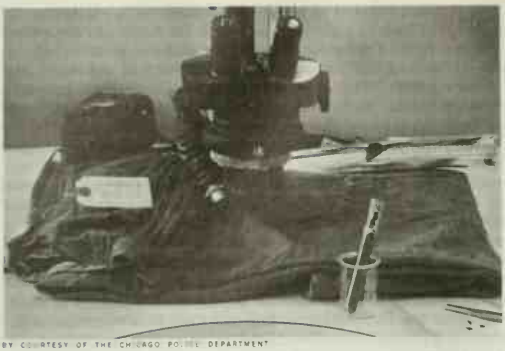
PNEUMATIC POLYGRAPH. GRAPH ON LEFT RECORDS BLOOD PRESSURE (CUFF ON UPPER ARM); RESPIRATION (RUBBER TUBE ON DIAPHRAGM); MUSCULATORY MOVEMENTS (CYLINDER UNDER LEFT ARM); SKIN REFLEXES (ELECTRODES ON FINGER TIPS)

A study of the graphical records and an evaluation of the deviations caused by certain responses will reveal unusual emotional activity.

Although the lie-detector test proved a great boon to the investigator, information obtained by this means is not generally accepted as direct evidence in the United States courts of law. Many court decisions denying recognition to this evidence have been based on the contention that the technique has not won general scientific acceptance. In the event that these tests are accepted as competent legal evidence, it is anticipated that the question of compulsory tests will give rise to legal disputes as to whether they affect the subject's privilege against self-incrimination.

SCIENTIFIC AIDS

Police Laboratory.—With the rapid advance of scientific methods of analysis, physical evidence such as paint, dirt and fibres assumed increasing importance as sources of clues. After 1920 the larger police departments endeavoured to employ experts for the purpose of examining evidence at the scene of the crime and at the laboratory. These police scientists are distinguished from medical examiners in that the latter are ordinarily concerned with homicides and then only with regard to the cause of death and the nature of the fatal weapon. The police laboratory expert, however, must deal with a wide variety of crimes and with all the



BY COURTESY OF THE CHICAGO POLICE DEPARTMENT

TRACES OF EVIDENCE FROM HIT-AND-RUN ACCIDENT: MICROSCOPIC STUDY IDENTIFIES FIBRES IMBEDDED IN GRILLE WITH VICTIM'S TROUSERS. PAINT PARTICLES (LOWER RIGHT CORNER) MAY IDENTIFY COLOUR AND MAKE OF AUTO. BLOOD OF VICTIM (IN TUBE) CAN BE COMPARED IN TYPE WITH BLOOD STAINS ON GRILLE

possible clue materials that can be used to provide evidence. The application of the physical sciences to the detection of crime is sometimes called scientific criminology or, more specifically, criminalistics. Chemistry, biology and physics are the major branches of knowledge employed in examining evidence.

The physical evidence found in connection with a crime may be divided into two classes. In the first the evidence constitutes part of the corpus delicti; it is one of the essential facts of the crime. Thus the white powder found on the person of an alleged narcotics seller constitutes an essential part of the crime. It must be identified as being a particular narcotic such as heroin or morphine. Poisons and other substances used illegally fall into this category. The second class consists of associative evidence, clue materials which link a suspect to the scene of the crime and thereby establish a higher probability of his guilt. A suspect, for example, apprehended near the scene of a burglary may have glass fragments in the lining of his trouser cuffs. A spectrographic analysis of the glass fragments may show that the chemical composition is the same as that of a broken glass window at the scene of the crime, thus connecting the suspect with the crime. Similarly a foot impression at the scene of a murder can be traced to the owner of a particular shoe; a flake of paint at the scene of a motor vehicle accident can be connected with a definite automobile; a tool mark can be matched with the defects in the blade of a burglar's jimmy. In all these comparisons the aim of the investigator is the same as that of the fingerprint expert: to discover a sufficient number of characteristics in the evidence to connect it uniquely with a known source by the laws of probability.

Chemical Analysis.—The forensic chemist ordinarily performs the relatively few biological examinations as well as the chemical analyses associated with criminal investigation. In cases of homicide the medical examiner makes the examinations connected with the autopsy and the cause of death. In the field of biology the chemist is primarily concerned with blood and semen stains. Semen stains occur in connection with rape cases, and their analysis is a simple microscopic examination to discover spermatozoa. Blood stains are found quite commonly in assault cases. A preliminary field test such as the benzidine or the phenolphthalein test is used to establish the possibility that the stain is blood. These tests require only a minute stain area. To establish the fact that the stain is blood, the Teichmann hemin crystal test or spectrophotometry is used. The precipitin test, employing a larger area, may then be used to determine whether the blood is human. Depending on the amount, age and preservation of the stain, the blood may be grouped into one of the four major divisions and in some cases into the subdivisions.

Microanalysis is employed by the forensic chemist to study structures by means of the compound microscope. Minute quantities of trace materials can be identified and their source determined. Plants and animal tissues, vegetable, animal and synthetic fibres, sand, soil and minerals are recognized and their connection with the case under investigation is established.

Deposits found under fingernails and dust or stains found in or attached to clothing or weapons have furnished the investigator with significant clues. Hair can be identified as human and the race of the person determined from it. It is not, however, possible to identify hair as belonging to a single individual. At best a similarity can be established.

The most challenging problem of the police chemist is the analysis of a minute sample of material such as paint or glass to determine the source of the substance. If sufficient trace elements and impurities are present, the sample can be connected uniquely with the source material. A stain on a suspect's shoe can be shown to have been acquired at the crime scene. The spectrograph serves well in this work.

Instrumentation has provided other techniques of rapid chemical analysis such as X-ray diffraction, infrared, visible and ultraviolet spectrophotometry, and electron microscopy. These instruments can deal with minute samples, which are often the only clue present, and can reveal physical or chemical characteristics so great in number, so diverse in nature or so rare in occurrence as to preclude all but a negligible probability of duplication by coincidence. They permit analysis without disturbing the sample, thus making it possible to keep the evidence intact for presentation in court and for tests by the defense.

Moreover, a police scientist does not have to be an expert in every branch of chemical analysis to use these instruments effectively. A reasonable familiarity with the techniques, the basic materials, the fillers and the accidental trace elements of the industries from which his samples come is usually sufficient.

Photography.—Of the technical aids available to the investigator the camera is by far the most important and the most widely used. The full resources of photographic science are employed: photography through the spectral range from the infrared region to gamma rays; photomicrography; microphotography; cinematography; orthostereoscopy; radiography in the hard and soft X-ray regions; and electron photomicrography. Six major functions are served by investigative photography: (1) for identification records, it provides a picture of the criminal or missing person; (2) in conducting a surveillance the camera can be used to obtain a visual record of the illegal activities; (3) the original appearance of the scene of the crime can be preserved for the court's consideration; similarly, a re-enactment of the crime can be recorded in motion pictures for court demonstration; (4) the initial appearance of evidence can be photographed before it is submitted to necessary changes by the police laboratory; (5) the camera can be used to reveal hidden aspects of the evidence; by the employment of filters or magnification certain details and relationships of the evidence can be revealed and emphasized to prove a point in question; (6) to demonstrate investigative findings to the court the photograph serves as an invaluable visual aid. Court exhibits in the form of photographic enlargements vividly supplement the testimony of investigators and laboratory experts and provide a meeting ground for the contentions of opposing counsels.

BY COURTESY OF THE NEW YORK POLICE DEPARTMENT

SLIDES OF FACIAL FEATURES DESCRIBED BY A WITNESS ARE PROJECTED ON SCREEN TO IDENTIFY SUBJECT

(C. E. O'H.; J. D. Ni.)

Document Examinations.—A great part of the work of a police laboratory is concerned with the examination of questioned documents. Problems of handwriting, typewriting, paper and ink are continually arising in connection with investigative work, particularly that dealing with forgery and anonymous letters.

The classical problem of document examination is the com-

parison of handwriting to determine the true author of a questioned document. At its simplest this problem is a straightforward comparison of the questioned writing with the known writing of a suspect. Such a case would occur, for example, in connection with a threatening letter or a ransom note.

The more difficult problems are those of forgeries and disguised writings. To establish the identity of the author of a questioned writing the document expert searches for certain characteristics of penmanship. Only a small part of an adult's handwriting is written consciously. The greater part is written without adverting to mechanical details. It is for this reason that a forger cannot imitate another person's writing exactly and will include, unconsciously, fundamental movements ingrained in his own writing habits. Line flow, relative slant, pen pressure, letter connections and spacing, line curvature, tremor, proportion, base alignment and shading are the most important characteristics. These elements, if sufficiently individual, will serve to identify the writing. In a successful handwriting examination there must be an adequate combination of significant similarities between the questioned and the known writing without any unexplained major differences. (*See* also HANDWRITING.)

Typewritten documents offer kindred problems, although here the emphasis is on identifying the machine and thus indirectly locating the author of the document. Among the questions which the expert is called upon to answer are the following: was the questioned writing typed with *this* typewriter?; what is the make and model of the typewriter used?; was the entire document written with the same typewriter?; does the model of the typewriter set a maximum age to the writing? The identification of a typewriter as being uniquely the machine employed depends upon the discovery by the expert of a set of individual characteristics of the type faces.

In examining a specimen of typewriting the expert studies the design, alignment, slant, footing and defective forms of the letters. Most typewriters possess individuality with respect to the alignment of the letters and the relative perfection of the type faces. Normal wear and abuse introduce additional defects. The resulting set of characteristics is often sufficiently numerous to establish the unique character of the typewriting and the machine.

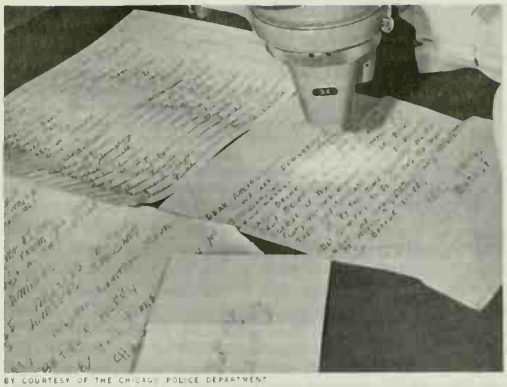
The detection and deciphering of alterations is another major problem of document examination. Checks, wills, insurance policies, passports, licences, birth certificates and other official records are often altered by erasing or obliterating. By examining such a document with the aid of a microscope or under ultraviolet light the erasure or obliteration may become apparent. Deciphering is ordinarily achieved by chemical methods and by special photographic techniques such as the use of infrared films.

Photography is also the most effective method of revealing the writing on charred documents, carbon paper and on the indentations of the undersheet of a pad or checkbook. Chemical methods are employed to detect secret writing, to differentiate types of ink and to estimate within broad limits the age of an ink writing.

Although the investigator is assisted by technical aids, such as the crime laboratory, the medical examiner's autopsy and toxicological studies, he must rely mainly upon his own physical and mental resources to provide a solution to the crime that he is investigating. He must be a student of people in all aspects and must be thoroughly familiar with law, normal and abnormal behaviour, and the wide variety of ways by which crimes may be committed.

Firearms.—The development and distribution of firearms have made their study a highly complex field for the specialist. Information of value in criminal investigation may be obtained by expert examination of guns, bullets, cartridge cases, pellets, wads, powder burns and powder deposits.

Firearms vary in calibre, type and design, and bullets fired from them (as well as expended cartridge cases) have certain characteristics that help to identify them. Rifled firearms have a number of spiral grooves, commonly from two to seven, cut in the barrel. The width, depth, angle and direction of these grooves vary with different makes, models and calibres; portions of the bore remaining between these grooves are known as



BY COURTESY OF THE CHICAGO POLICE DEPARTMENT

MICROSCOPIC COMPARISON OF ANONYMOUS HAND-PRINTED EXTORTION NOTE WITH KNOWN WRITING OF SUSPECT

"lands" and possess specific dimensions. The markings found on a fired bullet show a general consistency with certain calibres and types of firearms, as well as specific inconsistency with many others. When a suspected firearm is obtained, test bullets are fired into a suitable medium, such as cotton, oiled sawdust or water, and are recovered and compared with the evidence bullet.

As a result of its manufacture, use and abuse, each firearm acquires certain distinguishing characteristics, some of which leave their marks on the surface of fired bullets; the marks that take the form of groups of fine lines are called striae. By using a comparison microscope, whereby a single image composed of portions of images of the test and evidence bullets is created, the expert is enabled to evaluate the coincidence of striations, judge the degree of "match," and conclude that a specific gun did or did not fire a specific bullet—or that insufficient markings are available for a conclusion. As in other aspects of criminal investigation, the skill and experience of the examiner are of paramount importance in this work. There is always some coincidence whenever two different sets of similar fine lines close together are compared; experiments indicate that the degree of false coincidence ranges from 12 to 22%. The degree of coincidence required for a positive bullet identification is a matter of opinion. Some examiners require positive comparisons of three different sides of the bullet (Burrard), others require at least three separate grooves (Churchill) and still others require the entire circumference (Goddard). Evidence bullets are sometimes defaced or distorted, thus interfering with their evaluation; experienced investigators may be able to reach definite conclusions in about 60% of their examinations of bullets.

The cartridge case is also marked (by the extractor and ejector) and its primer frequently receives an imprint from the breech-face in addition to a firing pin impression; thus a recovered cartridge case presents opportunities for microscopic examination similar to those of a recovered bullet.

Defaced serial numbers may sometimes be sufficiently restored by chemical or electrochemical techniques; through such numbers the ownership of the firearm may be traced.

Careful examination of powder burns and powder deposits may indicate how close the victim was to the firearm at the time of discharge. They may also tell how a firearm was held at the time of discharge; idiosyncrasies of specific firearms mechanisms may support or refute such testimony.

In addition to firearms, the firearms expert is also concerned with flare pistols, tear gas devices, blank cartridge guns, air, gas and spring guns, humane slaughtering devices and powder-actuated tools. (S. BN.)

See also FEDERAL BUREAU OF INVESTIGATION.

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INVESTITURE CONTROVERSY. Investiture is the formal installation into an office or estate by a superior authority. In medieval European law it had special reference to the feudal relation between suzerain and vassal: the suzerain received the homage and oath of the vassal and invested him with a piece of turf, a banner or branch, symbolic of the authority conferred on him. Later the sword and sceptre became the common symbols of lay investiture. In the investiture of ecclesiastics, the ring and crosier were the accepted symbols of ecclesiastical authority.

Investiture had its main historical interest in connection with the relations between the medieval civil and ecclesiastical authorities. Since bishops and abbots were often not only ecclesiastical lords but also lords of fiefs, they possessed both civil and ecclesiastical authority. This led to a conflict between civil and church rulers, each of whom considered the bishop or abbot to be his representative. The struggle over the right to invest bishops and abbots, which absorbed several popes and emperors of the 11th and 12th centuries, was one of the most important aspects of a larger struggle for power between papacy and empire, and its outcome was significant for the political history of the later middle ages.

After the time of Charlemagne civil rulers had usurped almost complete control over appointments to bishoprics and abbeys, which added greatly to their power and revenues; lay rulers were able to prevent free canonical elections, keep bishoprics and abbeys vacant for years, sequestering their funds, and sell church offices to the highest bidders. In asserting this control they claimed the right to confer on ecclesiastics the symbols not only of civil power but the crosier and the ring as well. The psychological effect of this was to persuade the populace, most sensitive in the middle ages to allegory and symbolism, that the lay prince was the source of religious as well as of civil authority. In turn, bishops and abbots, and particularly the bishops of the Holy Roman empire, became increasingly "king's men," to the detriment of their spiritual obedience and obligations. When in the 11th century the pope sought to break lay control of ecclesiastical office, he clashed first with the German emperor.

The spirit of reform that dominated the papacy of the 11th century was best expressed in the program announced in Rome at the Lenten synod of 1075 by Gregory VII, which forbade lay investiture, deposed simoniacal clerics and condemned clerical marriage. In retaliation the emperor Henry IV, with the support of the German bishops, attempted to depose the pope. Germany and northern Italy were torn by a controversy that did not end till 1122, when Pope Calixtus II and the emperor Henry V agreed on the concordat of Worms. Its provisions were reaffirmed by the first Lateran council (1123). The emperor renounced the right to invest with ring and crosier, but he continued to control appointments to bishoprics and abbeys.

In France lay investiture had a similar development, but because of the weakness of the monarchy during the 11th century no common royal policy existed. The church's dealings were primarily with powerful local nobles. By 1200 the kings had abandoned lay investiture, but they continued to control appointments to major benefices.

After the Conquest in England, William I frequently violated the canon law in his dealings with the church, but since he was a strong supporter of reform he continued to enjoy the support of the papacy. A minor lay investiture controversy arose under William II (Rufus) and Henry I, when the latter sought to force Anselm to pay homage for the ecclesiastical holdings of Canterbury. This dispute was finally settled by compromise in 1107; as on the continent, the king continued to make most appointments to major ecclesiastical benefices, but freedom of election was guaranteed.

See also PAPACY: *The Medieval Papacy (590–1304)*; GREGORY: *Gregory VII*; HOLY ROMAN EMPIRE: *Empire and Papacy*; HENRY (German kings).

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INVESTMENT BANKING. In a broad sense, investment banking embraces all the institutions and processes by which capital formation takes place, including: (1) the transfer of ownership of existing wealth through brokerage houses; (2) security substitution, such as is involved in the issuance of securities by investment companies; and (3) security management, or the decision as to where investors' funds are to be placed. In a narrower sense, investment banks are firms which originate, underwrite and distribute new security issues of corporations and government agencies.

It is often said that modern production is "capitalistic" in the sense that it requires large amounts of capital for successful operation. This need for capital explains to a significant degree the shift from the sole proprietorship and the partnership to the corporation as the dominant legal form of business organization. Individual proprietorships and partnerships can for the most part look only to their owners, one or a few, as sources of funds. Corporations can obtain funds from thousands and hundreds of thousands of owners (shareholders) and can obtain these funds by varying the terms of successive stock issues in such a manner as to make the most effective appeal to prospective stock purchasers. In addition, corporations can borrow funds and can tailor their debt contracts to the requirements of lenders. The corporation has access to larger amounts of funds because it can offer a greater variety of security contracts and thus can adapt itself to the willingness or unwillingness of investors to take risks. Bonds (debt contracts) can be offered when investors demand safety; stocks (equity contracts) can be sold when investors are willing to take greater risks for the opportunity of greater gains.

The market for funds, the commodity with which investment deals, is made up of the demand for funds and the supply of funds. Three important parts of the demand for funds may be distinguished. The business demand for funds has already been mentioned. Similarly, governments and public authorities demand funds for the construction of public buildings, highways and governmentally owned utility plants. Third, consumers enter the market to borrow funds to finance the purchase of homes and other durable consumer goods. The supply side of the funds market is made up of four parts. Individuals save portions of their incomes and make their savings available in the funds market through the purchase of bonds, stocks and mortgages. Financial institutions (insurance companies, savings and loan associations, investment companies) and nonfinancial institutions (churches, hospitals, universities) receive funds from individuals and make them available to fund users by buying securities. Business corporations provide funds by retaining portions of income earned and using this income to purchase operating assets, thus supplying some of their own demand for funds. And governments may provide funds by collecting taxes in excess of current expenses and investing the funds in outstanding government security issues.

Institutions in the Funds Market.—Financial institutions

are sometimes called fund-aggregative institutions. They obtain funds through some form of arrangement with those whose investments they manage. For example, insurance companies obtain funds through the receipt of premiums on policies; commercial banks and savings banks receive deposits; and investment companies sell shares. These institutions then purchase government bonds or bonds and stocks of corporations which are in the market for funds. Institutions operating in this manner gather together the small funds of many individual investors and attempt to provide such investors with a better diversification and a more skilful management of funds than the individual could have achieved through his own efforts. Individual savers, instead of buying bonds or stocks of operating companies directly, place their funds with financial institutions of the fund-aggregative type, which in turn offer them in the funds market. This means that corporations and governments seeking funds must take note of movements of this kind and must note also the interest rates current at the time of the contemplated issue.

A second class of financial institutions in the field of investment banking engages in the marketing of securities. Such institutions are not on the supply side of the market, as are the fund-aggregative institutions, but are between those who demand the funds and those who supply them; they endeavour to bring the two sides of the market together with as little friction and cost as possible. Securities marketing institutions are divided into two groups: institutions which facilitate the original distribution of securities from corporations to investors; and those which assist investors to trade among themselves in securities which corporations have issued some time in the past. Marketing institutions which purchase security issues from corporations and sell them to investors are often spoken of as investment banking firms, but it should be noted that investment banking in the proper sense encompasses all the institutions, processes and procedures by which funds are transferred from savers to users. Marketing institutions having to do with "old" or already-issued securities are in turn subdivided into two classes: the securities exchanges, together with the members and member firms which buy and sell securities on the floors of these exchanges; and the over-the-counter market, made up of security brokers and dealers who buy and sell through contacts provided by the telephone, the telegraph and the teletypewriter.

Financial houses dealing in securities which have been outstanding for some time aid in the transfer of funds in several ways. Corporations desire to have their outstanding securities sell at as high prices as possible since the prices of these securities determine the prices at which new securities can be issued and thus determine the cost of new funds. For example, if a corporation's stock is selling at 40, the firm cannot sell a new issue of stock having the same contractual features at 60, for no one would buy it. Often a corporation will find it to its advantage to list its securities on a securities exchange. (*See* LISTED SECURITIES.) Trading on the floor of an exchange takes place among individuals who are members of the exchange. Those who are not members can use the facilities of the exchange by employing a member, through a member firm of which the exchange member is a partner, to trade on the floor for a commission paid to the member firm. (*See* STOCK EXCHANGE.)

The securities of most corporations are not listed on an exchange, but are bought and sold among investors through purchases from and sales to dealers. This is the over-the-counter market (*q.v.*). A dealer may buy a security from an investor and sell it to another investor, or may sell it to another dealer who in turn sells it to one of his investor clients. Most small and medium-sized corporations find that the interest in and sponsorship of their securities provided by a dealer serves to maintain prices at higher levels than if the securities were listed. Practically all trading in government bonds and most trading in corporate bonds takes place in the over-the-counter market. Since the stock issues of the largest corporations are listed on exchanges and since the stocks of these companies are traded in more frequently, it is probable that the volume of trading in stocks on the exchange exceeds that on the over-the-counter market, but many classes of stocks are traded predominantly in the over-the-counter market, particularly the stocks of insurance companies, banks and mutual investment companies.

Acquisition of New Funds.—The next consideration is that of investment banking in the narrower sense, the origination, underwriting and distribution of new security issues. Corporations obtain funds from two major sources on the basis of the term of the contract with the supplier of the funds. Short-term funds which must be repaid within one year are obtained from commercial banks, from trade creditors and from the government in the form of accrued tax liabilities. Long-term funds are obtained from individual and institutional investors through the sale of securities to these investors. These funds may be acquired from investors as creditors through the sale of bonds and mortgages, or from equity investors through the sale to owners of shares of stock or through the retention in the business of earnings which might have been paid to the owners as dividends. It is the function of investment banking firms operating in the new-issue market to assist corporations to acquire new long-term funds. Corporations use these funds to enlarge their operating assets or to pay off maturing security issues.

The investment banking house operates by purchasing all of the new security issue from a corporation and selling the issue in smaller units to the investing public. It buys from the corporation at one price and attempts to sell to investors at a higher price, a price sufficiently high to cover expenses of sale and leave a profit. Since the expenses of undertaking the sale may be relatively large for small issues, small and new corporations often find it uneconomical to pay the required "spread" of the investment bankers. Such corporations may obtain funds privately by sale of stock and bond issues to friends and relatives of the management and to employees without the intermediation of an investment banking firm. In other cases investment banking houses decline to assist new and small companies because they believe that the risks of investment in these companies are too great, and they are unwilling to recommend to their clients that the securities be purchased. As a result, investment banking firms are used to a much greater extent by companies which have lived through the first few difficult years, are now able to present a good earnings record and show promise of being able to make profitable use of additional funds.

Often a corporation seeks funds from its common stockholders by offering them the opportunity to buy more shares of the common stock issue presently outstanding. These shares may be offered to present shareholders at a price of, say, 40 even though the price of shares currently outstanding is 50. If the price falls below 40 before the new shares have been sold, the corporation will be unable to sell any more at the offering price, the stock offering will be a failure and the corporation will not have all the funds it planned to acquire from the issuance of the shares. To meet such a contingency the corporation will make a contract with an investment banking firm whereby the latter agrees to buy from the corporation at a price of 40 all shares which, by a certain date, have not been taken by the stockholders. In this way the corporation is assured of getting the funds it needs. The investment bank is paid a few cents a share for assuming the risk that it will have to take the shares, and a larger compensation per share for those shares which it has to take at the end of the period and sell to the general public. This arrangement is often called a pure underwriting contract or a stand-by underwriting.

The Mechanics of Underwriting and Distribution.—The typical underwriting arrangement involves the purchase of a security issue from a corporation by an investment banking firm or a group of such firms, and the sale of the issue to the general investing public, institutional investors as well as individuals. This procedure is followed in the case of bond issues of corporations as well as for stock issues which are not required by law or by decision of the board of directors to be offered first to old shareholders. The first step in the origination of a new security issue is a conference between officials of the corporation and the investment banker to determine whether the issue is feasible. The buying department of the investment bank conducts a preliminary investigation and decides whether the assets and earning power of

the corporation are such that it can recommend the securities of this company to its clients. This action is followed by conferences in which it is decided what amount and type of security is best suited to the corporation's needs. When this has been accomplished the formal documents in connection with the issue are prepared. In the United States the issue must in most cases be registered with the federal Securities and Exchange commission. Also a prospectus describing the security must be prepared and sufficient copies printed so that a copy may be given to each investor considering purchase. The arrangements between corporation and underwriters are set forth in a purchase agreement.

The underwriting and distribution of most security issues involves the organization of a syndicate of investment banking firms. When a corporation puts out a $100,000,000 bond issue no one investment banking firm wishes to take the risk of purchasing the entire issue. Therefore the investment bank which initiates the issue with the corporation organizes a group of investment bankers to divide the liability for the purchase, with the originator acting as manager of the group. Each member of the purchase group agrees to take a specific part of the entire issue. This arrangement is formalized in a contract called a purchase group agreement, or agreement among underwriters.

Distribution of the issue is effected through sale to individual and institutional investors. Most syndicate firms have distribution facilities and are able to dispose of the portion of the issue they have underwritten. Frequently the market coverage which can be obtained by the members of the syndicate is deemed insufficient, so selected dealers are used to bring about a wider distribution. These dealers are not members of the underwriting syndicate and they are obligated to sell only that portion of the issue they have subscribed for. Members of the syndicate pass along the securities to dealers at a reduction from the publicly offered price. This concession, as the reduction is called, reimburses the dealer for his expenses and provides him a profit if the distribution is performed skilfully. When distribution takes place through dealers, the members of the syndicate may be thought of as wholesalers who purchase from the manufacturer (the issuing corporation). These wholesalers sell some of the issue themselves to large consumers, particularly institutional investors, and sell the remainder to retail dealers who in turn sell to small investors.

Determining the Price.—One of the most important problems in security distribution is the pricing of the issue. There must be a decision first on the public offering price, the price which investors are to be asked to pay. If this price is too high, the issue will not be sold and the purchase group will bear a heavy loss. If the offering price is too low, the issue will be sold quickly but it will rise above the offering price immediately after issuance and the corporation will be dissatisfied with the price received. The major responsibility for setting the offering price rests on the investment bank, since it is in close contact with the market, is familiar with current interest rates and yields, and is best able to judge the probable demand for the issue in question.

The underwriters pay to the corporation a price which is lower than the public offering price by the amount of the spread. The spread is affected by the costs which the investment bankers anticipate in marketing the issue, by the difficulties foreseen in selling the issue at the offering price and by competition among investment bankers to obtain the issue for sale. The spread is divided into three parts, a fee to the originator of the issue, compensation to the members of the purchase group for undertaking the risk and a commission to the members of the selling group for selling the securities to investors. When new securities are to be issued the investment firm having close contact with the corporation is likely to be asked to originate the issue. This process is often called private negotiation. An alternative arrangement is competitive bidding. The corporation may itself settle upon the terms of the issue to be offered, and then invite all banking firms to submit bids. The issue will be sold to that firm which bids the highest. Competitive bidding has increased in importance in the United States, partially because it is favoured by the federal Securities and Exchange commission.

The investment banking system plays a significant role in the process of capital formation by transferring funds from savers to users. It is an extremely dynamic system, and adjustments to adapt it to changing conditions take place continually.

See Investment Bankers Association of America, *Fundamentals of Investment Banking* (1949). (M. D. Kn.)

INVESTMENT PAPER. The term investment paper, or, commonly, corporate or investment securities, applies to bonds, debentures, share certificates, collateral notes, equipment trust certificates and the like. Though called securities, not all such paper is issued upon mortgage or other security; and, though usually issued by a corporation, this too is not a requisite. The financial community divides investment paper—by issuer—into four main categories: governments, rails, utilities, and industrials.

Bonds and Debentures.—It is not clear what were the antecedents of the bond. The East India bond before the court in *Glyn* v. *Baker*, 1811, commenced as a receipt, "The United Company etc. do acknowledge to have received of W. G. Sibley 100 *l.*" (£100) and ended with an indemnity clause "in the penal sum of 200 *l.*" But midway it contained a promise to repay 100 *l* "to the said W. G. S. his executors, Etc. (by indorsement hereon)," and it was urged that this made for negotiability. The court, however, was clear that instruments of the sort were not negotiable "like bills of exchange." Parliament provided soon afterward that East India bonds were negotiable.

In the U.S., during the early part of the 19th century, great numbers of bonds were issued by states and counties in a frenzy to build canals and railroads. Like the modern bond these were elegantly engraved instruments, thrice the size of a merchant's note, and with the seal of the issuer "conspicuously put"; all with an eye to inspire confidence. But there were almost as many frauds as bond issues, and accordingly many were defaulted. By 1868, however, it was established that such bonds, as a simple promise to pay a sum certain in money to bearer, must be held fully negotiable. It made no difference that they were issued under seal while the merchant's note was not; the same law should apply.

Instruments called debentures, or debenture bonds, are usually issued for short terms, say, 10 or 15 years. In the U.S., the word debenture signifies that there is no mortgage security, as is usual with the corporate bond. But, to add a speculative element (and, ultimately, to bring about a better capital structure), many debentures—like some bonds—are issued with a conversion privilege. That is, the holder is given an option, on stated terms, to turn his debentures into stock. To add further spice to the transaction, the issuer may establish a sinking fund, and agree to call a given number of debentures by lot, at stated times, for payment. The lottery provisions were all spelled out on the back of the debenture in the *Crouch* case, 1873, which inclined the court to say that such an instrument could not be negotiable; later English cases reached a contrary result. These regulations, and many others lodging powers with a trustee, are now put in the indenture.

Bonds and debentures are almost as precarious to hold as money. That is, if they should be lost or stolen, a subsequent purchaser in good faith would get good title, since they are payable to bearer. Why a practice did not develop to issue such paper payable to "so-and-so or order," thus requiring an indorsement upon transfer, is a matter of surmise. But, for one thing, the long maturities, often 30 years or more in the case of bonds, would make the usual indorsement machinery very cumbersome. For another, there never was any thought that the transferor of a bond should engage to pay the instrument, upon default of the issuer, as the indorser of a negotiable note engages to do. Bonds are not negotiable in that sense; at most the transferor makes certain warranties, of title and so on, as upon the sale of a chattel.

One consequence was the invention of the coupon. It would be highly unsafe, as well as inconvenient, if holders had to bring their bonds and debentures to the issuer each time when collecting interest. But, by writing one coupon for each interest payment, and printing these with the bond, this was made unnecessary. Thus a 30-year bond, for example, is issued with 60 coupons attached, one for each semiannual interest payment, and the holder

may clip his coupons as they mature and put them through his bank for collection with relative safety. Coupons are themselves small promissory notes, payable to bearer, and may be negotiated apart from the bond. The following is a typical wording: The company "will pay to bearer twenty five dollars . . . on the first day of July, A.D. 1900 . . . being six months interest on its first mortgage bond number 4028."

Registration provides a further safeguard. That is, most bonds and debentures are issued payable "to bearer, or, if registered, to the registered holder hereof." This means that a holder of such a bond may send it to the issuer to have it recorded in his name. If fully registered, the issuer will return the bond, minus all coupons, with the name of the sender entered on the back of the bond as owner. It is more usual to register only as to principal, in which case the coupons are not detached. In the U.S., registration renders the bond not negotiable, since it is no longer payable to order or to bearer, though of course it may be sold by being transferred on the issuer's books. Only a small percentage of an issue is ever registered; bonds are quoted at a slight discount when registered.

Share Certificates.—It was not until late in the 19th century that share certificates became a medium for the investment of vast sums of money. At one time, in fact, no certificate at all was issued; the shares were simply inscribed in the owner's name on the books of the company. Transfer was effected, as it still is, by giving a power of attorney (usually with an assignment) to someone to appear before the company or its transfer agent and have the shares entered in the name of the transferee. One reason for this was that the corporation's share obligation was looked on as a chose in action (shares are called *actions* in France), of a different tenor than that of a bond or promissory note, but still a chose in action, to be set up on the liabilities side of the ledger, as is done in modern practice. Thus, while the common law said that a chose in action could not be assigned, it was nevertheless possible to achieve the same result by other means.

However, the shareholder wanted some evidence of his claim. The few specially created corporations of the 17th and 18th centuries, therefore, commenced to issue certificates. When the many privately organized joint-stock companies also started to do so, abuses crept in, and the British parliament passed the Bubble act, forbidding them to issue certificates. Thus, for more than a century, or until 1825 when the act was repealed, there were relatively few share certificates in the market. By the middle of the 19th century, though, the dam had burst; general incorporation statutes were being passed everywhere, and these enabled anyone—on complying with certain simple requirements—to form a corporation and to issue share certificates for sale to the public.

The wording of the certificate has not changed materially. It is a bare recital: "This is to certify that (so-and-so) is the owner of 100 full paid and non-assessable shares of the Common Stock of the General Popcorn Corporation, par value $100, transferable on the books of the company by the holder hereof in person or by duly authorized attorney. . . ." It became the practice for the corporation, as in the case of bonds, to issue elegantly engraved certificates, over the seal of the corporation, "conspicuously put." It may be doubted, though, that this inspired much confidence in the investor, for he has long since come to look first to such things as the company's dividend record, the quality of its management, the price-earnings ratio and the like.

Share certificates are spoken of in financial circles as "equities," bonds and debentures as "debt." This is a useful, but loose, way of speaking. For, as was pointed out in the Rhode Island Trust Co. case (1926), the shareholder "does not own the corporate property"; it is owned, in legal theory, by the corporation. Upon liquidation the shareholder, like the bond or debenture holder, merely has a claim upon the corporate assets, with mortgage bond holders generally being paid first (if the security is adequate), debenture and other unsecured claims next, and common shareholders last. Many corporations also issue preferred stock, which may be given precedence over the common upon liquidation, and usually has priority in the payment of dividends. But common shareholders, unlike other security holders, do have voting rights, though these are coming to have less significance in the large corporation, where shares are widely held.

Negotiability.—The share certificate, in the U.S., never attained negotiability before the courts. The McNeil case (1871), held that they would be treated as quasi-negotiable, where an owner had entrusted his certificates to another, indorsed in blank, but that was on estoppel principles. When equipment trust certificates and security receipts were introduced early in the 20th century, they, too, were denied negotiability: the latter because the promise is to deliver securities, not to pay money, the former because the trustee promises to pay only if and when money is received from the equipment buyer, usually a railroad. When bonds and debentures came to be issued with clauses making the holder's rights subject to the provisions of the indenture, these too were held to be not negotiable; the promise of the issuer, not being an unconditional one, did not fit the pattern of the merchant's note.

The share certificate presented special difficulties. Instead of being regarded as a mere chose in action, shares had come to be looked on fictitiously as tangible property, having a situs at the corporation's office; the certificate was called a muniment of title, like a deed to real estate. The recital on the face of the certificate, providing for transfer on the books of the company, gave some support for the view; but in 1909 the Commissioners on Uniform State Laws proposed the Stock Transfer act to give controlling importance to the market sale of the certificate. The act, with few modifications, was soon adopted throughout the U.S. Under it the good-faith purchaser of a stolen certificate, properly indorsed, obtains full title, and may have the shares transferred into his own name on the company books; nor may a creditor of the registered holder defeat transfer, as once was possible, by serving a writ of attachment upon the issuer. The book transfer recital is recognized only to the extent necessary to protect the issuer; that is, the issuer may still treat the registered holder as share owner: to vote, to receive notices, and as the person to whom dividends may be paid.

Until mid-20th century no comparable legislation was proposed for bonds and similar instruments. In Great Britain, none was necessary, for the court in *Goodwin* v. *Robarts* (1875), assumed jurisdiction to declare new instruments negotiable upon proof of custom. However, in the U.S., a few states amended the Negotiable Instruments Law to include bonds. New York in 1926 passed a more ambitious act, bringing "security receipts," "equipment trust certificates," and "corporate bonds" into the fold. Government issues, such as income or toll-road bonds and special assessment bonds, which also were being held not negotiable, were sometimes covered by the statute authorizing the issue, that is, by a clause providing specially for negotiability. Finally, in 1952, the Commissioners proposed a Uniform Commercial Code which deals comprehensively with investment securities.

The code defined investment securities in broad terms to include any instrument that is commonly dealt in as a medium for investment, is issued in series, and evidences either a share interest or an obligation, provided only, it is "issued in bearer or registered form." Thus, notes and bills payable to "so-and-so or order," which must be transferred by indorsement, are excluded; these are dealt with in a section of the code concerning commercial paper. The line is a somewhat arbitrary one, but it is an important one to draw, for those instruments defined in the code as investment securities may take such form as the issuer may choose to give them and still be negotiable, while commercial paper is held closely to the traditional pattern. Moreover, there are several places where different law applies; defaulted or overdue securities, for example, are given a limited negotiability, contrary to the rule concerning commercial paper.

Liquidity.—During the first half of the 20th century corporate wealth reached vast proportions. Mines, ships, factories, skyscrapers, whole industries in fact, came to be represented by paper instruments, negotiable in form. Thus the buyer may readily put his savings into a bond or debenture of a Delaware corporation, which in turn may own gypsum mines in Canada or a banana plantation in Guatemala. So, too, a person in San

Francisco, by simply indorsing his name on the back of a share certificate, may transfer control of the company to a buyer in New York or London. Many things have contributed to this, but the existence of a securities market is essential; it provides liquidity. Savings would never have been put into paper securities on this scale were it not readily possible to sell them again, at a price.

A market for shares in common stocks (stocks are called shares in England) existed in London throughout the 18th century; it was provided by the brokers of the time who met in coffee houses, in Change alley and elsewhere. The first regular list of prices, for the dozen or more stocks then being traded, appeared in 1714. The present London stock exchange was organized in 1802; the New York stock exchange was organized in 1792, though it did not assume its present name until 1863. Essentially a stock exchange (*q.v.*) is a place where members meet to execute customers' buy and sell orders for listed stocks; sales "at the market" are made to the highest bidder. Thus it is possible in a very few minutes for stocks worth millions of dollars to be sold. The ticker, which has been in use since 1871, reports current sales and prices by wire to all parts of the country.

The exchanges list only those securities which meet their standards. Many issues are not listed, either because the issue is too small, because it is not sufficiently seasoned, because the company does not wish to make the required reports, or for other reasons. These securities, which in the aggregate greatly exceed the value of the listed securities, are traded in by brokers in what is called the over-the-counter market. Also, new issues, which customarily are sold to syndicates of investment bankers on a negotiated basis for later distribution to investors, are traded over-the-counter prior to listing. Since 1926, when the Interstate Commerce commission ordered that equipment trust certificates be sold at competitive bidding, many rail and utility issues have been sold in that way to investment bankers.

Following the stock market crash of 1929, Congress passed the Securities act of 1933 and the Securities Exchange act of 1934 to regulate the securities business; these acts do not apply to securities issued and sold intrastate. Many states have blue-sky laws, so-called because their purpose is to prevent promoters from selling blue sky to the unwary investor. The Securities act, on the other hand, follows the British model, and is designed to safeguard investors, both new and existing, by giving publicity to the important facts concerning each issue before it comes on the market. Bonds and shares today may be purchased with far more information than was the case prior to 1929. *See* also BOND (IN FINANCE); COMMERCIAL PAPER; FINANCE; STOCK (SHARES).

(R. T. S.)

INVESTMENTS: INDIVIDUAL. In the economic sense investment is the productive employment of capital—the direction of savings into uses that fill an economic need. From the point of view of the suppliers of capital, investment is the commitment of present funds for the purpose of deriving a future return in the form of income or capital appreciation. Inherent in the concept of investment (as against speculation) is the emphasis on income and/or growth in value over a period of time (as against short-term trading profits), and the assumption of only that degree of risk that the investor can afford. This requires the selection of investment mediums that are appropriate to the investor's objectives.

Investment Mediums.—Investors have a wide range of general mediums from which to choose. These include: (1) savings types: social security benefits, pensions, annuities, the reserve element in life insurance contracts, savings deposits in commercial and savings banks, accounts in savings and loan associations, and government savings bonds (or savings certificates); (2) securities: federal, state and municipal obligations and corporate securities including bonds (debentures), preferred stocks (preference shares) and common stocks (ordinary or deferred shares) in a variety of industries; (3) real estate held for occupancy and for income, and real estate mortgages; (4) direct investment in a business.

Other classifications of investments are: (1) by investor status: either that of creditor (as through the holding of bonds and annuities) or owner (as through common stocks and real estate); (2) by security: whether the investment (if debt) is a secured (viz., mortgage) or general (viz., bank account) claim; (3) by maturity: whether the principal will mature at a future date (bond or life insurance) or will never mature except through market resale (viz., stocks); (4) by degree of marketability: whether the principal can be recovered through resale (as in a listed stock) or may suffer from a poor market (viz., specialized real estate); (5) by tax status: whether the investment has advantages to investors concerned with high income (tax-free municipal bonds) or seeking capital gains (stocks for appreciation) as against investments producing current taxable income (viz., dividend-paying stocks); (6) by degree of management required: whether constant care and attention is required of the investor (as in a portfolio of corporate securities) as against delegation of investment management to others (viz., life insurance, pensions, trust funds, investment company securities); (7) by degree of risk to income and principal: no risk (U.S. savings bonds or British national savings certificates) versus high risk (speculative stocks); (8) by degree of protection against inflation: no protection (bonds, pensions, bank accounts) versus possible protection (stocks, real estate).

Types of Investment Risk.—Investors must take into account various types of risks associated with different investment mediums and develop an investment program that is appropriate to their resources and particular investment objectives.

Quality Risk.—Investments differ with respect to assurance of income and safety of principal. At the one extreme are government obligations and the savings types; at the other extreme, low-grade common stocks. Corporation securities and real estate include a wide range of quality. The task of selection to minimize risk or to assume only that degree the investor can afford may be undertaken by the investor, or the analysis and selection can be delegated to others. In the investment market the quality of an investment is evidenced by the yield or return that is produced in relation to market price—the higher the quality, the lower the yield. (An exception is found in those "growth" common stocks that pay low dividends in relation to market price and whose appeal is mainly one of possible price appreciation.)

British investors have a similar range of investment opportunities. In the field of government securities, stocks of the central government, counties and municipalities are roughly parallel to U.S. federal and state securities. Many Dominion government issues have been placed in London and have widened the opportunities available to the individual investor. The post office savings banks and trustee savings banks are also popular because interest on small sums is free of tax. National savings certificates and premium savings bonds, both government-sponsored issues, have great appeal to small investors. Building societies also have considerable attraction.

Risk of Price Change.—Cyclical variations occur in interest rates and in corporate profits and dividends that affect the price and income of marketable fixed-income investments as well as equities. The value of high-grade (marketable) bonds rises and falls moderately as interest rates fall and rise. Equity-type securities (common stocks) rise and fall with investors' and traders' estimates of expected earnings and dividends. They reap the benefit of high corporate profits and suffer the most in periods of recession. Purchase of bonds with varying maturities and diversification of stockholdings over various industries will reduce the price risk somewhat; complete avoidance of price risk would require concentration on the savings types of investments. A long-range program of "dollar-cost averaging" whereby the same dollar amount is regularly invested in a diversified selection of stocks, through high and low prices, will minimize the problem of timing their purchase and sale.

Various formula plans that involve an automatic switching to and from defensive securities—high-grade bonds—into more volatile common stocks, depending on the course of stock prices, have been developed to obviate the need for judgment with respect to the course of security prices. Or the task of timing the changes in the investment portfolio may be turned over to others such as trustees, investment counsel or investment companies, which pro-

vide investment management (at a fee). In Great Britain investment counsel, as such, does not exist. All stock brokers will advise without payment; banks and investment advisory firms will review and manage portfolios at a fee.

Money-Rate Risk.—As indicated previously, the prices of marketable securities that return a fixed income (bonds and preferred stocks) rise and fall inversely with interest rates, without necessarily any change in quality. If the investor wishes to avoid such price changes he must concentrate his investments in the savings types whose return is not influenced by any but long-run changes in interest rates, or attempt to select equities whose value is determined mainly by prospective profits.

Purchasing-Power Risk.—The purchasing power of the income and principal of fixed-income investments rises and falls with changes in the general price level or cost of living. Placement of a substantial proportion of the fund in equities—common stocks and real estate—in the hope of obtaining a higher income and an appreciation of monetary value offers the best possibility of an inflation hedge. But such a hedge works only over a considerable period of time. The equities must be purchased at depressed levels (a problem of timing); and all equities are not equally good for inflation protection because industries and companies do not behave alike during any phase of the general business cycle.

Investment Goals and Objectives.—The steps in an investment program are: (1) to determine the investor's goals or objectives in order of their relative priority or importance and to select the general types of mediums that are appropriate; (2) to select the specific investments after careful analysis and with due consideration of the problem of timing.

Individual investors and their needs differ in so many respects that it is impossible to generalize concerning investment objectives or the means by which these may be attained. There are variations in the amount of income available for investment, size of the investor's total resources, age, health, number of dependents, standard of living desired, time and skill available for investment management. And these and other factors change through the years, so that the objectives themselves change. In budgets allowing for modest savings, only the most urgent goals can be attained. As savings accumulate or responsibilities diminish, the objectives can be widened and more risk can be assumed. The following is a suggested list of objectives offered as an illustration of the approach.

Emergency Funds.—The first goal is to provide for unexpected expenditures or interruptions to income. Absolute safety is required, at a sacrifice of investment income. Savings accounts and savings bonds are the mediums used. These provide assurance of principal with modest income, require no management and have satisfactory denominations (U.S. savings bonds may be purchased in units of face value as low as $25). They have no tax advantages and offer no protection against inflation. In Great Britain national savings certificates serve a similar purpose. These certificates are purchased in units of 15 shillings each and interest paid on them is not subject to tax. There is, however, a limitation on the maximum number that may be held by any one person.

Protection Against Death of the Income Producer.—Until a living estate is created, this goal is accomplished for the majority of investors through adequate life insurance. Policies should be selected that provide the greatest protection during the earlier years at the lowest cost; additional and later policies can provide substantial reserves and retirement income. The amount of insurance needed depends on number and age of dependents, income desired for dependents and the size of the estate exclusive of the insurance element. Insurance provides assurance of some income or principal for dependents, freedom from care and management, satisfactory denomination and diversification. It does not provide against inflation save through an increase in the amount of coverage.

Over and above insurance sufficient to provide a minimum income for dependents, funds accumulated for their support can be invested in a variety of mediums. For small investors, savings types and high-grade bonds are indicated. For wealthier investors, who can assume more risk, common stocks and real estate offer opportunities for appreciation and the tax advantages of capital gains, while tax-free municipal bonds are useful in protecting current income against high tax-bracket rates. There are no tax-free municipal bonds in Great Britain but, as noted above, some forms of saving give tax-free income on a restricted scale.

Home Ownership.—This is probably the most substantial single investment goal of most investors. The modern method of amortizing the purchase of a home through a long-term mortgage forces savings into this use and relieves the investor of the problem of accumulating and managing funds for this objective. Once invested in real estate for occupancy, savings are concentrated and are subject to special risks pertaining to such property. An offsetting advantage is the possible increase in value as a protection against inflation.

Education and Other Family Needs.—A variety of objectives fall within this category. In most instances safety of principal and assurance of modest income are important. Accumulations toward this goal should be so planned as to provide definite sums at definite times of need. A program of regular investment in savings bonds is appropriate in many cases. Special insurance protection should be arranged to assure the fulfilment of these goals in the event of the death of the income producer.

Retirement Income.—This is the next investment objective in many cases. Its importance will vary with the age and standards of the investor and his dependents. Annuities, pensions and social security benefits should be combined to provide a minimum risk-free income. In addition, an investment portfolio consisting first of high-grade bonds such as savings bonds, then of carefully selected equities chosen for appreciation as well as soundness may be added as the investor's income and savings increase. The additional sums invested in equities will depend not only on the size of the fund but also on the investment skill of the investor, as well as on his tax requirements and his need for offsetting possible inflation. New York Stock exchange houses make possible the purchase of stocks through regular monthly payments. For many investors equities can best be acquired indirectly through regular purchase of investment company shares (*see* below).

Supplementary Income Before Retirement.—When the above primary goals have been fulfilled, or while the later ones are being concurrently fulfilled, the remainder of the program may involve more risk taking. Safety of principal and future assured income may be given less attention, and current income to supplement salary or business earnings may be stressed. If the investor does not wish to undertake the tasks of selection, timing and management of a fund he may seek the advice of brokers, investment bankers or investment counsel; or he may set up a trust fund or buy investment company shares. The wealthy investor may take advantage of the tax-exempt feature of certain securities, and much of his fund can be invested in higher-risk equities.

Creation of an Estate.—The final goal of some investors, after providing for the above requirements, is the creation of an estate (over and above minimum requirements) for dependents, charities and other beneficiaries. The complex aspects of estate planning may deserve the employment of firms that make a specialty of advice on such problems. The general investment requirements in planning for an eventual estate are: (1) tax relief on current income; (2) substantial liquidity (and insurance) to provide for estate taxes; (3) growth of some of the fund through capital appreciation; and (4) provision against inflation. Practically all of the general mediums of investment listed previously might be involved in such a program.

Selection of Specific Investments.—Selection of the savings types of investments presents few difficulties. Questions of form and convenience predominate. The same is almost true of high-grade bonds, although these must be watched for possible deterioration in quality; also the timing of their purchase (and possible resale) requires some forecast of the trend of interest rates.

The chief difficulties arise in connection with the selection and timing of investment in equity-type investments in those programs in which such investments are appropriate. Investment in real estate for income involves so many special problems that most investors would be advised to avoid it; also, they may already

have a substantial commitment in real estate held for occupancy. Common stocks show the greatest cyclical changes in value, the greatest range in quality and may involve considerable risk. Their exact value is always indefinite. The investor faces the task of appraising general business conditions, the course of stock prices as a whole, the relative outlook for different industries and the earnings, dividends and price performance of individual companies. If he undertakes the task himself he may study business and financial sources, subscribe to investment and statistical services and seek the advice of his broker or bank. Having selected the industries that appear to have the most promise or are most suited to the type of diversification he needs, he will then give attention to the analysis of the individual enterprise, emphasizing its characteristics and peculiar risks, quality of management, financial strength and earning power as revealed by financial statements, prospects for earnings, dividends and price appreciation and the degree of seasoning and marketability of the issue. He must also make a valuation to compare with current market price and be prepared to reappraise his holdings for changes in quality and appropriateness for his particular purposes.

These problems of timing, selection, diversification and continuous management of a portfolio of common stocks are too formidable or too time-consuming for many investors. Consequently, they may turn to one or more of several methods of transferring the responsibility to others. In the United States, professional investment counsel may be retained, at a fee. For those who can afford his advice, the registered investment adviser can fit the program to his client's individual needs, balancing the several factors of income, preservation of capital, appreciation, tax matters and diversification in one co-ordinated program. Other methods of transferring managerial responsibility on a fee basis include the use of investment departments of larger banks, the supervisory services of the larger stock exchange firms and the common trust funds operated by some banks and trust companies. These funds are conservatively invested but, through diversification, superior stability and emphasis on regular income and protection of principal and purchasing power value, have a strong appeal to many investors seeking these requirements.

Two types of institutions provide means for buying into a large portfolio of common stocks by way of the purchase of their shares —fire and casualty insurance companies and investment companies. While established to underwrite risks, the insurance company invests its reserves in a diversified portfolio of securities from which it derives a substantial investment income. Depending on the nature of the portfolio, its shares may offer opportunity for substantial capital appreciation as well as regular income.

Stocks of insurance companies are, however, highly specialized and difficult for the layman to analyze and evaluate. He is likely to turn to the investment company (investment trust) for a more understandable medium for indirect purchase of equities. So important has this institution become that it merits special consideration at this point.

Investment Companies (Investment Trusts.)—Investment companies are financial corporations that pool the funds of their shareholders in a substantial portfolio of securities, so that the investor has a part interest in a variety of individual concerns. Each share of the company's stock represents a fractional interest in the portfolio. The general advantages held out to the investor are: (1) diversification and spreading of risk through holding securities in a cross-section of industries and companies; (2) selection and management of the portfolio by professional experts who through research and constant study adjust the fund continually to changes in market and business conditions; (3) timing of purchases and sales within the portfolio, presumably on the basis of seasoned judgment; (4) convenience through handling for shareholders the details connected with the ownership of corporate securities. These advantages would be especially valuable to the investor who cannot afford investment counsel, cannot obtain diversification with his limited capital and lacks the time and skill to select and manage his own portfolio with successful results.

Most modern investment companies are of the management type, that is, their management has complete discretion over the portfolio held, subject to any charter provisions concerning the general nature of the portfolio, in contrast with the older fixed trusts that could only invest in a given list of securities. The two main classes of investment companies are closed-end companies having a fixed capitalization and whose shares are bought and sold by the investor in the market, and open-end or mutual funds (known in Great Britain as unit trusts) which make a continuous offering of new shares (through distributors) and redeem them on demand; the shares of open-end funds are offered at their net asset value plus, in most cases, a loading fee of 2% to 9% and are redeemed at net asset value, calculated daily. Investment companies may also be classified by type of portfolio securities held as assets. Those owning both bonds and stocks are called balanced funds. Others are common-stock funds holding common stock only, plus a varying amount of cash. Some of the latter are diversified funds; others hold securities in one or more special industries.

Investment companies also differ with respect to their investment purpose. Some are designed primarily to produce income, others for capital appreciation, still others for a combination of both. They differ also in the degree of risk undertaken, ranging from very conservative to frankly speculative funds. The problem of the investor is to select the fund or funds whose objectives and degree of risk taking most closely match his own situation— the ones that will accomplish for him what he would wish to do for himself if he could diversify and manage his own holdings.

Investment companies in the United States are closely regulated by the Securities and Exchange commission, under the federal Investment Company act of 1940, with respect to promotion and sales practices, standards of operation and dissemination of information concerning financial condition and investment policies. Investment trusts in Great Britain are not subject to special legislative control apart from the Companies act of 1948. Unit trusts are subject to board of trade control under the Prevention of Frauds (Investment) act of 1958.

Investment companies (including a few that still operate as trusts rather than as corporations) had their origin in the English and Scottish trusts that were formed as early as 1860 to provide an investment service to individuals either unable or unwilling to select and manage their own security holdings. The early British trusts were mostly of the closed-end type and were conservatively managed. Wide diversification was practised and operating expenses were modest. The early American trusts copied the basic idea of diversification but were less soundly managed. They often indulged in short-term trading; inferior securities were acquired for the portfolio; affiliations with sponsoring banking firms led to abuses. The collapse of the stock market in 1929–32 brought enormous losses and many failures. After a period of confusion in the 1930s, the stronger survivors and new companies enjoyed the renewal of general interest in equities and, by improved performance under federal regulation, grew rapidly and became widely accepted. This is not to say, however, that they have all been well managed and have all produced satisfactory results for their shareholders.

As indicated previously, investment companies do not follow uniform investment policies. They differ with respect to the general types of portfolio securities held, the degree of risk undertaken, the extent of diversification of investment holdings, the extent to which they keep their funds fully invested in various stages of the securities cycle, the relative emphasis placed on income as against capital appreciation and the results obtained for their owners. Most investment companies pay out at least 90% of their net investment income (after expenses) in dividends, and thus avoid taxation on income. Capital gains taxes on any realized but undistributed gains from buying and selling portfolio securities are paid for the shareholders at the source and credit is taken on individual tax returns.

In the selection of an investment company, the investor should first eliminate those whose purposes and record do not coincide with his own aims and objectives, and whose general policies indicate more risk taking than he is prepared to assume. The reputation of the management, the size and growth of the company and

its performance during periods of market weakness should all be examined. Performance is best measured by the cumulative results over a considerable period of time (preferably covering all phases of the business cycle) with respect to dividends and change in net asset value per share as compared with other companies, individual securities and general stock market averages. Other factors to be studied include the expense ratio (per cent of income or of asset value consumed by operating expenses of research and administration), the dividend yield on purchase price and the proportion of dividends representing investment income and capital gains, respectively.

Many open-end investment companies make it possible for the shareholders to reinvest any dividends in new shares without a loading fee and to accumulate new shares by deposit of a regular sum at stated intervals, and thus to obtain the advantages of dollar-cost averaging as the value of the shares rises and falls.

Regulation in the Investor's Interest.—In addition to state blue-sky laws, U.S. federal laws provide protection to investors in a number of respects. The Securities act of 1933 requires corporations that offer new securities in interstate commerce or through the mails to present prospectuses containing a description of the securities and the issuer. Civil and criminal penalties are imposed for fraud and for omission or misstatement of material facts in the prospectus.

The Securities Exchange act of 1934 provides for regulation of securities exchanges and trading to prevent manipulation of prices and abuses of credit in securities transactions. The Trust Indenture act of 1939 requires compliance with standards concerning the indentures that support corporate bond issues and regulates the activities of corporate trustees. The Investment Company act of 1940 (above) and the Investment Advisers act of 1940 regulate investment companies and registered investment counsel firms. The Securities and Exchange commission is the regulatory body under all of these federal statutes.

The legislative position in Great Britain has been referred to above.

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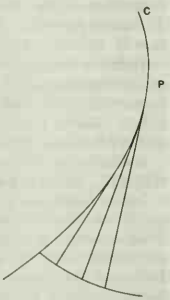
INVISIBLE EXPORTS: *see* EXPORTS: *Invisible Exports.*

INVOLUTE, of a curve C, is a curve that intersects all the tangents of the curve C at right angles. For examples, *see* CURVES, SPECIAL.

To construct an involute of a curve C, use may be made of the so-called string property. Let one end of a piece of string of fixed length be attached to a point P on the curve C and let the string be wrapped along C. Then, as the string is unwrapped, being held taut so that the portion of the string that has been unwrapped is always tangent to C, the locus of the free end of the string is an involute of C. With the same point of attachment P, different involutes of C are obtained by using pieces of string of different lengths. (E. P. L.)



INVOLUTE OF A CURVE C (*see* TEXT)

INVOLUTION, in mathematics, may refer to a transformation of period two of some mathematical system into itself. For example, in projective geometry the projective transformation of period two of a line L into itself may be defined as follows: let I_1 and I_2 denote two distinct points of L. Then for each point P of L there is a unique point, $T(P)$, of L such that P and $T(P)$ separate I_1 and I_2 harmonically (*see* PROJECTIVE GEOMETRY), and this relation between P and $T(P)$ is reciprocal; *i.e.*, $T(T(P)) = P$. As an example from topology, the transformation of period two of the unit 2-sphere (the surface of a solid ball of radius 1) into itself may be defined by sending each point into its antipode. It is significant that the topological space (*see* TOPOLOGY, GENERAL) obtained by identifying each point of the 2-sphere with its image under this transformation is the real projective plane. Observations of this sort have led to the systematic study of periodic transformations (*see* GROUPS, TRANSFORMATION) in topological spaces. (E. DY.)

IO, in Greek mythology, daughter of Inachus, the river-god of Argos and its first king. Under the name of Callithyia, Io was regarded as the first priestess of Hera. Zeus fell in love with her, and, to protect her from the wrath of Hera, changed her into a white heifer; according to Aeschylus in his *Supplices,* the metamorphosis was the work of Hera herself. Hera, having persuaded Zeus to give her the heifer, set Argus Panoptes to watch her. Zeus thereupon sent Hermes, who lulled Argus to sleep and cut off his head or killed him with a stone. But the wrath of Hera still pursued Io. Maddened by a gadfly sent by the goddess, she wandered all over the earth, crossed the Ionian sea (traditionally called after her), swam the strait known on this account as the Bosporus ("ox-ford") and at last reached Egypt, where she was restored to her original form and became the mother of Epaphus. She was thus identified with Isis, and Epaphus with Apis. He was said to have been carried off by order of Hera to Byblos in Syria, where he was found again by Io. This fable connects Io with the Syrian Astarte (*q.v.*). Both legends reflect intercourse with the east and identification of foreign with Greek gods. She was a favourite subject among Greek painters, and many representations are preserved on vases and wall paintings.

IOANNINA (YANNINA; JANINA), a town and *nomos* (department) in northwestern Greece, seat of the governor general of Epirus, a metropolitan bishopric and a divisional headquarters of the Greek army, stands in a broad valley on the western side of a lake, facing the gray limestone mass of Mt. Mitsikeli (5,938 ft.) on the opposite shore. Pop. (1961) 34,997 (town), 155,326 (dept.), including Albanians, Vlachs and Jews. The town is the chief market and commercial centre of Epirus, and is noted for its bazaar and its traditional embroidery, gold and silver work. The lake of Ioannina, the ancient Pambotis, is 6 mi. long and 24 sq.mi. in area, and about 1,500 ft. above sea level. In time of flood it is united with the smaller lake of Lapsista to the north. There are no large affluents, and the only outlets are underground channels or *katavothrai.* The mosque of Aslan Aga, on a promontory in the lake, is now the museum; the island in the lake has five small monasteries of the 13th to 17th centuries.

Prehistoric remains have been found in the neighbourhood, and the island has been connected with the fortress of Euroia described by Procopius (*de Aedif.* iv, 1); but Ioannina is first mentioned by name in ecclesiastical registers of the 9th and 10th centuries. It was stormed by the Norman prince, Bohemund of Tarentum in 1082. It assumed importance in the 13th century with the establishment of the Greek despotate of Epirus. After 1318 it reverted to the Byzantine empire and was made a metropolitanate by Andronicus II; but in 1349 it fell to the Serbs. Subsequently its possession was disputed by Italians, Albanians and Turks, to whom it succumbed in 1430. It remained Turkish until the Balkan War of 1913, although it was famous for its Greek schools. At the close of the 18th century it acquired fame and prosperity as the capital of Ali (*q.v.*), called the Lion of Janina, whose fortress is still to be seen. The town was occupied by the Germans during World War II.

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IODINE, a chemical element belonging to the halogen group, was discovered in 1811 by B. Courtois, a manufacturer of saltpetre. He noticed a substance that corroded the copper vats in which he was using a water extract from burned seaweed. He treated the extract with sulfuric acid, and the impurity was isolated as a black powder. When heated, this yielded a violet vapour and condensed in crystalline flakes. It was identified as an element

by J. L. Gay-Lussac in 1815. Iodine at room temperature is a nearly black crystalline solid, vaporizing easily to the deep-violet vapour from whose colour its name is derived (*iodes*, Greek for "violet").

Iodine and its compounds have many uses; *e.g.*, in medicine, the synthesis of organic chemicals, the manufacture of dyes, in analytical chemistry and in the "seeding" of clouds to produce rain. In medicine, iodine is of special importance because it is required in the diet to maintain proper metabolism; if the diet is deficient in iodine, endemic goitre and myxedema result. To prevent iodine deficiency, a small amount of iodine frequently is added to table salt. Iodine also may be used as a topical fungicide and bactericide, *e.g.*, to prepare a body surface for surgery; if improperly used, however, iodine causes inflammation of soft tissues. Iodides also are used as expectorants in chronic bronchitis and bronchial asthma. (*See* also ENDOCRINOLOGY: *Thyroid Gland;* MYXEDEMA; THYROID GLAND, DISEASES OF.)

The most useful artificial isotope of iodine is I^{131}, which has a half life of eight days. It is employed in medicine to measure the functioning of the thyroid gland; to treat thyroid cancer and other diseases; and to locate brain tumours. In investigations of a chemical, biochemical, physiological or similar nature, I^{131} is one of the artificial isotopes used to trace the course of compounds in metabolism, to determine the structure of molecules or for similar purposes. (*See* also RADIOACTIVITY: *Applied Radioactivity.*)

Sources.—Iodine is never found uncombined. It is present in sea water as iodide, 1 part of iodide to 8,000 parts of chloride; it occurs in much animal and vegetable matter, generally in very small amounts, but most abundantly in seaweeds. Appreciable quantities are also found in many natural brines. The largest source of iodine for commercial preparation is the nitrate deposits of Chile, from which saltpetre is prepared, iodine being present as sodium iodate. Iodine is estimated to account for 10^{-5}% of the earth's crust, and to be in 28th place in order of abundance.

For a long time in France and Great Britain and, more recently, in Japan, iodine has been recovered on a commercial scale from seaweed. The stages in the preparation are: drying and burning of the seaweed, leaching of the ash, release of the iodine by chemical reaction and purification. The burning is done in large ovens at as low a temperature as possible to avoid volatilizing sodium iodide. On extracting the ash with water a liquid containing 7–9 g. of combined iodine per litre is obtained. When cooled, considerable sodium sulfate and chloride crystallize, and the remaining liquid is concentrated by evaporation to a content of 30–100 g. of iodine per litre. The addition of sulfuric acid decomposes any sulfite and sulfide. Manganese dioxide added to the acidified liquor releases iodine, which is vaporized and purified by sublimation. In the modern French process, cuprous iodide, obtained by the reaction of cupric sulfate with the concentrated liquors, is the product instead of iodine.

Iodine from Chile nitrate deposits is a by-product of the preparation of Chile saltpetre. The mineral, containing 0.05% to 0.3% of iodine, is treated with hot water, filtered and cooled, precipitating most of the nitrate and leaving a liquor containing 6–12 g. of iodine per litre as sodium iodate. On the addition of a second liquid containing sodium sulfite and bisulfite, the iodate is reduced to iodine:

$$2NaIO_3 + 5NaHSO_3 \rightarrow I_2 + 3NaHSO_4 + 2Na_2SO_4 + H_2O$$

The amount of bisulfite liquor must be carefully controlled since excess will reduce the iodine to iodide. The free iodine is purified by sublimation in retorts.

A more recently developed source of commercial iodine is the brine extracted from oil wells. In California some brines contain 30–60 parts per 1,000,000 of sodium iodide. Two methods have been employed to obtain the iodine. In one process, silver nitrate in 2%–3% solution is added, precipitating the iodine as silver iodide, accompanied by considerable ferric hydroxide. On acidifying with hydrochloric acid, the ferric hydroxide is dissolved, and the addition of scrap iron yields a solution of ferrous iodide and metallic silver that is recovered. The ferrous iodide is decomposed by chlorine, or by sodium dichromate and sulfuric acid, the iodine precipitating in granular form. The precipitated iodine is melted under concentrated sulfuric acid and drawn off in liquid state at as high as 99.8% purity. In a second method, sodium nitrite and sulfuric acid are added to the brine, setting free the iodine in dilute solution. The iodine is concentrated by adsorption on activated charcoal, which, after it has become nearly saturated with iodine, is treated with sodium hydroxide to give a solution containing sodium iodide. The iodide solution is oxidized to iodine by acidified sodium nitrite, chlorine or chromic-sulfuric acid.

Physical Properties.—The atomic weight of iodine is 126.9044, the atomic number 53 and the molecular weight 253.8088. By mid-20th century, isotopes of masses 119–139 had been detected. Except for the natural iodine 127, these isotopes are radioactive and mainly short-lived. The radioactive isotopes are formed in the bombardment of tellurium and iodine with high-velocity particles and in the slow neutron fission of U^{235}. The electron configuration for the unfilled outer orbits (N and O) is: $4s^2$, $4p^6$, $4d^{10}$, $5s^2$, $5p^5$. The electron affinity of the gaseous atom is 3.22 ev. The molecules are normally diatomic but somewhat dissociated at high temperatures. Iodine has a density of 4.93 g. per millilitre at 20° C. The solid melts at 114° C. but has a sufficiently high vapour pressure to sublime readily at lower temperatures. The boiling point of liquid iodine is 183° C. The heat of fusion is 3.650 cal. per mole, the heat of vaporization 9.970 cal. per mole at the boiling point, and the heat of sublimation 14.460 cal. per mole at the melting point. The specific heat of the solid is 0.0513, the liquid 0.0631, the vapour 0.0355 cal. per gram. The entropy of the solid at 25° C. is 27.9 cal. per mole per degree. Iodine dissolves but little in water; at 20° C. the saturated solution contains 0.00133 mole per litre of solution. In most non-aqueous solvents the solubility of iodine is greater; in carbon tetrachloride it is 85 times the solubility in water. The solutions in water and alcohol are brown, in most other liquids, violet.

Chemical Properties.—In compounds the common oxidation states are minus one, plus five and plus seven. Iodine combines readily with most metals and some nonmetals to form iodides. With hydrogen, combination is incomplete since hydrogen iodide is unstable at temperatures sufficiently high for iodine and hydrogen to react. Iodine is reduced to iodide ion by reaction in solutions of hydrogen sulfide, sulfur dioxide and thiosulfate. In all these reactions iodine acts as an oxidizing agent but is the least active of the halogens in this respect. The formation of an iodide is accompanied by the evolution of less heat than is evolved in the formation of the corresponding bromides, chlorides and fluorides. The molal potential of the iodine-iodide electrode in aqueous solution at 25° C. is 0.535 v.

Iodine is the most readily oxidized of the halogens to an oxygen-containing compound. Potassium iodate is more stable than potassium chlorate, and iodine will react with the latter to go to the iodate. Iodine is oxidized to iodic acid by concentrated nitric acid and in basic solution to iodate by such oxidizing agents as chlorine.

Iodine reacts with aqueous ammonia to form nitrogen tri-iodide, $NI_3.NH_3$, which is highly explosive.

Iodine combines with iodides to form polyiodides. With aqueous iodide, the reaction $I_2 + I^- \rightarrow I_3^-$ accounts for the large solubility of iodine in solutions containing soluble iodides. A solution containing 100 g. KI in 100 g. of water dissolves 153 g. of iodine. Iodine at high concentration is poisonous and may cause serious burns; in dilute alcoholic solution (tincture of iodine) or aqueous solution it is used as an antiseptic.

Hydrogen Iodide and Iodide Ion.—Hydrogen iodide is a colourless fuming gas with a sharp odour. It is commonly prepared by the hydrolysis of phosphorus iodide, $PI_3 + 3H_2O \rightarrow 3HI + H_3PO_3$. A solution may be prepared by the reaction of iodine with hydrogen sulfide in solution, $I_2 + H_2S \rightarrow S + 2H^+ + 2I^-$. Hydrogen iodide liquefies at −36° C. and freezes at −51° C. The heat of formation at 18° C. is −5.91 kg.cal. per mole. The compound is not stable thermally, being 22% dissociated to the elements at 450° C. Iodine is liberated from hydrogen iodide by any of the other halogens, by oxygen or by concentrated sulfuric acid.

Like the other hydrogen halides, the gas is very soluble in water, 250 vol. dissolving in 1 vol. of water at 20° C. The aqueous solution, known as hydriodic acid, is a strong acid containing hydrogen and iodide ion. A constant-boiling mixture containing 57% HI by weight, boiling at 127° C., of density 1.70, is formed.

Hydriodic acid may be used to prepare iodides by reaction with metals or their oxides, hydroxides or carbonates, and as a reducing agent in organic chemistry. The iodide ion is a strong reducing agent, the strongest of the halide ions. It is oxidized to iodine by chlorine, bromine, ferric ion, cupric ion and many other oxidizing agents. Because of the reducing ability of the iodide ion, certain metallic iodides cannot be prepared; *e.g.*, cuprous iodide rather than cupric iodide results on the addition of an iodide to a cupric solution. While the iodide ion is colourless, solutions of soluble iodides tend to acquire a brownish tint as a result of oxidation of the iodide to free iodine by atmospheric oxygen. Iodides are generally soluble in water, common exceptions being silver, cuprous, mercurous and lead iodides. Although silver iodide is less soluble in water than silver bromide or chloride, in nonaqueous solvents the iodides are generally the most soluble of the halides. The iodides of metals in general form ionic-type crystals in which the iodide ion has a radius of 2.16 Å.

Potassium iodide, a white crystalline solid, melting at 682° C., of 3.12 specific gravity, is produced commercially to a greater extent than other iodides. It is made by the reaction of ferrous iodide, prepared from iron and iodine, with potassium carbonate, $2FeI_2 + 2K_2CO_3 + \frac{1}{2}O_2 \rightarrow 4KI + Fe_2O_3 + 2CO_2$, or by the reaction of cuprous iodide with potassium carbonate, $2CuI + K_2CO_3 \rightarrow 2KI + CO_2 + Cu_2O$.

Many organic iodides are useful in organic syntheses. Iodine enters organic molecules by direct addition at double bonds and by displacement of hydrogen. The latter reaction occurs less readily than with chlorine or bromine, and the iodine in organic compounds is in general more reactive than the other halogens. When used as a reducing agent in organic chemistry, hydrogen iodide is more effective in the presence of phosphorus, since the liberated iodine forms the more reactive phosphorus iodide.

Oxy Compounds.—Iodine is readily absorbed in alkaline solutions in which some hypoiodite is presumably formed, but since the hypoiodite is unstable, the product is a mixture of iodide and iodate, $3I_2 + 6OH^- \rightarrow 5I^- + IO_3^- + 3H_2O$. This reaction is reversed in acid solution, with iodide and iodate forming iodine. With the addition of an oxidizing agent such as chlorine in alkaline solution, all of the iodine may be oxidized to iodate and solid iodates crystallized from solution. Iodate may also be formed by anodic oxidation of iodide solution and by the reaction of iodine on a chlorate. The iodates are the most stable of the series chlorate, bromate and iodate, and usually the least soluble. Potassium iodate melts at 560° C. and at higher temperatures decomposes to potassium iodide and oxygen. Acid iodates such as $KIO_3.HIO_3$ exist, although no bromate or chlorate of this type is known.

Iodic acid is a moderately strong acid. It may be formed in solution by acidifying solutions of iodates or by the oxidation of iodine by nitric acid, $I_2 + 10HNO_3 \rightarrow 2HIO_3 + 10NO_2 + 4H_2O$. Iodic acid is much more stable than chloric and bromic acids. It is readily dehydrated at 110° C. to give the anhydride, iodine pentoxide, I_2O_5, a white solid that decomposes at about 300° C. without melting. The oxide readily recombines with water to give iodic acid. Treatment of iodic acid with concentrated sulfuric acid yields a different oxide, I_2O_4. The tetroxide is not an acid anhydride; with water it forms iodic acid and hydriodic acid.

The action of excess chlorine in alkaline solution will change iodide or iodate to periodate. A solution of periodic acid may be formed by acidifying a solution of barium periodate with sulfuric acid. Periodic acid is a stronger oxidizing agent in solution than perchloric acid although iodic acid is a weaker oxidizing agent than chloric acid. Periodic acid differs from perchloric acid also in that it is not always monobasic. Thus, not only such metaperiodates as KIO_4 and $AgIO_3$ but also mesoperiodates of which Ag_3IO_5 is an example, and paraperiodates such as Ag_5IO_6, are known. The existence of these salts may be attributed to the large size of the central iodine atom, about which a larger number of oxygen atoms may be co-ordinated. Most periodates are but sparingly soluble; this property as well as the proportion of acid and base are factors in determining which of the possible periodates forms in the reaction of periodic acid with a given base or metal ion. In commercial preparation, the reaction of sodium iodate with chlorine in alkaline solution yields the disodium meso salt, $2Na^+ + IO_3^- + 3OH^- + Cl_2 \rightarrow Na_2HIO_5 + 2Cl^- + H_2O$. Periodic acid, itself, crystallizes from solution as H_5IO_6, which may be dehydrated to HIO_4 by heating to 100° C. in a vacuum. Attempts to prepare the anhydride of periodic acid, I_2O_7, have not succeeded as oxygen is lost in further dehydration of the acid.

Analytical Chemistry.—Iodine is detected by the violet colour of its vapour or of its solution in carbon disulfide or carbon tetrachloride. In aqueous solution minute amounts of iodine in the presence of starch give a bright blue colour. None of the other halogens gives these colours. If present as iodide, the iodine is first set free by the action of an oxidizing agent such as chlorine water; or if present as iodate or periodate, by reduction with sulfurous acid. Iodine is determined gravimetrically by precipitation as yellow silver iodide, which is insoluble in nitric acid and ammonia. Volumetrically, iodine is titrated with a standardized solution of sodium thiosulfate, usually in the presence of starch as indicator. The iodine is consumed by reaction, $I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$, and at the end point the blue colour disappears, leaving a colourless solution.

The reaction of iodine with thiosulfate is of great importance in analytical chemistry. It is employed in the determination of many substances that have oxidizing properties. For example, dichromate may be determined quantitatively by first allowing the dichromate solution to react with excess potassium iodide solution, $Cr_2O_7^{2-} + 6I^- + 14H^+ \rightarrow 3I_2 + 2Cr^{3+} + 7H_2O$, and then titrating the liberated iodine with standard thiosulfate solution. Even substances with weak oxidizing powers may be determined in this way; *e.g.*, copper, by the reaction $2Cu^{2+} + 4I^- \rightarrow 2CuI + I_2$. Some other determinations that may be made in this way are of chlorine, bromine, iodate, persulfate, hydrogen peroxide, nitrite, arsenate, ferricyanide, permanganate, manganese dioxide and ferric iron.

Many reducing agents may be titrated directly with a standard solution of iodine in potassium iodide using the starch indicator. In these titrations the iodine is reduced to colourless iodide; *e.g.*, with arsenite, $HAsO_3^{2-} + I_3^- + H_2O \rightarrow AsO_4^{3-} + 3I^- + 3H^+$. Titrations of sulfite, sulfide, thiosulfate, ferrocyanide, stannous and antimonous ion may be made in this way. Determination of reducing and oxidizing agents in which iodine or iodide is employed are known respectively as iodimetric and iodometric determinations.

Iodine compounds are employed in other analytical procedures. A solution of mercuric iodide in excess potassium iodide, containing the complex ion HgI_4^{2-}, known as Nessler's reagent, is used in the determination of ammonia, with which it forms a yellow precipitate, $Hg_2NI.H_2O$. Small amounts of water in organic liquids are determined by titration with a pyridine solution containing iodine, sulfur dioxide and methyl alcohol. This solution is known as the Karl Fischer reagent. Potassium iodate and biiodate, $KIO_3.HIO_3$, are of importance as oxidizing agents in analytical chemistry. Potassium periodate is a valuable oxidizing agent in the determination of manganese. It will oxidize manganous ion to permanganate ion quantitatively in acid solution, the permanganate being determined colorimetrically.

The content of unsaturated compounds in oils is determined by measurement of the quantity of iodide absorbed. The per cent of its own weight of iodine that a sample of oil will absorb under certain specified conditions is known as the iodine number. Concentrated hydriodic acid is used in the Zeisel method for determination of methoxy groups.

Soluble iodides are employed in detection and estimation of alkaloids with which they form precipitates.

See also references under "Iodine" in the Index.

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IODOFORM, formerly valued as an antiseptic, although now no longer widely used in medicine, was discovered by G. S. Sérullas in 1822. It can be prepared by the action of iodine and an aqueous base on ethyl alcohol, acetaldehyde, acetone, isopropyl alcohol or almost any other compound containing either the CH_3-CO-C or the CH_3-CHOH-C groups. For this reason, the "iodoform test," which consists in the formation of iodoform by the procedure described, is commonly employed in the chemical laboratory for establishing the presence of the stated groups.

Iodoform, CHI_3, crystallizes in yellow hexagonal plates melting at 119°–120° C., and is readily soluble in alcohol or ether but is only very slightly soluble in water. It has a characteristic odour and is volatile in steam.

IOLITE: *see* CORDIERITE.

IONA, an island of the Inner Hebrides, Argyllshire, Scot., lies 6½ mi. S. by W. of Staffa and 1½ mi. W. of the Ross of Mull, from which it is separated by the shallow Sound of Iona. Pop. (1961) 130. Iona is low-lying; the highest eminence is Dun Bhuirg which rises to a height of only 332 ft. above sea level. The island covers 2,264 ac. and is 3 mi. long and 1½ mi. wide. At no time has it had more than a handful of permanent residents. Most of the island is rough grazing land but there is some permanent pasture and a few crops are grown. Sheep and cattle are reared. The principal occupations of the people are small-scale farming and the tourist trade. For many centuries water supplies were drawn from private wells but a communal water scheme was inaugurated by Argyll county council in 1960.

Archaeology.—The first part of the island to be inhabited was the top of Dun Bhuirg which was fortified sometime during the Roman period by natives of western Scotland.

Excavations in 1958 and 1959 have revealed the outline of the original monastery, founded by St. Columba in 563. The site of Columba's living cell, on a mound known as Tor Abb, traces of the round cells of the brethren and of two much larger buildings have been found. A layer of charcoal and other burnt material covering these remains date from the Norse invasions of the 8th or 9th century when the wooden buildings were burned down. The monastery was probably rebuilt, of stone, in the second half of the 9th century. Most of it is beneath the present abbey though part of a small stone building, possibly the church, has been found in the cloister garth. The High Crosses (St. Martin's, which is also known as the Iona cross, the stump of St. Matthew's, fragments of St. John's and pieces of another) appear to date from this period as also does the Relig Odhrain (St. Oran's cemetery), the royal burial ground with a small chapel.

A square precinct surrounded the Benedictine abbey and its cruciform church of St. Mary's, built in the second half of the 12th century. This abbey was paved and huge stone field drains kept it dry. In 1959 a roadway 7 ft. wide, made of red granite boulders from Mull, was uncovered. It led from the abbey, across the Relig Odhrain, past the nunnery to a landing place at Martyrs' bay and was the *Straid nam marbh* or Street of the Dead. It is thought to have been built between the 13th and the 16th centuries.

History.—The name of Iona, probably a corruption of Ioua, has long been accepted, though other old Gaelic spellings are simply I (pronounced "ee") Hy, Eo, Y, etc. I is found in I-Chaluim-Chille (Icolmkill, the Island-of-Columba-of-the-Church). Readily accessible from Ireland by sea, it formed an integral part of the dominions of the Gaelic-speaking kings of Scottish Dalriada. About 563 Columba, who was a kinsman of the royal house, came over from Ireland and with 12 followers settled on Iona. There he built a monastery and began to evangelize the Picts. He established the Celtic Church (*q.v.*) there and sent missionaries through mainland and insular Scotland. In 597 he died and was buried on the island. (*See* COLUMBA, SAINT.)

Columba's evangelizing work was continued by his successors who extended their sphere of influence to England and the European continent. According to Bede, in the 7th century Oswald and Oswui, sons of King Aethelfrith of Northumbria, took refuge in Iona where they learned the Gaelic speech and adopted the religion of the monastery. In 795 the first Norse invasion took place, to be followed by others in 802, 805, 840 and 986. The wooden monastery was burned down, and during the last raid the abbot and 15 monks were murdered. Iona's growing insecurity led to the transfer in 849 of the relics of St. Columba to the safety of Kells in Ireland. When Kenneth MacAlpin (*q.v.*), a follower of St. Columba, died in *c.* 860 he was buried on the island, probably because it was traditionally the burial place of the Dalriadic kings. The Relig Odhrain is thought to have been founded then as a separate burial place for Scottish kings. Its chapel was probably rebuilt by St. Margaret (d. 1093), wife of Malcolm Canmore, who restored the monastery, though the Celtic Church had by then given place to the Church of Rome.

The Norsemen, who had become Christians, included Iona in their diocese of Man and the Isles in the 11th century and in 1154 they put the see under the archbishop of Trondheim. This supremacy lasted until 1266 when the Hebrides were ceded to Scotland. In 1203 Reginald, lord of the isles, the son of a semi-independent Hebridean chief, Somerled, established a Benedictine monastery and nunnery on Iona. Somerled's descendants, the MacDonald lords of the isles, granted various estates in Tiree, Ardnamurchan, mid-Argyll, Kintyre and Islay for the upkeep of the abbey. With the forfeiture of the last MacDonald lord in 1493 the former vassal clans became independent and lawless, and during periods of unrest diverted much of the abbey's revenues to their own private purposes. Successive proprietors of Iona were the MacLeans and the Campbells.

In 1899 George Campbell, 8th duke of Argyll, transferred to trustees of the Church of Scotland the old ecclesiastical building. Before doing so he had carried out various improvements at his own expense. The trustees, mainly laymen, rebuilt the abbey church and it was opened in June 1912 for public worship for the first time for more than three centuries. In making over the abbey buildings the duke expressed the wish that they should be made available to all Christians, but differences in religious practices have so far rendered this impracticable.

The Iona Community.—In 1938 George MacLeod, parish minister of Govan (part of Glasgow), sought to infuse a new vitality into Christianity. He was convinced that the wide gap between actual life and theoretic religion should be closed and that, as in the Celtic Church of St. Columba, the spiritual and the material should be intertwined. The still pitiful condition of many of the ancient buildings on Iona offered George MacLeod and his seven comrades an opportunity for showing something of the spirit that had impelled Columba and his 12 missioners, more than 1,300 years earlier, to leave their native Scotia (Ireland) and carry the gospel to far-off lands. With the full approval of the Church of Scotland they began their work of restoring the ruinous buildings, and in 1959 when the cloisters, the sanctuary and the sacristy were finished the abbey was consecrated.

The Iona community is a missionary group of clergy and laymen within the Church of Scotland. In the early 1960s it had more than 6,000 full and associate members. Most of the year is spent working on the mainland, chiefly in industrial parishes, and abroad. The primary conditions of membership, however, entail residence for part of the summer on Iona and personal participation in the devotions of the community and in the physical work of restoration. The members adhere to a community "rule" of prayer and Bible study rather than to any particular ritual., Christian groups and individuals of all denominations, and young people, chiefly from industrial towns, visit Iona every summer for recreation of body, mind and spirit.

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ION EXCHANGE, a process in which ions (electrically charged atoms or groups of atoms) attached to or incorporated within the molecular structure of insoluble substances, called ion

exchangers, exchange with ions present in a surrounding solution. The process has also been called base exchange and exchange adsorption. Ion exchangers are essentially insoluble acids or bases, the salts of which are also insoluble. Ion exchangers may undergo exchange either with positively charged ions (cations) or negatively charged ions (anions). In the former case the process is referred to as cation exchange and in the latter as anion exchange. (*See* also ADSORPTION; SOLUTIONS.)

Numerous substances, of both natural and synthetic origin, possess ion exchanging properties. These include proteins, synthetic resins, cellulose, bone, living cells, silicate minerals and soils. For commercial and laboratory uses the inorganic ion exchangers include the natural zeolites, glauconite and greensand, and synthetic zeolites such as the sodium aluminosilicates (*see* ZEOLITE). Inorganic ion exchangers have been prepared from insoluble salts, heteropoly acids, and hydrous oxides. These include compounds such as zirconium and titanium phosphates, zirconium and tin oxides, ammonium molybdophosphate, and many other insoluble compounds possessing ion exchanging properties. Inorganic ion exchangers are of special interest because they are more stable than organic ion exchangers under certain conditions, such as high temperatures and ionizing radiation. The organic ion exchangers include the sulfonated coals (*see* SULFONIC ACIDS) and, most important of all, synthetic resins (*see* RESINS: *Synthetic Resins*). The synthetic resins are plastics which may be chemically modified to impart or enhance their ion exchanging properties.

Ion exchangers can be prepared in a variety of geometric shapes, forms and internal structures. Among the most important forms are sheets, or membranes, which are widely used for electrochemical purposes (*see* ELECTROCHEMISTRY). The structure of the synthetic resins can be modified to enhance or impart desired physical or chemical properties. These include the chelating resins, into which are incorporated chemical groupings possessing a preferential affinity for a given ion or group of ions. Another type of ion exchange resin incorporates materials, such as *p*-terphenyl, which scintillate when exposed to ionizing radiation. These scintillating resins permit the direct determination of the concentration of absorbed radioactive ions. (*See* NUCLEAR INSTRUMENTS: *Scintillation Counters.*) Paper can be impregnated with ion exchanging substances for use in paper chromatography (*see* CHROMATOGRAPHY: *Paper Chromatography*). A related development involves liquid ion exchangers in which ion exchange takes place between two immiscible liquid phases. (*See* LIQUID STATE.) These liquid ion exchangers are commercially available and are used for separations of materials, especially by continuous countercurrent operations.

For information about the use of ion exchangers in water softening and many other processes *see* below, *Applications.*

Historical Development.—In 1850, in separate publications by the English agriculturist Harry Stephen Meysey Thompson and the English chemist John Thomas Way, the phenomenon of ion exchange occurring in soils was recognized and systematically investigated.

In the early 19th century it was known that plants required nitrogen for growth and, further, that the ammonia given off by manure heaps was taken up by the soil. Sulfuric acid or sulfate salts were often used to fix the ammonia by the formation of ammonium sulfate. In 1845 Thompson, in collaboration with Joseph Spence, a chemist and druggist, conducted a series of experiments in order to test the extent to which soils could fix ammonia and "to ascertain whether it also extended to the sulfate, as if not, the use of sulfuric acid as a fixer, though preventing the escape of ammonia in a volatile form, would have been objectionable from its forming a highly soluble salt that would readily be washed down into the subsoil or carried off in drains." In one experiment a sample of soil forming a six-inch-high column was placed in a glass percolator. The soil had been mixed previously with a known quantity of ammonium sulfate. When water was passed through the column it was found to the experimenters' "complete surprise" that most of the ammonia was retained by the soil, that it could not be removed by leaching with water and that "this process was in some way connected with the presence of lime in the soil, as the sulfuric acid was washed out in combination with lime." Though Thompson was actually unaware of the correct explanation, the ammonium ion had exchanged with the calcium ion present in the soil, while the negatively charged sulfate ion was unabsorbed. The process can be written as:

$$Ca \cdot Soil + (NH_4)_2SO_4 \rightleftarrows 2NH_4 \cdot Soil + CaSO_4$$

In 1848 Thompson communicated a brief outline of his results to Way, who had recently been appointed consulting chemist to the Royal Agricultural Society of England. Way conducted a carefully designed series of experiments to elucidate the reaction of soils with metal ions. One of the most important conclusions Way drew from his investigations was that the cation exchange reaction was chemical in nature. He also pointed out that the displacing ability of individual cations from inorganic cation exchanging silicates was different but followed a reproducible order.

Way also demonstrated that the inorganic minerals in soil possessed marked exchanging properties (*see* SOIL: *Chemical Properties of Soils*). In fact he prepared the first synthetic cation exchangers of the aluminosilicate type having the approximate formula for the sodium form of $Na^+AlSi_3O_8$ in which the Na^+ is exchangeable. The first successful commercial applications of ion exchange were initiated in 1905 by Robert Gans, a German chemist, who obtained several patents for the preparation of synthetic hydrated aluminosilicates capable of softening water.

A disadvantage of cation exchangers of the inorganic or siliceous type is that their use is restricted to a narrow pH range near neutrality, because they eventually disintegrate in acid or highly basic solutions. Consequently their use is confined principally to water softening. In 1930 it was found that the sulfonation of various types of coal converted them to cation exchangers which could function even in highly acid mediums; this made it practicable to exchange metal ions for hydrogen ions. The predominating exchanging group in the sulfonated coals was a sulfonic acid group ($-SO_3H$) in which the hydrogen is exchangeable.

In 1935 I. B. A. Adams and E. L. Holmes discovered the ion exchanging properties of synthetic resins. Both men were employed as chemists in the British government research laboratory at Teddington, Eng. Their joint efforts led to the synthesis of phenolic resins, resembling Bakelite, capable of undergoing cation exchange; and resins capable of anion exchange. The latter resins were prepared from condensation of polyamines with formaldehyde. Although these first resins were not very useful in themselves, their synthesis meant that chemists could now synthesize ion exchange resins with properties nearly as desired. In 1942 G. F. D'Alelio showed that efficient resins could be made by incorporating individual chemical groups possessing exchanging properties into preformed synthetic plastics which in themselves had no exchanging properties but were exceedingly stable.

These discoveries accelerated the introduction of ion exchange processes into numerous technological and laboratory operations. Some of the more important developments were: (1) U.S. chemists of the Manhattan Project (atomic bomb research program) demonstrated that by simple and rapid ion exchange processes plutonium could be separated from uranium and fission products, and individual members of the chemical group known as the rare earths (*q.v.*) could be isolated. These findings led to the remarkably successful use of ion exchange to resolve highly complex mixtures of nucleic acids, amino acids, isotopes and several new elements. (2) In 1949 ion exchange resins were first prepared in the form of sheets, or membranes. While the use of membranes which permitted only ions of one sign to pass through had been known for years, the commercial availability of more stable and effective membranes made from the physically and chemically tough ion exchange resins greatly expanded the potential applications of a membrane system. In use, these membrane systems employ an electrical current to induce selective transport of ions, as explained below. (3) In 1953 there was introduced a process utilizing ion exchangers to separate ionized substances from nonionized or slightly ionized substances in water solution. This process, called ion exclusion, made use of the fact that nonionized substances such as alcohols and sugars are free to diffuse unhindered into the water

phase of the ion exchange resin while ions are excluded because of their electrical charges. Inasmuch as the nonionized materials retained by the resin can be removed by additional water washes, the technique of ion exclusion made possible the deionization and separation of many products without the use of heat, electricity or chemical regenerants. (4) In the 1950s U.S. chemists at the Oak Ridge National Laboratory discovered that exchangers (especially anion exchangers) can retain ions with an amazing tenacity from solutions in which the supporting or foreign electrolyte is present in concentrations up to 12 molal and higher and which form complex ions with the absorbed ion. Retention of the ions varies enormously with the concentration of the supporting electrolyte, so that the removal and separation of the ions can be accomplished very efficiently simply by passing different concentrations of the supporting electrolyte or pure water through a column of the ion exchanger (*see* below, *Techniques*).

Ion Exchange Resins.—An ion exchanging resin consists of a polymeric organic network or backbone and ionized or functional groups which undergo exchange. A very effective organic network is formed by the polymerization of styrene in the presence of varying amounts of divinylbenzene, which serves to crosslink the long chains of styrene into a three-dimensional fish-net type of structure. Functional groups are introduced subsequently into the polystyrene or, in the case of other ion exchangers, may be part of the monomer. Common functional groups in the case of cation exchangers consist of acid groups such as carboxylic groups (R—COOH), sulfonic groups (R—SO_3H) and phenolic groups (R—OH); while anion exchangers contain basic amine groups such as quaternary ammonium groups (R—R'_3N^+—OH^-) and primary, secondary and tertiary amines (R—NH_2, R—R'NH, R—R'_2N), where R represents the organic network and R′ represents organic radicals such as the methyl group ($-CH_3$). In a given resin the R′ groups may be the same or different. Resins in which all the functional groups are identical are called monofunctional. Schematic diagrams of a crosslinked polystyrene strong acid and strong base ion exchanger are shown in fig. 1. These ion exchangers are prepared in the form of spheres or beads varying from less than 0.04 mm. to 1 mm. in diameter. Larger-size beads tend to crack during the manufacturing process. The commonest particle diameters used for water treatment are the range from 0.84 to 0.297 mm., but for certain difficult separations smaller sizes are used.

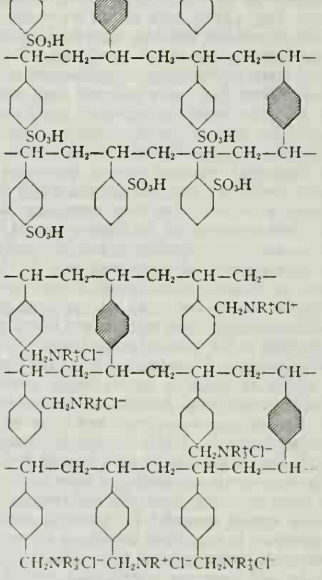

FIG. 1.—HYPOTHETICAL SCHEMATIC DIAGRAM OF A SULFONATED POLYSTYRENE CATION EXCHANGE RESIN CROSSLINKED BY DIVINYLBENZENE (TOP DIAGRAM) AND A STRONGLY BASIC QUATERNARY AMMONIUM ANION EXCHANGE RESIN (BOTTOM). THE CROSSHATCHED BENZENE RINGS SHOW THE DIVINYLBENZENE CROSSLINKAGE POINTS

Ion exchange resins of the type shown in fig. 1 are markedly resistant to chemical and physical attrition and are insoluble in all the common organic and inorganic solvents, including mineral acids and bases. High concentrations of oxidizing agents such as nitric acid can have deleterious effects by attacking the resins at a vulnerable point—the crosslinks. The salt forms of the cation exchange resins in contact with solutions can withstand temperatures up to about 140° C.; those of the anion exchange resins are stable up to about 90° C.

When immersed in water the ion exchange resins take up water and swell. The extent of swelling depends on the degree of crosslinkage—a quantity expressed by the percentage of divinylbenzene (DVB) used to prepare the resin. Thus a 10% DVB resin—the most commonly used—is made up of beads synthesized by the use of 90% by weight of styrene and 10% by weight of divinylbenzene. The extent to which a resin swells or shrinks depends on the salt concentration of the surrounding solution—the higher the concentration the less the swelling.

Ion exchange resins must have a crosslinked structure because the ionizable groups enhance the solubility and thus promote swelling. Too few crosslinks result in excessive swelling and reduced selectivity toward ions; while too many crosslinks so tighten the structure that the rate of the ion exchange reaction is too slow, since it depends on ionic diffusion. In practice a compromise must be effected in order to obtain a useful exchange resin. However, in special applications the ability to utilize resins of different crosslinkage is highly useful and sometimes indispensable. For example, when very large ions are to be taken up it is often desirable to use a low crosslinked resin so as to facilitate the entrance of the large ions into the "pores" of the resin.

Special resins are synthesized so as to contain functional groupings which have a specific or marked affinity for certain ions. Other special resins include types which undergo oxidation-reduction reactions. Instead of exchanging ions, these electron exchange polymers exchange electrons.

Ion exchangers are available which contain both acidic and basic groups. Such materials, containing the functional groupings attached to the organic matrix, are to be contrasted with a more widely used type of amphoteric resin called snake-cage polyelectrolytes. The latter are conventional cation or anion exchange resins in which are produced linear, (*i.e.*, non-crosslinked) polyions of opposite charge to the fixed groups. The linear chains of the counter-polyions are intertwined, in snakelike fashion, with the resin matrix so that they cannot escape or be displaced by other counter-ions. These resins are used for the so-called ion retardation separations mentioned later.

Extremely porous resins are prepared by a process in which the conventional polymerization technique is carried out in the presence of a substance that is a good solvent for the monomer but a poor swelling agent for the polymer. As a result, the solvent is squeezed out and beads are obtained with large pores. These macroreticular ion exchange resins are particularly useful for certain applications since the pore structure does not collapse on drying. The rates of acid-catalyzed reactions are much faster with macroreticular resins than with the conventional types.

In the table a summary is given of some of the major types of available ion exchange resins, together with other pertinent information.

When the acid or hydrogen form of a cation exchanger is neutralized with sodium hydroxide, a plot of the cubic centimetres of base added against the pH yields a titration curve. Such curves are an important and convenient method of characterizing ion exchange resins, because they give information on the number of kinds of functional groups present, their acid or base strength

Principal Types of Ion Exchange Resins Available Commercially

Resin	Total capacity (Milliequivalents 1 g.)	Total capacity (Milliequivalents 1 c.c.)
Cation exchangers		
Strong acid (sulfonated polystyrene)	4.2	2.2
Carboxylic	4–10	1–4
Phenolic methylene sulfonic	1.3–2.5	0.5–1
Sulfonated coal	1.6	0.6
Aluminum silicate	1	—
Anion exchangers		
Strong base	2.3–2.5	1.0
Weak base	6–10	2–2.5

and the capacity of the resin. The behaviour of a carboxylic acid resin of the type (R—COOH) closely parallels that of moderately weak acetic acid (CH_3—COOH), while the behaviour of monofunctional sulfonic acid resins resembles that of the strongly acid hydrochloric acid. On the other hand, the quaternary-ammonium-type anion exchange resins are nearly as basic as sodium hydroxide.

Techniques.—Contact between a solution and an ion exchanger involves either a batch or column process. In the batch process the resin is simply mixed with solution and agitated continuously or intermittently until equilibrium is reached—a period of a few minutes or several days depending on the resin and type of ions being exchanged. After equilibration the resin is removed by filtration. Batch techniques are infrequently employed for industrial purposes, but are often used in the laboratory for fundamental studies of the mechanism of ion exchange reactions.

Column methods generally involve fixed-bed operation, which refers to the use of a packed column of resin through which is passed the feed or regenerant solution. The resin is supported on a porous support while solution flows through by gravity or under pressure. The solutions are usually passed down through the resin, though up-flow operation is not uncommonly employed, especially when it is desired to remove suspended particles from the resin bed during regeneration.

A fixed-bed cycle generally consists of the following steps: (1) saturation of the bed with solution until the desired or undesired ions break through to a predetermined level; (2) removal or elution of the retained ions by regenerant solutions; (3) rinsing of the bed free of regenerant so that the cycle can be repeated. Between cycles the bed may be backwashed by up-flow passage of water.

A less used but potentially important variation of column operation is the so-called moving bed or continuous countercurrent system. Here both the resin and solution are made to flow through the system.

An effective method for separating difficultly resolvable mixtures on the laboratory scale is by the technique of chromatographic elution. The ions to be separated are placed on the top of the resin bed and subsequently eluted stepwise with a solution containing ions capable of displacing the absorbed ions. The displaced ions move down the column as bands or zones at different velocities. If the column is long enough the bands may completely separate from one another, and the substance confined to each band is recovered in the outgoing solution, called the effluent.

Most applications of ion exchange involve column operation, because of the completeness of separation which can be obtained and the ease with which automatic instrumentation can be employed. Column techniques correspond to the use of a large number of batch operations in series, an analogy closely akin to fractional distillation processes.

Mechanism of Ion Exchange Reactions.—The equilibrium between monovalent exchanging ions, A^+ and B^+, for a cation exchanger can be written as a simple chemical reaction:

$$A^+ + BR \rightleftarrows B^+ + AR$$

where R represents the immobile resin anion with an assumed charge of −1. Ion exchange reactions in dilute solutions exhibit (1) exchange of equivalent amounts of ions; and (2) preferential uptake by the exchanger of one ion over another. These properties are defined by the selectivity quotient, Q:

$$Q = \frac{[AR][B^+]}{[BR][A^+]}$$

where [AR/BR] is the molar ratio of the ions A^+ and B^+ in the resin phase in equilibrium with concentrations $[A^+]$ and $[B^+]$ in the solution phase. When $Q=1$ the resin shows no preference for A^+ over B^+. For easy separation it is important that Q be as far as possible from unity. When $Q>1$ then the resin shows preference for A^+ over B^+ and vice versa.

The selectivity quotient is not constant under varying conditions; it depends, for example, on the nature of the resin, the total concentration of the solution and the ratio of ions in the resin phase, and the nature of the ions. Inasmuch as the efficiency and hence the design of a column operation depend on the values of Q, it is apparent that the determination of Q is important. The greater Q differs from unity, then the shorter can be the column, the faster the flow rate and the sharper the separations.

In general terms and for dilute solutions, the affinity of an ion for an ion exchanger is governed largely by electrostatic forces and depends mainly on two factors—ionic charge and ionic size. Ions of higher charge are generally held more tightly, as in the series $Th^{4+} > La^{3+} > Sr^{2+} > Na^+$. For ions of the same charge the ion with the smallest radius in solution is held the strongest. Thus for the alkali metals the order is: $Cs^+ > Rb^+ > K^+ > Na^+$; which reflects the fact that while Cs^+ has the largest crystal radius its hydrated radius is the smallest. That the hydrated radius is the important parameter is shown by the fact that in alcoholic solution where the ions become dehydrated, the affinity of the alkali metal ions for the ion exchanger is in the reverse order. The affinity of a cation exchanger for H^+ depends on the acid strength of the functional group.

A related and much-used quantity for evaluating separability is the distribution coefficient K_d, defined for a given ion in any ion exchange system, as for A^+, for example:

$$K_d^A = \frac{[AR]}{[A]} = \frac{\text{concentration } A^+ \text{ per unit weight resin}}{\text{concentration of } A^+ \text{ per c.c. of solution}}$$

The ratio $K_d^A/K_d^B = Q$ is called a separation factor.

Inasmuch as the functional groups of a resin are fixed, it is possible to formulate ion exchange reactions as a Donnan equilibrium (unequal concentration of diffusible ions in the solution relative to fraction bound by the polyelectrolyte). Consequently, for a reaction involving H^+ and Na^+:

$$Na^+ + HR \rightleftarrows NaR + H^+$$

and omitting activity coefficients (*see* SOLUTIONS: *Solutions of Electrolytes*), the equilibrium quotient, K, is

$$K = \frac{[NaR][H^+]}{[HR][Na^+]}$$

This equation is identical in form with one based on the law of mass action.

When the resin phase is treated as an ordinary aqueous solution, and the standard state is taken to be the same in both phases, then the value of K becomes unity when both phases are dilute. However, in the ordinary 10% DVB resin the internal concentration is about 6 molal; hence it is necessary to insert activity coefficients into the equation to take into account the marked effects of concentration changes on equilibrium. When resins of very low crosslink are used, the internal resin phase becomes more dilute; *i.e.*, the resin takes up more water. This serves to reduce the selectivity of the resin for one ion over another because the differences in activity become less.

When ions of unequal valences are exchanging, such as Ca^{2+} and Na^+, the ion exchange reaction is

$$Ca^{2+} + 2NaR \rightleftarrows CaR_2 + 2Na^+$$

and

$$K = \frac{[CaR_2][Na^+]^2}{[Ca^{2+}][NaR]^2} = Q\left[\frac{Na^+}{NaR}\right]$$

From the definition of Q it is found that the selectivity of the resin for Ca^{2+} relative to Na^+ is given by the expression

$$Q(Ca/Na) = \frac{K[NaR]}{[Na^+]}$$

When the concentration of Ca^{2+} is very small relative to Na^+, then [NaR] remains nearly constant; and it is seen that the selectivity of the resin for the divalent cation is inversely proportional to the sodium concentration in solution. Thus in water softening, where a dilute solution of Ca^{2+} and Na^+ salts is dealt with, the resin is very efficient in removing the Ca^{2+}. However, in regeneration the use of a strong solution of sodium chloride is effective in eluting calcium. The use of greater concentrations of the ion of lower valence tends to reduce its relative affinity for the resin.

The resin phase must maintain electrical neutrality at all times. Because of the presence of a preponderance of nondiffusible "resinate" ions (R^- in the case of a cation exchange, and R^+ in the case of anion exchange) the penetration of ions of the same charge into the resin phase is hindered—a manifestation of the Donnan effect. Consider the case of the hydrogen form of a cation exchanger immersed in a solution of hydrochloric acid. In dilute solutions the concentration of Cl^- in the resin phases is nearly nil. However, as the external concentration of HCl increases, the concentration of Cl^- in the resin phase in the form of HCl increases and approaches that of the outside solution. Neglecting activity coefficients, the expression for the diffusion of HCl into the resin phase is:

$$\frac{[Cl^-]\text{resin}}{[Cl^-]\text{solution}} = \sqrt{\frac{1}{1+\frac{[R^-]}{[Cl^-]\text{resin}}}}$$

One gram of a 10% DVB resin, HR, contains about 5 millimoles of H^+ and R^- in roughly 1 c.c. volume; *i.e.*, it is roughly 5 M in H^+ and R^-. When immersed in a 0.1 M solution of HCl, the equation illustrates the fact that the ratio $[R^-]/[Cl^-]$ resin $= \frac{5}{0.1} = 50$, so that the concentration of Cl^- in the resin is very small; namely, about 0.014 M. When the concentration of HCl in solution is 10 M, the concentration of Cl^- in the resin is calculated to be about 8.1 M. This example shows that while the total exchange capacity of the resin was only 5 millimoles, the actual concentration of H^+ in the resin was 8.1 M, 3.1 millimoles greater than the total exchange capacity.

Those ions which enter the resin as a result of Donnan effects can be leached out with water, while those ions needed to neutralize the functional groups remain. In the case of uncharged substances, their concentration in the resin phase may actually exceed the external solution concentration because there exist no charge factors to exclude them and, in addition, the resin phase often acts to hold them selectively. This is the basis for the ion exclusion process described in the section *Historical Development*.

The presence of complexing anions in a solution of metal cations produces a radical change in the exchange properties of the metal ion. The affinity of the metal ion for a cation or anion exchanger may be varied by factors of a million or more. Consequently, most remarkable separations of metal ions are possible. In order to evaluate or predict semiquantitatively the separabilities, it suffices in most instances to know the distribution coefficients of the metal ions and the stability constants of the metal ion for a given number of ligand, or complexing, anions, *e.g.*, MA^+, $MA^0{}_2$, $MA^-{}_3$, etc. where M represents a cation with two positive charges and A an anion with a simple negative charge.

When a cation is complexed, its positive charge is lowered or it may become converted to an anion and therefore its absorption by a cation exchanger will decrease. When the complexed cation is negatively charged it is excluded even more efficiently by Donnan exclusion. However, the absorption of certain ions such as gold, iron, and gallium actually increases with increasing concentration of the supporting electrolyte up to 12 molal in some cases, with distribution coefficients reaching values of the order of 10^8. This behaviour appears to be related to the loss of water in the hydration sheath of the cation in the very concentrated interior of the ion exchanger and to unexplained interaction of the complexed ions with the resin matrix and functional groupings.

In the case of anion exchange resins, the formation of complex ions serves to enhance the absorbability because the Donnan exclusion becomes reduced or nil when the positively charged cation is converted to an anionic complex. When the concentration of supporting electrolyte increases, the absorption of a cationic complex by the anion exchanger increases because the Donnan exclusion becomes less effective. In the case of an anionic complex, the absorption may decrease under the same conditions because of competition from free anions. However, the Donnan effects do not apply when the concentration of the supporting electrolyte becomes very high, *i.e.*, comparable to or higher than that of the fixed ionic groups. In this range, invasion of the resin takes place. It happens that many complexed ions possess an extremely high affinity for an anion exchanger which is generally much higher than that observed by cation exchangers, reaching values of 10^8 or more. An important rule states that the maximum uptake of the metal ion recurs when the number of complexing anions combined with the metal ion results in the formation of a neutral (*i.e.*, uncharged) complex. By means of this rule, and utilizing the known stability constants for complex formation, one can calculate the concentration of the complexing anion at which the absorption of the complexed metal will be at a maximum.

An interesting phenomenon called site sharing is observed when anion exchangers are combined with polyvalent anions. In these cases, the anion exchanger can be considered a base which can absorb acids without exchange of anions. For example, consider a strong base anion exchanger in the sulfate form:

$$R_2SO_4 + H_2SO_4 = R_2(HSO_4)_2$$

Thus, when sulfuric acid is passed through the column of the sulfate form of the anion exchanger, the effluent is free of acid. The absorbed acid can be eluted with water or dilute sodium hydroxide without removing the originally absorbed sulfate ions. As long as the added acid is not too weak (*i.e.*, can donate a proton to the counter ion), it permits the removal and separation of acids from solutions. Inasmuch as the exchanger can be regenerated with water or dilute bases such as calcium hydroxide, commercial processes utilizing these facts have been developed for desalting brackish waters. In such a process the brackish water passes through the hydrogen form of a cation exchanger, releasing acid which is passed through the sulfate form of an anion exchanger; the product is an effluent of acid and salt-free water.

The phenomenon of site sharing permits the separation of many dissociated metal salts from acids, since they do not have H^+ ions to associate with the resin anion. Hence, salts such as Na_2SO_4 and $CuSO_4$ can be freed of acid.

The rate with which an ion exchange reaction reaches equilibrium does not depend on the chemical exchange reaction but rather on the rates of diffusion of the exchanging ions into and away from the ion exchanger. In a well-stirred solution, ion exchange kinetics is governed by one of two diffusion mechanisms: (1) diffusion of the ions through a hypothetical film of solution surrounding each ion exchange particle (F mechanism); or (2) diffusion of the ions through the exchanger particle itself (P mechanism). When both mechanisms are significant in an ion exchange reaction, the condition is said to be "intermediate" (I mechanism). It is helpful to know which diffusion mechanism is operative because it gives both qualitative and quantitative information on how the rate varies with changes in the particle size of the exchanger, concentration of the solutions, charge of the ions and many other parameters, including the internal structure of the resin. Since column methods are usually operated under nonequilibrium conditions, kinetic information helps to predict the performance of a given column process and hence the design.

The differences between ion exchange reactions governed by F or P rate mechanisms may be summarized in general as follows: (1) a P mechanism is independent of stirring or flow rates while the reaction rate of an F-mechanism-controlled reaction increases with increasing stirring or flow rates; (2) in the early stages a plot of the amount of exchange which has taken place against the

square root of time gives a linear plot for a P mechanism; while an F mechanism gives a linear plot when the log of the amount of exchange is plotted against the first power of time; (3) at high concentrations in the surrounding solutions the rates tend to be governed by a P mechanism, and at low concentrations by an F mechanism; and (4) the rate constant varies inversely as the first power of the radius of the exchanger particle for an F mechanism, and as the square of the particle radius for a P mechanism.

Applications.—Since the discovery in 1935 of synthetic ion exchange resins, technical application has increased to the point where it is regarded as a unit operation along with processes such as distillation, adsorption, filtration, and solvent extraction. The major use of ion exchange has been in water softening, in which calcium and magnesium ions, largely responsible for the hardness of water because they form insoluble compounds (*see* WATER: *Hard Water*), are removed by a granular bed of cation exchanger and replaced by sodium ions from the cation exchanger. When the cation exchanger becomes exhausted, by no longer having sufficient amounts of exchangeable sodium left, it is regenerated by passage of an excess of a strong solution of sodium chloride through the bed, thus removing the calcium and magnesium, which are usually discarded.

Water-softening units in individual homes find widespread use in the U.S.; home uses are being developed in Great Britain and in Europe (*see* HOME EQUIPMENT: *Water Softeners*). Some communities soften water before it reaches the home. Numerous industries soften water or provide deionized water in order to improve the quality of various products, such as television tubes, storage batteries, drugs, sugar and paper. A technique increasingly used in water conditioning includes the use of mixed-bed units. The cation and anion exchange resins are mixed so that complete demineralization occurs in the passage of water directly, instead of the usual technique in which water runs through a series of alternate anion-resin-containing tanks. In a mixed bed the resins are regenerated separately by separation of the lighter anion resin by hydraulic classification. After regeneration the resins are mixed, compressed air being used for agitation.

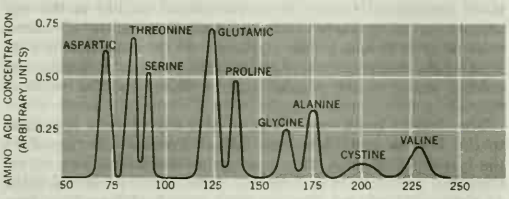

FIG. 2.—ION EXCHANGE SEPARATION OF AMINO ACIDS BY ELUTION WITH BUFFERS OF INCREASING pH FROM A STRONGLY ACID CATION EXCHANGE RESIN. THE SHAPES OF THE CURVES VARY DEPENDING ON FLOW RATE, CONCENTRATION OF SUBSTANCES BEING SEPARATED, TEMPERATURE, LENGTH OF COLUMN AND OTHER FACTORS

The recovery of metals from industrial wastes and the purification of solutions for re-use are important applications of fixed-bed exchange. However, for such processes to be worthwhile, the recovered metal must have a relatively high economic value, or the savings resulting from the re-use of the solution must be high. The first large-scale use of ion exchange for metal recovery (copper from rayon spinning wastes) took place in Germany beginning about 1940. Deionization of many organic chemicals such as gelatin, sorbitol and glycerol is achieved by ion exchange. Anion exchange resins are used successfully to remove formic acid from formaldehyde.

The isolation of materials present in small amounts is another major use of ion exchange. Streptomycin is a large organic molecule which behaves as a cation. It is concentrated from fermentation broths by absorption on a cation exchange resin, and is recovered in high concentration by displacement with dilute acid.

Rare earths are trivalent cations so similar in properties that ordinary ion exchange separation methods do not work with them. However, it is possible to convert the rare-earth cations into complexes by the use of complexing agents such as citric, lactic and other organic acids. These complexes are usually anions and as such are not absorbed by a cation exchange resin. The rare-earth cations are placed on the top of a bed of a cation exchanger, and elution is facilitated by the use of complexing solutions of suitable pH and concentration. Since the stability of the complex ions varies, the over-all differences in affinity of the individual rare earths for the resin are enhanced. Of further interest is the fact that under given conditions the rare earths are eluted in an orderly sequence based on atomic number. This behaviour led to the first positive identification and subsequent solution of element 61, named promethium. Similarly, the same complex or chromatographic elution technique led directly to the discovery of the elements curium, berkelium, californium, einsteinium and fermium. (*See* CHROMATOGRAPHY: *Ion Exchange Chromatography;* HYDROMETALLURGY: *Ion Exchange.*)

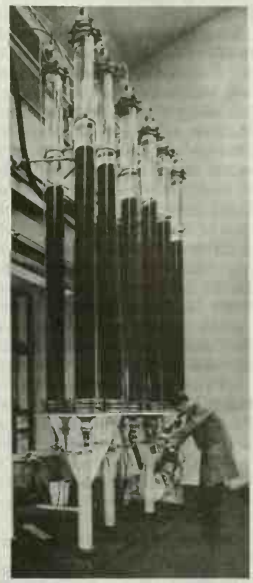

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FIG. 3.—ION EXCHANGE RESIN COLUMNS EMPLOYED IN THE LARGE-SCALE SEPARATION OF RARE EARTHS

The unusual absorption of complexed ions by anion exchangers has led to numerous commercial and laboratory applications. For example, concentrated hydrochloric acid can be freed from traces of iron impurity by an anion exchanger. The iron is absorbed as the chloride complex and can eventually be removed by elution with water or dilute hydrochloric acid.

Amino acids possess both acidic and basic groups so that they can be absorbed on either cation or anion exchange resins. By suitable variations in pH of an eluting solution, it is possible to obtain separations of individual amino acids, as is shown in fig. 2.

In medicine, weak base anion resins are useful in the treatment of ulcers. When taken orally in the form of a powder or in a capsule, they act to neutralize excess hydrochloric acid in the stomach. Cation exchange resins in the form of mixed potassium-ammonium forms are capable of removing excess sodium from the body, and thus reducing water retention believed to result from the water held by sodium ions.

It is possible only to mention the myriad of other uses of ion exchangers. These include the separations of peptides, nucleic acids, sugars, aldehydes and ketones, and the removal of calcium from blood to prevent coagulation. Since ion exchange resins are essentially acids or bases, they find considerable use as catalysts in hydrolysis and esterification reactions. They have the advantage that as catalysts they can be removed from the reaction mixture by simple filtration and re-used after regeneration.

The technique called ligand exchange has been applied for separations of nonionic molecules such as ammonia, amines, and alcohols. In this process the cation exchanger acts as a carrier in the presence of cations such as Cu^{++}, Ni^{++} or Ag^{+}, which can form complexes with anions or neutral molecules. The complexes are formed in the resin; no ion exchange takes place. Ligand exchange serves as a means of separating molecules which can form complexes with the complexing cation from those which do not.

Similar techniques were employed on the Manhattan Project in 1942 for the separation of plutonium and fission products from uranium by the use of anion exchangers containing complexing

anions such as oxalate, citrate or fluoride. Among many applications is the separation of carbohydrates and related compounds by the use of anion exchangers in the borate or bisulfite form, since the latter anions form complexes with compounds containing hydroxyl groupings.

Many studies of a fundamental nature are carried out with ion exchange resins, since they serve as tools for measuring the stability of complex ions, determination of the state of an element in solution and measurement of activity coefficients. Ion exchangers are widely used in analytical chemistry and other branches of chemistry for the purification of reagents and the preparation of different salt forms of compounds. Salts of acids, when passed through the hydrogen form of a cation exchanger, liberate H^+ which can be titrated, thus yielding the concentration of the original salt. Electrochemical methods of utilizing ion exchange resins, particularly in the form of membranes, are used for demineralization of water and chemicals. In a simple three-compartment cell a cation and an anion exchange membrane divide a container into three regions. Upon application of a current, the cations present in the middle compartment move through the cation membrane, while the anions move into the anion compartment. Thus the middle compartment is demineralized. A series of such cells can be used in which water or other liquids passing continuously through the middle compartment are demineralized. Electrochemical operations become less economical as the salt concentration in solution increases; *i.e.*, current consumption becomes higher. It is impractical to demineralize salt water completely, but it appears practical for reducing the salt concentration of brackish and sea waters to render them fit for drinking or irrigation.

Other methods of desalting brackish water make use of the site-sharing phenomenon (*see* above, *Mechanism of Ion Exchange Reactions*).

See also references under "Ion Exchange" in the Index.

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IONIA, the ancient name of a region comprising the central sector of the west coast of Asia Minor, bounded by Aeolis on the north and Caria on the south and including the adjacent islands. It extended from Phocaea (*q.v.*) by the mouth of the Hermus (mod. Gediz) river in the north to the territory of Miletus (*q.v.*) south of the Maeander (Buyukmenderes) river (100 mi.). Three flat river valleys, Hermus, Cayster (Kucukmenderes) and Maeander, led down between mountain ranges of 5,000–6,000 ft. to deeply recessed gulfs of the Aegean coast.

Before 1200 B.C. this land bordered on the Hittite empire. In early Greek times the name Asia seems to have belonged to this particular stretch of coast; and it is tempting to assume that it is the same as the Assuwa of the Hittite records. The coastal city of Milawata, named in these records as belonging to Ahhiyawa (perhaps Achaean Greece), is probably Miletus. The name Ionia does not appear in any records of this time, and Homer does not recognize any Ionic settlement of the Asiatic coast in Achaean times. The name Ionia must therefore have been first applied to this coast at a time subsequent to the collapse of the Achaean kingdoms in Greece when Ionic Greek refugees migrated eastward across the Aegean. It must be emphasized that though they formed their own distinctive civilization and dialects, the Greeks of Ionia were only one wing of the Ionic race, which, properly speaking, included the Athenians and many islanders (*see* IONIANS).

On archaeological data the Greek emigration to Ionia may be dated *c.* 1000–900 B.C. In ancient tradition it proceeded mainly from Athens and was led by sons of King Codrus. Modern research shows that the original settlements were numerous and small; but at an early date (8th century or earlier) the leading Ionic cities had consolidated their ownership of the whole coast line and formed an exclusive religious league, the Panionion, with its sanctuary under Mt. Mycale (Samsun Dagi). The cities of Ionia now numbered only 12: Phocaea, Erythrae, Clazomenae, Teos, Lebedos, Colophon, Ephesus, Priene, Myus and Miletus on the mainland, with the islands Chios and Samos. The cities of Ionia were pioneers of civic (and probably constitutional) development in the 8th–7th centuries; these eastern Ionians were individualists by nature and were the founders of Greek poetry and humanism. They seem to have played little part in Greek maritime enterprise of the 8th century in the Mediterranean. But after 700 B.C. Ionic seamen of Miletus and Phocaea were active in northeastern waters (especially the Black sea) and on the Mediterranean coasts of France and Spain, and planted numerous colonies; Miletus alone is said to have been the mother of 90 cities.

The overseas expansion of Ionia was in part due to the need of a new outlet after the deep Ionic penetration inland had provoked opposition and involved a conflict with the rising power of Lydia under the Mermnads. Gyges and succeeding Lydian kings periodically invaded Ionia, and Priene and Smyrna fell. But it was not till the reign of Croesus (*c.* 560–546) that the bulk of the Ionians came under Lydian sway. In this period, and down to 500 B.C., Ionic rational thought dominated the intellectual life of Greece. While the study of geography and nature was based on intelligent observation, research into matter and the universe proceeded on a more theoretical basis, especially in the academic atmosphere of Miletus (*see* THALES; ANAXIMANDER), and Ionians at home and overseas laid the foundations of Greek philosophy (*e.g.*, Heraclitus, Pythagoras, Parmenides). Ionic had necessarily become the language of literature and learning. The colossal temples of Ephesus and Samos were not only masterpieces of Ionic architecture but also bold engineering feats. Ionic sculpture combined geometrical form with an exceptional facility in the representation of textures, and the applied scientists of Samos were pioneers of cast bronze statuary. At the same time not the least of the achievements of the Ionians was the propagation of culture among native peoples in Asia Minor and the south of France.

The cities of Ionia were unable to offer any effective opposition to the Persian army after the fall of Croesus. Instigated by the tyrants of Miletus, they rose against Persia *c.* 499 B.C., but their fleet was crushed at Lade five years later. After the battle of Salamis (480 B.C.) they revolted again and helped to form the Delian league, which degenerated into an Athenian empire. Holding a precarious balance between Persian grandees and Athenian democracy, the cities of Ionia suffered from faction and disillusionment, which were not dispelled by the advent of Spartan forces after the Athenian disaster in Sicily in 413. In the 5th century they acquired a reputation for easy living, and their prosperity seems to have declined under Athenian rule. Traded to the Persian king by the Spartans in 387 B.C., the cities of Asia reverted to the uneventful routine of Persian rule punctuated by occasional local despotisms and the maneuvers of warring satraps.

In 334 B.C. the cities (save Miletus) transferred their loyalty to Alexander III the Great and were rewarded with freedom and democracy. With their experience of imperial affairs individual Ionians were particularly well qualified to assume important positions in the newly conquered lands of the east. After Alexander's death (323 B.C.) the Ionic cities were nominally independent under the sovereignty of Antigonus I (until 301), then subject to Lysimachus (till 281). Until the opening years of the 2nd century they were poised between the Seleucid (Syrian) alliance by land and Ptolemaic (Egyptian) supremacy along the coast; but even before this time some of the cities had embraced the alliance of the ambitious new dynasts of Pergamum. By the will of Attalus III of Pergamum (d. 133 B.C.) Ionia passed into the hands of the Romans. Thanks to Alexander's victories and the shifting east-

ward from the Greek mainland of the focuses of power and culture, the Ionic cities had enjoyed two centuries of renewed prosperity. But in the new Roman province of Asia honest administration was sacrificed to considerations of profit and political advantage in Rome, and the cities suffered without redress from the extortions of Roman tax-farming corporations and governors; and after the great rising when Mithradates VI overran Asia Minor they were crippled by the immediate levying of five years' tribute in 84 B.C. Thereafter they suffered from depredations of pirates and the exactions of the leaders in the Roman civil wars.

The establishment of universal peace by Augustus after the battle of Actium (31 B.C.) terminated 100 years of distress in Ionia. Under the empire the principal cities experienced a revival of prosperity and civic amenities, and many of the spectacular ruins on their sites date from that time. Ephesus, Miletus, Smyrna and Chios were among the most splendid cities of the Roman world and continued to flourish in Byzantine times.

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IONIAN ISLANDS (IONIOI NISOI), the collective name for the Greek islands of Corfu (Kerkyra), Cephalonia (Kephallenia), Zante (Zakynthos), Leukas, Ithaca (Ithaki), Cythera (Kythera) and Paxos (Paxoi), with their minor dependencies. These islands, though often described as the Heptanesos ("Seven Islands"), have no geographic unity. The name is derived from *Ionios,* the ancient name for the sea in which the islands (except Cythera) stand, itself of uncertain origin. The political unity of the islands is comparatively modern. Pop. (1961) 212,573. Total area 873 sq.mi. (2,260 sq.km.).

The Ionian Islands consist almost entirely of Cretaceous and Tertiary beds, but in Corfu Jurassic deposits have been found. The oldest beds which have yet been recognized are shales and hornstones with Liassic fossils. These are overlaid conformably by a thick series of platy Viglàs limestone, representing the rest of the Jurassic and the lower Cretaceous. Then follow dolomites and unbedded *Hippurites* limestones, evidently of Upper Cretaceous age. The Eocene beds are folded with the Cretaceous. Both occasionally assume the form of Flysch. Miocene beds are found in Corfu and Zante, and Pliocene deposits cover much of the low ground.

For physical description and classical history, *see* the articles on the individual islands.

Medieval and Venetian Periods.—The beginning of Heptanesian history dates from the 9th century. Leo the Philosopher (*c.* A.D. 890) formed all or most of the islands into a distinct province of the eastern empire under the title of the Thema of Cephallenia. Robert Guiscard captured Corfu (1081) and Cephalonia, but his early death prevented the establishment of a Norman dynasty. When the Latin empire was established at Constantinople in 1204 the Venetians received Corfu. After defeating the Genoese corsair Leon Vetrano, the senate granted fiefs in Corfu to ten noble families in order that they might colonize it (1206). The Greek "despot" of Epirus, however, captured the first Venetian colony in 1214, and a long period of Epirote, Sicilian and Neapolitan-Angevin rule followed, till in 1386 the people of Corfu made voluntary submission to the Venetian republic. Paxos, created a barony, was treated as part of Corfu.

The county palatine of Cephalonia (with Zante), seized by Matteo Orsini in 1194, owned the suzerainty first of Venice, then of Achaia, to which it was annexed in 1324. In 1357 it was bestowed upon the Tocco family of Benevento, and was united with Leukas (Italian Santa Maura) and Ithaca (called Val di Compare) in the duchy of Leucadia. In 1479 the Turks annexed these four islands. Over a period of time, however, they became Venetian; Cephalonia and Ithaca in 1483–85 and from 1500 onward; Zante in 1482 and from 1485 and Leukas in 1502–03 and from 1684. Cythera (Italian Cerigo), a Venetian marquisate of the Venier family from 1207, became a Venetian colony in 1363, but was parceled out between Venice and the Venier in 1393.

The Venetians, who exacted heavy contributions from the islands, won the adherence of the principal local families by the bestowal of titles and appointments; the Roman Catholic Church was established and the Italians and Greeks intermarried. Greek ceased to be spoken except by the peasantry who remained faithful to the Orthodox communion. On the fall of the Venetian republic in 1797 the treaty of Campo Formio annexed the Ionian Islands to France, but a Russo-Turkish force drove out the French at the close of 1798 and in the spring of 1799 Corfu capitulated. By treaty with the Porte in 1800 the emperor Paul erected the "Septinsular republic," but the treaty of Tilsit (1807) declared the islands an integral part of the French empire and they were incorporated with the province of Illyria (*q.v.*). British forces under Gen. John Oswald took Zante, Cephalonia and Cythera in 1809, and Leukas in 1810; Colonel (afterward Sir Richard) Church (*q.v.*) reduced Paxos in 1814; and after the abdication of Napoleon, Corfu was, by order of Louis XVIII, surrendered to Sir James Campbell. By the treaty of Paris (Nov. 9, 1815) the contracting powers (Great Britain, Russia, Austria and Prussia) agreed to place the "United States of the Ionian Islands" under the exclusive protection of Great Britain.

British Protectorate.—The constitutions, voted by a constituent assembly in 1817 and applied in the following year, placed the administration in the hands of a senate of six members and a legislative assembly of 40 members; but the real authority was vested in the high commissioner, Sir Thomas Maitland ("King Tom"). The successive British commissioners, Gen. Sir Frederick Adam (1823), Lord Nugent (1832) and Sir Howard Douglas (1835–41), did much for the administration, justice, education and communications of the islands, but their firm, often despotic rule was resented by the inhabitants, the principal opponent being the historian Andreas Mustoxidi (d. 1861). A complete change of policy was inaugurated in 1841–43, and Lord Seaton (1843–49) was induced by the European disturbances of 1848 to initiate a number of important reforms. But the party in favour of union with Greece was rapidly growing. Serious insurrections of the peasantry, especially in Cephalonia, had to be put down by military force, and the parliament passed a resolution in favour of immediate union with Greece.

Cession to Greece.—Contrary to the expectations of the Greeks, W. E. Gladstone, who toured the islands as high commissioner extraordinary, did not propose the abolition of the protectorate, and his successor, Sir Henry Storks, seemed indifferent or blind to the popular feeling. However, on the abdication of King Otho of Greece in 1862 the British government declared to the provisional government of Greece that the selection of Prince William George of Glücksburg would be followed by the cession of the Ionian Islands. After the prince's election by the national assembly in 1863 the high commissioner laid before the Ionian parliament the conditions of the cession. The rejection of one condition, the demolition of the fortifications of Corfu, led to a new prorogation, but on March 29, 1864, the plenipotentiaries of the five great powers signed the treaty by which the protectorate was ended. Neutrality was confined to Corfu and Paxos. On May 3, 1864, Sir Henry Storks left Corfu with the British troops and men-of-war. King George made his entry into Corfu on June 6.

After their annexation to Greece the history of the Ionian Islands was uneventful. Their prosperity somewhat declined. Corfu with Paxos; Cephalonia with Ithaca; Leukas and Zante form four separate *nomoi* or departments; Cythera is attached to the *nomos* of Attica. The islands retained the exemption from direct taxation which they enjoyed under the British protectorate; in lieu of this an ad valorem tax was imposed of 20½% on exported oil and a tax of 6% on wine exported to Greek ports; these commodities were further liable to an export duty of 1½% levied on all agricultural produce and articles of local manufacture. Many of the islands are subject to earthquakes, and the towns of Ithaca, Cephalonia and Zante were virtually destroyed in the disaster of 1953. A large-scale program of reconstruction was undertaken.

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(J. D. B.; W. M.; W. G. F.)

IONIANS, an important eastern division of the classical Greek people, distinguished by a well-marked dialect (*see* below), who gave their name to the district called Ionia (*q.v.*).

The Ionians as a people are mentioned only once in the Homeric epics, as an apparently unimportant contingent fighting alongside the Athenians; the (later Ionian) city of Miletus was still occupied by non-Greek Carians. In the Homeric *Hymn to Apollo*, however, composed by the "blind man of Chios" whom the Greeks supposed to be Homer himself, the Ionians are already the great and wealthy people who frequent the festival of Apollo at Delos. The date of the *Hymn* is probably not far from that of the first certain mention of Ionians in an oriental document, when Sennacherib, in 696, claims to have rounded up Ionian pirates or settlers near Tarsus and "given peace to Cilicia and Tyre." It was the generation of the first great outpouring of Greek colonization since the occupation of Ionia itself, a movement which brought Ionians of Euboea to eastern Sicily and to Cumae near Naples, and Samians to Nagidus and Celenderis in Pamphylia. Eastern expansion was checked only by the resistance of the eastern peoples. "Ionians" (Persian *Yauna*, Semitic *Yawani*; *cf.* Homeric *Iawones*) became and remained the oriental term for all Greeks. "Javan" figures in Hebrew lists of the descendants of Noah as a son of Japheth and "father" of the western sea peoples (Gen. x. 2–5; I Chron. i, 5–7; compare Iapetus [*q.v.*], husband of the nymph Asia, in Greek mythology). *Yunani*, moreover, remains the term for Greek in Turkish and Arabic.

Ionia was said to have been colonized from Attica, though also from other regions of central Greece, by people displaced by Dorian and Boeotian invaders from the northwest; this is confirmed by the fact that the four subdivisions of the people called *phulai* ("tribes"), found in Attica, reappear in Miletus and other Ionian cities. Another similar (but triple) tribal system, as well as their dialect, distinguished the Dorians (*q.v.*). Solon of Athens (*c.* 600) already calls his country "the senior land of Ionia." The eponymous hero Ion, however, did not figure among the traditional names of ancient kings of Athens, and he had therefore to be fitted into the mythical history as a war leader and ally; as a grandson he was also fitted into the heraldic genealogy of the "children of Hellen," said to have appeared already in a lost poem of Hesiod. By the time of Herodotus (*c.* 450) Greek thinkers had worked out a detailed ethnological theory which identified the Ionians with the aboriginal element in Greece (also called *Pelasgoi*, originally the name of a real, perhaps north Aegean people; *see* Pelasgians) and the Dorians with the immigrant northern Hellenes proper, "a very migrant people." Both in their way might therefore claim to be the "true" Greeks, and an element of racialism was introduced into Greek interstate polemics. Peloponnesian Dorians affected to despise as "soft" the Ionians of Asia, who (thanks to their exposed position) had been subjected by Persia, and Thucydides (viii, 25) finds it worthy of a passing comment when, in a battle between two allied forces, an Ionian wing on each side defeats a Dorian wing. This feeling, much exploited by city-state patriots, is even reflected in some modern writings on Greece, influenced especially by K. O. Müller's *Die Dorier* (1824). In actual fact, the culture and way of life of maritime Dorian cities, such as those of Rhodes or the colonies in Sicily, resemble those of Ionia rather than of inland and militarist Sparta; and when the Athenians made war on democratic (Dorian) Syracuse, Thucydides comments that they found their toughest antagonists in a people so like themselves.

In the dialect the *w*-sound represented in Greek by the digamma (*see* F) was lost early, and initial aspirates tended to be dropped. The broad *ā* (as in "father") was modified into *ē*, not far from English *-ay* in "say" (so, *mētēr*, "mother," for Doric *mātēr*; *cf.* Latin *mater*). Some short vowels were lengthened before a nasal or liquid that preceded a lost digamma; *e.g.*, *xeinos*, *kourē*, for Attic *xenos*, *korē*. In the Ionic of the Homeric poems in their present form a few non-Ionic forms survive, mostly, but not all, where the Ionic equivalents were unmetrical; even where the manuscripts have Ionic, it is sometimes necessary for metrical reasons to substitute a non-Ionic form. These non-Ionic forms are called "Aeolic," a term properly applicable to the dialect of the Greeks north of Ionia proper on the Asian coast and in the adjacent island of Lesbos and parts of the northern Greek peninsula, but loosely used by ancient scholars to describe a wide range of dialects, from the archaic (Mycenaean?) Arcado-Cypriot to some northwestern dialects akin to Doric. It seems clear, however, that the poems, or at least some traditional material used by Homer, existed in a somewhat different, perhaps less specialized dialect, before being reduced to literary Ionic. The development of literary Ionic may therefore have been completed only in the latest prehistoric times (*c.* 9th–8th centuries B.C.?) among the Greeks who had colonized the central part of the eastern Aegean coast since the end of the Bronze Age, and the islanders of the central Aegean, who met for worship and festivities at the holy islet of Delos. In Attica, alone on the Greek mainland, a kindred dialect was spoken, but one in which the characteristic features of Ionic were less pronounced.

The contribution of Ionians to the Greek achievement was of major importance, including the Homeric epic, elegiac and iambic poetry, the work of the first philosophers and the first histories and geographical works (the first European prose), as well as a major part in the opening up of the Black sea, especially by Miletus, and the western Mediterranean by Phocaea with its colony of Massilia (Marseilles). In the age after Alexander the Great the Athenian (Attic) form of Ionic, as the literary language par excellence, eclipsed other dialects and became the basis of the koine or "common speech," the language of practically all later Greek writing (including the New Testament) to the present day.

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(A. R. Bu.)

IONIAN SCHOOL OF PHILOSOPHY, an expression sometimes used to designate collectively a number of Greek scientific philosophers of the 6th–5th centuries B.C., including Thales, Anaximander, Anaximenes, Heraclitus, Anaxagoras, Diogenes Apolloniates, Archelaus and Hippo (*qq.v.*). While Ionia was the original centre of their activity, they differed from one another so much in their conclusions that it is scarcely exact to call them a school, though their common concern to explain phenomena in terms of matter or of physical forces distinguishes them from later thinkers.

IONIC METRE, a variety of classical metre found especially in Greek lyric and drama. The rhythm was considered to have oriental associations. The metron is ⏑⏑––. It is repeated to form dimeters, trimeters and even longer verses. Ionic verses may be varied by the omission of the second long of the first metron (syncopation): ⏑⏑–|⏑⏑––, or of the last (catalexis): ⏑⏑––|⏑⏑–. Occasionally, the second long of the metron is resolved into two shorts or even replaced by a single short. Horace uses pure ionics in one ode, iii, 12:

⏑⏑– ––| ⏑ ⏑––| ⏑⏑ – –| ⏑ ⏑ ––|

miserar(um) est nequ(e) amori dare ludum neque dulci.

The anacreontic, or "anaclomenon," is a variation of the ionic dimeter said to be produced by anaclasis; *i.e.*, the reversal of the fourth and fifth elements to produce ⏑⏑–⏑–⏑– –. This verse is found in Anacreon, Attic drama and the *Anacreontea*. The galliambic, the metre of Catullus lxiii, is basically a compound of anacreontic and catalectic ionic dimeter, with the second long of the first metron resolved:

⏑ ⏑ –⏑ –⏑ – –‖⏑⏑– ⏑⏑| ⏑⏑–

super alta vectus Attis celeri rate maria.

Ancient metricians posited the existence of an ionic metron *e maiore*— — ∪∪, but passages said to be in this metre can always be scanned in other ways. *See* further PROSODY, CLASSICAL.

(L. P. E. P.)

IONIC ORDER: *see* ORDER.

IONIC THEORY: *see* ELECTRICITY, CONDUCTION OF: *Conduction in Gases;* ELECTRICITY: *Ions.*

IONOSPHERE, an electrically conducting sphere completely surrounding the earth. The name is derived from the presence of ions and free electrons produced by the sun's ultraviolet radiation. The ionosphere exists in the earth's outer atmosphere, above the stratosphere and mesosphere and extends from heights of approximately 80 to 300 km. (50 to 200 mi.). (*See* ATMOSPHERE.) It was more commonly known as the "Kennelly-Heaviside layer" in the period 1901–30. The ionosphere makes possible all long-distance radio communications using high-frequency waves, since it reflects the signals back to earth, keeping them from being lost in space.

Before 1901 it was thought that wireless (radio) waves were useful only for short-distance communications, since they were known to travel in straight lines, like light. However, the success of Marconi's transatlantic tests in 1901 led to theories developed independently by A. E. Kennelly and O. Heaviside that radio signals were reflected back to earth from an electrically conducting region in the earth's outer atmosphere. A similar region had also been proposed by Balfour Stewart about 1882, to explain systematic changes observed in the earth's magnetic field. (*See* GEOMAGNETISM.)

Direct measurements of the ionosphere were not made until 1925, when, in England, E. V. Appleton and M. A. F. Barnett reported an experiment based on a wave-interference technique, and, in the United States, G. Breit and M. A. Tuve recorded radio echoes using a new system of transmitting short pulses of radio waves and receiving their echoes. In the latter experiment it was noted that pulses transmitted vertically with frequencies below 1 or 2 mc. per second were either reflected or absorbed by the ionized layers, whereas frequencies above 15 or 20 mc. usually passed completely through the atmosphere and were lost to space. This is because the higher frequency radio waves required a greater electron density for reflection. The time required for a pulse to travel to the ionosphere and back was a measure of the height of the reflecting layer.

This pulse technique has been developed to the point where equipment to record automatically the effective height of reflection for each frequency from 0.5 to 20 mc. is in wide use throughout the world. As a result, knowledge of how the distribution of free electrons changes with place, time of day, solar activity, etc., is quite complete.

The ionosphere contains two principal regions of free electrons. The lower (E-region) normally occurs at heights of 90 to 120 km. (55 to 75 mi.), while the upper (F-region) is usually found from 150 to 300 km. (100 to 200 mi.) above the earth. Rocket observations and theoretical calculations have indicated that the so-called layers of free electrons are, in fact, broad maxima of electron density, and that the ionosphere is highly ionized throughout.

The daylight value for the E-region maximum is roughly 10^5 free electrons per cm.^{3}, while in the daytime the F-region often has two maxima, known as the F_1- and F_2-layers. The F_2-layer, which is above the F_1-layer and is more persistent, may have about 10^6 electrons per cm.^{3}, though this is highly variable.

Characteristics of ionospheric layers change with time of day, season of year and geographical location. Variations in the normal E- and F_1-layers are generally small, but abnormal or sporadic ionization in the E-region is rather common in summer. Fluctuations in the F_2-layer are often relatively large and irregular, and such fluctuations are particularly pronounced during magnetic storms. The 11-year sunspot cycle and other forms of solar activity also influence ionospheric characteristics.

The ionosphere controls long-distance radio communication by establishing upper and lower limits of usable wave frequencies. The upper limit is determined by its reflecting properties and the lower limit by absorption in the lowest part of the ionosphere, called the D-region. During periods of solar activity the enhanced ultraviolet and X-radiation from the sun increases the ionization in the D-region, causing an increase in the absorption of radio waves, and this results in poor radio communication on those channels that depend on ionospheric reflections.

See also references under "Ionosphere" in the Index.

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IOWA, popularly known as the "Hawkeye state," a north central state of the United States, is bounded north by Minnesota, east by the Mississippi river, which separates it from Wisconsin and Illinois, south by Missouri and west by the Missouri and Big Sioux rivers, which separate it from Nebraska and South Dakota. The state's total area is 56,032 sq.mi., of which 258 sq.mi. are water surface.

Various meanings have been ascribed to the word "Iowa": among the most common are "beautiful land" and "this is the place." It is commonly supposed that the name "Hawkeye" was that of an early Indian chief. The state is the 25th in size of the states of the union. The state capital is Des Moines, and the state entered the union, Dec. 28, 1846, as the 29th state. The oak tree was designated the state's official tree in 1961. The wild rose is the state flower, and the eastern goldfinch is the state bird. The state flag consists of three vertical stripes of blue, white and red. In the centre of the white stripe is depicted a spreading eagle which bears in its beak blue streamers. Inscribed upon the streamers is the state motto: "Our liberties we prize and our rights we will maintain" and the word "Iowa" is in red letters below the streamers.

PHYSICAL GEOGRAPHY

Physical Features.—Iowa lies wholly in the prairie plains region between the extremes of approximately 40° 22′ and 43° 30′ N. and 90° 08′ and 96° 38′ W. Since its surface was overrun by one or more of the great ice sheets of the glacial epoch, the largest portion of the state is prairie tableland. The lowest elevation, 480 ft. above sea level, is at Keokuk in the southeastern part of the state. From this point the land rises in gentle swells to the point of highest elevation (1,675 ft.) in Osceola county in the northwestern part of the state. The greatest departures from the prairie surface are in the northeast and southwest. In the northeast—the so-called driftless area of Iowa—cliffs rise almost vertically from the banks of rivers to heights of from 300 to 400 ft. From the summit of such cliffs to the crest of a divide, usually a few miles distant, is another ascent of 300 ft. or more, which terminates occasionally in knob-topped hills crowned with small cedar trees. In the west, southward from the mouth of the Big Sioux river, a line of moundlike bluffs rises abruptly to a height of from 100 to 300 ft. from the flood plain of the Missouri river. Because of glaciation, the northern half of the state is more broken and irregular and has more shallow lakes and ponds than the southern half.

A broad watershed, extending in a southerly direction from Spirit lake on the northern border, divides the state into two drainage systems. That to the east, comprising about two-thirds of the whole area, is drained by tributaries of the Mississippi, of which the Des Moines, the Skunk, the Iowa (and its tributary the Cedar) and the Wapsipinicon are the largest. These streams have long courses and moderate slopes. The region to the west of the watershed is drained by tributaries of the Missouri, such as the Big Sioux, the Little Sioux, the Boyer and the Nishnabotna.

Climate.—Iowa has a climate of great extremes. The mean annual temperature is 49° F. (about 10° C.); the average range of extremes per year is about 135° F. The average mean annual temperature at Sibley in the northwest is 44°, while at Keokuk in the southeast it is 52.4°. Des Moines, located nearer the centre of the state, has an average mean annual temperature of 50.9°.

Rainfall is very unequal in its distribution throughout the year, as between the same periods of different years and as be-

tween the different parts of the state. While the mean annual precipitation is 31.44 in., about 71% of this falls during the six months from April 1 to Oct. 1. May, June and September are generally the wettest months. Within any one year the precipitation is usually less in the western part of the state than it is in the eastern part; the western part also has a greater percentage of its rain in the spring and summer than has the eastern part. Though the average frost-free growing season is from May 2 to Oct. 7, killing frosts may occur later or earlier. Injury to crops from drought and hot winds occurs infrequently, but harmful effects from excessive rainfall, hailstorms and prolonged excessive heat are more common.

Soil.—The fertile soil of Iowa, because of its depth and porous nature, is capable of withstanding the extremes of wetness and dryness remarkably well. Perhaps no other state in the union has such superior soil for agriculture; no other state has so many acres of grade A land or so large a proportion—from 85%–90%—of its land suitable for cultivation.

The soil is of four kinds: till (or drift), alluvial, loess (or bluff) and geest (or gravelly earth). Dark drift, composed chiefly of clay, sand, gravel, boulders and lime, is both the soil and subsoil of the greater part (about 66%) of the state and is especially predominant in the north and northwest. Alluvial soil, composed of material washed from other soils and decayed vegetable matter, covers about 6% of the surface of the state. This type of soil is found in the river bottoms, particularly in the valley of the Missouri, and varies much in fertility. Loess soil, chiefly a mixture of porous clay and carbonate of lime, forms the bluffs bordering the bottom lands of the Missouri and is common in the northeast. In fertility loess is not inferior to the better drift. Geest is found particularly in the northeast, but it covers less than 1% of the area of the state.

Vegetation and Animal Life.—When the first settlers came to Iowa they found the rolling prairies covered with deep, coarse grasses, berries and wild flowers. Forests of birch, maple, hickory, oak, elm, walnut, ash and cottonwood trees grew in the river valleys and in scattered areas. The Cedar river derives its name from the red cedar, the only evergreen native to the area. Native grasses and the original timber, except in a few places, have been destroyed; yet, trees and plants, some native and some immigrant, grow in profuse variety. The prairie rose, aster, honeysuckle, primrose, shooting star, violet, blue phlox, trillium, bloodroot and many types of ferns are common.

Situated along the Mississippi and Missouri flyways, Iowa is a haven for birds of many types. The robin, eastern goldfinch, starling, junco, blue jay, chickadee, red-winged blackbird, woodpecker, crow and meadow lark are frequently seen. The wild turkey, once plentiful, is almost extinct; the ring-necked pheasant, imported into the state, is now a major game bird. Owls and hawks are the principal birds of prey.

Wolves were once numerous in the region, but they have since disappeared. Except for the white-tailed deer, large game animals are rare. Among the small wild animals found are the beaver, muskrat, raccoon, skunk, jack rabbit, cottontail rabbit, ground hog, gopher and chipmunk. Although more than 100 kinds of fish have been seen in the area, the most common are the catfish, bullhead, carp, buffalo, sucker, walleyed pike, smallmouthed bass, rainbow, brook and brown trout, crappie and bluegill. There are about 25 varieties of reptiles, of which three (all rattlesnakes) are poisonous.

State Parks and Historical Sites.—The state conservation commission has jurisdiction over state parks, reserves and monuments; state forests and forestry; and state waters. Providing for the protection, propagation and preservation of fish, game and fur-bearing animals is an important function of the conservation commission. It maintains more than 120 wildlife refuges comprising about 35,000 ac. and more than 160 public hunting grounds totaling approximately 91,000 ac. Nearly 100 lakes, artificial and natural, are also the responsibility of the commission.

State parks include Backbone (near Strawberry Point); Dolliver Memorial (near Fort Dodge); Geode (near Burlington); Lacey-Keosauqua (near Keosauqua); Lake Ahquabi (near Indianola); Lake Darling (near Fairfield); Lake Macbride and Palisades-Kepler (both near Cedar Rapids); Lake Wapello (near Ottumwa); Ledges (near Boone); Nine Eagles (near Leon); Pike's Peak (near McGregor); Pilot Knob (near Forest City); Rock Creek Lake (near Kellogg); Springbrook (near Guthrie Center); Stone (near Sioux City); Waubonsie (near Sidney); and Wild Cat Den (near Muscatine).

Various historical sites attract thousands of visitors annually. Among these are the Amana colonies, which were established in 1855 as experimental religious communities; the Old Capitol, which is now the administrative office of the University of Iowa; Plum Grove farm, at Iowa City, the home of Robert Lucas, Iowa's first territorial governor; Effigy Mounds National monument, at Marquette (established 1949), which contains burial mounds of prehistoric Indians; Fort Atkinson State park; former Pres. Herbert Hoover's birthplace and the Herbert Hoover Library-Museum (dedicated 1961) at West Branch; the grave of Julien Dubuque at Dubuque; and the Anton Dvorak monument at Spillville.

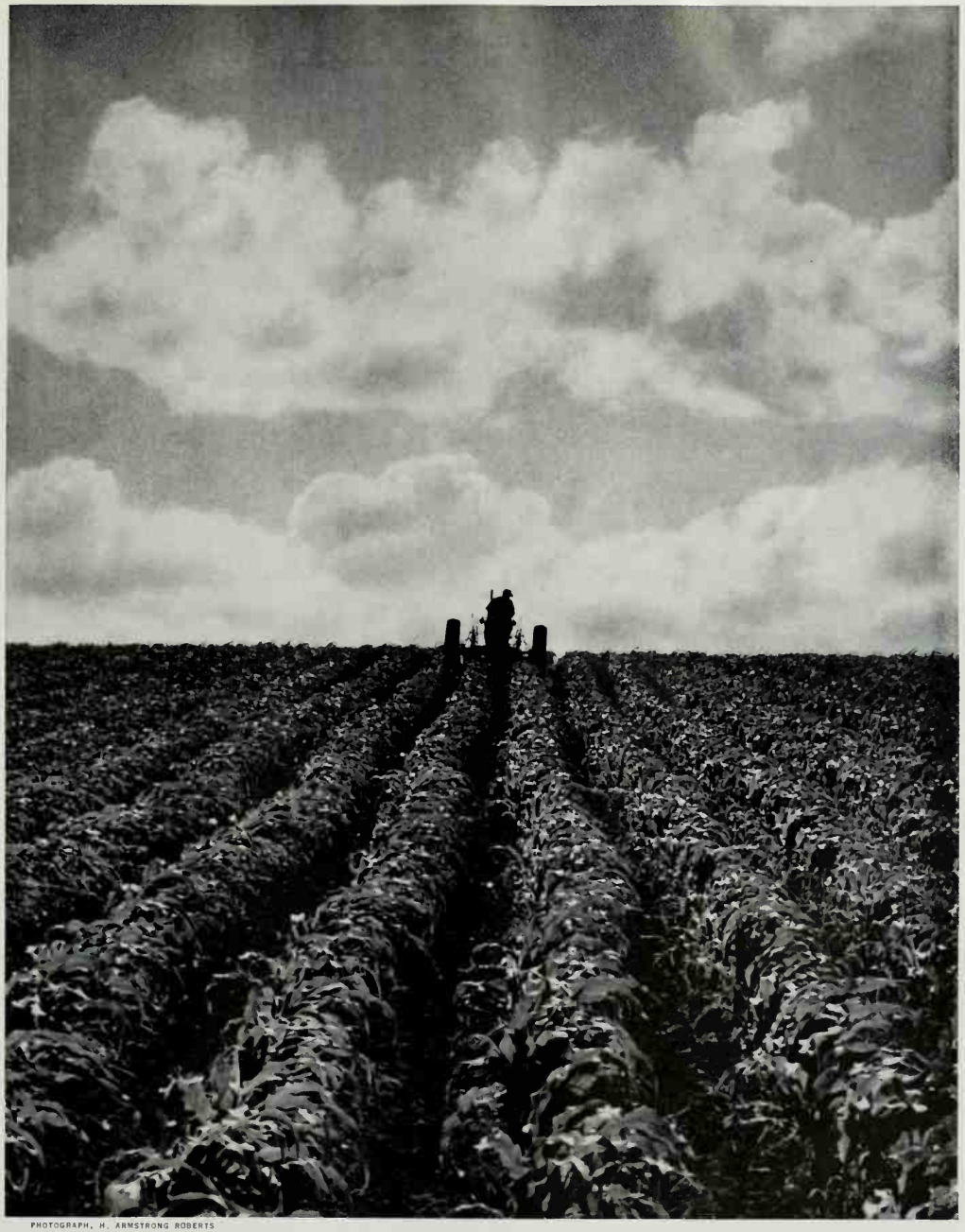
HISTORY

Early Inhabitants.—The name "Iowa" was taken from the tribal name of a group of Siouan Indians who occupied the area when it was first seen by white men—the Frenchmen, Father Jacques Marquette and Louis Jolliet, in 1673, and Father Louis Hennepin, in 1680. In the century following the visits of these early travelers, explorers and missionaries did little to disturb the Indians of the region. During those years, however, the Ioway tribe was pushed westward and largely supplanted by the tribes of Sauk and Fox, who had previously been driven from Michigan by the French.

First White Settlements.—No permanent white settlement had been established in Iowa when the French, who had held it since 1682, relinquished control to the Spanish in 1762. During the period of Spanish control, there was some penetration and exploitation of the area. The lead mines near the Mississippi river were a major attraction, and to these mines came a French Canadian, Julien Dubuque, who in 1788 obtained an Indian grant giving him the right to carry on mining operations near the present site of the city which today bears his name. Although Dubuque received confirmation of his grant from the Spanish governor, the wealth he sought eluded him and he died bankrupt in 1810. Louis H. Tesson in 1799 and Basil Giard in 1800 also received Spanish grants in Iowa, but were similarly disappointed.

Iowa was retroceded to France in 1800 and, as part of the Louisiana Purchase in 1803, became United States territory. During 1804–05 it was a part of Indiana territory; it was made a part of Louisiana territory from 1805 to 1812. Indian hostility forced the abandonment of the first American post in Iowa, Ft. Madison, near the mouth of the Des Moines river, during the War of 1812. After the conclusion of peace in 1815 the Sauk chief, Black Hawk, nourished a bitter hatred toward settlers, and in a final attempt to recover lands in Illinois, he instigated a war against the United States in 1832. Black Hawk's defeat resulted in the cession of nearly 9,000 sq.mi., the first of many Indian land cessions between 1832 and 1851. From 1812 to 1821 Iowa was a part of Missouri territory; from 1821 to 1834 it was a part of the unorganized territory of the U.S. After Black Hawk's war, settlers began to pour into Iowa. In 1834 it was a part of Michigan territory; in 1836 it was a part of Wisconsin territory. Government land surveys were not begun until 1836, making the first settlers technical trespassers on the public domain. Ostensibly to protect their holdings, the settlers formed voluntary associations or "claim clubs." Although proceedings of the associations relating to land claims were later recognized by U.S. authorities, they were often dominated by speculators rather than farmers.

Statehood and Early Problems.—Iowa was separated from Wisconsin in 1838 and the question of applying for admission into the union as a state was voted on as early as 1840. The measure was defeated then and again in 1842 by those who wished to avoid an increase in taxes. Finally, in 1844, a convention was held at Iowa City, a constitution framed and application for admission to the union made. Congress, however, rejected the application

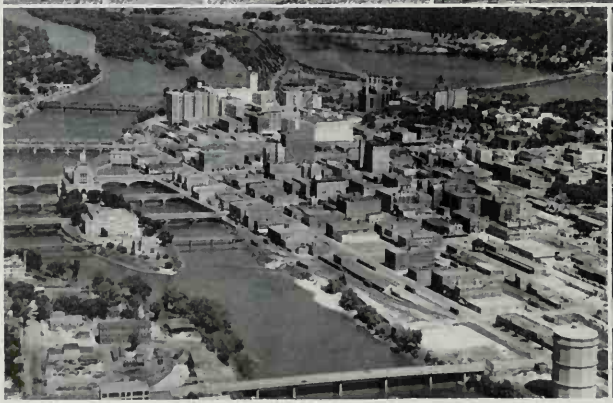


PHOTOGRAPH, H. ARMSTRONG ROBERTS

IOWA'S LAND

Farmer cultivating young corn plants. Iowa is the nation's leading corn-producing state, with about one-half of its cultivated acreage devoted to the crop

IOWA



BY COURTESY OF (CENTRE LEFT) IOWA DEVELOPMENT COMMISSION, (BOTTOM LEFT) FAIRCHILD AERIAL SURVEYS, INC.; PHOTOGRAPHS, (TOP LEFT) WIDE WORLD, (TOP RIGHT) JOSEF MUENCH, (CENTRE RIGHT) LORD FROM MONKMEYER, (BOTTOM RIGHT) ELLIOTT ERWITT

SCENES IN IOWA

Top left: Farmers at a hog sale. Iowa is the leading hog-producing state in the U.S.

Top right: The state capitol at Des Moines completed in 1882. The gilded dome, resembling that of the Hotel des Invalides, Paris, Fr., is 275-ft. high

Centre left: House at West Branch where Herbert Hoover, former president of the U.S., was born

Centre right: Coal barges on the Mississippi river at McGregor. Coal mining is a major industry of the state

Bottom left: The city of Cedar Rapids from the air. Municipal Island (on the left), originally a squatter's settlement, was bought by the city in the early 1900s and made into a civic centre

Bottom right: Iowans watching a horse-pulling contest at the state fair

because it disagreed with the proposed boundaries of the new state. A second constitutional convention was called at Iowa City in 1846; it drew up the present boundaries of the state and prohibited the organization of banks of issue. Congress approved the second constitution and Iowa was admitted to the union in 1846.

Burlington had served as temporary capital of the territory until 1839. In that year, Iowa City was designated as the capital city but was replaced by the present capital, Des Moines, in 1857.

Statehood by no means solved all problems faced by Iowa pioneers. The Spirit lake massacre of 1857, in which about 40 settlers were killed, provided grisly proof that Indians were still a danger to isolated settlements. Elsewhere, lawless elements defied regularly established authorities, and as a result vigilance committees were formed. From 1846 to 1860 there were approximately 45 lynchings in which 70 victims were summarily put to death. Sectional feeling, running rampant over the nation, also created problems in Iowa, resulting in a shifting of political allegiances. Although the Democratic party had been in power since statehood, the state supported the Republican party after the latter's formation in 1854. The American Civil War claimed the lives of more than 12,000 Iowans.

Issues and Reforms.—Economic expansion characterized the years following the American Civil War. From 1860 to 1910, for example, more than 9,000 mi. of railroads were constructed in Iowa. Yet there was considerable agrarian discontent during this period, as some of the farmers felt that they did not share adequately in the general prosperity. Thus, farmers' organizations and third parties, such as the Patrons of Husbandry (the Grange), the Greenback party and the Populist party, developed significant followings. Though not markedly successful in electing candidates, such movements forced the major parties to adopt reform programs and to enact progressive legislation.

Particularly important issues in Iowa were tariff reform, railroad-rate regulation and the prohibition of the manufacture and sale of intoxicating liquors; but the reformers in these areas had indifferent success. The tariff question split the Republican party when its more progressive members supported the "Iowa Idea"; *i.e.*, the expansion of trade through tariff reciprocity and downward revision of rates. Advocates of railroad-rate regulation were never able to accomplish all their aims, although a railroad commission was established as a result of their efforts. Prohibition was steadily debated from 1882, when it was attempted unsuccessfully, until the repeal of the prohibition (18th) amendment to the U.S. constitution in 1933. In that year the general assembly passed laws legalizing the sale of beer with 3.2% alcoholic content and established a state monopoly for the sale of intoxicating liquors, with a state liquor control commission in charge.

Reformers in Iowa achieved their most important victories in the field of welfare legislation. In 1913 the general assembly passed an employers' liability and workmen's compensation act and a mothers' pension act. The Perkins law of 1915 provided free treatment for crippled children of indigent parents. In 1917 a child welfare station for the study of children's problems was established at Iowa City.

The depression of the 1930s had the same effects in Iowa that it had in other areas, and the demand for relief legislation was met on both a state and national level. Concern for the aged found expression in a system of old-age pensions begun in 1935. In 1936 the Iowa employment security commission was created to encourage industry to provide more stable employment, maintain a free public employment service and grant benefit payments to those unemployed. A large-scale construction project to provide a system of dams for the upper Mississippi river was begun in 1931 and continued throughout the following decade. The agricultural program of the New Deal was a response to distress in the farm belt of which Iowa is such a significant part. The Iowa state planning board was created in 1937 to deal with various problem areas, and it continued in service until 1939.

The first women's army corps training camp was established at Ft. Des Moines, during World War II, and navy fliers were given training at Ottumwa and Iowa City.

In state and national politics Iowa has been predominantly Republican since before the Civil War. In presidential elections since 1900 only Woodrow Wilson (1912), Franklin D. Roosevelt (1932 and 1936) and Harry S. Truman (1948) carried the state for the Democrats. Iowa has elected only five Democratic governors since the Civil War: Horace Boies in 1889 and 1891, Clyde L. Herring in 1932 and 1934, Nelson G. Kraschel in 1936, Herschel C. Loveless in 1956 and 1958 and Harold E. Hughes in 1962.

GOVERNMENT

Iowa's present constitution was adopted in 1857, the constitution of 1846 having been superseded chiefly because it prohibited banking corporations. The constitution may be amended by an affirmative vote of both houses of two successive legislatures, followed by a majority vote of the electors of the state voting on the proposed amendment. Suffrage is granted to all citizens of the United States (except idiots, insane persons and those convicted of an infamous crime) who are at least 21 years of age, have resided in the state for six months and in one county for 60 days preceding an election. The franchise was conferred on Negroes by an amendment adopted in 1868. Women did not vote until passage of the federal amendment in 1920.

The supreme executive authority in Iowa is the governor. Other elective executive officials are: the lieutenant governor, secretary of state, treasurer, auditor, attorney general and secretary of agriculture. All officers must be citizens of the United States and have the age and residence qualifications of voters. The governor and lieutenant governor must, in addition, be at least 30 years of age and must have resided in Iowa for at least two years preceding election. All are elected for two-year periods.

The governor has extensive appointive power, oversees the making of the budget and may veto acts of the general assembly, although such acts may be passed over his veto by a two-thirds majority of both houses. The lieutenant governor is ex-officio president of the senate and takes the office of governor in case of the death, resignation or removal from office of the chief executive. The governor, secretary of state, auditor, treasurer and secretary of agriculture make up the executive council. This ex-officio board canvasses state election returns, supervises the incorporation of building and loan associations, appoints the board of mine inspectors, allocates space in the capitol and other buildings used by the state government to the various offices and departments and has other supervisory duties.

In addition to the elective offices a number of subordinate administrative offices have been created by the legislature. These offices, filled by appointment, include those of the adjutant general, the commissioner of public health, the superintendent of public instruction, the commissioner of insurance, the industrial commissioner, the labour commissioner, the commissioner of public safety, the superintendent of banking and the comptroller.

Much of the administrative work of the state government is performed by boards or commissions, usually bipartisan. Except for the commerce commission and the state board of public instruction, to which members are elected, membership on these boards is appointive. Among the other administrative boards are the state highway commission, the board of parole, the conservation commission, the board of control of state institutions, the Iowa development commission, the liquor control commission, the employment security commission, the real estate commission, the board of regents, the state tax commission and the department of social welfare.

The state legislature, called the general assembly, is composed of a senate and house of representatives which meets in odd-numbered years. Senators, who must be at least 25 years of age, are elected for a term of four years, one from each of the 50 senatorial districts, the terms of half of the members expiring every two years. Representatives are elected for a term of two years, one from each of the 99 counties, with an additional one from each of the counties (not exceeding nine) having the largest population. The ratio of representation and the apportionment of the additional representatives from the larger counties are fixed by the general assembly.

A judicial reform amendment providing for the first major reorganization of one of the three branches of the state's government since Iowa was admitted to the union in 1846 was approved by the voters in 1962 and went into effect in 1963. Following the so-called Missouri plan designed to remove judges from party politics (*see* MISSOURI: *Government*) the nine judges of the supreme court and the 71 members of the district court are appointed by the governor from a list of candidates prepared by nominating commissions. Supreme court members serve for terms of eight years (formerly six) but must be approved by popular vote after serving one year and, within one year of the expiration of their first term, must again be voted on for continuance in office; they do not run against other candidates. The same provisions apply to the members of the district court except that their terms are six years.

The supreme court has original jurisdiction in certiorari and mandamus cases, and appellate jurisdiction in cases sent to it from the lower courts. It also has the power to pass on the constitutionality of state laws. The district court has general, original and exclusive jurisdiction in all civil, criminal and probate matters not expressly conferred on an inferior court, and may hear appeals from inferior courts, boards or officers.

Each of the 99 counties has its own administrative boards and officers. The boards of supervisors consist of not more than seven members who are elected for three-year terms and have the care of county properties and the management of county business, including highways and bridges. The boards also fix the rate of county taxes within prescribed limits and levy the taxes for state and county purposes. Other county officers are: auditor, treasurer, clerk, recorder, sheriff, attorney, engineer, coroner, assessor and superintendent of schools.

Four cities, Camanche, Davenport, Muscatine and Wapello, were given special charters prior to 1857. Cities are of two types: those with a population of more than 15,000 and those with a population of from 2,000 to 15,000. All other incorporated places, except the special-charter cities, are classified as towns. Local adoption of the commission-manager plan of municipal government was authorized by the general assembly in 1915. Home rule legislation adopted in 1963 conferred on municipalities authority to act on local matters and powers of self-determination respecting internal affairs. Up to that time, the municipal governments were limited to those powers specifically granted to them by statute.

Finance and Taxation.—In 1929 a state tax commission was established for the purpose of centralizing the tax structure. Although the commission worked toward an integrated system, taxation has remained, in large part, a series of semi-independent levies. The tax sources for the state, with the percentage of total revenue in the second half of the 20th century, were: motor vehicle license, motor carrier and gasoline tax (38%); sales and use tax (34%); income tax: individual and corporation (13%); liquor profits and beer tax (5%); cigarette tax (3%); insurance premiums (2%); inheritance tax (2%); and miscellaneous taxes (2%). The state's revenue from all sources was about $350,000,000 annually. Of this amount, about one-sixth was derived from the federal government and about 70% from state tax sources. The state's expenditures totaled approximately $355,000,000, but there was no state debt. In the second half of the 20th century approximately 25% of the state's revenues was appropriated for education, nearly 38% was allocated to highways, more than 13% to public welfare and slightly more than 5% to health and hospitals. The state's income at this time was about three and one-half times as great as it had been prior to World War II; expenditures had increased at about the same rate. Iowa's per capita income ranked it 24th among the states in 1950 but it fell to 27th place toward the end of the next decade. It was only slightly below the national average, however.

Iowa has not levied a general property tax for the financing of the state government since 1941. There are, however, property taxes levied on a local level. This revenue is used primarily for schools, roads, municipal and county government and various local projects.

POPULATION

The population of Iowa in 1850, four years after it had obtained statehood, was 192,214. Its population ranked 27th among the 37 states and territories that then composed the union, and was classified as nearly 95% rural. The previous decade had been the period of the most rapid growth in Iowa's history—the population increased almost 346% from 1840 to 1850. At the beginning of the 20th century, the state had advanced to 10th in rank of population with a total of 2,231,853 persons by the 1900 census. The state was still largely rural in character: about three-fourths of the people were classified as nonurban dwellers. The next ten years saw an actual decline in the state's population—the 1910 census showed a drop of 0.3% from the census of 1900. The 1950 population indicated a total of 2,621,073 persons lived within the state, making it the 22nd in size of population among the states. The rural population was slightly more than 52% of the total at that time. Of the 1960 population, 1,462,512 or 53% lived in incorporated places of 2,500 or more, as compared with 46.9% in 1950, when these places constituted the urban area. The urban population, under a new definition set up in 1950, included also the thickly settled suburban area, or "urban fringe," adjacent to Des Moines, Sioux City, Davenport, Cedar Rapids, Dubuque, Waterloo and Omaha, Neb. (standard metropolitan statistical areas). By 1960 these areas housed 33.2% (915,762) of the total population. In 1960 Iowa had a population of 2,757,537, an increase of 136,464 or 5.2% over 1950, and ranked 24th in population.

The population per square mile in 1960 was 49, as compared

*Iowa: Places of 5,000 or More Population (1960 Census)**

Place	Population				
	1960	1950	1940	1920	1900
Total state	2,757,537	2,621,073	2,538,268	2,404,021	2,231,853
Algona	5,702	5,415	4,954	3,724	2,911
Ames	27,003	22,898	12,555	6,270	2,422
Atlantic	6,890	6,480	5,802	5,329	5,046
Bettendorf	11,534	5,132	3,143	2,178	—
Boone	12,468	12,164	12,373	12,451	8,880
Burlington	32,430	30,613	25,832	24,057	23,201
Carroll	7,682	6,231	5,389	4,254	2,882
Cedar Falls	21,195	14,334	9,349	6,316	5,319
Cedar Rapids	92,035	72,296	62,120	45,566	25,656
Centerville	6,629	7,625	8,413	8,486	5,256
Chariton	5,042	5,320	5,754	5,175	3,989
Charles City	9,964	10,309	8,681	7,350	4,227
Cherokee	7,724	7,705	7,469	5,824	3,865
Clear Lake	6,158	4,977	3,764	2,804	1,706
Clinton	33,589	30,379	26,270	24,151	22,698
Council Bluffs	55,641	45,429	41,439	36,162	25,802
Creston	7,667	8,317	8,033	8,034	7,752
Davenport	88,981	74,549	66,039	56,727	35,254
Decorah	6,435	6,060	5,303	4,038	3,246
Des Moines	208,982	177,965	159,819	126,468	62,139
Dubuque	56,606	49,671	43,892	39,141	36,297
Estherville	7,927	6,719	5,651	4,699	3,237
Evansdale	5,738	3,571	—	—	—
Fairfield	8,054	7,299	6,773	5,948	4,689
Fort Dodge	28,399	25,115	22,904	19,347	12,162
Fort Madison	15,247	14,954	14,063	12,060	9,278
Grinnell	7,367	6,828	5,210	5,362	3,860
Independence	7,069	4,865	4,342	3,672	3,656
Indianola	7,062	5,145	4,123	3,628	3,261
Iowa City	33,443	27,212	17,182	11,267	7,987
Iowa Falls	5,565	4,900	4,425	3,954	2,840
Keokuk	16,316	16,144	15,076	14,423	14,641
Knoxville	7,817	7,625	6,936	3,523	3,131
Le Mars	6,767	5,844	5,353	4,683	4,146
Maquoketa	5,909	4,307	4,076	3,626	3,777
Marion	10,882	5,916	4,721	4,138	4,102
Marshalltown	22,521	19,821	19,240	15,731	11,544
Mason City	30,642	27,980	27,080	20,065	6,746
Mount Pleasant	7,339	5,843	4,610	3,987	4,109
Muscatine	20,997	19,041	18,286	16,068	14,073
Newton	15,381	11,723	10,462	6,627	3,682
Oelwein	8,282	7,858	7,801	7,455	5,142
Oskaloosa	11,053	11,124	11,024	9,427	9,212
Ottumwa	33,871	33,631	31,570	23,003	18,197
Pella	5,198	4,427	3,638	3,338	2,623
Perry	6,442	6,174	5,977	5,642	3,986
Red Oak	6,421	6,526	5,763	5,578	4,355
Shenandoah	6,567	6,938	6,846	5,255	3,573
Sioux City	89,159	83,991	82,364	71,227	33,111
Spencer	8,864	7,446	6,599	4,599	3,095
Storm Lake	7,728	6,984	5,274	3,658	2,169
Urbandale	5,821	1,777	1,083	298	—
Washington	6,037	5,902	5,227	4,697	4,255
Waterloo	71,755	65,198	51,743	36,230	12,580
Waverly	6,357	5,124	4,156	3,352	3,177
Webster City	8,520	7,611	6,738	5,657	4,613
West Des Moines†	11,949	5,615	4,252	3,631	1,700
Windsor Heights	5,906	1,414	—	—	—

*Populations are reported as constituted at date of each census. †Name changed from Valley Junction in 1938.

Note: Dash indicates place did not exist during reported census, or data not available.

with 49.6 for the U.S. as a whole. By 1960 the urban population was increasing. Distribution by colour and nativity, according to the 1960 census, was as follows: 96.9% native white; 2% foreign-born white; and 1.1% nonwhite. Along with the rest of the U.S. the percentage of persons 65 years old or over was increasing, being 10.5% in 1960. The percentage of the population 14 years old and over that was in the labour force (54.3% in 1960) was steadily decreasing.

EDUCATION

History and Administration.—The first schools in Iowa were private. In 1830 a private school was opened in the Half-Breed tract, now Lee county. In 1834 free tax-supported schools were legally authorized for the area and by 1838 there were more than 40 schools established. When the Iowa territory was formed (1840) a law was passed defining the means of establishing free schools. The educational system has as its basis a law passed by the state legislature in 1858. Education was made compulsory by the general assembly in 1902. Since that time, legislation has extended the school year to at least 24 consecutive weeks for children between the ages of 7 and 16 unless they have completed the eighth grade or are over 14 and employed. In 1911 the legislature authorized large, centrally located, consolidated schools to replace small, scattered ones. Part-time schools for employed children between 14 and 16 were provided for in 1919. In the second half of the 20th century Iowa had the distinction of having the lowest percentage of illiteracy in the union. At that time, the state was spending $299 annually per pupil or slightly more than the U.S. average. This represented almost three times as much per pupil as had been spent prior to World War II.

At the head of the Iowa system of public schools is the state superintendent of public instruction, assisted by the state board of public instruction. The superintendent is, by law, the executive officer of both the board of educational examiners and the board of vocational education. The county administration is in the hands of a popularly elected board of five officers who, in turn, appoint a county superintendent of public instruction for a three-year term. Each school district has its separate board of education or trustees.

School revenue is derived from the state's permanent school fund, which grew out of land granted to the state by the federal government, and from local or district taxation.

Colleges and Universities.—Iowa has about 50 institutions of higher learning, which are governed by the state board of regents. This nine-member board is appointed for six-year terms by the governor with the approval of the senate. Schools supported by the state include the University of Iowa (Iowa City), Iowa State University of Science and Technology (Ames) and State College of Iowa (Cedar Falls).

The University of Iowa (formerly State University of Iowa) was established by an act of the legislature in 1847. Instruction was begun in the spring of 1855. The law department was added to the college of liberal arts in 1868, the medical department in 1870, the dental department in 1882 and the department of pharmacy in 1885. All these later became colleges. The graduate college was added in 1900 and the college of engineering in 1905. The school of education, created in 1907, became the college of education in 1913; and a school of commerce, established in 1914, became the college of business administration in 1959.

In addition to these nine colleges, a preparatory department was maintained from the founding date of the university until 1879; a homeopathic medical department, later a college, from 1876 to 1919; and a college of fine arts from 1911 to 1915. Within the college of liberal arts are the schools of fine arts, journalism, religion and social work. In 1949 the school of nursing became the college of nursing. The extension division was organized in 1913, the Iowa child welfare research station in 1917, the institute of hydraulic research in 1931, the institute of public affairs in 1949, the bureau of labour and management in 1950, the institute of gerontology in 1951, the institute of agricultural medicine in 1955 and the Iowa urban community research centre in 1958.

The central building of the university campus is the Old Capitol, which was turned over to the university when Des Moines became the state capital in 1857. The medical centre includes general, children's and psychopathic hospitals; the hospital-school for severely handicapped children; medical laboratories and the medical research centre.

Iowa State University of Science and Technology is the state land-grant college; the name was changed from Iowa State College of Agriculture and Mechanic Arts in 1959 at which time the following divisions became colleges: agriculture (established 1868), engineering (1868), sciences and humanities (1868), home economics (1872), veterinary medicine (1879) and graduate college (1919).

State College of Iowa at Cedar Falls was chartered as Iowa State Normal school in 1876 and was renamed Iowa State Teachers college in 1909.

Among the privately supported educational institutions in Iowa are: Briar Cliff college (Sioux City, Roman Catholic, 1930); Buena Vista college (Storm Lake, United Presbyterian Church in the U.S.A., 1891); Central college (Pella, affiliate of Reformed Church in America, 1853); Clarke college (Dubuque, Roman Catholic, 1843); Coe college (Cedar Rapids, affiliate of United Presbyterian Church, 1851); Cornell college (Mount Vernon, affiliate of the Methodist Church, 1853); Drake university (Des Moines, related to the Disciples of Christ, 1881); Grinnell college (Grinnell, nonsectarian, but related to Congregational Church, 1846); Iowa Wesleyan college (Mount Pleasant, affiliate of Methodist Church, 1842); Loras college (Dubuque, Roman Catholic, 1839); Luther college (Decorah, affiliate of Evangelical Lutheran Church, 1861); Marycrest college (Davenport, Roman Catholic, 1939); Morningside college (Sioux City, Methodist, 1889); Parsons college (Fairfield, affiliate of United Presbyterian Church, 1875); St. Ambrose college (Davenport, Roman Catholic, 1882); Simpson college (Indianola, affiliate of Methodist Church, 1860); University of Dubuque (Dubuque, affiliate of United Presbyterian Church, 1852); Upper Iowa university (Fayette, nonsectarian, 1857); Wartburg college (Waverly, American Lutheran Church, 1865); Westmar college (Le Mars, affiliate of Evangelical United Brethren Church, 1900); and William Penn college (Oskaloosa, Friends, 1873).

HEALTH AND WELFARE

The Iowa department of public health, established in 1924, is headed by a commissioner, who is required to be a physician with special training in public hygiene and sanitation. The department is concerned with the major causes of sickness and death, mental health and the prevention and control of communicable diseases. Major health programs are administered by the division of maternal and child health, the division of dental hygiene, the division of cancer control, the division of gerontology, heart and chronic diseases, the division of public health engineering and industrial hygiene, the division of public health nursing and the division of public health education.

The charitable, penal and reformatory institutions of the state are supervised by a board of control of state institutions which has three members appointed by the governor. The institutions include: a soldiers' home at Marshalltown; a school for feebleminded children at Glenwood; a hospital for epileptics and school for the feeble-minded at Woodward; four hospitals, or mental health institutes, at Clarinda, Independence, Mount Pleasant and Cherokee; a juvenile home for destitute, neglected or homeless children at Toledo; the Annie Wittenmyer home for children at Davenport; a training school for delinquent boys at Eldora; a similar institution for girls at Mitchellville; a men's reformatory at Anamosa; a women's reformatory at Rockwell City; and a state penitentiary at Fort Madison. The state also maintains a school for the deaf at Council Bluffs, one for the blind at Vinton and a combination school and hospital for handicapped children at Iowa City.

In 1907 the general assembly passed a law that established the indeterminate sentence for certain criminal offenders. The governor appoints a board of parole of three members, one of whom must be an attorney, and of which not more than two may be

members of the same political party. A bill calling for the sterilization of certain mental defectives was passed in 1929. The provisions of the bill are carried out by an ex-officio board of eugenics.

In 1937 a state department of social welfare was created to administer old-age assistance, aid to the needy blind, aid to the disabled (since 1950), child welfare and the care of dependent children and general relief in the state. The state board supervises the county boards of social welfare. The employment security commission manages a system of old-age and retirement insurance, which went into effect in 1946.

THE ECONOMY

Agriculture.—The superior quality of the soil and the warm, moist months of spring and summer make Iowa one of the foremost states of the union in the production of corn (maize), oats, hay and soybeans. Much of the produce is utilized in the further production of poultry, hogs, dairy cattle and sheep. Of the total farm acreage of approximately 35,000,000 ac., more than 60% was under actual cultivation in the second half of the 20th century. The average size of farms was about 185 ac., and the average value of farm land per acre was nearly $200. There was a pronounced trend toward larger holdings.

In the second half of the 20th century, cash receipts from farm marketings and government payments averaged more than $2,000,000,000 annually, more than $1,500,000,000 of which came from livestock and livestock products, and about $375,000,000 from crops of all kinds. Corn is the most important crop, and Iowa ranks first among the states in corn production with almost half the cultivated area of the state devoted to its culture. In the quarter-century after 1935 the total average annual yield was increased almost 400%. After corn, the most important Iowa crops are oats, barley, soybeans and hay.

By the second half of the 20th century the value of Iowa livestock was greater than that of any other state and twice as great as the valuation in 1920. Hogs, cattle, sheep and lambs are the principal types of stock raised. Dairy products and poultry are also vital parts of the state's agricultural program. The average egg production during 1950–60, for example, exceeded 4,000,000,000 eggs per year; Iowa farmers sold 1,500,000,000 lb. of whole milk annually in the same period and the state was first in the amount of cream sold.

Industry.—Although Iowa is famous for its agriculture, a considerable amount of industry has been attracted to the state by the Iowa development commission. During the second half of the 20th century Iowa industries employed more than 160,000 persons and paid more than $600,000,000 annually in salaries and wages. The estimated total value added by industry in a typical year of the 1950s was 3.81 times as great as that of 1929.

Most of Iowa's industrial plants are engaged in the processing of foods of various kinds. Meat-processing plants are the most important, the largest pork-processing plant in the United States being located in Iowa. Of secondary importance are dairy products-processing establishments and poultry-processing plants. Machinery manufactured in the state includes tractors, combines, corn-pickers and hay-balers. Printing and publishing are important industries. A large aluminum-rolling mill is located at Davenport and a leading manufacturer of fountain pens is at Fort Madison. Des Moines, Cedar Rapids and Waterloo are the state's leading industrial centres.

Mineral Production.—Iowa's first settlement was a mining camp, but this event proved to be no index to future mineral production. The early lead and zinc mines around Dubuque are little worked, and these products are of small significance in comparison with the state's total mineral output. During the second half of the 20th century, Iowa was among the first ten states in its production of gypsum and cement, but ranked 29th among the states in the value of all of its minerals.

Transportation.—From the close of the Civil War to 1920, the railroad was Iowa's most important means of transportation, although river traffic was of considerable importance during the 19th century. It was in those years that the "Big Four" railroads (the Chicago, Burlington and Quincy; the Chicago and North Western; the Chicago, Milwaukee, St. Paul and Pacific; and the Chicago, Rock Island and Pacific) established control over almost three-fourths of the railroad mileage (about 8,900 mi.) in the state. Since 1920, however, the railroads have steadily declined in favour of motor vehicles and airplanes.

Iowa has long had a state highway system, but it was not until 1919 that highways were classified as primary and secondary. In 1925 the state highway commission began its control of the primary road system. By the second half of the 20th century there were about 8,700 mi. of highway in the state primary system. Motor vehicle registrations increased from 437,000 in 1920 to more than 1,200,000 by 1960. Iowa was receiving about $35,000,000 in federal funds annually under the national highway program initiated in 1956.

The creation of the Iowa aeronautics commission by the general assembly in 1945 testified to the increasing importance of air travel. The number of licensed pilots increased from 1,882 in 1940 to more than 16,000 after World War II; more than 1,600 privately owned planes were registered with the aeronautics commission and there were more than 200 airports and five commercial airlines doing business in the state.

See also references under "Iowa" in the Index.

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Current statistics on production, employment, industry, etc., may be obtained from the pertinent state departments; the principal figures, together with the current history, are summarized annually in the *Britannica Book of the Year,* American edition. (P. W. GL.)

IOWA, UNIVERSITY OF, an institution of higher learning, in Iowa City, Ia., was organized by an act of the legislature in 1847. *See* IOWA: *Education.*

IOWA CITY, a town on the Iowa river in east central Iowa, U.S., 57 mi. W. of the Mississippi river, the seat of Johnson county. Founded as the capital of Iowa territory in 1839 and incorporated as a town in 1853, Iowa City lost the state capital to Des Moines in 1857 but retained the state university and historical society. The university buildings, including the Old Capitol, now dominate the centre of the community. Iowa City was an important immigrant dispersal point during the late 1850s; from there in 1856 about 1,300 European Mormons proceeded to Utah, carrying their baggage in handcarts. Ohio, Pennsylvania and New York provided the largest number of early settlers, including Amish and Mennonite groups which in the mid-20th century still maintained their identities. By 1900 there were 2,622 Bohemians and Germans present and foreign born or their children made up 50% of the population; this proportion then declined. (For comparative population figures *see* table in Iowa: *Population.*)

Iowa City has a council-manager government, in effect since 1951. The residents mainly serve the needs of the state university, the university hospitals, a veterans hospital, Mercy hospital, Oakdale tuberculosis sanatorium and the hog, cattle and corn agriculture of the county. Aside from a toiletries plant and a brush factory there is little local industry. Lake Macbride State park and the Herbert Hoover birthplace lie to the north and east.

(A. G. Bo.)

IPECAC (IPECACUANHA), an expectorant and emetic, is obtained from the dried roots of *Cephaëlis ipecacuanha* (Rio or Brazil ipecac) or of *Cephaëlis acuminata* (Cartagena, Nicaragua or Panama ipecac). The former is indigenous to Brazil but also grows in Colombia, while the latter is obtained mainly from

Colombia and Nicaragua. Ipecac owes its emetic properties to the presence of the alkaloids emetine and cephaëline, which occur mainly in the cortical portion of the root. Ipecac is used in large doses as an emetic (it may be poisonous in excessively large doses) and in smaller doses as an expectorant and diaphoretic. The alkaloid emetine was formerly the mainstay in treating amoebic dysentery, but it has been largely replaced by synthetics and antibiotics.

IPHICRATES (*c.* 410–*c.* 353 B.C.), Athenian general, is chiefly known for the use he made of lightly armed troops (*peltastae*); he increased the length of their weapons and improved their mobility by reducing their defensive armour. He also paid special attention to discipline, drill and maneuvers. Iphicrates used his peltasts skilfully in the Corinthian War (394–386), and near Corinth he almost annihilated a battalion of Spartan hoplites in 390. Transferred to the Hellespont, he was equally successful. After the peace of Antalcidas (386) he assisted Seuthes, king of the Thracian Odrysae, to recover his kingdom and was sent with a force of mercenaries to assist the Persians to reconquer Egypt; but a dispute with the Persian commander Pharnabazus led to the failure of the expedition. On his return to Athens (373) he commanded an expedition for the relief of Corcyra, which was besieged by the Spartans. On the peace of 371, Iphicrates returned to Thrace and fought for the Thracian king Cotys in a war against Athens for the Chersonese. The Athenians, however, soon pardoned him and gave him a joint command in the Social War or "war of the allies" (357–355). He and two of his colleagues were impeached (perhaps in 354) by Chares, the fourth commander, because they had refused to give battle during a violent storm. Iphicrates was probably acquitted but died soon afterward.

IPHIGENIA, in Greek mythology the eldest daughter of Agamemnon, king of Mycenae, and of his wife Clytemnestra. Her father had to sacrifice her to the goddess Artemis in order that the Achaean fleet, of which he was leader, might be delivered from the calm (or contrary winds) by which Artemis was detaining it at Aulis and proceed on its way to the siege of Troy. Iphigenia is not mentioned in Homer.

As a member of the house of Atreus (*q.v.*) she shared in the unhappy fate of that family and is a key figure in certain Greek tragedies. In Aeschylus' *Agamemnon,* Clytemnestra uses her daughter's death as a pretext for murdering her husband. In Sophocles' *Electra* the reason for Artemis' detention of the Greek fleet is said to have been the shooting by Agamemnon of a deer belonging to her; she will not allow the fleet to move until Iphigenia has been sacrificed. Euripides' unfinished *Iphigeneia in Aulis* begins with Agamemnon's sending for his daughter on pretext of marrying her to Achilles but really in order to sacrifice her. Euripides' earlier play *Iphigeneia in Tauris* depicts Iphigenia in the land of the Tauri (the Crimean peninsula) as priestess of Artemis, having been rescued from sacrifice by the goddess, who substituted for her a deer. When her brother Orestes (*q.v.*) comes to carry away Artemis' image in order that he may be purified from the murder of his mother, Iphigenia saves him from having to be sacrificed and escapes with him to continue her service of the goddess in Attica. There, after her death, she is to be honoured (at Brauron) by offerings of garments of women who have died in childbirth. Variants of her story are found in later authors. In some localities she was identified with Artemis; Pausanias says that in Hermione (Argos) Artemis was worshiped under the name of Iphigenia. He also claims that Iphigenia was originally the goddess Hecate.

Iphigenia's story found favour with later European dramatists, providing the plot of Racine's *Iphigénie* and of Goethe's *Iphigenie auf Tauris.* Racine's play was the basis for the opera *Iphigénie en Aulide* by Gluck, who also composed *Iphigénie en Tauride.*

I-PIN (SUI-FU; SÜCHOW), a Chinese river port at the junction of the Min and Chin-sha (upper Yangtze) rivers in southwest Szechwan (Ssu-ch'uan) province and head of navigation to small steamers on the Yangtze. Pop. (1953) 177,500. It is the site of the Yangtze river crossing for the railroad to Yünnan in the south. A highway runs northward to the salt centre of Tzekung (Tzu-kung). With its transportation facilities, I-pin acts as the collection centre and export port for products of the Yünnan and Tibetan uplands, such as medicinal herbs and extracts, musk and metals, and as the dissemination point for salt, cotton and other manufactures to the surrounding mountain peoples. It is the nearest large city to the Liang-Shan Yi Autonomous district inhabited by Yi (Lolo) tribesmen (*see* also YI). Lac produced by the exudation of a species of insects feeding upon the twigs and young branches of trees is collected at I-pin from the Lo-shan (Chia-ting) region up the Min. (H. J. WS.)

IPIRANGA, GRITO DO, the "cry of Ipiranga" (Ypiranga), so-called because Brazil's independence was proclaimed at this place by Dom Pedro on Sept. 7, 1822. Sentiment for independence had been growing since the preceding year when King John VI returned to Lisbon, leaving his son Pedro as regent. When the Portuguese parliament limited the powers of the regency, the action was interpreted as an effort to reassert Portuguese rule in Brazil. A messenger sent to intercept the young regent returning to the capital from São Paulo met him on Ipiranga hill, where he vowed: "Independência ou morte!" (Independence or death!). He was proclaimed Pedro I (*q.v.*), emperor of Brazil, Oct. 12, 1822. (R. E. P.)

IPOH, capital of Perak state, Malaya, in the Federation of Malaysia, is on the Kinta river (*q.v.*), a tributary of the Perak, 110 mi. N.N.W. of Kuala Lumpur and 75 mi. S.E. of George Town. Pop. (1957) 125,770. Steep hills rise within a few miles on all sides except the south. The flat alluvial plain around Ipoh which has been repeatedly churned over by tin mines produces more than half of Malaya's output, making Ipoh effectively the mining capital of the country. The town dates from the end of the 19th century, when the smaller tin fields around Taiping lost significance and British companies, using immigrant Chinese labour, transferred to the rich Kinta ores. At that stage the tin concentrates were taken down the Kinta river but the railway was soon extended from Taiping to Ipoh linking with Penang. No smelting is done in or near Ipoh. Beneath the mines is a limestone structure riddled by solution, and east of the town limestone rocks rise through the alluvium with gigantic caves which are used as Chinese temples, and at times as hideouts for outlaws.

Ipoh has the spacious rectangular layout of a modern pioneer township. A high degree of electrification has been achieved in the town by the use of diesel generators and hydroelectricity from the Chenderoh dam on the Perak river. In addition to the tin, rubber from foothill plantations is also marketed. The town is dominated by Chinese of the Hokkien and Hakka communities, and its suburbs have spectacular residences of wealthy miners. Ipoh is the most important station on the Kuala Lumpur-Prai railway and is the focus of a series of main roads across the Kinta valley, north of Penang and south to Kuala Lumpur. Air services also operate to Penang, Kuala Lumpur and Singapore. *See* also PERAK. (E. H. G. D.)

IPOMOEA, a large genus of mainly climbing herbs or shrubs of the morning-glory family (Convolvulaceae; *q.v.*). It includes the sweet potato, morning-glory (*qq.v.*) and manroot.

IPPOLITOV-IVANOV, MIKHAIL MIKHAILOVICH (1859–1935), Russian composer of instrumental music, operas and songs, was born at Gatchina on Nov. 12, 1859. In 1875 he entered the St. Petersburg conservatory as a composition student, where he studied, during his last two years, under Rimski-Korsakov; on leaving the conservatory in 1882 he went to Tbilisi (Tiflis) where he founded and conducted regular symphony concerts and directed a music school. In 1893 he joined the staff of the Moscow conservatory, of which he was director from 1906 to 1922; until 1906 he had also been conductor of Mamontov's opera company in Moscow, giving some notable first performances. In 1924–25 he visited Tbilisi to reorganize the Georgian state conservatory, which had developed from his former music school, but returned to Moscow in 1925 as director of the Bolshoi theatre. He died there on Jan. 28, 1935. Ippolitov-Ivanov's 11 years in the Caucasus led to a lifelong interest in Georgian folk music and inspired some of his most successful orchestral compositions: an *Armenian Rhapsody,* the symphonic poem *Mtsyri,* and five suites, of which the first (*Caucasian Sketches,* op. 10) won widespread popularity.

None of his six operas has held the stage, nor has his completion of Mussorgsky's *Marriage*.

See S. Bugoslavsky, *M. M. Ippolitov-Ivanov* (1936). (G. Ab.)

IPSUS, BATTLE OF (301 B.C.), called "the battle of the kings," was the culmination of a decisive campaign in the struggle between Antigonus I Monophthalmus, king in Asia Minor, and the other "successors" (*Diadochi*) of Alexander the Great. The battle, which resulted in the defeat and death of Antigonus, is memorable above all for its political consequences: the irrevocable dismemberment of the empire of Alexander and the disappearance from it of the last traces of a central authority.

The campaign was precipitated by the onslaught launched in 302 in northern Greece against Cassander, king of Macedonia, by Antigonus' son Demetrius Poliorcetes. When Cassander sued for peace Antigonus demanded his unconditional surrender. Unwilling to comply with these terms, Cassander sent his ally Lysimachus, king of Thrace, to invade Asia Minor, and arranged for Ptolemy of Egypt and Seleucus of Babylon to invade the other parts of Antigonus' kingdom from the south and east. Demetrius was forced to evacuate Greece and sail to his father's aid. In the summer of 301 Seleucus and Lysimachus joined hands and their combined forces faced the army of Antigonus and Demetrius at Ipsus in central Phrygia (the site cannot be identified precisely). Antigonus had 70,000 foot, 10,000 horse and 75 elephants; the allies 64,000 foot, 10,500 horse and at least 400 elephants. The large number of elephants which Seleucus had brought from India proved invaluable. Demetrius routed the opposing cavalry but pursued too far and was separated from the main battle by the enemy's elephants. Antigonus' infantry made but a poor resistance, many deserting, and Antigonus was killed, crying vainly, "Demetrius will come and save me." (R. H. Si.)

IPSWICH, a city of Queensland, Austr., lies on the Bremer river 24 mi. W. of Brisbane by rail. Pop. (1961) 48,679. Ipswich is the centre of an extensive farming, mining and manufacturing district. Coal mines within the municipal area produce about 1,500,000 tons annually and employ about 2,000 men. Another 3,500 are employed in the state railway workshops. Other industries include woolen mills, sawmills, foundries, hardboard manufacture and a butter factory. The first settlement, known as Limestone, was established in 1829. Renamed in 1843, Ipswich was incorporated as a municipality in 1860 and proclaimed a city in 1904. (V. N. S.)

IPSWICH, a county and parliamentary borough and the county town of Suffolk, Eng., lies 72 mi. N.E. of London by road. Pop. (1961) 117,325. It is an ancient market town and port at the head of the Orwell estuary and a farming and industrial centre. A large Roman villa site and an extensive pagan-Saxon cemetery of the 6th century on the right bank of the river Gipping have been found. A big kiln site in the eastern part of the town where first Ipswich ware, and later Thetford ware, were manufactured continuously from the 7th to the 12th centuries shows that Ipswich remained an important trading centre throughout the period in spite of the Danish settlements of the late 9th century and the sack of the town by the Vikings in 991. It prospered as the export town for the East Anglian cloth industry from medieval times until the mid-17th century. In 1200 King John granted the town its first charter, and it was incorporated in 1446. With the decline in the cloth trade the town suffered a setback, but the manufacture of agricultural machinery in the late 18th century paved the way for an industrial expansion in the mid-19th century.

Christ Church mansion (16th century), standing in a park, is an art gallery and museum; Sparrowe's, or the Ancient house, dating in part from the 15th century, has a fine 17th-century pargetted façade; Wolsey's gateway (*c.* 1529) is the only remnant of the cardinal's foundation that once supplied scholars to his great college (Cardinal's college, now Christ Church) at Oxford. The older churches are all towered flintwork structures, wholly or mainly Perpendicular in style, except in St. Peter's which is principally Decorated, with a Norman font of Tournai marble. Ipswich was the birthplace of Cardinal Wolsey, and from 1747 to 1759 Thomas Gainsborough lived and painted there. Ipswich school, founded in the 15th century, was refounded by Queen Elizabeth I in 1566. There is an Anglican bishopric of St. Edmundsbury and Ipswich. Several old coaching inns survive, including the "Great White Horse" of *Pickwick Papers* fame. Ipswich harbour extends 11 mi. downstream to Shotley point, and the dock commissioners control about 6,000 ft. of quayage, including a wet dock and a deep-water quay. Principal imports are coal, petroleum, grain, chemicals (for fertilizers), timber, roadstone and general cargo. Exports are barley, coke-breeze, malt and fertilizers. Beside agricultural machinery, Ipswich is also well known for the manufacture of lifting, excavating and irrigation equipment, fertilizers and cigarettes. Other industries include milling, malting, printing, clothing and textiles.

Ipswich Ware.—A type of middle Saxon pottery turned on a slow wheel with simple everted rims, sagging bases and extensive knife trimming at the base, was manufactured between the 7th and 9th centuries in kilns found at Ipswich. Widely distributed along the coast of East Anglia from the Wash in the north to Bradwell-on-Sea in Essex, it is derived in part from local pagan-Saxon ware, but the sagging bases and knife trimming indicate Rhineland influences.

Thetford Ware.—A type of late Saxon pottery first identified at Thetford in Norfolk and found widely distributed in Lincolnshire, Cambridgeshire, Norfolk, Suffolk and Essex, was manufactured between the 10th and 12th centuries. It succeeded Ipswich ware, of which it is a more sophisticated type, and is turned on a fast wheel. Kilns have been found at Ipswich on the same site as Ipswich ware kilns.

See J. G. Hurst and S. E. West, "Saxo-Norman Pottery in East Anglia," *Proceedings of the Cambridge Antiquarian Society*, 2:29–60 (1957). (D. Cx.)

IPSWICH, a town of Essex county, eastern Massachusetts, U.S., 28 mi. N.N.E. of Boston, on both sides of the Ipswich river and fronting on Ipswich bay. (For comparative population figures *see* table in Massachusetts: *Population;* there are in addition about 2,000 summer residents.)

The town was settled under the name of Agawam in 1633 and was incorporated in 1634 as Ipswich, being named for the English town. During the early days of the colony it was little inferior to Boston in wealth and influence, and frequently took an opposing position on public questions. Ipswich was the home of several of the leading writers of the colonial period, including Nathaniel Ward (1578–1652) and Anne Bradstreet (1612–72). Nearly 40 houses built before 1725 are still standing. The John Whipple house (1640) contains the collection of the Ipswich Historical society. The Choate bridge, built in 1764, is the oldest stone arched bridge in the U.S.

Ipswich has a selectmen-executive-secretary form of government in effect since 1955. (K. S. T.)

IQBAL, MOHAMMED (1877–1938), Indian Muslim poet and philosopher who sought to arouse the Muslim peoples to a new sense of their destiny, was born at Sialkot on Nov. 9, 1877. He studied law and philosophy in the Punjab and in Europe, and taught for a time at Government college, Lahore. He was knighted by the British government for excellence in literature (1922), was elected by the Punjab legislative assembly (1927) and was president of the annual session of the Muslim league (1930). He died in Lahore on April 21, 1938.

The recurrent themes of Iqbal's Urdu and Persian poetry are a memory of the vanished glories of Islam, a complaint about its present decadence and a call to unity and reform. Reform can be achieved by strengthening the individual, through three successive stages: obedience to the law of Islam, self-control and acceptance of the role of the vicegerent of God (*na'ib* or *momin*). A life of action is preferred to ascetic resignation. Iqbal's thought was influenced by Jalal-ud-Din Rumi, J. M. E. McTaggart, Nietzsche and Bergson. He attempts to rescue Islam from the grip of fatalism (*qismat*) by safeguarding man's freedom. In his *Asrar-i Khudi* (Eng. trans., *Secrets of the Self*, by R. A. Nicholson, 2nd ed., 1940) he says that God is as the soul in the body of the universe; God knows the future as potentiality and not as a predetermined actuality, the universe being still in the course of formation with man sharing in God's creative activity. In *The Reconstruction of*

Religious Thought in Islam (1934) he urges that in social ethics Islam must free itself from worn-out tradition and revive the right to interpret the law (*ijtihad*), so that each generation may solve its own problems guided by the work of its predecessors. Iqbal tended to be progressive in adumbrating general principles of change but conservative in initiating actual change. Earlier a supporter of Pan-Islam, he later realized the impossibility of this ideal. He is considered by many as the author of the Pakistan concept. His other works include *Ramuz-i Bekhudi* (Eng. trans., *The Mysteries of Selflessness*, by A. J. Arberry, 1953) and *The Development of Metaphysics in Persia* (1908).

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IQUIQUE, a city and port of Chile, capital of the province of Tarapacá (*q.v.*), 75 mi. S. of Arica and 820 mi. N. of Valparaíso. Pop. (1960) 51,468 (mun.). The Pacific coast runs due north and south and the city is built on a narrow level plain between the sea and bluffs, the latter rising steeply 2,000 ft. to the level of the desert plain of Tarapacá, celebrated for its rich deposits of nitrate of soda, which gives way to the Atacama desert (*q.v.*). Facing the city is the low barren island of Serrano, which is connected with the mainland by a stone causeway 1,500 ft. long and shelters the anchorage from southerly storms. A mole extending from the northeastern end of the island affords further protection.

The city is laid out on the rectangular plan, with broad streets and large squares. Water is brought by pipes from the oasis-town of Pica, 50 mi. inland. Iquique is a city of commercial importance and is provided with banks, substantial business houses, newspapers, clubs, schools, railways, tramways, electric lights, telephone lines and steamship, air and cable communication with the outside world. It exports iodine and immense quantities of nitrate of soda obtained from the adjacent desert region.

A large number of vessels are engaged in the nitrate trade, and Iquique ranks as one of the two leading ports of Chile in the aggregate value of its foreign commerce. It is connected by rail with the inland town of Tarapacá and various mining centres, and through them with the ports of Pisagua on the north and Patillos on the south.

Iquique was an insignificant Peruvian fishing settlement until 1830 when the export of nitrate began. In 1868, the town was nearly destroyed by an earthquake, in 1875 by fire, and again, in 1877, by earthquakes, a fire and a tidal wave. It was occupied by the Chileans in 1879 in the war between Chile and Peru, and was ceded to Chile by the treaty of Oct. 20, 1883.

IQUITOS, Amazon river port in northeastern Peru, and capital of Loreto department, 2,300 mi. upstream from the Atlantic ocean, is 640 mi. N.N.E. of Lima. Pop. (1961) 55,696. Located 3° 45′ S. at an elevation of about 350 ft., the climate is equatorial with an average rainfall of 103 in., but temperatures are not so high as in the middle latitudes—the warmest month (February) averages 78.3° F., and the coldest month (July), averages 74.1° F. The humidity is high, especially in the early morning hours.

Iquitos was founded as a Peruvian settlement in 1863 at a place occupied previously by an Indian village. The Peruvians became interested in the region during the rubber boom of the late 19th century, and Iquitos became the chief shipping port for this part of the world. In spite of the great distance from the Atlantic, ships drawing 14 ft. can reach Iquitos even at low water. The most prosperous period of rubber production was between 1906 and 1912, after which production dropped to only a fraction of what it had been. Population declined and for a long time this remote jungle region and the city which was its commercial centre remained stagnant.

Since 1950 there has been a renewed interest in the economic development of eastern Peru. Highways from Lima, including the Lima-Pucallpa highway, reach navigable water east of the Andes, and airplanes make the trip over the mountains in a few hours. Iquitos has started to grow again in response to the increased settlement and production in its tributary area. The products, most of which continue to move out by steamer, include small amounts of rubber, balata, chicle, medicinal plants, tagua nuts, cabinet woods, cotton, rice, coffee, tobacco and hides. (P. E. J.)

IRAKLION (HERAKLEION or CANDIA), the largest city in the Greek island of Crete, lies on the north coast, northeast of the central Mt. Psiloriti (Ida), and derives its name from the ancient Heracleum which probably occupied the same site. Pop. (1961) 63,458. The town gained much importance as a trading centre after the construction of the new harbour, the airport and a number of motor roads. The chief exports are grapes, sultanas, olives and olive oil, wine, carobs, citrus fruit, almonds, soap and leather.

The Saracens, who captured Crete between 823 and 828, made the city their capital, but they were defeated and massacred in 961 by Nicephorus II Phocas. In 1204, after the capture of Constantinople by the crusaders, Crete was sold by Boniface, marquis of Montferrat, to Venice, but was occupied by the Genoese and only became Venetian territory in 1210. Most of the extensive Venetian walls of Iraklion still survive.

In 1669 the city was ceded to the Turks after a long siege. Francesco Morosini, later doge of Venice, commanded the defenders, and the finely sculptured fountain he erected still remains, though his loggia was pulled down and the surviving Venetian churches desecrated. There is a modern cathedral, Armenian and Roman Catholic churches and also the interesting old church of St. Menas. A modern museum contains the finest collection in the world of Minoan antiquities from Knossos, 3 mi. S.E., and from other Cretan sites, and there are interesting remains of later dates in the new historical museum. The Turkish mosques have been destroyed or converted to other uses. A monument commemorates Dhaskaloyannis, flayed alive there after the rebellion of 1770.

In a massacre that followed the Cretan rebellion (1897) 17 British sailors were killed there, and Adm. Sir Gerard Noel forced the Turks to surrender the city. With the rest of Crete, after a period as a protectorate, Iraklion passed to Greece in 1913. During the German invasion in 1941 the city suffered heavily from aerial bombardments.

Iraklion is the capital of a *nomos* (department) of the same name; this department consists of the hilly country round Mt. Iouktas on the east and the valley of the Kairatos on the west, opening out into a coastal plain, perhaps the most fertile land in Crete except that of Mesara. *See* also CRETE. (R. W. HU.)

IRAN (PERSIA), a kingdom of western Asia bounded north by the U.S.S.R. and the Caspian sea; east by Afghanistan and Pakistan; south by the Persian gulf and the Gulf of Oman; and west by Iraq and Turkey. The total area is 636,295 sq.mi. and the length of the frontiers about 2,750 mi. Teheran is the capital. In 1935 the Iranian government asked foreign governments to use "Iran" as the name of the state instead of "Persia" (*q.v.*). Although on Oct. 25, 1949, the Iranian government stated that it would no longer insist on this, "Iran" remained in common use.

Frontiers.—The frontier with the U.S.S.R. is that laid down in the treaty of Turkmanchai (1828), further defined in a convention of July 8, 1893, and modified in minor details in 1951. The Afghan frontier was defined in 1881 and in the convention of July 8, 1893. From the Siah Kuh river to Kuh-e Malek Siah (the junction of the Afghan, Pakistan and Iranian borders) it follows a line fixed by Sir Frederick Goldsmid in 1872 and by Sir (Arthur) Henry MacMahon in 1903–05. The southern boundary is the coast line from Gavater to the mouth of the Shatt al Arab. Iranian territory also includes the islands of Hormuz, Larak, Qeshm (Qishm), Hengam, Forur, Qais, Hendorabi, Sheykh Sa'd, Sheykh Sho'eyb, Khark and Kharku. There are also Iranian claims upon the territory of Bahrain. The frontier with Turkey extends from the Little Ararat to meet the Iraqi boundary at Kel-e-Shin. From that point the frontier line with Iraq extends about 550 mi. to the Shatt al Arab; it then follows the low water line to the mouth of the river and includes the anchorages of Khorramshahr (Mohammerah) and Abadan (*qq.v.*). This line was established by an international commission by the treaty of Erzurum (1847), demarcated in 1914 and reaffirmed by an agreement between Iraq and Iran in 1937.

The article which follows is divided into these sections:

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2. Relief and Drainage
3. Climate

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5. Animal Life
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For history *see* PERSIAN HISTORY.

I. PHYSICAL GEOGRAPHY

1. Geology.—What knowledge of the geology of Iran existed prior to the search for oil is contained in the work of A. F. Stahl (1911). Later, systematic exploration was carried out by the former Anglo-Iranian Oil company (A.I.O.C.) in the southwest and, after 1951, by the National Iranian Oil company (N.I.O.C.) over most of the country. In 1959 the N.I.O.C. published the first comprehensive geological map of Iran in which all existing knowledge appears to be synthesized.

The Iranian upland, of which Iran occupies the western two-thirds while the remaining part belongs to Afghanistan and Pakistan, is an important section of the Alpine-Himalayan fold mountain system. It forms a great loop, the border ranges converging in the northwest and northeast. Theories of a symmetric arrangement of folds and nappes on both sides, north and south, of a stable central (median) mass have proved to be wrong. The rocks, formerly mistaken for the base, were those metamorphosed during an early Cretaceous orogeny.

Thick red and green shales in the Kuh-e Dinar and elsewhere in the Zagros mountains are of Cambrian Age, and the rock salt with various components of the Hormuz and Ravar series in the south and east may be coeval or even older. Old Red Sandstone is widely found in northwestern, northern and eastern Iran. It turned into thick, black carboniferous limestone when the country was covered by the Tethys sea. Marine sedimentation went on in Triassic time but in two or three different facies. During the Lower Jurassic period about 10,000 ft. of detrital material with intercalated coal seams were deposited over most of Iran. This was largely metamorphosed in central Iran during a marked pre-Middle Cretaceous diastrophism. The resulting land surface was not covered until the Middle Cretaceous, while in the Elburz, Kopeh Dagh and Zagros geosyncline marine sedimentation continued, with various breaks, through Upper Jurassic and Cretaceous times through to the Eocene and Oligocene periods. The Eocene deposits are mainly limestone in the Zagros region, with a tuffaceous formation containing basic lava flows ("Green Series") in the Elburz, and a thick type of flysch in east and southeast Iran.

The existence of the Central Iranian basin is proved in the Oligocene period from the occurrence of the lagoonal Lower Red formation. It was again intruded by the southern sea during the deposition of the oil-bearing Asmari limestone, but was re-established as a closed basin in the Upper Miocene when up to 15,000 ft. of salty marls and clays (Upper Red formation) were deposited corresponding with the Fars formation of the southwest.

Irrespective of various older orogenic movements the main molding of the Iranian mountain ranges occurred during the Pliocene and even later, as tilted Bakhtiari conglomerates, raised gulf beaches and active fault lines demonstrate. Autochthonous folding is juxtaposed on thrusting. The prevailing strike is northwest–southeast or west–east, but strong meridional components are found in the east. Fracturing has also been a factor in determining the topography.

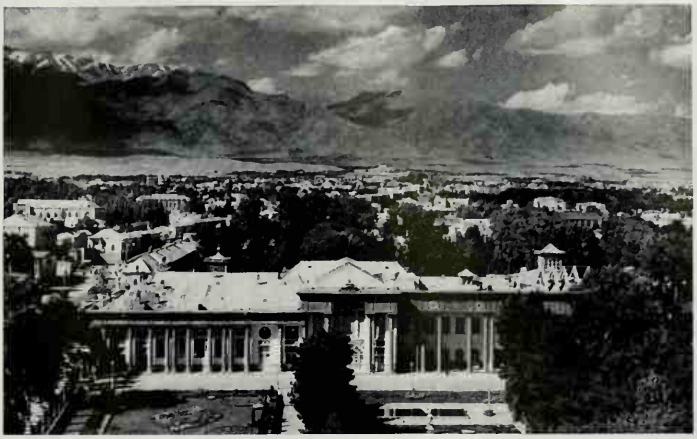
An additional element was brought in by the Plio-Pleistocene volcanism in Azerbaijan (Kuhha-ye Sabalan, Kuh-e Sahand), Elburz (Mt. Demavend), Kerman (Kuh-e Hazaran, Kuh-e Laleh Zar) and Baluchistan (Kuh-e Taftan, Kuh-e Bazman). Salt domes of different ages are widespread in the Persian gulf area and in central Iran.

2. Relief and Drainage.—Most of Iran is an upland which consists of a central plateau and a high mountainous fringe marking it off from surrounding lowlands. The fringing mountain chains are of considerable width in the west and southwest, called Zagros, and from an average elevation of 8,000–10,000 ft. rise to 12,000–13,000 ft. in several places. The northern fringe is narrow in its western part (Elburz mountains [*q.v.*]), but includes the highest elevations in Iran (Mt. Demavend [*q.v.*] 18,580 ft., Alam Kuh 15,865 ft.). The eastern, Khurasan, section is a double chain on both sides of a wide vale. The interior is an immense plateau made up of wide valleys and depressions separated by low ridges and protracted mountain ranges, mostly running in a northwest–southeast direction. In the east, a north–south direction interferes and thus separates the Iranian from the Afghan-Baluch plateau. Valleys and depressions generally lose in elevation from the northwest to the southeast, descending from about 4,000–6,000 ft. to 1,500 ft. and even less than 1,000 ft. The largest depressions are the Dasht-e Kavir, southern Dasht-e Lut, the Jaz Murian basin, and the Isfahan-Sirjan valley. The most important interior range runs from south of Qom past Yazd and Kerman into the Sarhad-e Bala.

The main contrast is between the dry, desert interior and the humid outward fringes which receive the bulk of all precipitation in Iran. The permanent rivers originate in the higher massifs of this outward fringe. They also bear, with some remarkable exceptions, the main divide between the closed interior basins and the outward drainage. Important rivers of the northern slopes are the Aras (*q.v.*), Safid Rud (*q.v.*; which, with its main branch, Qezel Owzan, completely separates the catchment basin of Lake Reza'iyeh, or Urmia [*q.v.*], from the main basin of Iran) and the Atrak; of the western and southwestern slopes the Karkheh, Dez, Karun and Mand; of the interior the Qareh Su of Saveh, Rud-e-Qom, Zayandeh Rud of Isfahan, Kor, Kalshur of Birjand, and Kalshur of Khurasan. There are a great number of seasonal and episodic streams. Any runoff within the interior basins which escapes infiltration and evaporation is gathered in salt lakes (like Urmia or Bakhtegan [Niriz]) or in salt marshes (*kavir*), the surface conditions of which change widely from season to season.

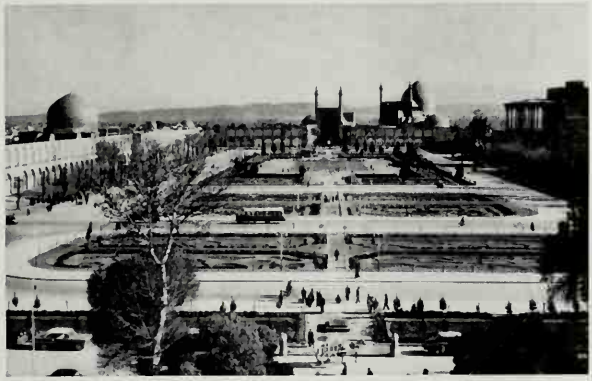
The lowlands possessed by Iran are insignificant in area in the north (the Caspian coast, the Moghan and Atrak steppes) but more extensive in the south (the Khuzistan plain, the gulf coast).

3. Climate.—The climate is subtropical and continental in character. The summer is long, hot and, except for the humid coastlands, extremely dry. Northern winds prevail. Teheran (4,000 ft.) has a July mean temperature of 29° C. (84° F.). Daily maxima reach 43°–46° C. (110–115° F.) in July and August, but nights are mostly cool. Above 6,000–7,000 ft. the summers are pleasant, and the Iranians call this zone *sardsir*, or the cool land; it attracts in summer not only the flocks but also many people from the hot regions, especially the southern lowlands (the *garmsir*,



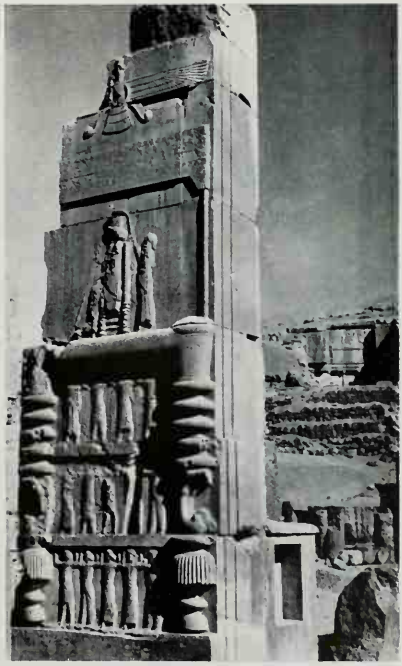
A view of Teheran, the capital of Iran, with the Iranian houses of parliament in the foreground and the Elburz mountains in the background

VIEWS OF IRAN



Isfahan's famous square, the Maidan-i-Shah. At the left is the mosque Masjid-i-Shaikh Lutfullah; at the right, the Ali Qapu (sublime porte or highest gate)

Aerial view of the reservoir formed by Karaj river dam (completed 1962), near Teheran. In addition to irrigation, it provides part of the city's water supply and electric power



A carved doorway of the 100-column hall at Persepolis, capital of ancient Persis. In the background is tomb of Artaxerxes II

PHOTOGRAPHS, (TOP) JOE COVELLO FROM BLACK STAR, (CENTRE) INGE MORATH—MAGNUM, (BOTTOM LEFT) AUTHENTICATED NEWS, (BOTTOM RIGHT) FRANCES MORTIMER FROM RAPHO GUILLUMETTE

IRAN

Washing Persian carpets at Ab 'Ali, just outside Ray, a little town near Teheran

Turkmens threshing wheat by the old, slow method of trampling it under hoof

A hand water pump used by people of a small village near Gorgan in northeastern Iran

PEOPLE OF IRAN

Oil pipelines crossing the hilly country of Khuzistan in the Agha Jari area

The schoolmaster of a small Iranian tobacco village teaches the children how to read and write

PHOTOGRAPHS, (TOP LEFT) INGE MORATH—MAGNUM, (BOTTOM LEFT) IRANIAN OIL OPERATING COMPANIES, (OTHERS) DAVIS PRATT FROM RAPHO GUILLUMETTE

or warm land), which suffer from fierce heat. Ahvaz in July and August has mean temperatures of 38° C. (100° F.) with maxima exceeding 49° C. (120° F.). The gulf ports are slightly cooler but most of the time are oppressively humid.

The transitional seasons are normally short. Autumn is especially agreeable on the plateau while spring is delayed, cool and wet in the northern and western uplands. In winter there is an inflow of cold, dry air from central Asia through the gaps of Khurasan. Other sources of intensely cold air are the northwestern plateaus. Azerbaijan is probably the coldest province (the January mean temperature at Tabriz, 4,600 ft., is 29° F., with a minimum well below 0° F.). Frost, often severe, is experienced everywhere except in the *garmsir*, up to 4,000 ft.

In winter wandering depressions bring in mild and humid air from the Mediterranean eastward over Iran, and the clash of the air masses causes heavy snowfalls in the north and west and rainstorms in the south. Precipitation in the south is strictly limited to the winter while in the northern and western uplands rain falls until April and even May. These are the regions where cultivation is feasible upon rainfall alone. They usually receive over 12 in. whereas the higher parts of the Zagros receive 20–30 in. The Caspian slopes of the Elburz have an annual rainfall of more than 40 in., the Khurasan ranges barely 20 in. The lowest of the arid interior basins, the Great Kavir, Lut and Seistan, receive less than 4 in. Irregularity of rainfall through the years is extraordinary in most parts. It varies at Teheran from 4 in. to more than 20 in. and at Bushire (*q.v.*) from below 2 in. to more than 26 in. Permanent snow and glaciers can be found on the highest summits in the Elburz and Zagros mountains. Elsewhere the thaw begins in March or April, freeing the pastures for the annual migration of the pastoral tribes and filling the streams with water for irrigation.

4. Vegetation.—There are more than 10,000 known plant species in Iran of which a great number are endemic. Four main floristic regions can be discerned: two are natural forest areas, covering the northern and western façades of the upland; the other two are more or less open steppe and desert. All the natural vegetation types have suffered destruction from use and misuse by man and his flocks through the ages, and it is difficult to determine the true natural conditions.

The Hyrcanian forest on the Caspian coast, where rainfall is abundant, is almost tropical in appearance with its tall, creeper-covered, deciduous trees. It contains several relics of the Late Tertiary European forest including Caucasian wingnut (*Pterocarya fraxinifolia*) and Caspian honey locust (*Gleditsia caspica*). The northern slopes of the Elburz are clothed in forests in which oriental beech, oak, hornbeam, maple, ash and elm predominate; the conifers are represented only by the yew. The remains of a dry forest cover the outer slopes of the Zagros ranges. It is made up of oak, maple (two endemics are *Quercus brantii* or *Quercus persica* and *Acer cinerascens*) and a variety of other trees. There are many Mediterranean intrusions below 6,000 ft. This forest reaches from the Turkish frontier southeastward to Shiraz and farther, but is not found on the western foothills.

The interior plateau and mountain ranges belong to the Irano-Turanian type of vegetation. The steppe, dense where the rains are adequate, contains mainly low shrubs with herbs like *Salvia*, the composite *Cousinia*, giant fennel (*Ferula*). Spiky cushions of *Astragalus* and prickly thrift (*Acantholimon*) dominate above 8,000 ft. Wormwood (*Artemisia*) is widespread at lower altitudes. It gives way to camel's thorn (*Alhagi camelorum*) in the semideserts where also tamarisk replaces poplar and willow along the river beds. Halophytes occupy the salty districts, saxaul the sands. The southern slopes of the Elburz and the Khurasan ranges were once covered with sparse forests of juniper and even in the true desert were loose stands of wild pistachio, almond and other bushes. Thin forests of these shrubs with maple and juniper covered the interior slopes of the Zagros and the higher ranges of Laristan and Kerman.

In the southern *garmsir* Saharo-Sindian elements intrude and even characterize the steppe or semidesert vegetation. There are thin stands of konar (*Zizyphus spina-christi*), kahur (*Prosopis spicigera*) and acacia trees. A dwarf palm exists in Baluchistan. But most characteristic of this region is the date palm which is cultivated in every oasis.

5. Animal Life.—Detailed knowledge of the animal life in Iran is incomplete. The position of the country at the crossroads of three continents (plus the Indian subcontinent) led to the immigration of many species. However, endemism is pronounced. There are more than 100 species of mammals known, of which about 18% are endemic. The lion (the national emblem of modern Iran) is now extinct. A few tigers may exist in the Caspian forests, while panther and wildcats are fairly common. Cheetahs, jackals, wolves, foxes, hyenas, brown bears and wild boars are widely distributed, as are a great number of rodents. Jerboa, mongoose, Persian squirrel and Indian crested porcupine occur in suitable localities. Wild sheep (mouflon) and ibex are still common on mountain ranges, while the Persian gazelle roams the steppe and the wild ass the desert.

In addition to a large number of resident birds, including many European species, others visit Iran to breed or to winter. More than 320 species are known in the Caspian lowland. Game birds are numerous including partridge, sand grouse and snipe. Many varieties of duck visit Iran in winter; swans and geese are found on the Caspian coast and in Seistan. Large numbers of pelicans and flamingos breed on the southern lakes and on the shores of the Persian gulf. Various types of owl are found and also falcons, buzzards and kestrels; eagles are fairly common.

Most of the rivers are too variable in flow to contain a wide variety of fish. The chub, barbel, trout and catfish are found in the Elburz rivers. The Caspian sturgeon and salmon are of special importance. Various carp live in the rivers of the south. The waters of the gulf and of the Makran coast contain a great variety of fish. Among the amphibia, the Greek tortoise is common except at high altitudes. The agamids are the commonest lizards. the waran reaching more than three feet in length. Snakes and vipers (many poisonous) are also common.

II. GEOGRAPHICAL REGIONS

The obvious division of the country is into plateau and bordering mountain ranges in the north and south. Azerbaijan, the eastern borderlands and the Khuzistan plain form separate units.

Azerbaijan.—This is an area of faulted blocks and basins, largely drained toward the shallow and salty lake of Urmia while the remainder is drained by the Aras, Little Zab, and Qezel Owzan. Geographically the region forms a transition between eastern Anatolia, Transcaucasia and the Persian interior, and has served as a crossroads and battlefield throughout history. Great volcanic cones, *e.g.*, Kuhha-ye Sabalan, 15,000 ft., are a distinctive feature and are associated with the fault system. The winters are bitterly cold and snowy, the summers hot and almost arid. The plateaus afford good grazing, a fact that attracted the Mongols and still supports nomadism (Kurdish and Shahsevan tribes). The plains round Lake Urmia are well irrigated and densely populated. Tabriz, 35 mi. from the marshy shores of Urmia, is a great market and route centre, and the second city of Iran. (*See* also AZERBAIJAN.)

Zagros Mountains.—These are of the Jurassic type; *i.e.*, numerous parallel ranges and valleys corresponding closely to the underlying fold structure. They form a belt 875 mi. long from the borders of Azerbaijan to northeast of Bandar Abbas and up to 200 mi. wide. The ranges, of moderate elevation in the north, are tightly packed and lofty (14,000 ft.) in the central section between the Dez valley and northwest of Shiraz, spread out again in southern Fars and Luristan. Heavy winter snows and many springs maintain perennial streams. These issue through *tangs* (narrow defiles) to the western lowlands. Together with the steep ascents, these gorges make routes extremely difficult. In spite of signs of formerly more intense settlement and cultivation in many valleys, the country is now almost exclusively pastoral with seasonal migration between lowland and upland. The chief population centres are on the few old-established cross routes; *e.g.*, the Kermanshah route between Baghdad and Teheran and the Shiraz route from Bushire. There is a modern road through Khorramabad, while the

Trans-Iranian railway uses the Dez gorge. Oil occurs in the shallow anticlines along the southwestern foothills, the reservoir rock being the Asmari limestone which is capped by the thick beds of the Fars series, both of Miocene age. There are seven producing fields between Lali (on the Karun) and Gach Saran. A lesser field is exploited at Naft-e Shah, west of Kermanshah.

Makran.—This is a coastal plain and extended hill-land with a north–south strike east of Bandar Abbas which soon turns eastward into southwestern Pakistan. The region is extremely arid and vegetation is scanty. Erosion is heavy in the hills, caused by occasional rainstorms in winter, which also flood the coastal plain, the main area of cultivation. Fish has been a main resource on the coast since ancient times. Dried, it is exported or used as local food for both man and beast. Some of the interior valleys grow dates. (*See* also MAKRAN.)

Northern Border Ranges.—These comprise two distinct sections: the Elburz mountains (*q.v.*) and the border ranges of Khurasan. The Elburz mountains stretch in a great arc around the southern shores of the Caspian sea. Many peaks exceed 13,000 ft.; some bear glaciers (Takht-e Soleyman, Alam Kuh and Mt. Demavend). The slope to the Caspian is very steep with many torrential streams flowing in deep gorges. The southern and drier side has steep scarps overlooking immense gravel fans. Where deposits are fine enough to be irrigated they prove very fertile.

The Caspian plain, nowhere more than 25 mi. wide and generally less, dried out only in postglacial times. From a marshy lagoon coast it rises gently up to alluvial fans. The originally dense forest has largely been cleared or ruined into impenetrable bush, formed of christ's-thorn (*Zizyphus spina-christi*), pomegranate and other species. The warm and humid climate is favourable for a wide range of crops including rice, tobacco, cotton, citrus fruits and tea. It is one of the most densely populated regions of Iran.

The Elburz range declines in height to the east and finally, at 56° E., turns in a southeasterly direction. There the Khurasan ranges begin, the Kuh-e Aladagh and Kuh-e Binalud (11,200 ft.) and, north of the Atrak gorge, the Koppeh Dagh (10,000 ft.). The wide valley in between is drained to the west by the Atrak, to the east by the Kashaf Rud. The uplands, formerly clad in juniper forest, offer fair grazing grounds, while the valley is richly cultivated, especially near Meshed (Mashhad), which is often called one of the granaries of Iran. Besides being a city of pilgrimage, it stands at the Khurasan gap which witnessed more than one invasion from central Asia.

Central Plateau.—This is far from being the flat, featureless country so often pictured. It is crossed by a great number of ranges which, structurally, resemble the marginal folds. In their topographic appearance they betray the peculiar processes of arid land formation. Conventionally a long, quasicontinuous chain of various ranges which runs from west of Qom past Yazd and Kerman into the Sarhad-e Bala is called the Central Iranian range. There are other ranges of considerable length; *e.g.*, the Tabbas-Kerman and the Kuhistan-Sarhad ranges which merge into the Baluchistan folds. The valleys between the ridges have wide sloping sides which are largely gravel-covered pediments (*dasht*). The depressions are filled with silty colluvial masses, drenched in the wet period but, according to their salinity, covered by salt crusts when dry (*kavir*). The conception of great pluvial lakes, later dried up, is not supported by the facts. The Great Kavir, according to modern investigations, consists of a group of depressions separated by erosion surfaces which cap structures of the salt-bearing Upper Red formation. In the large depression of the southern Lut (*lut* = naked, bare of vegetation) wind erosion and deposition are the dominant processes. Within this area is a large massif of sand dunes (*rig*).

The largest oases are found in the northwest, on the inner slopes of the border ranges, and are fed by permanent streams; *e.g.*, Teheran, Kazvin, Qom, Mahallat, Isfahan, Nishapur (Neyshabur). Other smaller and dispersed oases depend for their water on subterranean galleries tapping underground sources of fresh water.

Eastern Borderland.—The eastern frontier of Iran cuts right through the grain of the country. In the north it follows the gorges of the lower Hari Rud, in the centre it crosses the great Seistan depression and in the south it traverses the Baluchistan ridges. The border country is a barren, almost uninhabited region, with an extremely low rainfall, extreme temperatures and violent winds. From the beginning of June the "wind of 120 days" blows with unceasing force from the north, excavating the ground and building up dunes. The lowest part of the Seistan basin is occupied by a fresh water lake, Hamun-e Saberi, which is fed by the Helmand and other Afghan rivers. Seistan was a centre of early Iranian civilization, but repeated destructive invasions and frontier quarrels have ruined it.

Khuzistan Plain.—In this plain the shallow anticlines of the Zagros foreland gradually die out and the extended gravel fans of the Karkheh, Dez, Karun and Zohreh rivers merge into the tidal flats at the head of the Persian gulf (*q.v.*). Rainfall diminishes in the same direction and steppe changes into semidesert, but irrigation water is plentiful and was used in early times. The Tigris swamps have always formed an effective barrier to the west, so this corner was the cradle of ancient Elam (*q.v.*) and played an important role within the Persian empires and early Islam. Decay set in later, but new development came with the oil industry and today Khuzistan is one of the most important provinces of Iran.

(H. Bo.)

III. THE PEOPLE

1. Racial Divisions.—When the name "Iran" was officially adopted for the country known for centuries as Persia, the intention of the shah was to stress the Indo-European origin of the inhabitants whose forebears had entered it from the central Asian steppes in the 2nd millennium B.C. But the people who are generally known as Persians are of mixed ancestry, and the country has important Turkish and Arab elements in addition to Balochis, Kurds (*qq.v.*), Lurs, and minority communities of Armenians, Assyrians (Nestorian Christians), Georgians, Dravidian Brahuis and Afghan Hazaras of Mongolian origin.

Kurdish nationalism (embracing the Kurds of Turkey, Iraq, Syria and Persia) received some encouragement from the British after World War I and, persisting as an intellectual movement, later flared up in local revolt in Persia as elsewhere; the separatist tendencies of the Turkic people of the Azerbaijan province received Soviet encouragement to rebel in 1945–46; and signs of hostility toward the Iranian government have been shown by the Arabs of Khuzistan. But, generally speaking, there is little racial animosity and considered as expressions of racial consciousness such outbreaks have usually been somewhat artificial. The great preponderance of Shi'ah Islam and the way of life prescribed by it form unifying factors transcending racial differences and the differences between tribesman, peasant and townsman and between six estates—*ulama* (the learned and religious leaders), nobles, landowners, merchants, citizens and peasants—into which Persian society was traditionally divided. The religious minorities —Christian, Jewish and Zoroastrian—are too small to create a problem, but discrimination against them is not unknown. The Kurdish tribes living on the northwestern borders from Reza'iyeh in the north to the plains of Kermanshah are nomadic and, until such movement was forbidden by Reza Shah Pahlavi, some crossed into Iraq on their annual migration after the melting of the snows in search of fresh grazing for their flocks. The organization demanded by these moves has kept alive the tribal system under the chiefs (agas), but mountain conditions have led to the breakup of the larger tribal units and there is little cohesion within the groups. Among the settled Kurds the tribal system remains, but the authority of the agas is less than among the nomads. The Lurs of the Pish Kuh and Posht Kuh ranges on the western frontier south of Kermanshah were almost independent of the government under their own valis (viceroys), until Reza Shah brought them under control and deported some sections to Khurasan. Their life resembles that of their northern Kurdish neighbours.

The Bakhtiari (*q.v.*), a large tribe of the southern Zagros, are akin to the Lurs; their main divisions are the Haft Lang, mainly nomadic, and the Chahar Lang, mainly sedentary. The name "Bakhtiari" is properly confined to the ruling families and their retainers. The leaders are among the most advanced tribal chiefs

of Iran; in 1906 they took a leading part in the revolution which led to the granting of a constitution. They show a keen business sense and for many years they were customarily educated in Europe, and their daughters received at least an elementary education. The women among the Kurds, Lurs and Bakhtiaris had in the past more freedom than did the women in the smaller towns and villages. They did not wear the veil and were not secluded from male company. In Kurdistan there is a tradition of matriarchy, and tribes have been successfully ruled by women. The Kashgai, a large tribe of Turkic origin, are neighbours of the Bakhtiari, with summer quarters extending over the highlands between Shiraz and Isfahan. In winter their flocks are found in the lowlands northwest and east of Shiraz. Reza Shah attempted to subjugate the Kashgai but they soon reasserted themselves after his abdication. A revolt of the tribe in 1946, when the leaders demanded autonomy on the pattern of that which the Azerbaijanis were expecting, was quelled, but the tribe remains an important political force.

The southern region of Khuzistan (or Arabistan) is more akin to the delta lands of southern Iraq both in physical geography and in population. Some Lurs visit the northern fringes for winter pasture but the majority of the population is Arabic speaking and tribal, whether sedentary or nomadic. The principal tribes are the Al Kathir and the Bani Lam, who have a large branch in eastern Iraq, on the Tigris north of 'Amarah. The sedentary and seminomadic tribesmen rear horned cattle and cultivate cereals or rice. Some also keep sheep or camels and own or work in date gardens.

In Khurasan bordering on the U.S.S.R. are the Turkmen tribes and some Kurdish and Balochi tribes. There are few nomads since conditions are favourable for agriculture, and the tribal structure, though persisting, is gradually being replaced by the village community. Throughout the country there are smaller tribal groups of varying racial origin, owing their present location to voluntary migration or to expulsion from an earlier home. They thus present a picture as confused as that of the detribalized elements of various racial origins among whom homogeneous blocks are even more rarely to be found. An exception is the Turkic community of Azerbaijan which has been settled for many centuries in more or less compact groups in the towns and villages of the province.

Whatever may have been the original population of Persia before the coming of the Aryan invaders, it was absorbed by them and by subsequent waves of conquering tribes whose blood has been mixed with that of the people of the plateau to a much greater extent than with that of the mountain tribes. Thus, among the Persian-speaking people there persists a widespread physical type on the border of the medium- and longheaded classifications for which the term "Iranian" has been reserved by some writers. Distinct from them are the shortheaded Kurds, Lurs, Bakhtiaris, Turki, Balochis and the people found in southern Fars and Makran who speak a language with Dravidian traces.

2. Language.—The languages of Iran are: Persian, Kurdish, Luri, Balochi and Arabic.

Persian (Farsi) is an Indo-European language based upon the Old and Middle Persian tongues which were introduced by invaders from the central Asian steppes east of the Caspian. After the conversion of Persia to Islam many Arabic words were introduced and a modified form of the Arabic script was adopted and is still used. In the written language some Arabic constructions also were adopted. There has been a tendency (as in Turkey) to expel Arabic words and forms, but devotion to the early literature, which contains them, hampers such efforts at persianization. Dialects are spoken in certain parts of the country.

Kurdish is a language distinct from Persian although belonging to the Indo-European group. The principal dialects are Gorani and that spoken by the Mukri Kurds of the northeastern district.

Luri, the language of Luristan, of the Bakhtiari and of some other tribes, has affinities with Old Persian.

Turkic.—The Azeri dialect of Turkish spoken in Azerbaijan is grammatically close to Anatolian Turkish but the pronunciation is broader. It has more Persian and fewer Arabic words than the Turkish of Anatolia. Turkic as spoken by the Turkmen of Khurasan is closer to eastern Turkish than to the Azeri dialect.

Balochi or *Baluchi* is an Aryan language mixed with modern Persian (*see* BALOCHI LANGUAGE).

Arabic is spoken by the Arab tribes of Khuzistan and along the coast of the gulf and of Makran, and by some sections of the Khamseh tribes of Fars. (*See* also IRANIAN LANGUAGES; PERSIAN LITERATURE.)

3. Religion.—The state religion is Shi'ah Islam (*see* SHI'ISM) of the Ithna 'Ashariya sect which recognizes 12 hereditary imams. There is also a Sunni minority. The Zoroastrians (*gabrs*) are relics of the followers of Zoroaster (*see* GABAR; ZOROASTRIANISM), whose doctrine was founded upon the ancient Mithraic faith; the majority of those who refused to accept Islam in the 7th century A.D. fled to India, where they formed the Parsee community. Jews have been in Persia since the Babylonian captivity. The Christian churches are represented by Nestorians (Assyrians), Armenians (Gregorians and Catholics) and Protestants and Catholics who are Europeans or else converted Assyrians or Armenians.

Muslims.—The Shi'ahs were, in the past, strongly influenced by the mujtahids (doctors of theological law), whose edicts affected political and other secular affairs until the 1906 revolution marked the beginning of a decline in their power. Reza Shah did much during his reign to break their authority, which was founded on the superstitious awe of the ignorant rather than on profound religious belief. Sunnis (2,000,000 approximately) are found in scattered groups in various parts of Iran. The compact communities are the Kurds, the Balochis and the Turkmen (Turkomans).

There are also some dissident sects: Sufis, the mystics whose teaching dates back to Abbasid times; the Isma'ilis, who originated in a schism after the death of the sixth imam (*c.* A.D. 797) and afterward created the society of the Assassins (*q.v.*) and who were the direct forebears of the modern Isma'ilis whose head is the Aga Khan; the Ali Ilahis, an extreme sect found among the Kurdish tribes; and the Baha'is, who, in spite of the repression of 1850, still exist in Iran and have played an influential part in the reform movements. The numbers of these sects are small and no reliable statistics are available.

Zoroastrians are a small community (15,000) living principally in and around Yazd and Kerman. They are both urban and country people, successful as traders and famed as gardeners.

Jews.—In spite of legal equality, the Jews are generally barred from important administrative positions, though some have deserted the traditional business of moneylending and trade and have become doctors. Small Jewish communities are to be found in most towns. Some have left Iran for Israel and the total number in Iran in 1960 was about 60,000.

Christians.—The Armenians number about 50,000 and are both rural and urban. Peasants are most numerous in Azerbaijan and the largest town communities are found in Tabriz, Teheran and Isfahan, where the suburb of Jolfa is almost exclusively Armenian. There are also some other very small groups of Christians. The Assyrians are Nestorians (*q.v.*) or Uniate Catholics (20,000) known as Chaldeans. Most of them live in the Urmia region of the northwest and are peasants, small traders, mechanics and motor drivers.

Catholic missionary work, begun early in the 17th century by the Carmelites, was suspended about 1780 but renewed in 1850 when the Lazarists opened a mission in Tabriz. Protestant activity dates from 1811. In 1829 a U.S. mission was established at Reza'iyeh and later taken over by the Presbyterians, who founded missions in Teheran, Tabriz, Hamadan and Rasht. The Church Missionary society began work at Isfahan in 1869. Until the time of Reza Shah, mission schools were tolerated, but the teaching of religion in all schools was forbidden in 1928 and the mission schools were absorbed into the state system. The hospital system was introduced to Persia by missionaries in the 1830s and hospitals, welfare centres and dispensaries continue to do most valuable work. Purely missionary activities meet with almost insuperable difficulties in Iran as in all Muslim countries.

4. Customs and Culture.—Iran is dominated by an agricultural society and the conduct, customs and moral outlook of all

classes, rural and urban, are greatly influenced by the way of life of the farmer, peasant and landlord. A notable feature of Iranian society is its fluidity, and though there are recognized classes transition from one to another is easy for there is no caste system. The individuality of the Iranian is a trait which perhaps partially explains the age-old reputation for tolerance of divergent customs, cultures and religious beliefs. The mullahs (priests) exercise such influence as they have in religious matters and in their guidance of public opinion.

The townsmen and villagers as a rule lead a fairly easy life and this has resulted in the development of a strong artistic taste, an appreciation of beauty and a keen sense of humour. With few exceptions the towns are commercial rather than industrial and have a large class of shopkeepers, craftsmen and traders, grouped by their common occupations and guilds. The peasants and tribesmen live in adobe houses or tents according to the climate of their district and their way of life.

Up to 1930 the position of women was on the whole better in the tribes than in the settled communities where they were entirely dominated by the men and their status suffered from polygamy and easy divorce. Much was done under Reza Shah to destroy old traditions by permitting women to discard the veil and seek employment. They enjoy equal legal standing with men, and in larger cities they engage in professional occupations. Women were given the right to vote early in 1963.

5. Population.—In Nov. 1956 the first nationwide census of population was conducted. From this census Iran was found to have a population of 18,954,704, of which 5,449,391 lived in towns of 5,000 inhabitants or more and the remaining 71% in 40,000 villages. A large proportion of the population is found in the area around Teheran. Other areas of dense population are the southern shores of the Caspian sea, the eastern half of Azerbaijan and the higher parts of Khurasan. Generally speaking, rainfall and elevation are two main geographical factors determining the distribution of population. In 1956 Teheran (*q.v.*) had more than 1,500,000 persons, but by 1959 it was estimated that the population had risen to 2,000,000. Other major centres with populations exceeding 100,000 are: Tabriz, Isfahan, Meshed, Abadan, Shiraz, Kermanshah, Ahvaz, Hamadan (*qq.v.*) and Rasht. Six cities have populations ranging from 50,000 to 100,000: Arak, Ardabil, Dezful, Kazvin (*qq.v.*), Yazd and Qom. There are 21 urban centres of 25,000 to 50,000 inhabitants and 50 smaller townships with 5,000 to 25,000 inhabitants. In 1961 the population of Iran was estimated to be 21,349,684. (M. H. GA.)

IV. ARCHAEOLOGY

A. Pre-Achaemenid Period

The physical geography of Iran did not encourage the early formation of political and economic unity. The central desert is uninhabitable and a barrier to communications, and life could develop only where there was water: in the mountain valleys, in the land between mountain and desert and in the outer plains of the Caspian and Khuzistan, ancient Susiana. Furthermore, Iran possesses adequate agricultural and mineral resources so that stimuli for the organization of an industrial and commercial economy were lacking. These conditions led in the prehistoric period to a great variety of local cultures and, except in Susiana which geographically is part of the Mesopotamian alluvial plain, delayed the growth of urban life; most of Iran remained illiterate until the 1st millennium B.C. The relative chronology of the early cultures depends for the most part on a limited number of stratified sites in the north and west and on correlations with the well-established sequence of Mesopotamia.

Paleolithic remains are known from cave excavations and surface finds, the earliest being a hand ax of Acheulian type. Industries found near Kermanshah closely resemble the Mousterian, Baradostian and Zarzian of Iraqi Kurdistan. The transition from food collecting to farming and settled life formed part of developments that began in the foothills of the mountain ranges between the Mediterranean and Turkistan, a zone in which prototypes of domesticated animals and cultivated plants existed in a wild state. A phase of incipient cultivation is attested at Tepe Asiab near Kermanshah, the earliest open-air settlement, which, though lacking architecture and pottery, produced blades with sickle sheen, ground stone ornaments and figurines (*c.* 10,000–7000 B.C.). A more advanced community, possessing both plain and painted pottery, occupied Tepe Sarab in the same area (*c.* 7000–6000 B.C.). Its assemblage is in part reminiscent of the upper levels of Jarmo in northeastern Iraq.

During the 6th and 5th millenniums village farming communities became well established (Sialk I–II, Chashmah Ali, Anau IA, Susiana tepes, sites in the Marv Dasht and Solduz plains). Hoes and sickle blades attest the practice of agriculture, and the goat at least was domesticated. Permanent dwellings were constructed, at first of mud but later of hand-shaped, sun-dried mud brick. Hammered copper tools make their first appearance (Sialk I, 3) and increase in number. Pottery shows greater refinement and variety in form and finish, painted wares having geometrical and representational designs. Whereas in the south and west the fabric was buff coloured, in the north and northwest it was predominantly red. On typological grounds these early settlements are comparable with those of the Hassuna and Tell Halaf periods in Mesopotamia, but evidence of connections between Iran and the west is slight, except in Susiana where the material culture had close affinities with that of Qal'at Hajj Mohammed in southern Iraq.

Further technical advances were made in the 4th millennium, notably the potter's wheel, molded brick, the casting of copper for tools and weapons and, at Susa, the invention of the semipictographic "proto-Elamite" script. Since this first appears on clay tablets in a level (Susa C) contemporary with the Protoliterate period of Sumer (late 4th millennium), the idea of writing may have been borrowed from the west. At this period Sumerian influence on the art of Susa is marked, particularly in glyptic. It was further strengthened in the 3rd millennium when Sumer developed close political and commercial relations with Elam (*q.v.*), the district of which Susa was a chief city. When in the second half of the millennium Elam fell under the domination of the Akkadian and 3rd Ur dynasties, Sumerian ritual practices, art and literature profoundly and permanently affected the native culture. The kings of Akkad and Ur built temples and made offerings to the gods of Susa, and the Akkadian language and script for a time largely supplanted proto-Elamite. At Kurangun and Naksh-e Rostam in Fars, rock carvings of a divine couple with worshipers also show Sumerian influence. Near Sarpol, in the ancient territory of the Lullubi, three rock reliefs of local rulers have Akkadian inscriptions which invoke Akkadian deities and in subject and treatment are close to the rock carving of Naramsin of Agade in the Darband-e Gawr pass (south of the Shehrizor) and to his victory stela. The best preserved is that of Annubanini, who is shown armed with bow and harpé trampling on a prostrate foe. The goddess Ishtar, represented according to Mesopotamian conventions, leads two bound and naked prisoners toward the king, and further prisoners appear in a lower register.

In northern Iran a culture characterized by burnished gray pottery with metallic shapes appeared early in the 3rd millennium and persisted into the 2nd (Hissar II–III, Turang Tepe, Shah Tepe, Asterabad treasure). In its later phase there was a great increase in wealth, probably due to trade along the route linking the Tigris and Oxus. Gold and silver were abundant and imports included Baltic amber and ivory, possibly from India.

Early in the 2nd millennium the replacement in the west of buff by red painted ware with new shapes, including the tripod (Giyan III), is connected by some authorities with the arrival of the Indo-Iranians, who imposed themselves as a ruling class in the native Kassite tribes. Subsequently the pottery, metalwork and iconography of western Iran show connections with the Amorite and Hurrian civilizations of north Mesopotamia (Giyan II–I, Hasanlu). In Elam the national revival of the 13th–12th century led to the most brilliant period in the history of its art. Its kings carried out extensive building work at Susa and other cities, notably at Dur-Untashi (modern Choga Zambil), southeast of Susa, which was founded by Untash-Huban in the 13th century and destroyed by the Assyrians about 640 B.C. An imposing ziggurat, numerous temples and a palace provide important evidence of cult

practices and funerary ritual and testify to the advanced technical skill of architects and craftsmen. The arts reached a high degree of perfection, particularly that of metalworking, as is shown by the magnificent bronze statue of Napirasu, the wife of Untash-Huban, from Susa. The importance of Iran as a centre of metalworking in the ancient near east is evident from the so-called Lorestan (Luristan) bronzes, obtained by the clandestine digging of tombs. They include weapons, horse trappings, jewelry and votive objects. The earliest are of the 3rd and early 2nd millenniums and show strong Sumerian influence. The majority, however, belong to the latter part of the 2nd millennium. The decorative themes are still largely inspired by Babylonia, but a distinctive style develops and the popularity of ornamental horse trappings expresses the interests of a population particularly concerned with horse breeding.

Between the 9th and 7th centuries western and northwestern Iran fell under the political domination of the powerful states of Assyria and Urartu and was also invaded by nomadic horse-riding tribes from the north, notably the Indo-Iranian Medes and Persians, first recorded in the 9th century, and the Scythians, who appear in the 7th century. These events find their reflection in Iranian art and architecture. At Hasanlu in the Solduz plain, the ancient district of Manna, a strong citadel and outer town were built in the 9th century, a period of Assyrian control. The basic culture was Iranian, with Hurrian elements, the characteristic pottery being the grayware of central Iran. A number of objects, however, are Assyrian in type, and the plan of two important buildings somewhat resembles that of contemporary north Syrian palaces (the *bit-hilani*).

At about the same time there is archaeological evidence of the arrival in central Iran of a new people, perhaps the Indo-Iranians (Sialk VI and cemetery B). They introduced new funerary customs and pottery, including a buffware elaborately painted with geometric and animal designs. A hoard found at Ziwiye, probably the ancient town of Izibie in Manna, contained objects of gold, ivory and bronze, some of which were local provincial work of Manna, while others were Assyrian, Urartian and Scythian. Judging from Assyrian sculptures, the fortified towns of Parsua and Media were similar to those of Urartu, where citadels were sited on natural hills and defended by walls of cyclopean masonry. Sargon II's relief of the temple of Musasir, west of Manna, shows a gabled building with a columned portico guarded by human and animal colossi. His detailed description of the rich loot taken from the temple proves that this district of Iran shared Urartian culture and religion. A number of rock tombs found in Media and Manna may have belonged to local rulers of the 9th to 6th century. The façade imitates a flat-roofed house with columned porch, the prototype of which was a wooden dwelling of a type still found in the area. A low door leads to one or more funerary chambers hewn in the rock.

In Elam the three centuries that followed the collapse of political power at the end of the 12th century are a dark period. A few objects from Susa and rock reliefs at Malamir show that there was a revival of art between the 9th and 7th centuries but there too Assyrian influence is evident.

B. Achaemenid Period

When the Persian and Median tribes first entered Iran their art was presumably that of a nomadic or seminomadic people—ornamental horse trappings, weapons, jewelry, leatherwork and the like—and they can have had little if any knowledge of architecture. In the course of their migration and eventual settlement, a process which in the case of the Persians lasted three centuries, they assimilated the civilization of western Iran, which, as has been shown, was strongly influenced by Assyria and Urartu. Nothing is known of the monuments of the short-lived Median empire, but this inheritance is manifest in those of the Achaemenids. With the foundation and expansion of the empire, Persian art became more cosmopolitan. As is graphically described in a foundation tablet from Susa, Darius I drew skilled craftsmen from all quarters of the empire for the task of building and equipping capital cities that would be worthy centres of imperial administration. Achaemenid art was thus not a new creation but the continuation of older traditions, Iranian, Mesopotamian, Urartian and, to a lesser degree, Egyptian and Greek. The Persian genius, however, integrated these diverse elements into a harmonious whole and in a remarkably short space of time evolved an imperial art, distinct from anything known earlier and in spirit essentially Persian. (*See* Persian Art.)

Architecture.—The period of Persian settlement in Parsumash under Achaemenes and Teispes may be represented by terraced structures of cyclopean masonry at Masjed Soleyman and Bard-e Nishundah. Their construction resembles that of the citadels at Pasargadae and Persepolis but the inferior workmanship suggests an earlier date. The principal sites of the imperial period are Pasargadae, built by Cyrus II between 559 and 550; Persepolis, the spring capital, work on which was begun by Darius I about 520 and continued by Xerxes and later kings; and Susa, the winter residence and administrative centre of the empire. Ecbatana, the summer residence, is unexcavated since it lies under modern Hamadan, but there is evidence of building by Darius I and Artaxerxes II.

At Pasargadae, Achaemenid architecture was still at an experimental stage. It reached its final form at Persepolis under Darius and Xerxes and thereafter remained static. In both cases, the choice of site was determined by the requirements of defense. As in Urartu, the citadel was placed on a natural spur of rock backed by a steep slope, the rock was leveled in terraces and was enclosed by a fortification wall of finely dressed limestone blocks, unmortared but joined by iron clamps. At Persepolis there is only one entrance approached by a double flight of steps. The fortifications continue up the hill at the back, and below the platform are an intervallum and wall enclosing a town area. On the platform, which varies in height from 8 to 18 m. (26–59 ft.) and is 135,000 sq.m. (161,459 sq.yd.) in area, stand public buildings (the Apadana, or audience hall, council hall, throne hall), the treasury and other administrative buildings, residential palaces and an extensive harem, all linked by courts and passages. More palaces lie in the town area. The Pasargadae platform is much smaller (6,000 sq.m.). It was originally designed as a palace enclosure but before its completion the capital moved to Persepolis and instead it was used for magazines and residential quarters. On the plain beneath are an audience hall, residential palace and gatehouse. They are widely spaced and originally stood in an irrigated garden surrounded by a wall. About one kilometre (.6 mi.) to the west is a sacred precinct with two stone fire altars and a terraced mound of uncertain function.

The basic unit of the Achaemenid palace is a hypostyle hall with a columned portico, the prototype of which was a wooden dwelling of the type depicted on the earlier rock tombs of Media and Manna. To this further porticoes and secondary rooms might be added according to the function of the building. A hypostyle hall without portico was used for the gatehouses and at Persepolis for subsidiary units of the treasury and harem. The plan of the treasury is unusual in that it has two interior courts. At Pasargadae the hypostyle halls vary in proportion from almost square to approximately 3:1, but at Persepolis they are usually square. The buildings were normally single-storied with a flat roof constructed of beams overlaid with mud. Interior lighting was obtained through doors and windows, but as these faced onto porticoes or corridors they admitted little illumination. Use of clerestory lighting is assumed, but evidence for it is found only in the audience hall at Pasargadae where the columns of the hall are higher than those of the porticoes. Unbaked mud brick was used for the superstructure and limestone for wall foundations, except in the treasury, harem and certain minor buildings at Persepolis. Limestone was also used for door and window frames, niches, antae and columns. In some buildings, however, column shafts were of timber encased in painted plaster. At Pasargadae the stone shaft was smooth and the torus either smooth or horizontally fluted in a manner which recalls archaic Ionic column bases. The stone impost block was composed of addorsed protomas of animals or mythical monsters.

At Persepolis the column became more elaborate. The shaft was

vertically fluted, an elaborate capital was interposed between shaft and impost block and, after Darius, the base was campaniform with plant ornamentation. In the time of Xerxes the number of columns was greatly increased, the throne hall and one of the treasury halls having a hundred. Another innovation at Persepolis was the cavetto cornice of doors derived from Egypt. A combination of black and white stone used effectively at Pasargadae for interior finish does not appear at Persepolis. Principal entrances were often flanked by bull colossi of Assyrian type, and sculptures in low relief adorned doors, some of the window frames and the parapets of stairs. The interior walls of the Persepolis Apadana were covered with glazed tiles having floral and animal designs, and the wooden door leaves had decorated gold plates.

At Susa the audience hall of Artaxerxes II is a hypostyle building similar to the Apadana at Persepolis, but the residential palace of Darius I is laid out on the Mesopotamian plan with three large interior courts off which open halls and living rooms. The monumental entrance and courts were decorated with molded and enameled brickwork. Four kilometres (2½ mi.) northwest of the palaces is a building of unusual type which may be a temple. It consists of a square columned chamber, surrounded by a passage and approached by a porch from which steps lead down to a courtyard enclosed by narrow chambers.

The Achaemenids built both rock and free-standing tombs. The earliest rock tomb is Da-u-Dukhtar, near Kurangun, which may belong to an early member of the dynasty. There are four at Naksh-e Rostam, near Persepolis, one of which is identified by an inscription as that of Darius I. The other three are uninscribed but are assumed to be the tombs of Xerxes I, Artaxerxes I and Darius II. Three more cut into the rock at the rear of the Persepolis platform presumably belonged to Artaxerxes II and III and Darius III. This type of tomb was directly derived from that found in Media and Manna, but there were new features. From the time of Darius, the exterior represented the façade of a royal palace with the characteristic columns and cavetto cornice; a narrow passage with niches for coffins replaced the funerary chamber; and the rock was cut back above the tomb façade to accommodate an elaborate relief. This depicts the king standing, bow in hand, before a fire altar with Ahura Mazda in the winged disk and the moon floating above. The king's dais and the altar rest on a throne, the crosspieces of which are supported by figures representing the subject peoples of the empire, a device known in Assyria. In contrast the tomb of Cyrus II at Pasargadae is free-standing. It is a reproduction in stone of a single-chambered wooden house with gabled roof and stands on a high stepped platform. There is a similar tomb, Gur-i-Dokhtar, south of Kazerun.

Two identical limestone towers, one at Naksh-e Rostam and the other at Pasargadae, are identified by some authorities as fire temples, by others as tombs. Each stands on a stepped platform and is approached by stairs, the total height being about 12 m. The interior contains a single chamber, without windows, which was hermetically sealed when the door was closed. The exterior reproduces a three-storied building with flat roof, dentil cornice, corner posts and simulated windows. This type of house is known from Urartian bronzes and depicted on 7th-century Assyrian sculptures of north Iranian towns.

Sculpture.—Achaemenid sculpture is represented by palace reliefs, the carvings on rock tombs, the monument of Darius I at Bisitun (*q.v.*) and a few free-standing statues. Relief sculpture, in which the Persian artist excelled, formed the principal decoration of the royal palaces at Pasargadae and Persepolis. It was an integral part of the architecture, which determined its position and dominated the principles of its composition. A combination of high relief and sculpture in the round was used for the bulls and winged bulls with human heads of the gatehouses and palace entrances, and for the animal protomas of columns. Low relief was applied to the inner surfaces of door jambs, window frames and the parapets of stairs. All the themes are associated with royalty and in many cases depict court ceremonies which took place at the spot where they were displayed. In the palace interiors at Persepolis the king is shown enthroned and accompanied by an attendant or the crown prince, giving audience, and entering or leaving the main hall. In the residential palaces his personal servants, carrying paraphernalia for the royal ablutions or provisions for the table, appear in the doors of small rooms and in the windows, and sentries stand on duty at the guard chambers. Another group of door-jamb sculptures depicts a king or hero in combat with a lion, bull or mythical monster. On the platform steps are guards and the people who passed up the steps on business: Persian and Median dignitaries ascending to the council chamber, servants carrying supplies to Darius' residence. The most ambitious composition of this type, nearly 300 ft. in length, is the representation of the Nauruz, or New Year festival, on the two stairs leading to the Apadana platform. Files of Median and Persian officials, royal guards and tribute bearers from 23 nations converge before the palace, and plant motifs and symbolic groups of lion and bull combat and the winged sun disk flanked by sphinxes are used decoratively as space fillers. The design is identical on both stairways, but the processions move in opposite directions with all the changes resulting from the different angle of vision. In scale and conception these Apadana reliefs are unparalleled in ancient western Asiatic art.

At Pasargadae low relief is found only on the door jambs and most of the sculptures are fragmentary. The king leaving the palace occurs in the private residence, but the other subjects are different from those of Persepolis. A four-winged figure with Elamite robe and Egyptian atef crown stands in the gatehouse and mythological beings such as a bull man and fish man, only the feet of which remain, in the audience hall.

In the representation of these themes certain set conventions were rigidly applied—for example, the division of a subject into horizontal registers, the rendering of figures in profile and their projection on a single plane, hierarchic scaling and isocephaly. Portraiture does not exist and little attempt is made to depict ethnic differences other than by costume. Details such as embroidery or metalwork are, however, carved with exquisite precision. The monotony of a repetitive and restricted repertory is further increased by the rendering of themes in pairs, usually as mirror images. Nevertheless the original effect of the sculptures was brilliant, for they were at least partially painted in vivid colours and in some cases the royal beard and jewelry were inlaid with metal and precious stones.

Achaemenid sculpture was ultimately derived from that of Assyria, perhaps through Media, although evidence is lacking. Its themes, artistic conventions and technique are all found in Assyrian art. The earlier tradition was, however, considerably modified, an important factor being the need to adapt it to a different style of architecture. In the mud-brick palaces of Assyria sculpture was applied to orthostats lining doors and the walls of interior courts, chambers and corridors. In Persia orthostat reliefs occur only in an interior court of the brick-built treasury. With this single exception, Achaemenid sculpture was confined to stone architectural members of restricted area, doors, windows and stairs. On such surfaces the great Assyrian pictorial narratives of battle and hunting were inappropriate and are totally absent. While the dominant influence on the development of Persian sculpture was incontestably Assyrian, the rendering of drapery and perhaps also the greater plasticity and definition of modeling as compared with Assyrian work may be attributed to the Ionian craftsmen employed by the Achaemenid kings in the construction of their cities.

The theme of the victory relief of Darius I carved on the rock at Bisitun continued an ancient tradition. The attitude of the king standing bow in hand with one foot on the prostrate Gaumata, the file of prisoners before him and the victory-giving deity, in this case Ahura Mazda, can be paralleled as early as the 24th century on the monuments of Naramsin of Agade and the rock carvings of the Lullubi kings (*see* above).

Minor Arts.—With the growth of a wealthy and luxury-loving court, the Iranian metalsmith found full scope for his traditional skill and produced jewelry, dress ornaments, weapons, tableware and decorative elements for furniture of unsurpassed quality and design. Gold and silver were used extensively and semiprecious stones, paste and glass were combined in multicoloured inlay.

Stylized animal motifs, and especially fantastic creatures of Mesopotamian inspiration, predominated. Rich jewelry was worn by both sexes, the most characteristic types being the torque and armlet, both of which are open hoops, often with terminals in the form of an animal's head or body. Gold bracteates and roundels were sewn onto garments, a practice known in western Asia from the 2nd millennium. The description given by Herodotus of the Persians in Xerxes' army can be no exaggeration: "They glittered all over with gold, vast quantities of which they wore about their persons." The tables of the rich were graced by superb rhyta, amphorae and drinking bowls, and weapons were elaborately ornamented with intricate designs. Achaemenid metalwork has been found in Persia, Mesopotamia, Asia Minor, Egypt, Cyprus and Russia. The majority of the pieces, however, have been obtained not from excavations but from dealers, so that their provenance is often unknown. One important group of goldwork, distributed among museums and private collections, is said to have come from Hamadan and to have been found in association with inscribed gold plaques of Arsames and Artaxerxes II. It presumably formed part of a royal treasure.

In glyptic art many of the subjects and the modeled style of cutting were inherited from Assyria and Babylonia, but Greek influence is apparent in the more spacious treatment of the background and in certain elements of the designs. It was particularly strong on the seals of Asia Minor, which were probably cut by Greek engravers. Subjects include scenes of battle, hunting and domestic life, combat between man and beast, and animals, both actual and imagined. Private persons normally used stamp seals, either conical or scaraboidal in shape, but the cylinder was retained for official purposes. (J. M. M.-R.)

V. ADMINISTRATION AND SOCIAL CONDITIONS

1. Constitution and Government.—Up to 1906 the shah was an absolute monarch in the ancient tradition. He delegated wide powers to a grand vizier but was himself absolute in legislative, executive and judicial functions. The mullahs exercised considerable temporal as well as spiritual power and played an important part in the events leading to the setting up of a national consultative assembly (*majlis*) by Muzaffar-ad-Din Shah in 1906 and the first grant of a formal constitution.

The fundamental laws of the constitution dealt point by point with the constitution, duties and functioning of the *majlis* and the conditions regulating the formation of the senate. A supplementary fundamental law was promulgated on Oct. 7, 1907, in which Islam, according to the Shi'ite Ja'fari doctrine, was prescribed as the official religion of Iran, which the shah must profess and foster. The *mujtahids* (doctors of theological law) are its guardians and a committee of no fewer than five "*mujtahids* or other devout theologians," properly elected, may veto any law which infringes Islamic ordinance. This power seems to have remained largely theoretical. The right of equality before the law, the guarantee of life, liberty, home and honour; the right to be tried in an appropriate tribunal; the liability only to penalties laid down by the laws; the right of property; the right to freedom of teaching; a free press; freedom of assembly and the secrecy of the post—all were set out at length. The powers of the state derived from the nation are defined as legislative, executive and judicial in such a way as to form a representative constitutional monarchy. The shah derives his power in trust from the people. These powers, like those of the *majlis*, are defined. The ministers are responsible to the *majlis* and the senate for all acts carried out in the name of the shah, and the shah's person is exempted from all responsibility. The appointment and dismissal of ministers is effected by royal decree and it has become the practice, when a new prime minister is required, for the *majlis* to meet and agree on a name for submission to the shah; the shah appoints the person named and the latter selects his ministers for the shah's approval. If the *majlis* or the senate, by an absolute majority, declares itself dissatisfied with the cabinet or with one particular minister, that cabinet or minister must resign. The number of deputies in the *majlis* was at first 162 but had been raised to 200 by 1957 and the term of office extended from two to four years.

In April 1949 a constituent assembly was formed to examine the draft of two new articles of the constitution, one of which gave the shah the right to dissolve either or both chambers while the other laid down the procedure for future amendments of the constitution of 1906. Under that constitution there was to have been a senate with 60 members, 30 elected and 30 nominated by the shah. No steps were taken, however, to create the senate until 1949, when the *majlis* passed a bill laying down the procedure for its election. This bill conformed generally to the articles of the fundamental law constituting the senate but stipulated that the internal regulations of the senate were to be approved by the senate itself (not by the *majlis*) and prescribed a system of two-stage election for the members. The first senate assembled in 1950. Laws may be initiated by the shah, by the cabinet, by the senate or by the *majlis*. Bills initiated by the cabinet are debated in the *majlis;* those proposed by the *majlis* are sent to the senate. The shah's signature is necessary before any bills can become law. Only the *majlis* has the right to enact and approve laws connected with revenue and expenditure. The supplementary law of 1907 provided for the establishment of provincial and departmental councils (*anjunmans*) but no steps had been taken to establish them by the early 1960s. The cabinet comprises a prime minister with, usually, 13 to 15 ministers.

After 50 years of trial of the constitutional parliamentary system no truly independent parliament and cabinet had yet been established. All economic affairs are centralized in the high economic council which is presided over by the prime minister.

From 1925 to 1941 Reza Shah had ruled with absolute powers, ignoring the constitutional checks upon them, and all control of affairs passed out of the hands of the *majlis*. His successor respected the constitution but the amendments of 1957 strengthened his prerogatives.

2. Provincial Administration.—Until 1938 Iran was divided into 26 provinces. In that year a reorganization took place and ten large provinces (*ostans*) were created. These were subdivided into districts (*shahrestans*). Further adjustments took place in 1946 and in 1947 (when Teheran, the capital, became an *ostan*). The administrative divisions as of 1961 are shown in the table.

TABLE I.—*Ostans and General Governorships*

Ostan and capital	Area (sq.mi.)	Pop. (1961 est.)
Baluchistan-Seistan (Zahedan)	69,807	482,509
Central (Teheran)	36,139	3,703,194
East Azerbaijan (Tabriz)	26,656	2,312,499
Fars (Shiraz)	50,656	1,230,336
Gilan (Rasht)	15,753	1,568,256
Isfahan (Isfahan)	9,409	1,550,336
Kerman (Kerman)	71,197	655,974
Kermanshah (Kermansbah)	17,529	768,000
Khurasan (Meshed)	120,710	2,261,197
Khuzistan (Ahvaz)	24,167	1,491,661
Kurdistan (Sanandaj)	10,873	625,766
Mazanderan (Sari)	20,386	1,376,461
West Azerbaijan (Reza'iyeh)	17,452	878,797
General governorships		
Bakhtiari-Chahar Mahall (Shakrkord)	10,502	383,590
Hamadan (Hamadan)	7,413	783,258
Luristan (Khorramabad)	11,737	585,421
Oman Sea (Bandar Abbas)	23,228	266,547
Persian Gulf (Bushire)	9,494	223,744
Semnan (Semnan)	26,255	202,138
Total	636,363	21,349,684

Each *ostan* is administered by an *ostandar* (governor general), appointed by and directly responsible to the minister of the interior. He is assisted by a staff from other departments, health, education, etc., appointed by their ministers. The *shahrestan* is under a *farmandar* (governor); further subdivisions are the *bakhsh*, consisting of *dehistans* (rural areas and groups of villages). Cities in the larger administrative divisions have their own municipality or town council under a mayor appointed by the minister of the interior. The Teheran council has 12 members; the town councils in first-class *shahrestans* have 9 and the others 6. Members, who receive no salary, are elected for two years. Under the mayor they determine the kind and amount of the municipal taxes, study and approve the municipal budget (which must have the final approval of the minister of the interior) and supervise the financial affairs of the town. The administrative system, which is based on

the prefectural system of France, is seen to be highly centralized. (*See* also separate articles on the *ostans.*)

3. Political Parties.—Political party organizations date only from the earlier years of the 20th century. Secret political parties were first created by progressive elements of the intelligentsia with the object of fighting foreign influence as well as the despotic monarchy. They established contact with corresponding and sympathetic political groups abroad and played a significant part in bringing about the constitutional revolution. Since that time, political activities have occasionally been suppressed or restricted as under Reza Shah (1926–41) and after the fall of Mohammed Mossadegh (*q.v.*) in 1953. There were three distinct phases of activity, during which no less than 30 different parties and groups developed.

The Fall of Mohammed Ali Shah (1908) to the Accession of Reza Shah (1926).—Absolute freedom of political activity prevailed during this period and parties were formed such as the "Democrat," with liberal outlook, which was effective in the overthrow of Mohammed Ali Shah's dictatorship. The Etedaliyun party, composed of Qajar princes, big landlords and religious leaders, was opposed to the Democrats. The Adalat was the first Communist party organized in Iran after World War I (not to be confused with a party of similar name organized between 1942 and 1945).

From the Occupation of Iran by the Allies (1941) to the Fall of Mossadegh.—During this period more than 20 political parties and groups were formed. The main parties were the Tudeh party of Iran, the Democrat-e-Azarbaijan, the Democrat-e-Kordestan (all of leftish inspiration), the Eradeh-Melli and Adelat (anti-Communist) and the Iran party. The Tudeh party was the most vigorous political organization, enjoying the full support of the Soviet government and reached its zenith in 1945 with three ministers in the cabinet. It was legally banned in 1949 after an abortive attempt was made on the life of the shah, and then went underground and succeeded in extending its activities into the defense forces until 1956 when its secret network was discovered and military leaders executed or imprisoned. Since then the Tudeh party has pursued its activities outside Iran and behind the iron curtain. The Iran party was established in 1944 by a group of the intelligentsia, mostly trained abroad, with the main object of fighting foreign influence. In 1948–49 it pursued a purely nationalistic and anti-Communist policy. On Mossadegh's fall it lost its importance, but its leaders were repeatedly involved in political unrest from 1957–61. The Goruh-e-Iran-e-Now (formed in 1954) was composed of a small number of well-educated young men, some of whom filled important government positions after 1957.

The Period 1957–61.—Early in 1957 the ban on political party activities was removed and two new parties were formed. The Mardom (People's party) won 40 seats in the 19th *majlis*, held its first congress in Oct. 1959 and in the elections of the summer of 1960 gained 50 seats, though all the deputies subsequently resigned. The Melliyun (National party) was organized in 1958 by Manuchehr Eghbal, who was then prime minister; in the elections of 1960 this party won 120 seats and had a majority in the *majlis*, but when these elections were nullified and its leader resigned his post, the Melliyun too faced a crisis.

The 20th *majlis* which followed the 1961 elections was dissolved by the shah after Ali Amini formed his government in May 1961, and party political activity in the country subsequently declined to a minimum.

4. Taxation.—Until 1899 there was a system of tax farming which led to many irregularities and abuses; this was abolished but not until the 1906 revolution was any real improvement introduced. A ministry of finance was then created and between then and 1927 Belgian and American missions (the latter under Morgan Shuster and A. C. Millspaugh) did create an orderly tax system. Many new laws and regulations were mostly related to indirect taxes. In 1956 a comprehensive tax law superseded the existing tax laws. This law, which was revised in 1958, dealt with all classes of taxes such as those on wages and salaries (7% to 50%), real estate, cultivated lands, banks and companies, contract transactions, professional occupations, etc.

5. Working Conditions and Housing.—Wages are low in comparison to the cost of living. This is especially true of the farmers and peasants who earn far less than urban factory workers or labourers. Available statistics reveal that between 1936 and 1955 the cost of living in Iran increased twelvefold whereas the increase in the daily wage level was barely fivefold. In certain industries wages vary from place to place; *e.g.*, labourers engaged in construction work in Teheran or oil workers of Abadan are paid as much as 250 rials, considerably higher than the daily average, which in the early 1960s was 45 rials for unskilled workers (£1 = 214.4 rials approximately; $1 = 76.5 rials).

The Labour law of 1959 calls for a 48-hour week, paid vacations, employment contracts and collective agreements, health and safety regulations and registration of labour unions and employers' organizations. The employment of foreigners is controlled by regulations enacted in 1960. The Worker's Social Insurance law (1960) provides for a system of social security benefits including coverage for sickness, retirement, maternity, family allowances, etc. However, all these labour and social provisions are confined mainly to small groups of industrial workers and mineworkers and are not widely enforced.

In Oct. 1961 the shah created the Pahlavi Dynasty trust to which he donated an estimated $140,000,000 worth of his personal properties. The trust was an expansion of the Pahlavi foundation established in 1958 to encourage economic and social development and the improvement of living conditions.

Housing.—Up to 1941 housing presented no special problems but the great influx into the cities, particularly Teheran, which began after the Allied occupation, led to higher rents which, in turn, forced the government to distribute cheap land among its employees for building private houses. The experiment went on successfully in Yusofabad to the north of Teheran. Ministries and government agencies as well as some banks and larger business concerns executed housing projects for the benefit of their employees. Organizations such as the Bank Sakhtemani (construction bank), the Bank Rahni (mortgage bank), Sherkat Sahami Bimeh Iran (Iran Insurance company) and the State Housing organization (created in March 1958) played a large part in planning and financing such projects, especially on the periphery of larger cities. By the early 1960s there was a noticeable slowdown in building activities, but the organization was responsible for the construction of 10,000 small houses in the earthquake and flood-stricken areas.

6. Public Health and Welfare.—In 1904, in accordance with a provision of the International Sanitary convention held in Paris during the previous year, a sanitary council was created. In 1925 the president of the council became the director of public health services, and in 1945 the ministry of health was established. Until 1911, when it became obligatory by law for all students of medicine to take a diploma of the Government Medical school, certificates to practise had been given to apprentices of Iranian doctors and to assistants trained in foreign hospitals. This reform made possible a gradual expansion of the medical services.

In the early 1960s the ministry of health had on its payroll more than 4,500 trained medical officers (including physicians, assistant physicians, surgeons, midwives and dentists) working at hospitals, dispensaries and medical posts distributed over the country. In addition there were many private hospitals sponsored by foreign missions, commercial institutes and charitable foundations. Following the seven-year plan of 1947 the country was divided into a number of health districts in which systematic campaigns against diseases such as malaria and trachoma were successfully conducted. Private social security and welfare agencies include the Workers' Insurance, Social Insurance and Imperial Social Services organizations and the Red Lion and Sun society, some of which provide dispensaries in remote villages.

7. Justice.—Before the constitution of 1906 there existed in Persia two systems of law: the *Shari'a* or Islamic religious law based on the Koran and administered by the clergy, and the common or customary law known as *urf*, which governed transactions not specifically covered by the *Shari'a*, although, theoretically, the Islamic law applies to every act of man. (*See* ISLAMIC LAW.) In

addition to these were royal edicts. The Islamic law gradually became restricted to questions of personal status (marriage, inheritance, etc.), faith and morals. The *urf* represented local custom in matters such as water and grazing rights, landlord-tenant relations, etc. The shah's edicts covered public administration, public security and taxation. The fundamental law of 1907 laid down the general principles of criminal and civil procedure. In 1912 a new law set up a judicial administration modeled upon European standards and in 1914 a system of commercial courts was established. Attempts to enforce these measures and to introduce reformed legal codes were successfully blocked by the action of the mullahs and it was not until Reza Shah came to power that modern systems were enforced. The civil code, based upon the *Shari'a* with adaptations from the French code, was adopted in 1928 and absorbed most of the functions of the Islamic law. The penal code, abolishing the principle of the *lex talionis* (law of retaliation), was introduced in 1926 and is also based upon French law, as are the commercial code and the civil and criminal codes of procedure. The most important change was the authorization by the *majlis* in 1928 of the articles of the civil code which provided a uniform basis for the application of the modified *Shari'a* law and thus eliminated the individual interpretations of the *mujtahids*. In 1931 the privileges of the teachers of Islam were further curtailed by a law requiring that all marriage contracts and acts of divorce be registered with a civic official. The law is administered by minor courts which sit in villages and small towns with a single magistrate and have jurisdiction in civil cases involving small sums and petty offenses. Appeal is to the district courts which correspond to the French courts of first instance and deal also with major misdemeanors and with the more important civil cases. The provincial high courts, to which lie appeals from the district courts, deal with offenses classed as crimes and with disputes between examining magistrates and public prosecutors of the district courts. The supreme court of cassation or appeal is in eight sections and hears appeals from the provincial courts or from special tribunals.

Police.—The police, some of whom carry firearms, are subject to the minister of the interior and are nominally under the local civil governors, though there is a chief of police in larger towns.

Jurisdiction Over Foreigners.—A system similar to the regime of capitulations in Turkey was voluntarily conceded by a firman of Shah Abbas to Sir Anthony Sherley in 1600 to induce British merchants to enter Persia to trade. But although these privileges were extended to the nationals of other countries they were not formally recognized until 1828, when, under the terms of the treaty of Turkmanchai, Russia obtained important commercial and diplomatic privileges. Russian consuls, with extraterritorial rights, could be appointed at will. Similar rights and privileges were later granted to other powers by virtue of most-favoured-nation clauses in other treaties. These privileges were renounced by the Russians in their treaty of 1921. In 1927 after the reformation of the judicial system (which was necessary to make it acceptable to foreigners) Reza Shah announced the formal abrogation of the capitulatory regime, to take effect within 12 months. The French government accepted at once. The British government objected on the ground that the rights which their nationals enjoyed were based on firmans issued by shahs of Persia before the signature of the treaty of Turkmanchai and on general international law. Eventually abolition was accepted as part of a settlement of various matters under dispute, and with the introduction of certain safeguards which applied to British subjects and to most other foreigners. These provisions may be summarized as the application of international law to all foreigners; the use of only written evidence in court cases; nonjurisdiction of religious courts over foreigners; limitations concerning imprisonment, arrest and search; access by an arrested foreigner to his consul; facilities for release on bail; imprisonment in hygienic conditions; trials to be normally public; in personal matters facilities for recourse to the national's courts and nonliability to civil arrest in normal cases.

8. Education.—Until the first reforms were introduced by Nasir ad-Din (*q.v.*) in the middle of the 19th century, education, in the narrower sense, had been centred in the religious schools, the *maktabs* in the villages and towns and the *madressehs*, or religious colleges, which gave higher education in theological subjects, law and medicine. But Persia enjoyed the advantage of widespread and popular interest in its literary heritage so that, unlike other Muslim countries of the period, education, in spite of the illiteracy of the majority of the population, was founded upon the Koran and also upon the Persian classics, which are still widely known by recitation. In 1852 Nasir ad-Din founded the Dar ul-Funun (College of Science) in Teheran and three years later established a ministry of science and arts, aiming to create a teaching body in the first instance and then to modernize and extend primary education. A translation bureau was formed in 1862 to translate European works into Persian, and a royal library in 1873, the year of the shah's first visit to Europe. He then decided to send a few young Persians of good family to France for military training at St. Cyr, for engineering at the École Polytechnique, and to study law and medicine and modern art. But the development of the modern educational system more properly dates from 1897 when a "society for the establishment of national schools" (afterward known as the Anjuman-i-Ma'aruf, or Education council) was founded. Its efforts resulted in the opening of numerous elementary and secondary schools, which with some foreign schools (notably the American Mission college which had been founded in Teheran in 1872, the Anglican Stuart Memorial college founded in Isfahan in 1904 and French Catholic schools) formed the basis upon which subsequent progress was made. The constitution of 1906 emphasized the importance of modern education and the freedom of all to study sciences, arts and crafts and to publish books, provided that religious laws were not transgressed. The establishment of schools at government expense and the regulation of compulsory education were recognized as a national responsibility. In 1911 a ministry of education was established. Its work was greatly extended between 1911 and 1921 but the chief impetus was given after the accession of Reza Shah in 1925. In the 1960s thousands of Iranian students were studying in American and European educational institutions.

The educational system is centralized under the ministry of education, which has directorates general dealing with education proper, vocational education, physical training, administration, higher education, inspection, fine arts, publications, archaeology, the national library and religious foundations (waqfs). Other ministries, *e.g.*, labour, industries and mines, roads and communication, and posts, telegraphs and telephones, have their own training centres, but the ministry of education has a general supervisory power over all such centres and over all private educational institutions. The school period up to university level is 12 years, equally divided between elementary and secondary education, with specialization for three years prior to university entrance.

There are six universities (Teheran, Tabriz, Meshed, Shiraz, Isfahan and Ahvaz), with about 35 faculties and about 17,000 students. The University of Teheran, founded in 1934, has 13 faculties with about 12,000 students, and includes an institute of nuclear science established in 1959 under the aegis of the Central Treaty Organization. The teacher training college, formerly part of the university, was accorded independence, but replaced by Teachers Training institute in 1963. The nongovernmental National university was also in the process of formation and the Institute of Technology in Teheran reached university level in various fields of technology by the early 1960s.

In 1963 the Shah created the "knowledge corps," a semimilitary organization attached to the ministry of education. All conscripts holding high school certificates are enrolled in this corps and required to spend their compulsory military period in educating illiterate villagers.

9. Defense.—During the reign of Nadir Shah (1736–47) British, French, Italian and Austrian military missions in turn took a hand in the organization of the Persian army, but the Cossack brigade, founded in 1882, armed and trained on the Russian model and commanded by Russian officers, was the only efficient unit. In 1921 the Cossack brigade had a strength of about 14,000; the household troops about 20,000; the South Persia rifles, British-trained and equipped during World War I, about 6,000; and the

Swedish-trained gendarmery (*amnieh*) about 12,000. When Reza Khan became minister of war he immediately began to organize the army purely on Persian national lines, and his ability to secure the downfall of the Qajar dynasty and to seize and retain power was a result of the new spirit with which he imbued it. By 1939 the strength of the army had increased to 105,000 and it had considerable successes against the tribes. But it had to yield before the British and Soviet forces in 1941. A conscription law of 1925 (somewhat modified in 1938) prescribes two years' military service for men over 21.

The three armed services are all controlled by the minister of war. The strength of the army in the early 1960s was about 200,000 and consisted of six corps. The air force had 8,000 officers and men and was equipped with U.S. jet and propeller aircraft. The navy, with 6,000 men, had a number of frigates, mine sweepers, gunboats and other smaller vessels in the Persian gulf. After 1950, in addition to the military academy and the command and general staff school, basic and advanced branch and service schools were established. United States military missions are attached to the army and gendarmery and the staffs are organized on the U.S. pattern. The chief of the supreme commander's staff is directly responsible to the shah who is the commander in chief of the armed forces according to the constitution. Iran is committed to collective defense through membership of the Baghdad Central Treaty Organization (CENTO), formerly Baghdad pact (*q.v.*).

VI. ECONOMY

A. Production

In 1946 the government initiated a seven-year plan for the development of the country's economy, which is based mainly on oil production and refining and on agriculture, and created a board which presented an outline plan, approved by the *majlis* in Feb. 1949. A detailed project prepared by a U.S. firm in 1947 was not adopted, and further recommendations submitted by another U.S. firm were presented to the government in Aug. 1949. Of an estimated total expenditure of $656,000,000, agriculture was to receive 25%, transport 23.7%, industries and mines 14.3%, petroleum development 4.8%, communications 3.6% and social welfare 28.6%. The whole of the revenue from the petroleum industry was earmarked for the plan, which went into effect in 1949. Progress was hampered by the cessation of oil revenues after the first two years and by the inability of the Bank Melli Iran to grant adequate loans in face of the other needs of the government.

With the resumption of oil output in 1954 the prospects were greatly improved and a second seven-year plan estimated to cost $930,000,000 was approved in March 1956. By the early 1960s the plan organization had considerable achievements to its credit in its agricultural projects but it was not so successful in the field of industry. Production of construction materials, textiles and sugar was increased significantly. By January 1962 Iran's third economic plan for the period Sept. 1962–Sept. 1967 had been prepared. Its aims were to further economic growth and the raising of the national income by an average of at least 6% per year. The total development outlay was estimated to be 348,000,000,000 rials. Project allocations were: agriculture 20%, industry 28%, transport and communications 26% and social projects 26%.

1. Agriculture.—Although Iran is primarily an agricultural country, the percentage of the whole area under cultivation is extremely small. In addition to the vast deserts and the land lying fallow each year, very large cultivable but unused areas await development. Water is wasted, methods are out of date, landholdings are often uneconomical in size, and the system of land tenure gives little incentive to the cultivator.

The bulk of the land is held under three main types of ownership: (1) *khalisa* lands, which are public domains, sometimes leased in large blocks to wealthy persons who then often sublet; (2) *milkiat*, land held in full private ownership in accordance with Islamic law; (3) waqf, land held in trust either for groups of persons or for religious or educational purposes.

Tradition and these types of ownership favour absentee landlordism. It was estimated that the class holding 250 ac. (100 ha.) or more constituted only 0.2% of the total rural families and landowners but held 33.8% of the total annually cultivated land. Crop sharing varies in different parts of the country but, in general, is based on the principle that there are five factors in production—land, water, seed, oxen and labour, the last including implements. Whoever provides one of these elements receives one-fifth of the crop. This system applies both to the crop-sharing peasants and to small landowners or communal owners working their own land, but not to leasehold or hired labour. It is modified by local custom and differs between summer and winter and between irrigated and rain-fed crops. In 1946 and 1952 decrees were issued by the government designed to modify this system so as to improve the peasants' lot, but the difficulty of applying them hampered their effectiveness. In 1951 the shah issued an edict for the sale of crown lands on long-term installments to farmers occupying them. The area affected exceeded 800,000 ac. of cultivated or potentially cultivable land. By the early 1960s more than 25% of this land had been distributed under this program. In 1954 the government presented a bill to the *majlis* for the distribution of more than 10,000 ac. of state lands. In Jan. 1962, in the absence of parliament, the shah gave his assent to the amended land reform law under which no landlord is allowed to own more than one village; it was first applied in Azerbaijan.

Water Supply.—It is estimated that, of the total cultivated area, about three-fifths is dry-farmed, two-fifths irrigated. Methods of irrigation are as follows: (1) *Qanats*, water channels, sometimes 13,000 ft. long, tap the water table underground at a level higher than that to be irrigated. The slope of the *qanat* is less than that of the surrounding land and the water is delivered by gravity. The *qanat* is the traditional Persian system of irrigation, though it is used also to a limited extent in Iraq and northern Syria. (2) River irrigation using brushwood dams is common and the dams are renewed annually. Under the seven-year plan there were numerous projects for irrigation from surface sources. (3) Wells with water wheels are used chiefly in the south; these consist of skin buckets worked by oxen. (4) Plans for drilling 2,300–3,000 tube wells to irrigate about 600,000–700,000 ac. were part of the seven-year plan. A dam on the Karaj river near Teheran (inaugurated in Oct. 1961) stores 200,000,000 cu.m. In addition to irrigation, it provides part of the city's water supply and electric power. Another dam on the Dez, in the southwest of Iran, was completed in 1963.

Farming Methods.—Most of the agricultural work such as seeding, planting, reaping and threshing is done by hand, and the implements used in farming are primitive and few. Iron-tipped plows, wooden drags, light mattocks, long-handled wooden spades and sickles are among the chief agricultural implements. However, mechanical methods are gradually taking the place of the old and primitive ones. By the early 1960s imported tractors and other agricultural implements were put to use mainly in the Gorgan and Khuzistan plains.

Crops.—In order of importance the cereal crops grown are wheat, barley and rice. The most important wheat-growing districts are the Reza'iyeh plains in Azerbaijan, the Quchan-Meshed plains in northern Khurasan, and areas in the Kermanshah, Isfahan, Fars and Kerman districts. Wheat is usually sown in the autumn and harvested in the spring, either as an irrigated or rain-fed crop; in the valleys and intramontane plains it is more usually an irrigated crop sown in the spring and harvested in the summer. The average yield is low—less than 1,000 lb. per acre, as against about 2,000 lb. in Great Britain—although in especially favoured regions more than 1,800 lb. per acre has been recorded. Barley is grown in the same areas and in the same way as wheat but is harvested a little earlier; the yield is somewhat higher. Rice is the principal crop of the Caspian provinces, where the climate, unsuitable for wheat, is favourable for rice. It is grown elsewhere on a small scale wherever there is sufficient water. The fields are plowed in winter or early spring and flooded at the end of April. The seed is sown in May and the crop is harvested in August or September. The average yield is slightly more than 1,000 lb. of husked rice per acre. Small quantities of millet (sorghum) and some maize (corn) are grown.

Beans, French beans, lentils, onions, tomatoes, carrots, peas,

cucumbers and most vegetables found in temperate and subtropical climates are grown both as summer and winter crops, generally irrigated. Potatoes were introduced at the beginning of the 19th century by Sir John Malcolm.

There is an exportable surplus of raisins, almonds and apricots; excellent peaches, apples, cherries, figs, dates, olives, oranges, lemons, grapes and melons are also grown. Nuts are found in many districts; pistachios and walnuts are particularly good. Citrus fruits are grown at Shiraz and on the Caspian coast, the estimated crop being about 100,000 metric tons annually. Melons and watermelons are grown in most districts; Isfahan melons are famous. There are many varieties of grape and wine is made in many parts of the country. Dates are a staple food on the Persian gulf and Makran coast. The production of noncitrus fruits has been estimated at more than 1,000,000 tons a year, and between 10,000 and 12,000 tons of dried apricots, nearly 60,000 tons of raisins, 4,000 tons of pistachios and 8,000 tons of shelled almonds are produced annually.

Cotton is the most important of the industrial crops. It is grown by irrigation in many areas, particularly in Azerbaijan, Teheran, Mazanderan, Khurasan, Kermanshah, Fars and Khuzistan. Production of ginned cotton in the early 1960s fluctuated between 70,000 and 90,000 metric tons, a higher output than before World War II. Three types are grown: Filistani, a long-staple cotton; American short staple; and a local short staple, which is hardier than the other two. Silk is produced by the breeding of silkworms in the Caspian coast area. Sugar beets, the growing of which was encouraged by Reza Shah, are an important crop. They are grown mainly in Khurasan, near Meshed; round Teheran; and in the Kermanshah and Shiraz areas. Cane sugar is an old but neglected crop. Jute is indigenous to Mazanderan but the production is low. Tea is a comparatively recent introduction; plantations were developed in Lahijan and the area rose after 1932 from about 700 ac. to 24,000 ac. Production is about 8,000 tons. Tobacco is extensively grown. The entire crop is purchased by the government and processed by the tobacco monopoly. The high production figure of 1,000 lb. per acre has been claimed. The cultivation of the opium poppy was prohibited in 1946–47; the order was enforced vigorously and production has virtually ceased. Gum tragacanth is collected in the hill country from Kerman to Kermanshah, gum arabic near Shiraz and elsewhere.

Livestock.—The most important livestock are sheep and goats, which are not only the principal means of subsistence for the nomadic tribesmen but the chief suppliers of milk and meat to the peasants, who derive most of their cash income from the sale of animal products. Wool is the raw material of the carpet industry, lambskins from the karakul flocks are an important export, and tribal tents are made from goats' hair. Though sheep and goats are found everywhere the largest numbers are raised by the tribes who depend on the seasonal vegetation in the mountain pastures. Good natural grazing land is uncommon and it is probable that the country is overstocked and that controlled grazing and the growing of special grazing crops will be necessary if serious soil erosion, already threatening, is to be checked. Cattle are of increasing importance because of the rising consumption of milk and milk products in the towns. The general quality of dairy cows is low, but in Sarab (Azerbaijan) and Golpayegan two good breeds have been produced. With help from the U.S. Technical Co-operation mission an extensive livestock improvement program has been laid down. Oxen are largely used for draft purposes. Horses are of three types: the Turkoman in the north, the Arab in the south and a cross between the two which is the common Persian breed. Mules and asses are used primarily for transport purposes. Mules (chiefly bred in the southeast, in Luristan, Kurdistan and the Bakhtiari country) are not large but can carry 350 lb. or even more at a good pace 30 mi. in a day. The donkeys are also sturdy and can carry up to 200 lb. Both are also used as draft animals. Camels are still widely employed in the waterless areas of central and southeastern Iran. Poultry are found in nearly every village and particularly in the north where they are of increasing importance as food for the peasants and in the dependent urban areas.

2. Forests.—It is estimated that 44,000,000 ac. or about 11% of the total area of Iran is forest land, which may be divided into four main groups. The most important, though not the largest (8,000,000 ac.), is the Caspian forest, extending along the Caspian coast and the seaward slopes of the Elburz chain to northeastern Azerbaijan. About half consists of dense forest of high quality. In the whole area it has been estimated that there is a growing stock of 315,000,000 cu.m. of timber. The second group comprises the oak forests of the Zagros mountains, stretching from Kurdistan in the northwest through Luristan to eastern Fars and covering about 25,000,000 ac. Only about one-tenth of this is dense and productive forest; the remainder is open forest of low grade. The limestone forests of the northeast stretch from Bojnurd to the southeastern slopes of the Elburz; the principal tree is the juniper but small maples and hawthorn are also found. From Khurasan to Kerman and northern Fars is a scattered group of pistachio forests with wild (inedible) almonds. Other important groups are the small subtropical forests in the Persian gulf-Makran area and desert forests of scrub round the Dasht-e Kavir and the Dasht-e Lut. Much damage has resulted from grazing sheep and goats, from charcoal burning and other human depredations. A forestry organization was established in 1949 whose functions are forest administration, including education and research; establishment of forest and timber industries; demarcation and survey; and the purchase of wastelands for reafforestation. (*See* also *Vegetation,* above.)

3. Fisheries.—Although several thousand persons are engaged in the fishing industry in the Persian gulf, the industry is quite unorganized and production figures are not available. Much of the fish caught is consumed fresh in the coastal areas but there is an appreciable export trade in dried and salted fish to Iraq, India and Arabia. The fishing on the southern coast of the Caspian sea with the two bays of Pahlavi and Gorgan was from 1928 to 1952 in the hands of the Société Mahie Iran, a joint Iranian-Soviet concern. In Jan. 1953 Iran refused to renew the concession. A government company was formed. The annual catch averages more than 3,500 tons (including 150 tons of caviar). In 1956 a joint Iranian-Japanese concern was formed to exploit the Persian gulf fisheries.

4. Mining.—Iran possesses extensive mineral resources. A mining law of 1952 reserved exploitation of deposits of hydrocarbons and radioactive materials to the state; other categories of minerals could be developed by either governmental or private enterprise. In 1938–39 the only mineral export, apart from petroleum, was 6,000 tons of red oxide. Great impetus was given to the mining industry by exploration carried out under the seven-year plan. Red oxide, sulfur, salt, copper, chromite, lead and iron ores amounting to more than 100,000 tons annually were exported in the early 1960s. Projects include the development of the iron deposits at Shamsabad and the coal (now exceeding 170,000 metric tons annually) in Kerman.

Oil.—Eratosthenes of Alexandria (*c.* 276–194 B.C.) appears to have been the first to mention petroleum or its allied products in the region of the Persian gulf and later travelers recorded its existence in Persia. The first project for its exploitation dates from 1896 when the shah granted a concession for a small area in the province of Mazanderan to a Persian. This was acquired by a Georgian adventurer named Khostaria in 1916. Meanwhile William Knox D'Arcy in 1901 obtained a concession covering 480,000 sq.mi. which was afterward transferred to the Anglo-Persian (Anglo-Iranian) Oil company (A.I.O.C.). This concession was canceled by the shah in 1932 but a new concession covering 100,000 sq.mi. in southwestern Iran was signed in 1933 with a period of 60 years. In 1944 the Iranian government decided to postpone consideration of all further oil concessions until after the war. A written promise was given by the prime minister to the Soviet government in 1946 to introduce a bill permitting the formation of a Soviet-Iranian oil company to exploit the resources of northern Iran, but the bill was rejected in 1947 by the *majlis.* The movement against the foreign exploitation of Iranian oil was then directed against the A.I.O.C., a supplemental agreement which would have given additional benefits to Iran was rejected and the 1933 concession was canceled in 1951, in spite of a clause in it

which stipulated that arbitration should be sought in case of any dispute between the company and the government. A bill for the nationalization of the oil industry was passed and the National Iranian Oil company (N.I.O.C.) was set up to take over the A.I.O.C.'s interests. All British employees of the company were withdrawn in Sept. 1951.

Under the earlier A.I.O.C. concession the royalties to the Iranian government varied within fairly wide limits. During the nine years ending in 1928 they averaged £708,000. In 1929 they were £1,437,000, in 1930 £1,288,000, but in 1931 they dropped to £306,872, an amount which the government would not accept; this led to the cancelation of the concession and its replacement by that of 1933.

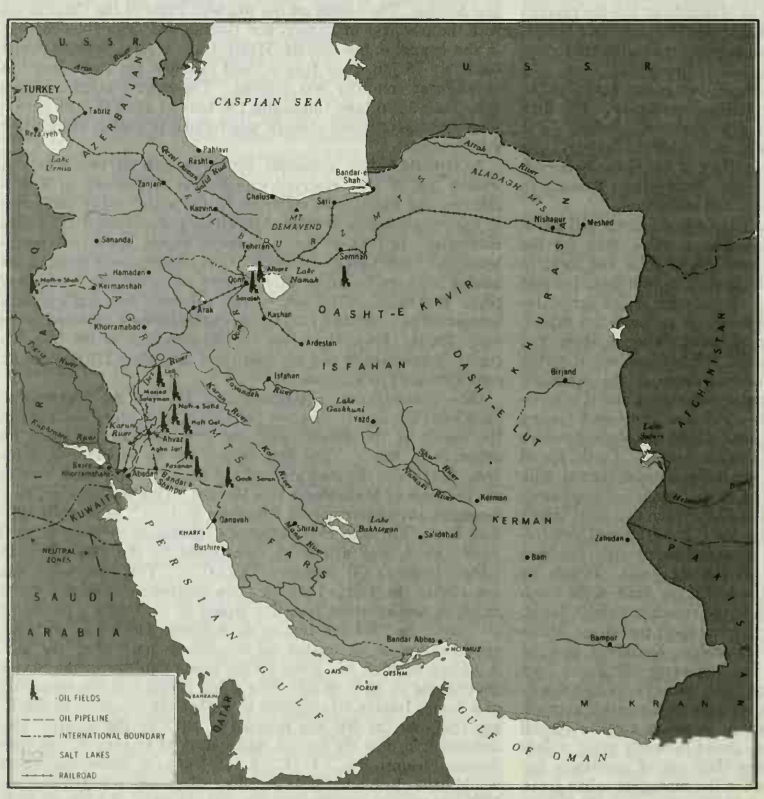
The output of crude oil rose from 83,000 metric tons in 1913 to 7,200,000 metric tons in 1933. During World War II it dropped to 6,705,000 metric tons (1941) but in 1949 reached 27,247,933 metric tons. Under the National Iranian Oil company's administration production and refining were greatly reduced and exports practically ceased. In Oct. 1954, an international consortium of eight oil companies (later joined by nine others) reached an agreement with the government which promised the revival of the industry (*see* PERSIAN HISTORY). The annual production of crude oil then increased from about 16,000,000 metric tons in 1955 to more than 50,000,000 in the early 1960s; revenue to the Iranian government increased from £32,200,000 to over £100,000,000 in the same period.

The oil operations organization of the N.I.O.C. has carried out extensive prospecting all over the country and a fairly detailed geological map of Iran was produced. The Alborz oil field (southwest of Teheran) was discovered in Aug. 1956, when well no. 5 struck oil and went out of control at the approximate rate of 80,000 lb. a day. Sarajeh gas field (40 km. S.E. of Alborz oil field) was discovered in Feb. 1959.

In 1955 the N.I.O.C. signed contracts with British and French firms for a ten-inch products pipeline from the southern oil fields to Teheran (920 km.). This was completed in 1960. Extensions of this line to Shahrud, in the east, and Rasht, in Gilan province, were under construction, as was the pipeline between the southern oil fields and Shiraz.

The terminal for loading crude oil on Jazireh-ye Khark (Khark Island) on the Persian gulf, 23 mi. from the mainland, was opened in 1960. The oil is carried by pipeline overland from Gach Saran to Ganaveh and undersea to Khark where tankers up to 50,000 tons can be loaded at the jetty.

5. Industry.—Out of a population of nearly 20,000,000 the number of industrial workers in the early 1960s was more than 200,000 plus an estimated 200,000 engaged in the carpet industry, in hand-loom weaving and in the hand production of hosiery and knitwear. Thus, although the development of industry was much encouraged by Reza Shah, whose aim was to make Persia self-sufficient in some measure, industry is still much less important than agriculture. Although most modern industry is artificial, in the sense that it was deliberately created by the government, it depends in the main upon indigenous raw materials and was able from the first to draw upon some existing technical skill. Most of the industries started by Reza Shah were grouped under the Industrial and Mining bank, which was, in effect, a holding corporation and an industrial bank, which controlled more than 100 factories and a number of mines. This bank was liquidated in 1949 and all its industries with their assets and liabilities were taken over by the seven-year plan organization and reorganized into groups under specialized corporations. In 1959 most plan organization companies and factories were transferred to the ministry of industry and mines.



PRINCIPAL TOWNS, OIL FIELDS, PIPELINES AND RAILROADS IN IRAN

Textiles.—The majority of textile mills, excluding Teheran, are located in the Isfahan and Mazanderan areas. Production of cotton fabrics, estimated at 70,000,000 m. in 1948, had more than doubled by the early 1960s, and by the mid-1960s Iran would approach self-sufficiency in respect to cotton goods. The woolen industry produces more than 3,000,000 m. of cloth and about 700,000 blankets annually.

Government-owned jute factories in Shahi produce chatai, sack lengths, matting and rope. The Silk Industry corporation was established under the seven-year plan organization to encourage the production of natural silk on the Caspian coast, thus reviving an industry which had flourished in the 17th and 18th centuries. At Rasht there is a breeding station and a silk-reeling plant which could handle about 250 tons of cocoons a year; there is also a silk-reeling and weaving plant at Chalus. The total yearly capacity is estimated at about 1,000,000 m. of fabric and 30,000 pairs of stockings. Annual production of silk cloth exceeds 600,000 m.

Carpets.—Although the de-

mands of the export trade caused some reduction in the artistic standard of Persian carpets, this deterioration applied mainly to the "factories" established by foreign dealers. In them the carpets are still hand-woven but the design is modified to suit the country of import, the weave is usually looser and the nap is left longer than in the finer products. Carpets of the finest design, colour and texture as still made by the tribes and in the traditional centres of manufacture, the districts of Tabriz, Hamadan, Bijar, Sanandaj, Soltanabad, Kashan, Shiraz and Kerman. World demand has fallen and the industry is no longer so important in the Iranian economy as in the mid-1920s when 10,000 metric tons of carpets were exported annually; in the early 1960s the average was 5,000–6,000 metric tons. (*See* also RUGS AND CARPETS.)

TABLE II.—*Direction of Trade*
(in per cent)

Country	Imports				Exports			
	1937–38	1946–47	1954–55	1960–61	1937–38	1946–47	1954–55	1960–61
Belgium	3.0	0.6	—	2.0	0.4	1.0	—	1.0
France	1.8	1.1	2.8	5.0	1.4	6.6	10.5	4.0
Germany	25.5	0.5	18.1*	20.0*	29.7	—	17.8*	17.0*
India	7.7	15.2	7.8	2.0	4.7	14.2	2.0	2.0
Japan	—	—	8.6	6.0	—	—	2.1	2.0
Soviet Union	32.5	23.2	7.4	3.0	35.0	21.3	14.1	15.0
United Kingdom	8.2	12.9	10.0	18.0	6.2	12.5	7.9	12.0
United States	8.6	23.2	20.1	20.0	8.2	18.5	12.4	11.0
Other	12.7	18.3	25.2	24.0	14.4	25.9	33.2	36.0

*Federal Republic of Germany.

Food Processing.—The ministry of customs and monopolies (created in 1958) is in charge of all government rice cleaning and tea plants. There are also numerous privately owned plants, located mostly in the Caspian region. The total tea output of the country increased from 4,000 tons in the early 1950s to more than 6,000 tons in the early 1960s. Sugar refining is mainly government controlled; production, 20,000 tons in the mid-1940s, has increased fivefold. Flour mills are all privately owned. Food canning, vegetable oil, pasteurized milk (in Teheran) and non-alcoholic drink industries were also established.

Cement.—The Building Materials corporation owns a cement factory near Teheran. Other factories were added and cement production increased from 27,000 tons in 1946 to more than 400,000 tons in the early 1960s. There is a refractory brick factory at Aminabad.

Power.—Electric power in Iran falls short of meeting the demand and costs are high. Capacity should be greatly increased by many projects, including hydroelectric plants planned or under construction. By the early 1960s about 100 municipal power plants were completed out of 180 planned. Untapped natural gas from the oil fields is a potential of industrial power.

Other Industries.—By the early 1960s other industrial establishments included an army munitions plant near Teheran with both chemical works and machine shops. The glass industry flourished under private ownership. There are also tanneries, soap and oil-extraction plants, a match industry (which fills local demand and exports to neighbouring countries) and cardboard and paper factories. Craft industries, for which Iran has been renowned for many centuries, continue to exist: the cotton printing of Isfahan; the pottery, mosaic, faïence and tilework of Isfahan; the *repoussé* and carved silverwork of Shiraz, Zanjan and Isfahan; the wood carving of Abadeh and Golpayegan. In spite of the influence toward commercialization which the import of foreign machine-made goods has upon these national industries, the creative instinct and pride of craftsmanship are by no means extinct.

B. TRADE AND FINANCE

1. Trade.—The domestic market system is not well developed. Because of lack of transport, storage and credit facilities there is no easy flow of commodities between producers or importers and consumers, and there is always a great divergence between wholesale and retail prices. In towns the bazaar, both a wholesale and retail institution, is the principal point of assembly, storage and breaking of bulk. It is departmentalized to a striking degree, retailers specializing in one kind of goods concentrated in one section of it. In Teheran department stores are beginning to appear. In villages a few shops or peddlers supply the needs of a scattered population in sugar, tea, cotton piece goods, kerosene, cigarettes, etc.

Foreign trade.—In Iran this is carried out under the following regulations: the government exercises control over normal import and export trade and holds monopoly control concerning the export and import of important commodities. Private traders and agencies, however, may be authorized to import and export these goods subject to the payment of special taxes. Consequently most foreign trade is centred upon Teheran. Trading conditions have become more stable since the rule of Reza Shah, and since the introduction of measures of control the country has maintained a precarious but favourable balance of trade.

The principal exports (apart from petroleum products) are fruit and dried fruit, rice, skins and hides, wool and hair, animal casings, cotton, gums, oilseed, minerals and carpets. Main imports are sugar, tea, coffee, cocoa, paper and cardboard, silk, cotton and woolen textiles, iron and steel, copper and brass (manufactured), machinery and machine tools, electrical apparatus and motor vehicles (including parts and accessories). Imports in general greatly exceed exports.

The main direction of trade is shown in the table, excluding duty free imports (by the National Iranian Oil company, government departments, etc.) and oil exported by the N.I.O.C. or fish exported by the Caspian sea fisheries.

2. Currency and Weights and Measures.—The legal monetary unit is the rial, the nominal equivalent of the older kran, which it superseded in March 1932. The rial, which is subdivided into 100 dinars, at first had a value of 0.07322382 g. of fine gold but in May 1957 its value was legally set at 0.0117316 g. of gold. Officially 100 rials make a pahlavi and its gold content corresponds with that of the old British sovereign. The pahlavi is minted but issued at the market price (about 90 rials in the early 1960s) each Nauruz (Persian New Year). In 1944 silver coinage was authorized and 1-, 2-, 5-, and 10-rial pieces were issued. There are also notes for 10, 20, 50, 100 and 200 rials issued by the Bank Melli Iran. The equivalents of the old and the new currency are 1 shahi = 5 dinars; 1 kran = 1 rial; 10 tomans = 1 pahlavi. A sum of 10 rials is in common usage still referred to as a toman, the equivalent in the old currency of 10 krans.

The metric system of weights has been officially adopted but in the country districts old local standards still prevail. The principal of these are: the gareh (a little more than 6.35 cm. or 2.5 in.) as the unit of linear measure; the farsakh (the distance a laden horse or mule could cover in one hour, about 3.88 mi.) as the unit for long distances; the jarib (rather more than 1,000 sq.m. or $\frac{1}{4}$ ac.) as the unit of area; the kharvar (about 650 lb., or 300 kg., a donkey load) as the unit of weight.

3. Banking.—The banking system was introduced into Persia in 1888 when the New Oriental Banking corporation of India opened branches in the principal towns. In the following year a concession for the establishment of a state bank was granted to an English group under Baron Paul Julius von Reuter, which took over the business of the corporation. The Imperial Bank of Persia, thus formed, had the right of issuing bank notes in the Persian currency to a total value of £800,000. Its name was changed to the British Bank of Iran and the Middle East in 1949. In 1952 all branches in Iran were closed down.

A Russian bank, a subsidiary of the Russian State bank, was founded in 1889 but this Persian branch, with all its assets and liabilities, was transferred by the Soviet government to Persia in 1921 and became the Bank-e-Iran. In 1925 a new Soviet bank, the Russo-Persian, was established to encourage mutual trade.

In 1930 the right to issue notes was transferred from the Imperial Bank of Persia to the Persian national bank, the Bank Melli Iran, which had been founded in 1927, with capital derived from

the value of the crown jewels and domains and other government assets including the Bank-e-Iran. The Bank Melli now has many branches and agencies throughout the country. In 1943 the issue department of the bank and its accounts were separated from the banking department. In 1934 at least 60% of the notes issued were to be covered by gold or silver coins and bullion. In 1940 the value of the crown jewels was counted to make up the deficit when an increase in the note issue was authorized. The currency law of 1954 provided that at least 40% of the cover for notes issued must be in gold or foreign exchange convertible into gold, subject to a minimum gold cover of 35% of the note issue. Iran's gold subscription to the International Monetary fund, to the capital stock of the International bank and to the International Finance corporation, together with foreign exchange and government liability, is secured by the crown jewels.

Other banks are the Bank Keshavarzi Iran (Agricultural bank) and the Bank Sakhtemani (Construction bank) which branched off from the Bank Melli Iran in 1952, and the Bank Rahni Iran (Mortgage bank), which was founded in 1939, finances building construction. The Bank Sepah (founded 1926) deals mainly in inland exchange and holds army pension funds. The first privately owned bank, the Bank Bazargani Iran (the Commercial bank), was registered in 1950.

By the early 1960s there had been a rapid increase in the number of banking establishments. There are now 26 banks; of these 8 are government-owned, 9 are private, 8 have mixed capital and 1 is foreign. Bank Markazi Iran was established in May 1960 by law. It functions as a central bank controlling monetary policy, compiling financial statistics, issuing exchange regulations and providing a clearinghouse.

4. Public Finance.—The bulk of the revenue is derived from indirect taxes (because of their ease of collection). Up to the year 1941–42 efforts were made to balance the budget, and loans from the Bank Melli were confined to those necessary for financing development and productive projects. The disruptions caused by World War II caused a fall in revenue and an increase in expenditure so that the government debt to the bank, which in March 1940 was 1,986,000,000 rials, had increased to about 4,936,000,000 rials by March 1946. In March 1954 it had reached over 17,000,000,000 rials owing partly to the loss of the oil revenue. By 1960 the budget deficit had been reduced to 1.1% and the government debt to the bank had been cut down to 4,750,000,000 rials. In the early 1960s the budget estimates ran at more than 80,000,000,000 rials for both revenue and expenditure.

C. Communications

1. Railways.—Until 1927 when work on the new railway system was begun, no railway construction had been undertaken except a five-mile line from Teheran to the shrine of Abdul Azim which was completed in 1887 and an extension of the Russian system from Jolfa to Tabriz built in 1916. (This finally became Persian property in 1935.) Reza Shah decided for political and economic reasons to create a railway system which would comprise four main lines: (1) a north–south line from Bandar-e Shah on the Caspian through Teheran to Bandar-e Shahpur on the Persian gulf; (2) a northwest line from Teheran to Tabriz to connect with the Russian line to Jolfa; (3) a northeast line to link Teheran with Meshed with possible extensions beyond; and (4) a southeast line from Qom to Kerman. Work on the Trans-Iranian (north–south) was begun in 1927 and the line was opened for traffic in 1938. The total length in the mid-1960s was approximately 860 mi.

The Teheran–Tabriz (463 mi.) and Teheran–Meshed (507 mi.) lines were in operation in the mid-1960s. The connection of Teheran to Tabriz had brought Teheran within reach of Europe by rail through the old Tabriz–Jolfa (91 mi.) line. On the southeast line the section between Qom and Kashan was completed by 1957 but by the early 1960s construction work on the remainder of the line had progressed. The gauge of all these lines is standard except the Tabriz–Jolfa line which is five feet. Locomotives are diesel.

2. Roads.—The important land routes which passed through Persia linking east with west in ancient times fell into decay with the opening of the seas to navigation. The Safawid shahs restored the road system in the north and west during the 16th and 17th centuries but it was not maintained, and natural obstacles and tribal unrest made travel in Persia a precarious and dangerous undertaking. These conditions persisted until World War I when roads fit for light motor traffic were built by the Russian and British armies in the northwest, southwest and east. When Reza Shah came to power, however, there were still only two main routes suitable for motor traffic (Teheran to the Iraq border at Qasr-e Shirin and Teheran to Shiraz), totaling less than 1,200 mi. and indifferently surfaced. As a part of his policy of centralization and tribal control Reza Shah initiated a plan of road construction in which appreciable progress had been made by 1939. During World War II the important supply routes were further developed and improved by the occupying forces, although there was some deterioration afterward. Under the seven-year plan, however, a scheme was started which aimed to reconstruct, or build by linking existing sections, six principal north–south and six principal east–west roads connecting the main cities of Iran and aggregating nearly 8,000 mi.

3. Inland Waterways.—The only navigable river of importance is the Karun, which is navigable by light vessels between Khorramshahr and Ahvaz (112 mi.), below which are rapids that are negotiable only with difficulty during the low-water season (August to November). Above Ahvaz it is navigable again almost to Shushtar. The river is used by vessels of the A.I.O.C. and there is also a separate service from Khorramshahr to Ahvaz.

4. Seaports.—Khorramshahr (*q.v.*) is the principal port at the head of the Persian gulf. It is situated on the north bank of the Shatt al Arab at its confluence with the Karun. The depth of the channel is from 2½ to 3 fathoms. A branch of the railway connects the port with Ahvaz. The port of Bandar-e Shahpur was erected after the construction of the railway by the reclamation of a mud flat in the Khowr-e Musa about 45 mi. from the sea. It was designed by Reza Shah to give an all-Persian outlet for the railway, the Shatt al Arab being in Iraqi territory. Abadan on the Shatt al Arab was the principal oil port of the A.I.O.C. Bandar-e Ma'shur on an extension of the Khowr-e Musa is also an oil port of importance. Bushire is an ancient port about 140 mi. S. of the mouth of the Shatt al Arab. It was formerly the principal point of entry for the Isfahan and Shiraz areas but has lost much of its trade. Ships anchor from three to seven miles offshore and cargo is discharged by lighter. Other Persian gulf and Gulf of Oman ports frequented by trading dhows and pearling vessels are Lengeh, Jask and Chah Bahar.

Pahlavi (*q.v.*) was the principal Caspian port for many years but it is now not greatly used. Bandar-e Shah was built in 1926 as the terminal of the railway but both this port and Now Shahr are subject to much silting. All Caspian ports were extensively used during World War II. In 1958 the administration general of ports was transferred from the ministry of roads to that of customs and monopolies.

5. Civil Airports.—The principal airports are at Teheran (Mehrabad) and Abadan. There are smaller airfields at all the principal towns. The main international airlines have services to Teheran. Iranian National Airways maintains internal air services as well as services to Pakistan and middle east countries.

6. Posts and Telecommunications.—These are administered by the ministry of posts, telegraphs and telephones (P.T.T.). The telegraph line from Tabriz through Teheran to Bushire was formerly part of the Indo-European system which connected London and India. The line now forms part of the national system which covers most of the country. Outlying districts are being brought into the network by radio. Long-distance telephone land lines were constructed by the Allied armies and later taken over by the government. They link Teheran with the southwest oil-field area, the main ports in the Persian gulf and Iraq. One follows the Trans-Iranian railway through Qom and Ahvaz to Bandar-e Shahpur, Khorramshahr and thence to Basra; the other follows the main highway through Kazvin, Hamadan and Kermanshah to Baghdad. There is no national radiotelephone network but international communication by telephone is available from Teheran to

most parts of Europe and the British Isles and, by relay through Bern, Switz., with the United States. There is also a point-to-point service with Karachi, Pak. Radiotelegraphic communication is available to all parts of the world. Radio broadcasting is operated and maintained by the ministry of P.T.T.; programs are handled by the department of propaganda and information. There is limited television programming from Teheran by Television Iran and the U.S. Armed Forces Radio and Television service; a third station was inaugurated in 1961 at Abadan.

Postal services are under the general post office department of the ministry of P.T.T.; mail is distributed by motor truck contractors to places not directly served by the railway. There are regular airmail services to principal cities and military planes serve the southern posts and towns where surface communications are inadequate. *See* also references under "Iran" in the Index.

(M. H. GA.)

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IRANIAN LANGUAGES. The Iranian languages, of which the Persian branch is the most important, belong to the Indo-European (*q.v.*) family, within which Old Iranian and Sanskrit (*see* SANSKRIT LANGUAGE) form the Aryan group (the terms Aryan and Iran having a common origin). How close Old Iranian is to Sanskrit may be judged from the translation into Sanskrit of the Avestan phrase *yō vō āpō vayuhiš yazāitē ahurāniš ahurahe vahištābyō zaoθrābyō* ("he who worships you, the good waters, the Ahurian [daughters] of Ahura, with the best libations"), which becomes *yō vō āpō vasvīs yajātē asurānis asurasya vasisthabhyō hōtrābhyō;* and the original Avestan words, undisguised by the alphabet, would be still nearer to the Sanskrit.

The principal phonetic distinctions of Iranian from Indian are as follows: (1) original *s* becomes *h* in Iranian; (2) Iranian voiced stops or spirants correspond respectively to Indian voiced and voiceless aspirates; (3) Iranian has *z*, absent in Indian; (4) Iranian diphthongs *ai, au* are found in Indian as *ē, ō,* etc. Examples are given in the accompanying table. Later on the two branches, Iranian and Indian, diverged widely.

Sanskrit	Avestan	Old Persian	Modern Persian
Sindhu (Indus)	*Hindu*	*Hindu*	*Hind*
Asura Medhās	*Ahura Mazdāh*	*Ahuramazdā*	*Hurmuzd*
bhūmi (earth)	*būmi*	*būmi*	*būm*
kratu (insight)	*xratu*		*xirad*
hasta- (hand)	*zasta-*	*dasta-*	*dast*
açva- (horse)	*aspa-*	*asa-*	*asp*

Three successive stages in the history of the Iranian languages, typified by Ancient, Middle and Modern Persian, the principal branch of the group, correspond with successive national vicissitudes. Old Persian was used on the monuments of the Achaemenid dynasty (6th–4th centuries B.C.) destroyed by Alexander the Great. Middle Persian is known from the Parthian or Arsacid period (2nd century B.C.–3rd century A.D.) and more abundantly from the Sasanian epoch (*c.* A.D. 224–651) terminated by the Arab conquest and domination. With the Persian renaissance (9th century A.D.) Modern Persian appears. It changed little thereafter and is still alive. Other Iranian idioms passed through stages similar to those of Persian.

Ancient Iranian Languages.—Of the Median language are known only loan words in Old Persian and, from Herodotus, the word for "dog" (*spaka*), besides several personal names. Of the Old Saka-Scythian group of languages (Scythian and Sarmatian) only personal names in Greek inscriptions, found in south Russia, have come down. The only ancient Iranian languages really known are Avestan (*see* AVESTA) and Old Persian.

The former is the language of the Zoroastrian sacred books. By early European scholars it was improperly called Zend, a term designating only the commentary to the Avesta, written in the form of Middle Persian called Pahlavi (*see* below and PAHLAVI LANGUAGE). The age of the Avesta is dubious. Two parts of it are clearly distinct: the so-called Gathas are more or less at the same linguistic stage as the most ancient Vedic hymns of Old Indian. These archaic poems composed by the prophet of Iran, Zoroaster (*q.v.*), are authentic documents of his religious reform. The greater part of the Avesta, the so-called recent or younger Avesta, is a collection of texts of varying antiquity and is characterized by a gradual simplification and a lax use of grammatical forms. In its present state it is the size of the *Iliad* and *Odyssey* combined. At the time of its codification (4th–6th centuries A.D.) Avestan had long been a dead language known to the priests alone. Its original home is uncertain but must no doubt be sought in eastern Iran. It was long taken for the language of Bactria, but later arguments were advanced for localizing it in ancient Khwarizm (Khiva). The Avestan alphabet was evolved from the late Pahlavi script; before this, the Avestan texts are thought to have been transmitted orally.

Old Persian was used in the cuneiform inscriptions of the Achaemenid kings. The text is usually accompanied by translations into Elamite and Akkadian (Assyro-Babylonian). The most important document is the famous inscription of Darius the Great (reigned 522–486 B.C.) on the rock of Bisitun (Behistun), near Kermanshah, which was first read and published by Sir Henry Rawlinson in 1846.

Middle Iranian.—This term describes the state of Iranian languages from the 3rd to the 10th century A.D., although in the case of Persian the transition from the Middle to the Modern phase must have been completed by the 8th century. The Middle Iranian languages are Parthian, Middle Persian, Bactrian, Khwarazmian, Sogdian and Saka. Linguistically all except the second are closer to Avestan than to Old Persian.

Parthian was the official language of the Arsacid period. More than 2,000 Parthian ostraca, largely records of wine deliveries dated in the 1st century B.C., have been recovered from the site of Nisa, one of the Arsacid capitals (near present-day Ashkhabad). Otherwise Parthian is attested chiefly in later, Sasanian, inscriptions and in Manichaean texts. The Parthian hymn cycles composed by the Manichaean missionary Mar Ammo in the second half of the 3rd century A.D. rank among the highest literary achievements of the Middle Iranian period.

Middle Persian, the official language of the Sasanians, is found in their inscriptions as well as in Manichaean and Zoroastrian books. Of the former by far the most important is the great inscription (*c.* A.D. 262) of Shapur I, a historical record of the war against the Romans, with parallel versions in Parthian and Greek.

The Middle Persian Manichaean literature (3rd–10th centuries) shares with the Parthian and Sogdian Manichaean texts the advan-

tage of being written in an easily readable Aramaic alphabet, whereas the Zoroastrian books (largely commentaries on the Avesta and treatises on religious subjects, composed down to the 9th century) are written in the highly ambiguous Pahlavi script and abound in Semitic ideograms. The extant Pahlavi literature has been computed to amount to 628,000 words (E. W. West). The Manichaean texts, discovered in central Asia at the beginning of the 20th century, are much less numerous but have shed much light on the reading of Pahlavi books.

The first specimen of the Bactrian language, recorded in Greek letters, comes from an inscription of the 2nd century A.D., which was discovered in northern Afghanistan in 1957.

Khwarazmian is found only in glosses and sentences imbedded in medieval Islamic law books.

Sogdian, the native language of the province centred on Samarkand, is available in three distinct Semitic alphabets, one being employed for lay documents and for Buddhist texts, one for Christian and the third for Manichaean literature. Each group, moreover, is characterized by dialectal variations. Sogdian traders and missionaries, traveling and settling in colonies along the route connecting Sogdiana with China, raised their language to the status of a lingua franca of central Asia between the 4th and the 10th centuries. A great deal of Sogdian literature was still awaiting publication at mid-20th century.

Saka is known in two varieties. One, richly attested, was once the language of the kingdom of Khotan in Chinese Turkistan and hence is known as Khotanese. The other (of which only one Buddhist fragment survives) was connected with Tumshuq, also in Chinese Turkistan. (*See* SAKA.) Phonologically, the Iranian language which is closest to Khotanese is the present-day Wakhi in the Pamirs. The amount of Khotanese literature that has been recovered (largely Buddhist, but including some documents of lay content) is hardly less than what has survived in Pahlavi. The language is permeated with Indian elements. The study of Khotanese, still in its initial stage in the 1960s, seemed bound to have a profound effect on philologists' understanding of Iranian in all its branches.

Modern Languages.—All Iranian languages now used display some tendency toward an analytic stage (simplification of the sounds and, in morphology, the use of new auxiliary tenses, etc.). Of these languages by far the most important is literary Persian, as found in the extensive Persian literature and among educated speakers.

Modern Persian is a direct descendant of Middle Persian, but has borrowed many words from a source akin to Parthian, and contains numerous Arabic and Turkish elements. It is written in Arabic characters. Though Modern Persian is a single language, local variations spoken in Iran, Afghanistan, India and Russian Turkistan (Tadzhik S.S.R.) are considerable.

Dialects, parallel to literary Persian, are used in most Iranian towns and villages. The dialects of Fars, Luristan, Khurasan and Kerman belong to the same southern group as the literary language. On the other hand, numerous other vernaculars represent the remains of former northwestern idioms.

Such are the local dialects of the Caspian provinces, the language of the Kurds (spread over a vast area and sporadically found in northern Syria and even close to Ankara in Asia Minor), the language of the Balochis (*see* BALOCHI LANGUAGE) and the tongues of isolated groups (such as those of Kashan, Simnan, etc.).

Among Modern Iranian languages of the eastern group are the Afghan language, Pashto (*q.v.*) or Pushto, the various dialects of the Pamir group (Shughni, Wakhi, Munjani, etc.), Yaghnobi (a modern descendant of Sogdian) and Ossetic (*see* OSSETIC LANGUAGE), spoken in the heart of the Caucasian mountains south of Ordzhonikidze (Vladikavkaz), a survivor of the once powerful Sarmatian group of Saka spoken in south Russia.

See also references under "Iranian Languages" in the Index.

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IRANIAN LITERATURE: *see* PERSIAN LITERATURE.

IRAQ (AL JUMHURIYAH AL 'IRAQIYAH or AL 'IRAQ), an independent country of southwest Asia and a republic since 1958, is bounded north by Turkey, east by Iran, southeast by the Persian gulf, south by Kuwait and Saudi Arabia, and west by Jordan and Syria. Its area is 169,284 sq.mi. and population (1962 est.) 6,802,843. It comprises the three former Turkish provinces (*vilayetler*) of Basra, Baghdad and Mosul (*qq.v.*). The frontiers were agreed and delimited between 1922–37; until 1926 it was uncertain whether the Mosul region would form part of Turkey. In the north and much of the east, the frontiers follow natural features in difficult hill country with few routes. There is however one comparatively easy route via Kermanshah to central Iran. Toward the head of the Persian gulf the Iraq-Iran frontier is arbitrary, and the entire Shatt al Arab is included in Iraq. The western and southern frontiers are again arbitrary—straight lines drawn between a few outstanding natural features.

This article has the following sections:

I. Physical Geography
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  2. Social Conditions
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  4. Justice
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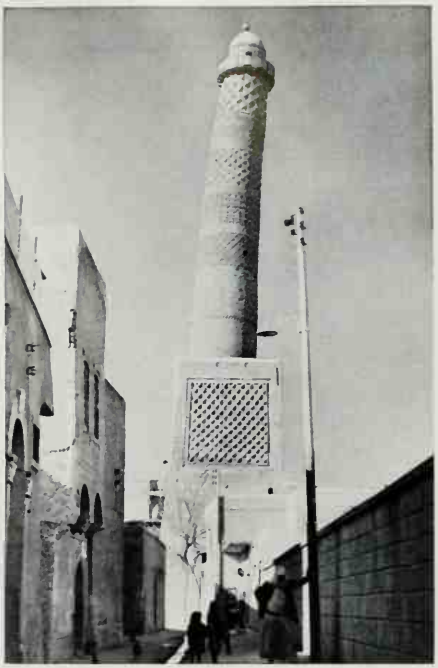
  6. Defense
V. The Economy
  1. Agriculture

Typical mountainous country in Kurdistan in northern Iraq

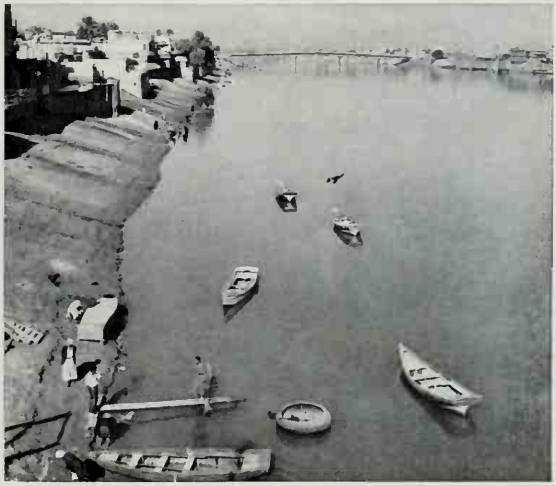


The leaning minaret of an ancient mosque at Mosul in northern Iraq

Part of the Citadel mound in Irbil, an important foothill town and religious centre in northeastern Iraq

VIEWS IN IRAQ

The Al Malwiyah tower (9th century) with a spiral ramp in the northeast corner of the Ziyadah (outer enclosure) of the Great Mosque at Samarra



A view of the Tigris as it flows through Baghdad, the capital of Iraq

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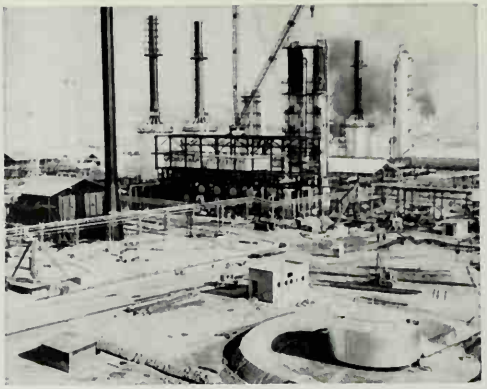
IRAQ

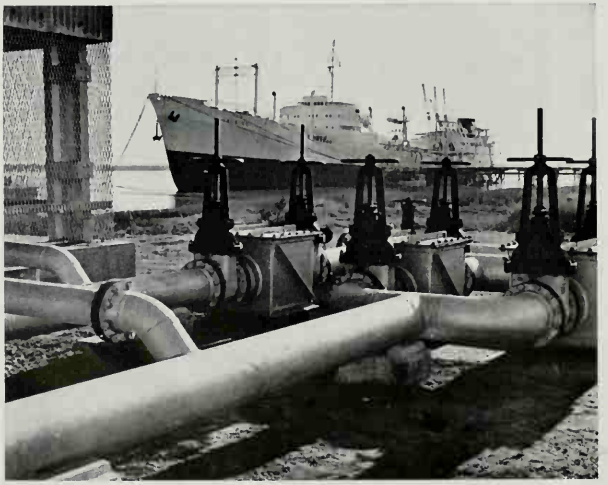
Packing dates for export. Iraq supplies most of the world's demand for this fruit



A stabilization unit at Kirkuk oil field, in northeastern Iraq

Thoroughfare in one of the modernized sections in Baghdad which are gradually changing the face of the old city

SCENES IN IRAQ



The port of Fao (Al Faw) on the Persian gulf, terminal of the pipeline from the Zubayr oil fields

A market scene at Sulaymaniyah, a town in Kurdistan in northern Iraq

BY COURTESY OF (BOTTOM LEFT) BASRAH PETROLEUM COMPANY, (TOP RIGHT) IRAQ PETROLEUM COMPANY LTD., (TOP LEFT) ARAB INFORMATION CENTER, CHICAGO, PHOTOGRAPHS, (CENTRE RIGHT) KEYSTONE, (BOTTOM RIGHT) CAMERA PRESS—PIX FROM PUBLIX

2. Irrigation
3. Livestock
4. Forestry
5. Oil
6. Industries
7. Trade and Finance
8. Communications

I. PHYSICAL GEOGRAPHY

1. Geology and Structure.—Iraq consists of a lowland trough lying between asymmetrical and very different upland massifs to the east, north and west, and continuing southeastward as the Persian gulf. The region is one of crustal weakness and subsidence, with relatively young and plastic sedimentary rocks engulfed and downwarped between (on the west) the ancient, rigid and highly resistant block of Syria-Arabia and (east and north) the highly folded and topographically imposing younger Zagros and Anatolian mountain chains. The Zagros folds are mainly immense anticlines or hogbacks running from northwest to southeast with great regularity, and rising abruptly from the flat low-lying riverine plain. The Iraq-Iran political frontier follows this well-defined physical boundary for only about 250 mi.; farther south, Iranian territory extends westward to include a stretch of lowland at the head of the Persian gulf, while toward the northeast the frontier swings east into the Zagros formation, thus including an extensive hill territory within Iraq. On the northwest and west, the land rises more gradually and regularly into the plateau of Syria-Arabia, which consists of a mass of Archean granites overlain by sedimentary layers, chiefly of the Mesozoic (Jurassic and Cretaceous) and Cenozoic (Eocene and Miocene) periods. Slight tilting or differential erosion have produced minor topographical features and the western edge of the Euphrates valley is in some places marked by a discernible cliff (*iraq*) from which the name of the country is said to originate. In the extreme northwest there are several small and gentle but clearly defined folds, which appear as ridges aligned more or less in an east–west direction, the chief of which is the Jabal Sinjar near Mosul.

2. Relief and Drainage.—The fundamental elements in the physiography are the twin valleys of the Tigris and Euphrates (*qq.v.*) rivers, joined in the south, but diverging in the north, separated by a tongue of higher land stretching southward from the Anatolian foothills to just north of Baghdad, and known as Al Jazirah ("the island"). Like Egypt, Iraq is very largely the gift of its rivers; and a consideration of both rivers is an essential basis to understanding the geography of the country.

Both rivers rise in the eastern highlands of Asia Minor, and pursue an intricate course southward around the numerous east–west aligned mountain ridges. In places, earth movements and the emission of lava have greatly affected their course; *e.g.*, the lava flow from Karacali Dag near Malatya has diverted the Euphrates to the southwest. Both rivers also flow at times in enormous gorges cut directly across the fold ridges, and it is inferred that the folds may have developed subsequent to the drainage pattern. Emerging from the Anatolian mountains into the upland country of Syria and Kurdistan, they have cut normal narrow valleys into the plateau surface and dropped considerably in level. Between the Turkish frontier and the Baghdad region, the Euphrates falls by about 800 ft. (1:3,000) and the Tigris by 1,000 ft. (1:1,750), hence both streams are swift and heavily charged with sediment at all seasons. In the region of Baghdad there is a sharp change: from there the valleys are extremely flat—Baghdad itself is only 110 ft. above sea level. Northward from the head of the Shatt al Arab, where the two rivers may be said to merge, there is a fall of only 8 ft. in 100 mi. To explain this somewhat unusual pattern two theories have been evolved. The earlier, postulated by J. de Morgan, is that at one time the Persian gulf extended as far as the Baghdad area. Two smaller rivers, the Karun and the Kharkeh, both of which are relatively large in volume and swift (owing to rapid descent from the Zagros mountains) then emptied directly into the Persian gulf, and in so doing rapidly built out deltas toward the south. Ultimately these deltas extended entirely across the gulf to its southern shore, thereby cutting off the Tigris-Euphrates system from the open sea and the scouring effects of currents. In consequence, the Tigris and Euphrates deposited huge quantities of silt and mud which gradually filled in the head of the gulf, and dried out to form a low, irregular land surface, with the head of the gulf rapidly receding toward the southeast; a rate of two miles per century has been suggested. As substantiating evidence, De Morgan invoked (1) the presence of a low but prominent ridge 250 ft. high running across the river valleys from Ramadi to a point a few miles southeast of Baghdad; this, he suggested, was the old coastline of the gulf; (2) the remarkable flatness of the lower valleys of both rivers, with a succession of river channel, marsh flats and sandy-ridges; and (3) the undoubted changes of coastline within historic time in the configuration of the gulf coastline around Basra.

In 1952 the validity of this view was challenged by G. M. Lees and N. L. Falcon (*Geogr. J.*, vol. cxviii, March 1952), who demonstrated that in the past 100 years in some areas there had been no significant advance of the coastline toward the southeast; that at Basra the alluvial deposits lie directly upon land-formed rock series and not, as would be expected, upon strata showing a former marine incursion; and lastly, that the historic changes in land and coastal forms may have been less than at first supposed. They therefore postulate a more stable coastline, roughly at its present day position, with the accumulation of silt from the rivers producing a downwarping of the land surface in order to accommodate increasing weight. As the land surface sank there would at first be temporary hollows which gradually filled up through the deposition of alluvium and also by the "trapping" and "fixing" of wind-borne dust by water surfaces. Discussion still continues, with inconclusive results in favour of either theory.

Regime of the Euphrates and Tigris.—Both rivers are at their lowest in September and October, and as temperatures fall, evaporation is markedly reduced, leading to an increased flow from November in the Euphrates, though not in the Tigris, which being narrower and deeper is less affected. In spring the melting of snows in the Anatolian and Zagros mountains produces flooding, with a maximum level in April (Tigris) and May (Euphrates). This difference is due to earlier melt in the more southerly Zagros, and also to the character of underlying rock strata: the western Zagros include many impermeable layers from which runoff is rapid, while in the Euphrates basin there is much porous limestone through which meltwater percolates relatively slowly. The Euphrates rises by 11 ft. at Hit, and its flow increases from 8,800 to 64,300 cu.ft. per second; and the Tigris by 18 ft. with, at Baghdad, a normal increase in volume from 11,900 to 106,650 cu.ft. per second. There are important differences in the two rivers. After leaving its mountain area, the Euphrates receives only two left-bank tributaries, the Belikh and Khabur; there are no right-bank tributaries. Consequently, there is much loss by evaporation during passage through the Syrian steppe and lowlands of Iraq. The Tigris, on the contrary, though devoid of right-bank tributaries, flows parallel to the Zagros ranges, from which it receives many affluents, including the Great and Little Zab, Diyala and Karun. The Tigris therefore not only carries far more water but is also subject to much more sudden flooding, since its catchment area is wider, and local rainfall can have a greater effect—it may rise by 10–20 ft. in one day. Another feature common to both rivers but more developed on the Tigris is the formation of natural embankments, or levees, in the lower valley. This phenomenon, characteristic of many silt-charged rivers flowing over flat plains, *e.g.*, the Mississippi in the U.S. and the Yellow river in China, gradually raises the river bed above the level of the surrounding plain, and tributaries thus enter with difficulty, often forming a marshy or flooded area near the confluence. Another feature is that if flooding destroys the bank of a natural levee, the river may develop an entirely new course. This has happened on many occasions in the past on both rivers; *e.g.*, the mainstream of the Euphrates flowed past Hillah in the early 19th century, but 100 years later had shifted to a new channel just east of Najaf. In the lower valley therefore there are many old channels, some dry, some occupied by distributary streams which lead off water from the main course, and others now used for irrigation. Because of the extreme flatness many thousands of square miles in lower Iraq are regularly

flooded from 10 to 20 ft. deep. Settlements, roads and railways are therefore sited on natural or artificial mounds. Baghdad in particular has been subjected to devastating floods, especially in 1954; but with the completion of river control projects, including that of the Wadi ath Tharthar, flooding has been greatly reduced in the north.

3. Geographical Subregions.—It is possible to distinguish on a physiographic basis four major subregions: lower Iraq, made up of the twin lowland of the Euphrates and Tigris rivers; upper Iraq, the now separated river valleys with an intervening plateau zone; Assyria and Iraqi Kurdistan; and the western desert region.

Lower Iraq or the *Lower Valley* (sometimes referred to as the delta lowlands) begins at the ridge between Ramadi and Baghdad and extends about 350 mi. southward to the Persian gulf. The Tigris and Euphrates diverge respectively east and west below Baghdad, which is therefore in a narrower waist of lowland. The Tigris has a particularly tortuous course; between Baghdad and Kut the distance by river (213 mi.) is about twice that by road. This stretch of the river is marked by large numbers of old meander channels, some cut off to form oxbow lakes. Because of the natural levees and the difficult entry for tributary streams there is much marsh. Many subsidiary rivers empty into the Suwayqiyah depression, and navigation of the mainstream is difficult because of the sharp bends and strong current. Below Kut the course of the Tigris is much straighter, with a flatter slope (1:29,000 as compared with 1:15,000) and this allows free-flow irrigation on a large scale—a more difficult matter above Kut. The Tigris has shifted its course several times in the last 1,500 years: between the 8th and 16th centuries it flowed in what is now the Shatt al Gharraf. In its lowest section, especially from 'Amarah southward, the waters are dispersed into distributary channels and marshes, both east and west; only 19% of the flow at Baghdad passes down the main (navigable) channel from 'Amarah to Al Qurnah.

From Ramadi southward the Euphrates flows at first in a well-defined channel, about 150–300 yd. wide and of low season depth, 3–7 ft. Natural levees occur, as on the Tigris. Between Al Musayyib and As Samawah the river discharges into various distributaries, and in early Arab times formed one enormous swamp, with many present-day remnant features: old channels, levees, cutoffs and lakes. From As Samawah there is a well-defined channel as far as Nasiriyah, or even Suq ash Shuyukh, lying within an open plain which is now largely arid and almost featureless. Below Nasiriyah distributary channels (natural and also man-made) take off the whole of the Euphrates water, which ultimately drains into Lake Hammar, a vast expanse of reedy swamp, only 2–3 ft. deep in places. From Al Qurnah, the point of junction between the waters of Lake Hammar and the Tigris, the river is known as the Shatt al Arab.

Away from the rivers patches of swamp and marsh occur with irregular ridges between. Parts are still largely uninhabited and unsurveyed; in other areas are communities of Marsh Arabs, who live in reed and brushwood huts set often on brushwood foundations, and who subsist on rice, fish and *ageyl* (an edible species of rush). Along the river there is much variation in the quality of the land; some parts have infertile sands and gravels while others have alluvium and clay which when watered can be highly productive.

Upper Iraq.—This comprises the valleys of the two main rivers, together with the tongue of irregular and somewhat higher ground which stretches southeastward between them as a prolongation of the Syrian steppe. At its entry into Iraq the Euphrates has cut a broad flat valley about 10–12 mi. wide, and because of the absence of tributaries the sides are generally steep. Rejuvenation of the Euphrates led to many meanders being incised into the flat floor, giving a second set of terraces, with the river about 150–500 yd. wide. Irregularities in rock strata have produced rapids and shoals, and the river tends to hug the western bank, producing a marked escarpment on the west, and more open country to the east. The Tigris on leaving Turkey has cut an irregular winding passage among low foothills and ridges: in places it runs parallel to the strike of these folds (mainly northwest-southeast) but elsewhere it cuts directly southward by narrow gorges through the hills themselves. Hence the upper Tigris has something of an alternation in topography; where the river flows southeastward it tends to have a wide, shallow bed, with steep-sided hills on the western (right) bank, and open rolling country to the east. Separating these reaches are north-south running defiles, the narrowest of which is at Baghloja, about 18 mi. below the confluence with the Iraqi Khabur, where the Tigris is only 40 yd. wide, with a series of rapids which are almost cascades. Such conditions continue as far as Mosul, after which relief becomes much less accentuated, ultimately falling away to open steppe through which the Tigris flows in a broader channel marked by shingle deposits. There the Tigris is joined by the Great and Little Zab rivers; the latter, though small in volume, being liable to rapid flooding. One last, isolated, defile occurs where the river breaks through the Jabal Hamrin above Ba'iji at a gorge which is now used to carry the oil pipelines from Kirkuk to the Mediterranean. From Tikrit southward the Tigris wanders on a flat plain, breaking up into several arms, with the beginning of some of the features developed to a greater degree below Baghdad; at least two major changes of course have occurred.

Between the Euphrates and Tigris, and bounded on the north by the Jabal Sinjar lies Al Jazirah, a region of undulating steppe, small-scale fold ranges and closed drainage basins. The steppe continues into Syria and Jordan with the fold structures arranged in an arc running from west to southeast. The warping of the whole area has produced closed drainage basins, the largest of which is the Wadi ath Tharthar (a long defile running more or less parallel to the Tigris about 30 mi. farther west) which was important as a grazing area and is now part of the Tigris flood control project.

Assyria and Iraqi Kurdistan.—Fronting the Tigris on the east between the Turkish frontier and the broad Diyala valley is an upland area roughly rectangular in shape which rises in steps eastward from river level. The first step is the Jabal Hamrin (1,600 ft.), and behind it lies an undulating territory of river basins, rolling plateaus and irregular hills which ultimately pass into the main Zagros range. The lower (western) part, broken by the valleys of the Great and Little Zab, is the ancient region of Assyria (*q.v.*); farther east, as the mountain zone begins, there is an alternation of high ridges aligned northwest–southeast, with river basins between.

The plain of Mosul is drained mainly by the Great Zab and consists of irregular steppe rising from about 700 to 2,000 ft. A rich heavy soil made this plain the granary and centre of ancient Assyria, with its capitals of Nineveh, Nimrud and Khorsabad. The zone between the two Zab rivers (central Assyria) is much less densely settled, partly because of the lack of good water; some springs are brackish and sulfurous. An exception occurs round Irbil, where the soil and water are better; this region still produces the best wheat in Iraq.

In Iraqi Kurdistan, mountain ridges trend generally northwest–southeast, attaining 10,000–11,000 ft. in a few places, with a summit average at about 8,000 ft. Between the ridges are trough valleys (often synclinal) usually occupied by rivers which have eroded out basins. All the streams weave a tortuous way south and southwest toward the lowlands, and are marked by gorge and defile sections (*darband*) where they skirt or cut through ridges. In a few places, *e.g.*, Sulaymaniyah, Al 'Amadiyah, Rawanduz, patches of lowland allow cultivation, but much of Kurdistan is given over to pastoral nomadism. Remoteness and difficulty of access have hindered surveys and development. (*See* also KURDISTAN.)

Western Desert.—Lying to the south and west of the riverine lowlands, this region extends from Kuwait and Saudi Arabia on the south as far as Jordan and Syria. The desert area slopes gently upward from the Euphrates lowland, and is formed of Cretaceous and Tertiary rock series, which are often exposed as irregular pavement. Differential resistance to erosion produces minor relief features, and there has been some small scale tectonic disturbance, hence the surface is by no means uniform or featureless. In the extreme south, the actual frontier with Kuwait is formed by the Wadi al Batin, a rift structure three miles wide running

inland from Zubayr as far as central Arabia. To the north lies Sahra' al Hijarah, in the main a region of shallow mud-lined depressions, rocky outcrops and loose sand, passing, near the Euphrates, into an extensive swamp area.

Farther north lies the Wadian region with steeper slopes. Because of this steepness normal drainage developed again, and there is a network of dry valleys which are aligned northeastward to the Euphrates, and still carry flood water for an hour or two each year. The region takes its name from these valleys (wadies). There is no fringe of continuous sand or salt marsh, as farther south; the Wadian therefore offers more practicable routes westward and has been used from earliest days for transport, and now for oil pipelines.

4. Climate.—Because of the simplicity and regularity of relief, Iraq has a straightforward climatic regime. In the lowlands two contrasting seasons occur: a dry and intensely hot summer (May–October), and a relatively cool, humid winter (December–March) with short transitional periods. In the mountain zones relief exerts a considerable effect, and winters can be moderately severe. From May onward the predominating element is the existence of a semi-permanent zone of extremely low atmospheric pressure, situated at the seaward end of the Persian gulf, and over West Pakistan. This draws in air from the northwest, which produces a very persistent and regular northwesterly wind (*shamal*) over the whole of Iraq. Coming from land areas, these currents are dry, and hardly any cloud forms, so that for several weeks or even months the sun beats down uninterruptedly, producing extremely high temperatures—July and August means are about 35° C. (95° F.), with mean day maxima up to 43° or 49° C. (110° or 120° F.). Some drop is apparent close to water surfaces because of intense evaporation, but the physiological effect is hardly improved because of higher humidity. Strong winds produce blowing dust or sandstorms; July is the worst month, with an average of five storms at Baghdad and eight at Ash Shu'aybah. No rain falls between May and October, the first onset beginning at the end of October, with January–February the wettest period.

During the winter season conditions are more variable. Relatively shallow and transient depressions move eastward from the Mediterranean to the Persian gulf, and give rise to the *sharki*—a cool, damp southeasterly which brings rain and variable weather. At other times a cold air mass from the interior of Asia may extend westward, bringing fine but cold conditions. Hot air masses from the south may also affect Iraq; January temperatures of more than 27° C. (80° F.) are known but frost may occur anywhere, even at Basra, though this is unusual. The northeast has its own climatic conditions, as much as 30–40 in. of rain occur on the highest mountains, with 15–25 in. in Assyria. There are therefore two climatic provinces within Iraq; a hot arid lowland, and the damper northeast where rainfall is sufficient for crop growing, with slightly lower summer temperatures and a colder, continental winter, up to three months of snow lying in some places. Over-all, Assyria and Kurdistan apart, the main features of Iraqi climate are aridity and overwhelming summer heat, the difficulties of which are intensified by high atmospheric humidity locally near the rivers. Lacking in most cases the opportunity to move to higher altitudes, many better-off Iraqis have constructed underground rooms or cellars (*sirdab*) in which to pass the hottest part of the day.

5. Soil Character.—Reflecting the physiographic and climatic divisions of the country, the soils fall into two contrasted groups: heavy alluvial deposits associated with the main rivers, and very light soils in the rest of the country. The alluvial soils contain a significant proportion of humus and clay, and dry out to a hard tenacious mass which can be used for building. The light soils are deficient or entirely lacking in humus, with a low clay content; but they may have a proportion of wind-deposited minerals, some of which are valuable plant nutrients.

For both groups of soils there is an acute problem of salinity induced by watering under conditions of sharply seasonal rainfall followed by a hot arid season. This produces evaporation of soil moisture, and consequent accumulation of alkaline salts at or near the surface, in quantities sufficient to inhibit cultivation. On entering Iraq, the Tigris and Euphrates contain about 30 parts per 100,000 of salts; in their lower courses this proportion has trebled. In 1949 the Haigh commission estimated that 60% of all irrigated land in Iraq had become salinated, and an over-all assessment is that 1% of total cultivated area is abandoned each year because of salinity. Crop yields have fallen by 20%–30% since 1920 with a 50% decline in a few extreme cases. It is now recognized that irrigation itself is not sufficient; there must also be a system of rapid underground drainage to lead away irrigation water after use, before it is evaporated with consequent salination.

6. Vegetation.—Iraq is a meeting place of two major plant groupings, both of which show the predominating influence of drought. Toward the north and east (broadly from latitude 32°–33° N.) there is a steppe vegetation of perennial bushes and low shrubs, with mugwort (*Artemisia*), goosefoot (*Chenopodiaceae*) and grass species dominant, together with a "flush" of short-lived creepers and grasses, which amount to 60%–70% of the total vegetation. Toward the south and west, vegetation is often restricted to thorns (chiefly tamarisk and species of *Haloxylon*, of which *H. persicum* affords useful camel-fodder and fuel), a few shrubs, *e.g.*, rhanterium and papposum, and other salt-resistant plants. Poplar, willow, licorice and tamarisk flourish (usually in small clumps) near the rivers, and below Al Qurnah the marshland is an area of reeds, tall grasses and sedge. Open oak forest occurs on the Zagros mountains between 2,000 and 6,000 ft., now mostly reduced to scrub by intensive cutting and unrestricted grazing; above this is an alpine zone of cushion plants and dwarf species broadly similar to those of alpine Europe. Millions of cultivated date palms produce one of Iraq's most important exports (see *Agriculture*, below).

7. Animal Life.—This has been much reduced: the oryx, ostrich and wild ass are now practically extinct, and the last lion appears to have been killed around 1910. Bats, rats of various species, jackals and wildcats are the most common mammals, with wild pig and gazelle in remoter parts. Reptiles are numerous: lizards (the largest, *Varanus griseus*, reaching four feet); snakes (mainly "racer" species and sand snakes), only three species of which (the horned and blunt-nosed vipers and a rare cobra) are poisonous; and two types of tortoise, of which *Trionyx euphraticus* is peculiar to Iraq. Many kinds of fish occur, including the "Tigris salmon," a barbel which can attain seven feet. Iraq is also visited by vast numbers of migrant birds.

II. THE PEOPLE

There are important racial and cultural distinctions among the population of Iraq, with the major, predominant difference lying between Arab and Kurd. The Arabs are a markedly homogenous group, and occupy most of the centre, west and south of Iraq, where they have probably lived since very early times. Both nomads and settled peoples in these areas are of this basic type; some authorities see a difference in the Marsh Arabs or Madan (*see* ARAB) who may be descended from the ancient Akkadians and Sumerians. The Kurds are racially akin to the Iranians, and form another, smaller homogenous group located mainly in the north and east; they are probably descendants of the Medes. Kurds with their racial associates, the Yezidis and the Assyrians, were estimated in 1961 to number 850,000, or about 12% of the total Iraqi population. Smaller groups are (1) the Turkmen (Turkoman; *q.v.*) who live in communities in Irbil and Sulaymaniyah provinces; (2) the Shabaks of Mosul, who possibly originated in central Asia; and (3) the Mandaeans (*q.v.*), who though distinct as a religious group are less so as a racial element. Until 1948 Iraq had a significant Jewish community, living mainly in the towns; the majority have migrated to Israel. Arabic, the official language, is the most widely spoken. Kurdish and Turkish dialects are common in the north and variants of Iranian are found among the eastern tribes.

Religion divides the people of Iraq. The majority (about 75%) of the Arab population are Shi'ah Muslims, as are 50%–60% of the Kurds; but a minority of Sunni Muslims (about 25% of the Arabs and 40%–50% of the Kurds) have long held effective political dominance. Most tribal chieftains and politicians are Sunnis, a fact which partly explains the disturbed nature of Iraqi

politics. There are also a number of small Christian groups, who live mainly in the north, round Mosul, or in the larger towns: Nestorians (*q.v.*), Jacobites, Chaldeans, Syrian Catholics (*see* ROMAN CATHOLIC CHURCH) and Gregorian Armenians (*see* ARMENIAN CHURCH). They have generally been in political disfavour. Other religious groups are the Yezidis, a Shi'ah offshoot who combine features of several religions; and the Mandaeans, who revere John the Baptist.

Population.—The population of Iraq at the census in 1957 was 6,538,109. It is very unevenly distributed: for the most part the valleys of the two large rivers are relatively densely inhabited, while the deserts of the west and even some area of the riverine lowlands have a scanty population. On a basis of persons per square mile of cultivable land, population is concentrated in four main regions: the banks of the Shatt al Arab; along the middle and upper Tigris around Baghdad and across to the Euphrates at Hillah; the lowland basin round Sulaymaniyah; and the upper Euphrates. By no means all of the great river valleys (especially just north of the Shatt al Arab) are as densely peopled as would be imagined. This is important because, with so much land sparsely populated, there is less incentive to farm it well, and some authorities have suggested that a denser population might result in improved methods of agriculture.

Towns play an important part in Iraq. Baghdad, the capital, is by far the largest; other large towns are Basra, Mosul, Kirkuk and Najaf (*qq.v.*). The rest are spread fairly evenly throughout the riverine areas. Special features of the settlement pattern are: (a) the number and even spread of towns of relatively small size (10,000–25,000 inhabitants); and (b) the extent to which the populations of even large towns are partly agricultural; *i.e.*, there is much less of the sharp distinction between town and country which is characteristic of western countries. Over most of Iraq the occurrence of towns and villages is closely related to water supply from rivers or irrigation canals, but in Assyria and Kurdistan rainfall is sufficient for nonirrigated cultivation, and there is a more uniform spread of settlement over the entire province—in sharp contrast to the rest of Iraq. Nomadism is important not only in the western deserts, but also between the two rivers, both in Al Jazirah and the drier and sandier parts as far south as the Shatt al Gharraf. Nomads are also an important element in the towns, which they frequent in large numbers at certain seasons. Religious pilgrimages to Karbala', Najaf and Samarra' swell the local population; and in Kurdistan seasonal migration (transhumance), mainly from winter (lowland) to summer (upland) pastures, is widely practised. Some Kurdish tribes even cross the frontiers into Iran and Turkey. (W. B. Fr.)

III. HISTORY

For the pre-1914 history of Iraq, *see* MESOPOTAMIA; CALIPHATE; PERSIAN HISTORY; and articles on the former empires (BABYLONIA AND ASSYRIA; TURKEY) of which the territory had formed part.

1. World War I.—The entry of Turkey into World War I in Nov. 1914 led immediately to the dispatch of a small British expeditionary force from India to the head of the Persian gulf. It had three main objectives: to secure Great Britain's unique and valued position in the gulf and to safeguard its friends in that area; to prevent a hostile Turko-German penetration of southern and eastern Persia, such as to threaten India; and to safeguard the infant petroleum industry in southwestern Persia where oil was first produced by the Anglo-Persian Oil company in 1912. The force, collected at Bahrain, landed at and secured Abadan, and occupied Basra (Nov. 22). With increasing local contacts and commitments in the southern areas of the Basra *vilayet*, a rudimentary British civil administration came into existence under the chief political officer, Sir Percy Cox (*see* COX, SIR PERCY).

Turkish counterstrokes having been repulsed, and country-wide river flooding survived, the expeditionary force, enlarged to army corps dimensions, reached upward into lower-Euphrates country as far as Nasiriyah, and up the Tigris to Qurnah and 'Amarah. In the autumn of 1915, however, a bold advance pressed upriver nearly to Baghdad could not be sustained, and resulted in withdrawal to Kut, where the army of Gen. Sir Charles Townshend was surrounded, besieged and finally, after 140 days, in spite of strenuous efforts for its relief, forced to surrender on April 29, 1916. The summer was employed by the British in a thorough overhaul of establishments and communications, under a vigorous commander, Gen. Sir Frederick Stanley Maude. In the winter of 1916–17, after patient preparation, he ousted the Turks from their positions in the Kut area and advanced to the occupation of Baghdad (March 11, 1917) and beyond it, before settling down to a summer of consolidation. Maude died of cholera in Baghdad (Nov. 18, 1917).

Early in 1918, while the occupied territory was already under an improvised but comprehensive civil administration (conducted with admirable devotion, though not without its painful episodes), Maude's successor Gen. Sir W. R. Marshall was able to advance up the Euphrates and to plan a final blow on the Tigris. Late in October he advanced through the Jabal Hamrin, crossed the Tigris and administered a final defeat to the Turks at Kalat Sherghat (Sharqat) a few days before the armistice of Mudros (Oct. 30). Kirkuk was also occupied and then Mosul itself. (*See* also WORLD WAR I.)

2. The Iraqi State.—Two uneasy years followed. The British administration, hampered by the repatriation of key men, by war-weariness, and by uncertain policy, maintained itself in spite of lower-Euphrates Shi'ite intrigues, endemic tribal disorders, the reluctance of the Kurds of the Iraqi northeast to be controlled, and the entry of a stream of Arab-nationalist propaganda from Syria. The last-named element took its place in the Iraq of 1919–20 with echoes of the 19th century yearnings for Arab emancipation, awareness of the real or alleged promises of Arab independent statehood made by Sir Henry MacMahon as high commissioner in Egypt in 1916, the Wilsonian fourteen points (and notably the self-determination principle), and with the specific Anglo-French declaration (Nov. 1918) that Iraq and Syria were to become free, self-determined states. It resulted that, while tribesmen chafed at the exigencies of an efficient and honest regime, the Iraqi intelligentsia demanded, first privately and then openly, an "Arab government" of their own. Converting some leading sheikhs to their view, and noting the wholesale withdrawal of British forces, together with indications that concessions to their views either by Whitehall or the local civil commissioner (Sir Arnold Wilson) were slow and reluctant, they managed in the summer of 1920 to bring about disorders which, except in the principal towns and some quiet areas, upset administration, cost lives, and cut communications (including the new Basra-Baghdad railway) in much of the territory. A major military effort, with the re-entry of important British forces, was needed to restore order, collect arms and punish the recalcitrant. These tasks were accomplished by mid-autumn 1920, Sir Percy Cox returning to Iraq as high commissioner in October.

The general policy to be adopted had by now been settled in London—it was one of Iraqi self-government under British advice and (temporary) control—and a mandate for the territory, awarded to Britain by the Supreme Allied council at San Remo in April 1920, had been accepted. Cox inaugurated an all-Iraqi council of ministers, entrusted departmental and provincial administration to Iraqis under British advice or inspection, founded an Iraqi army—and looked for a king. He was found without difficulty in the person of Amir Faisal (*see* FAISAL I). Driven by the French from his Syrian throne (July 1920), he was encouraged to proceed to Iraq, was there widely acclaimed, and thanks to his personal gifts and wartime fame was elected to the throne by a rough-and-ready but decisive referendum. He was crowned in Baghdad on Aug. 23, 1921; an Iraqi state and monarchy had come into existence.

3. Monarchy Under Mandate.—The British mandate lasted until the autumn of 1932: the monarchy, from 1921 to 1958. The period during which the two institutions ran concurrently was a vitally formative period for the modern Iraqi state. Successive high commissioners—Sir Percy Cox, Sir Henry Dobbs, Sir Gilbert Clayton, Sir Francis Humphrys—were devotedly supported by the comparatively large but diminishing staff of British advisers and experts—ministerial, departmental, regional—engaged by the Iraqi

government, which included some outstanding personalities; and the Iraqi administration, from the council of ministers and headquarter departments to remote outstations, developed and consolidated into a machine of considerable efficiency, with many officials of high merit. Relations between the British and Iraqi elements, too easily perverted to suspicion or worse, were normally preserved on a level of cordial co-operation. The mandate over Iraq, with its solid state-building achievement (and its early relinquishment) was beyond doubt the most successful of the mandatory experiments of the period.

The years 1921–32 showed many interesting features. The administration of the territory was established, and survived regrettable but inevitable incidents of tribal disorder, urban faction and political restlessness. Lawlessness in Kurdistan (which lacked Arab-inspired loyalty), mid-desert Bedouin anarchy and the theocratic recalcitrance of the Shi'ite (largely Persian) mujtahids (religious teachers) of the holy cities were gradually overcome. The Iraqi army and the police grew in efficiency. The monarchy appeared popular, with the king an indispensable element in unifying and inspiring public sentiment. The country in fact settled down to find its own orientation and level of security, and to be governed as a modern state. Its relations with neighbours were various: with Persia, never cordial but never violent; with Arabia, marked by serious frontier raids and bitterness (in which Hashemite-Saudi antipathy played a main part) until a measure of reconciliation was achieved in 1925. The Turks, neighbours and ex-suzerains, demanded at the 1923 Lausanne conference no less than the "return" of the Mosul *vilayet*, or most of it, to Turkey, as being predominantly Turkish in race. This led to the long-drawn "Mosul question" which, after many fruitless meetings at Geneva and Istanbul, and the mission to Iraq in 1925 of a fact-finding League of Nations commission, was decided by the League in favour of Iraq, with preservation of substantially the old *vilayet* boundary as the Iraq-Turkish frontier: a decision which, after initial protest, was loyally accepted by Ankara. The League decided, however, that British control in Iraq must be extended to 25 years.

The British decision to implement its mandate by a suitable Anglo-Iraqi treaty was a shrewd one, though it did not render the unpopular imposition of foreign tutelage either invisible or acceptable. A first treaty, with its attached agreements, was signed in June 1922, subject to ratification by a constituent assembly. The latter was convened in March 1924 and succeeded, in face of much intimidation and reluctance, in ratifying the treaty and passing also an organic law, which endowed the country with the institutions of a limited monarchy and two-chamber parliament. Meanwhile, short-lived Iraqi cabinets came and went, the social services developed and British staffs continued to diminish.

A new Anglo-Iraqi treaty, in 1927, marked some advance, but the desired final step of terminating the mandate was delayed by divergent views on timing and by the interest of other League of Nations members. The years 1927–30 were marked by mutual misunderstanding and impatience, as well as by the normal effervescence of Iraqi domestic politics, by problems of security, the development of new (road, rail and transdesert) communications, and by the discovery in 1927 of an important oil field at Kirkuk. But the 20-year treaty signed in June 1930 laid down an acceptable relationship between the two nations, with minimal British privileges, and provided for Iraqi membership of the League in 1932. This was accepted by the League itself, under strong British sponsorship, and on Oct. 3, 1932, Iraq achieved its ambition of complete independence and League membership.

4. Independence.—The years 1932–39 were uneasy and disappointing. The sudden death of Faisal I in Sept. 1933, a grievous loss, made way for the short and inglorious reign of his pleasure-loving son Ghazi, and the road accident which killed Ghazi in April 1939—followed, in Mosul, by anti-British rioting—passed the throne to Faisal II, a child of three, under the regency of his cousin (and uncle) the young amir Abd-ul-Ilah (*q.v.*). The material development of the country continued; oil production, with its resulting revenues, began actively in 1934; and industry, irrigation, communications and the public services all made progress. British control ceased, and advice at all levels grew rarer. Though one nationalist stalwart, Ja'far al-'Askari, was murdered, the state was served by many devoted ministers and officials, notably Nuri as-Said (*q.v.*), Yasin al-Hashimi, Hikmat Sulaiman and Jamil al-Midfai. New party groupings—although an authentic party system had little progressed—showed the advent of a new left-wing reforming nationalism among the middle-class intelligentsia. Cabinets continued to change rapidly, elections to be largely controlled, personal and class interests, mainly conservative, to be dominant.

A saddening, indeed shocking, episode of the time was the massacre of over 300 Assyrian villagers, at Simail (Sumayyil) in northern Iraq, by an army unit in Aug. 1933, an episode applauded by most Iraqi opinion, and never punished. It was followed by the departure of a large part of the hapless Assyrian community to Syria. A *coup d'état* by the ferocious Gen. Bakr Sidqi in Oct. 1936 was the first of a series of military interventions in the government; and though Bakr himself after some months of power was murdered in Aug. 1937, the evil precedent had been established. This was equally true of the politicians' practice of organizing tribal uprisings (never, in practice, controllable) against the government of their rivals in office.

Anti-British feeling gained ground during this period, largely by natural reaction against former control and through the Iraqi view of events in Palestine. Admiration of Hitler's Germany was shown in close contacts with that country and significant Nazi-type youth movements in Baghdad.

5. World War II.—The war period in Iraq falls into two unequal parts, separated by a single month of abnormal happenings. During the first 20 months from Sept. 1939 the normal restlessness of public life in Baghdad was aggravated not by mobilization or military disturbance but by increasing pressures, ambitions and controversies, and by the beginning of war shortages and economic dislocation. The murder of a minister of finance, Rustum Haidar, set off a long train of inquiries and vendettas; German victories and the fall of France seriously affected the attitude of the dominant army officers, and not least that of the "golden square" of four outstanding Anglophobe generals. In spite of a diplomatic breach with Germany (though not with Italy), a pro-German party, civil and military, formed and consolidated, while increased army pressure bore on successive civilian cabinets. Political strife grew ever bitterer and, after the finally enforced flight of the regent himself from the country, a revolutionary regime under a puppet amir was formed by Rashid Ali al-Gailani as prime minister supported by the "golden square."

In March 1941 the incoming British ambassador—Sir Kinahan Cornwallis, a veteran of the Iraqi administration of 1921–37—found himself at deadlock with the Gailani cabinet over British rights of military transit, for which the treaty of 1930 provided. Relations became critical, British women and children were evacuated, and on April 30, 1941, Anglo-Iraqi hostilities began in earnest at the British air base at Habbaniyah. This "war," highly embarrassing to Great Britain and its allies though waged with little conviction by the Iraqi forces, lasted some 30 days. The German aid expected by the Gailani government came too late and scantily; Iraqi opinion, and even its armed forces, were deeply divided. The attack on the scarcely defensible camp at Habbaniyah was never pressed, and, while all British and some U.S. subjects were confined uncomfortably in the British embassy in Baghdad and elsewhere in the country, light British forces reached the scene of action from Palestine, and others landed from India at Basra. These sufficed to bring about, in a few days, the disintegration and then the flight of the Gailani supporters, followed by the re-establishment of the legitimate regime, and constitutional government, under the returned amir Abd-ul-Ilah. The child-king returned from his Kurdish refuge to Baghdad.

During the remainder of the war period British troops stayed in Iraq, in a purely beneficent and defensive "second occupation" (as it was called by critical Iraqi politicians) until 1945. During this period political life was revived, within limits. Iraq adhered to (indeed, played a major part in) the inter-Arab negotiations at Cairo which produced the Arab league, as well as participating in all the end-of-war international congresses at Hot Springs, Bretton Woods, Chicago and San Francisco. Efforts, not wholly success-

ful, were made by responsible statesmen to restore national unity and self-respect. In spite of varied forms of control, retail prices rose, distress was widespread (though a few war millionaires flourished) and normal economic life was disturbed. The public services and officialdom deteriorated, and national development (including oil production) suffered; but security, except for a persistent nucleus of trouble in Kurdistan, was well maintained. The regent visited Great Britain and the United States, and Iraqi statesmen toured widely among Arab capitals.

6. Postwar Hopes and Distresses.—Once rid of British garrisons and wartime embarrassments, and with legitimacy and a degree of democracy restored, the state might well hope for rapid progress. Able men, though drawn still from a narrow circle, served the government—Hamdi al-Pachachi and his cousin Muzahim, Arshad al-'Umari, Fadhil al-Jamali, Salih Jabr, the Baban brothers Jalal and Jamal, and a dozen more, in addition to the veteran Nuri as-Said (Nuri Pasha), whose 10th premiership was announced in 1949 (and his 13th in 1958). The divorce between cabinet and parliament remained almost complete, still more the gap between parliament and nominal electorate. The regime was ill based and, increasingly year by year, failed to reflect much or most of the views, and the frustrated emotions, of the younger politicians and would-be reformers. The monarchy, with Abdul-Ilah still regent till 1953, was active and influential, with conservative leanings; the king went to complete his English education at Harrow. Reform or improvement in some public services was observable, especially after the shadow of acute financial shortage disappeared in the early 1950s as oil revenues increased. The oil development which produced these was extended, and material progress in many directions was notable. Almost the last of the veteran British advisory corps left between 1945 and 1947, only newly recruited technicians and specialists remaining. A permanent nonpolitical development board was set up in 1950, to spend 70% of oil revenues. Political parties, restarted in 1946, continued till 1954, and tended to coalesce into conservative progovernment and radical antigovernment groups, the latter of which seemed destined for permanent exclusion from power. Communism, ever present above or under ground, was habitually suppressed, especially by Nuri Pasha, but could still exercise attraction and had power to encourage disorder and fan anti-western feeling. The latter attitude, in spite of an explicit (but not uncritical) prowesternism among the ruling clique, constantly gained ground and force among the opposition. British policy in Palestine was a major cause of this. The newspapers by their violence called for frequent measures of discipline or suppression. Political life, in fact, was full of tension and instability, even in periods of apparent tranquillity, and outbreaks of mob violence, often Communist-organized, were unpleasantly common, notably in the capital. Tribal disorder, except for a time in Kurdistan, seemed to be a rarer phenomenon than in earlier years.

Relations with Iran remained strained and suspicious, in spite of a state visit by the regent to Teheran in 1949. With Turkey a friendly treaty was made in 1947, against opposition protests. The Fertile Crescent conception (that is, Iraqi-Syrian-Jordanian union) had its supporters during the period, but came to nothing. Iraqi relations with Egypt were not cordial, those with Saudi Arabia improved. Outspoken support of all Arab objectives was incumbent on every politician, as was hatred of Zionism and the state of Israel. The U.S.S.R., feared as the worst of menaces by Nuri Pasha and his followers, was viewed not without sympathy, or at least with indifference, by the opposition, by whom western Europe and the United States were condemned as reactionary, self-interested, and inimical to Arab ambitions.

Episodes of these years, more important than state visits, official openings of new public works, or the installation and rapid fall of cabinets, included the participation of Iraqi forces in the unsuccessful Arab intervention against newborn Israel in 1948: forces which gave, indeed, a better account of themselves than most of the Arab armies. They were withdrawn in 1949. (The departure to Israel of some five-sixths of Iraq's 150,000 Jews dates from this period.) The Palestine expedition was, by some months, preceded by the signature at Portsmouth by Ernest Bevin, the secretary of state for foreign affairs, and the Iraqi prime minister, Salih Jabr, of a new Anglo-Iraqi treaty (Jan. 1948) to replace that of 1930, which had long been unpopular; but massive and destructive riots in Baghdad, and a timely *volte-face* by the regent, led to the repudiation of the treaty by the Iraqi government and the hasty installation of a neutral caretaker government for some weeks, followed by general elections. Finally, the serious riots of Nov. 1952, starting with minor student grievances but soon transformed into a political demand for single-stage elections to the chamber (long an opposition desideratum), were a damaging blow to public order and confidence. With wholesale hooliganism and loss of police control, they led to the appointment of a leading general, Nureddin Mohammed, as temporary prime minister and, under martial law, to the temporary suppression of political parties. Normal forms of government were restored early in 1953; but it was to no peaceful heritage that the young King Faisal II, straight from Harrow, succeeded on his coronation on May 2. He was 18, small and unimpressive, a sufferer from asthma, but well meaning, dignified and popular. The regent, loyal and affectionate, remained as his chief personal adviser, and became crown prince.

7. Reign of Faisal II (1953–58).—The five-year reign of the young king covered a period of outward peace. There were fair hopes that the now great and increasing resources of the state treasury, derived from augmented oil revenues, would create a sounder and more broadly based national economy in agriculture, industry and commerce, and could thereby provide nonpolitical careers for the underemployed intelligentsia; and that the delights and distractions of an expanding and widely shared material prosperity would neutralize the fairly general "political" resentment known to be felt at the suppression of political parties and the sternly (but on the whole benevolently) authoritarian tone of political life under Nuri Pasha, who enjoyed the complete support of the throne. But this was not to be.

The reign opened with the inauguration of the great 30-in. transdesert oil pipeline from Kirkuk to the Syrian coast, followed unhappily by devastating Tigris floods which inundated the outskirts of Baghdad itself. The king and Nuri visited Pakistan. After some rapid changes of cabinet (without relation to popular or parliamentary feeling) Nuri Pasha assumed office, for the 12th time, at midsummer 1954, this time for three full years. He abolished all political parties, including his own, and imposed his customary strict discipline on political life and the press, with particular severity against the Communists. The excluded politicians, nevertheless, with a fairly large urban following, coalesced increasingly into a dumb but potentially powerful opposition, and sentiment hostile to the regime gained ground, invisibly, even in the army. The monarchical regime, in fact, with its "strong" government, its scant respect for political exuberances, its openly pro-western leaning in international affairs, and its local support mainly from feudal, conservative, upper-class, and satisfied circles, became a minority faction less robust than it appeared.

Nuri Pasha's outspoken anti-Communism was, with his habitual sympathy for Turkey, mainly responsible for the conclusion of a defensive alliance with that country in Feb. 1955. This, joined by Pakistan and Iran, became the Baghdad pact (*q.v.*), and was, in effect, a (not exclusively) military organization designed to safeguard the exposed northern tier of middle eastern nations against the U.S.S.R. The accession to the pact of Great Britain made possible a specific reformulation of the latter's rights, as an ally, at the surviving air base of Habbaniyah. This in turn permitted the politically convenient demise of the existing (1930) Anglo-Iraqi treaty, long an object of opposition-nationalist attack. The pact, which the United States joined as a benevolent "observer," was, however, greeted with the strongest dislike, not only by most of Iraqi, anti-Nuri opinion, but by almost all other Arab countries, notably Egypt, as being an organization faithless to Arab loyalties and too friendly to "imperialism." Iraqi-Egyptian relations as a consequence further deteriorated.

During the crisis of outraged Arab feeling precipitated by the British-French and Israeli action at Suez in Oct.–Nov. 1956, Iraq broke off diplomatic relations with France, and it required all the resolution of Nuri and the palace to prevent a similar en-

forced break with Britain. Anti-western disorders in fact broke out at various centres, and martial law was proclaimed; but the government, which temporarily but pointedly absented itself from Baghdad Pact council meetings attended by Britain, was able to ride the storm. The cessation of oil exports, due to the destruction of the Iraq Petroleum company's pipeline pumping stations by Syrian troops, was a severe, if temporary, financial blow to Iraq.

In 1956–57 an exchange of official visits improved Iraqi-Saudi relations; those with Syria deteriorated and those with Jordan, now clearly threatened by a Syro-Egyptian *rapprochement*, grew ever closer. The membership of successive cabinets in Baghdad rang the changes among Nuri's supporters. The king, in Sept. 1957, announced his engagement to a young Turkish-Egyptian princess.

The integration of the United Arab Republic (of Egypt with Syria) in Feb. 1958 led immediately to the announcement by Iraq and Jordan of a federation known as the Arab Union, which, as a Hashemite defensive move against republicanism, was formulated and brought into existence by a rapid series of conferences and agreements. A federal constitution and government (with Nuri as federal prime minister) came into existence, and general elections were held. But all this, including the Iraqi monarchy itself, was brought to nothing by the sudden and (it appears) unforeseen military revolution of July 14, 1958, led by Gen. Abdul Karim Kassem (or Qasim). Long planned in great secrecy, it was accomplished by a single day of street violence, wholesale arrests, an attack on the British embassy and the bloody "liquidation" of the king, the crown prince and almost the whole royal family—and Nuri Pasha—in circumstances never fully established. Order was thereafter quickly restored, a republic proclaimed under a council of sovereignty, and a revolutionary cabinet of civilians and officers formed, with Kassem as prime minister. The latter declared Iraq to be rid at last of a "corrupt gang imposed on the country by imperialism." The hitherto frustrated politicians and their followers, and doubtless a large part of the urban public, believed the millennium to have arrived. No counterblow, throughout Iraq, was struck. The revolution, received with horror in Jordan, and with doubt in Arabia, was warmly welcomed by the United Arab Republic.

8. Post-revolutionary Period.—The revolution failed to gratify these high hopes. Iraqi relations with the United Arab Republic rapidly deteriorated to extreme bitterness when Kassem's government refused the close bonds with Egypt and Syria which had been expected by pan-Arab optimists, and when Communist influence in Baghdad visibly increased. With Turkey relations were correct, even after Iraq had renounced the Baghdad pact; with Iran they fast deteriorated to the point of angry recriminations and troop movements when Iraq claimed a riverain strip on the Shatt al Arab, which the treaty signed at Sa'dabad in 1937 had ceded to Iran. Diplomatic relations were early established with the U.S.S.R., China and other Communist countries, and with these a series of pacts, trade agreements and missions were exchanged. The Communist element in Baghdad itself appeared, to western eyes, alarmingly prominent. This, and the internal acts of the regime, lost it much of the sympathy of the non-Communist world at large; its credit indeed never stood lower than in the post-revolutionary period of strain, suppression and reprisals. Kassem, fundamentally well meaning, not undemocratically minded and certainly non-Communist, showed little capacity for resolute or constructive action on enlightened lines; he tried, at best, by occasional gestures and utterances, to show a "neutrality" not consistently anti-western.

The political world, in which parties were still prohibited until licensed under an "Association law" in Jan. 1960, rapidly split into two main schools. One, supported by most hitherto excluded "progressive" politicians and returned exiles, favoured Egypt and pan-Arabism; the other, supported by the Kurds and well-organized Communist elements, preferred a more generalized pan-Arabism which reflected deep-seated Iraqi-Egyptian—and perhaps Nasser-Kassem—jealousies. Early differences and an alleged "plot" within the revolutionary ruling clique itself led to the deposition of Col. Abdul Salam 'Arif, Rashid Ali al-Gailani and other leading personalities, the resignation of cabinet ministers and the arrest of scores of old-regime high officials and statesmen. This gravely weakened the administration, and the conduct of the Communist-inspired military (or "people's") court trying these offenders, and condemning a number to death, brought much discredit on it.

The suppression of a short-lived military uprising in Mosul in March 1959, apparently in the Baathist or Nasserite interest, increased the Communist ascendancy; but demands for more Communist privileges, and their direct representation in the cabinet, were rejected by Kassem, and savage rioting in Kirkuk in July was attributed by the leader (who later, however, reversed his judgment) to their adherents. Four old-regime officials (including men of outstanding merit), and nine officers implicated in the Mosul rising, were put to death in September. Scores of further arrests followed an attempted assassination of Kassem in Oct. 1959; he was wounded, and retired for two months to a hospital; and amid the habitual and envenomed Cairo–Baghdad wireless and press polemics, "Nasserite agents" were generally blamed. The trial of suspects began late in December, the death penalty being demanded for some 100 individuals, in some cases in their absence. In March 1960 a number of death sentences were commuted to terms of imprisonment.

In the economic field, insecurity, restrictions, censorship and loss of public confidence were inhibiting factors. Works of development, for which treasury allotments were reduced from 70% to 50% of the oil revenues, slowed down, though an ambitious £400,000,000 program was published. The ministry of development was abolished. Land reform, confidently announced, made appreciable progress in some areas, but with varying results on the scale and efficiency of cultivation. Soviet contractors and experts multiplied, often in replacement of British. Varying pressures were brought to bear on the oil companies, but the work of these (except for the foreclosure of one minor concession) was not interrupted, and by their efforts oil production increased. Iraq left the sterling area, alleging nonpolitical reasons.

A serious revolt which broke out in Kurdistan in March 1961 continued throughout the year. It was suppressed with great severity, but incomplete success. On June 25, 1961, a few days after Great Britain had recognized the sovereignty and full independence of Kuwait, Kassem laid claim to the entire territory of the oil-rich amirate as an integral part of Iraq. At the request of the amir British troops were immediately sent to strengthen the defenses of Kuwait. This was sufficient to deter the Iraqi army from intervention, but later in the year Kassem repeated his claim to the territory. The admission of the sovereign amirate to the Arab league led to Iraq's abstention from its meetings. Further protracted negotiations with the Iraq Petroleum company and its subsidiaries ended in failure in October. The companies were thereupon deprived of the greater part of their concession areas, requests for statutory arbitration being ignored (see *Oil*, below).

An end to Kassem's repressive, eccentric dictatorship came with a long-planned coup by "free officers," mainly of the Baath Socialist party, on Feb. 8, 1963. This was followed by the execution immediately of Kassem and later of dozens of known Communists. The authors of the revolution, the National Council for the Revolutionary Command, pledged themselves to honour Iraq's foreign and industrial obligations and installed a seemingly capable team of ministers. Col. Abdul Salam 'Arif, Kassem's former deputy, became president of the republic. Plans for social, agricultural and industrial reform were published, though "security" absorbed most of ministerial time. Relations with the oil companies improved. Claims to Kuwait were, by implication, dropped. Relations with the U.S.S.R. markedly deteriorated, and Iraq's outspoken antimonarchism offended Jordan and Saudi Arabia while drawing it closer to (also Baathist) Syria. The western powers all recognized the new regime. Early cordiality with Egypt led to Iraq's inclusion, in April, in the plan for a wider U.A.R. to comprise Egypt, Syria and Iraq. It was clearly destined to be dominated by Nasser, but Baathist antipathy to some features of this union caused the Baghdad government, after *ad hoc* ministerial

changes, to cool visibly toward the project. On Nov. 18, 1963, President 'Arif and a team of generals seized power from the cabinet of Baath socialists. 'Arif indicated that he would co-operate closely with all Arab nations, especially the U.A.R. (S. H. Lo.)

IV. ADMINISTRATION AND SOCIAL CONDITIONS

1. Constitution and Government.—Iraq was for long a dependency of the Ottoman empire, though not fully brought into the central system of administration; thus while Turkish rule left a considerable imprint on some aspects of life, others were much less affected, and Iraq was far from being fully assimilated. After World War I and a period of British military government, a constitutional monarchy was set up in 1921, with the Hashemite Faisal I as king. The constitution was revised in 1924, and in 1932 the British mandate ended and Iraq became a fully sovereign state. Dynastic difficulties followed the death of Faisal I in 1933, his younger son Abd-ul-Ilah acting as regent for his young nephew (who became King Faisal II in 1953). This period was characterized by the growing influence of the army in political life, and by the development of a system of government under which, though democratic in theory, the real power lay in the hands of a few high officials, wealthy townsfolk, and tribal and religious leaders. The increasing unpopularity of the government led by the regent and his prime minister, Nuri as-Said, culminated in the military coup of 1958 which brought an end to the monarchy and gave power to the army group backed by Gen. Abdul Karim Kassem (who was in turn overthrown in 1963 by Colonel 'Arif [see *History*, above]). The 1924 constitution was annulled and a provisional constitution proclaimed on July 27, 1958, provided for the establishment of Iraq as an independent, sovereign and Islamic republic. Under the 1924 constitution, provision existed for popularly elected assemblies, with adult male suffrage; but this machinery was not always satisfactorily used under the monarchy or up to the mid-1960s by the "national revolutionary council."

By the 1924 constitution Iraq was divided into *liwa's* (provinces), each administered by a *mutasarrif* (governor). The settled and desert *liwa's* were subdivided into a varying number of *qadhas* and *nahyahs* under *qaimmaquams* and *mudirs* respectively. By 1960 the three desert *liwa's* (then designated as territories) had been distributed administratively among certain of the 14 settled *liwa's*. (*See* Table I.) The administration of the country is exercised by the government through the *liwa's;* the *mutasarrif* is responsible to the minister of the interior and also represents other ministries, though these may have their own representatives on the *liwa'* councils, which include some elected members. The *liwa'* council has a right to a share of local taxes and may also receive government grants for particular projects.

TABLE I.—*Administrative Divisions and Desert Territories*

Liwa's	Area (sq.mi.)	Pop. (1960 enumeration)
'Amarah	6,929	349,799
Irbil	5,913	281,367
Baghdad	7,692	1,411,693
Basra	6,958	542,660
Diwaniyah	42,753	520,757
Diyala	6,078	349,677
Hillah	2,660	376,213
Karbala'	2,619	237,319
Kirkuk	7,546	417,656
Kut	5,720	303,553
Mosul	19,645	756,482
Nasiriyah (formerly Muntafiq)	5,580	468,954
Ramadi (formerly Dulaym)	53,270	249,429
Sulaymaniyah	4,631	313,881
Desert territories*		
Northern Desert	39,127	—
Southern Desert	29,399	—
Al Jazirah	12,056	—

*The areas of these territories are also included in the areas of the *liwa's* above.

One long-standing problem has been the position of minority groups. The chief of these, the Kurds, have shown some nationalist feeling, aiming at uniting into one territory the peoples of Kurdish culture who are now scattered within Iran, Turkey, Syria and Iraq, and number probably 4,000,000–5,000,000—larger than the populations of several sovereign middle eastern states. From time to time Kurdish nationalist feeling has been a source of discord, e.g., with Iran and Turkey, and of internal weakness which could be exploited by outside powers such as the U.S.S.R.

2. Social Conditions.—A survey in Iraq during 1956 indicated that the average peasant annual income in cash and kind amounted to £14–20 per family. This is about the average within the middle east generally—slightly lower than in Egypt and Syria, but higher than in Arabia and Iran. A number of factors are responsible for this, some of which derive from the physiographic environment, others from purely social conditions. Of the former group, climate, irregular flooding and difficulties with soil fertility are the chief, and there is also a high incidence of disease, affecting humans, plants or animals. Three great afflictions in Iraq are malaria, parasitic infestation—chiefly schistosomiasis (bilharziasis) and ancylostomiasis (hookworm)—and dysentery. It is an unfortunate fact that often with an increase in irrigation, malaria and parasitic infestation also spread; and there are a few parts of riverine Iraq where 50%–70% of the total population are affected, though the situation is better than in Egypt.

Oppressive social conditions depress the living standards of many Iraqis. Heavy rents and taxes may absorb as much as 60%–85% of the total produce of an agricultural holding; a survey in southern Iraq by D. Warriner in the late 1950s showed that in many instances a peasant had to pay taxes to the government, rents to the principal landowner, to minor subtenants and to local overseers, and dues for irrigation water, leaving him with only 20% of all that he produced. Most land in Iraq is owned by wealthy townspeople, whose social and economic position was greatly strengthened after World War I; partly because under modern laws an entire tribal territory may be registered in the name of one leading individual, who comes to be regarded as sole owner; and partly because of the restricted outlets for capital investment within the middle east. Land with a settled cultivating peasantry is often purchased as an investment, to produce a fixed return on capital; hence an owner may discourage initiative; he is content to receive the fixed income and does not risk experiment or further investment in long-term improvement. The peasant, often suffering from debilitating disease, has neither the ability to plan nor the energy to initiate improvements, even were he permitted to do so; thus low resultant yields remain characteristic. Conditions in Iraq, more than in some other middle eastern countries, favour the wealthier classes rather than the small cultivator; flood control, dyking, marketing of produce abroad can be undertaken by an individual possessing capital, who can afford to wait for his return, but not by an underfed peasant totally dependent for existence upon the next harvest. As a result, Iraq has shown to a high degree a social unbalance: great disparity of wealth and poverty, much land held by absentees, and tribal patriarchal authority transforming itself into economic dominance, while at the same time divesting itself of social responsibility to those from whom its wealth is derived. The 1958 revolution is thus not hard to explain; and one of its principal results was an important program of land reform and redistribution, which by the early 1960s affected about 500,000 ac. Of this, a certain proportion represented genuine transfer from landlord to peasant; but, as in other middle eastern countries, there have also been collusive transfers which leave real ownership untouched.

The growing contrast between an archaic countryside and developing towns has produced in the mid-20th century a second social phenomenon in Iraq: a considerable migration into, and expansion of, the towns. Most of the increased wealth is spent or displayed in the towns, which thus offer a strong attraction to the more intelligent peasant; Baghdad grew by 50,000 annually during the 1950s and doubled in size during the same period. The *Iraq Times* stated in 1956 that in some areas more than 80% of the total rural population had migrated to the towns; and many of these live as squatters, in huts made of reeds, mud or flattened gasoline cans, with few or no amenities. This explosive development of town life brings political as well as social problems. The growth

of a rootless, underprivileged town proletariat, by no means always employed, adds yet another dangerous element to the already perilous social mixture in Iraq.

On the other hand, the growth of an educated middle class may prove a stabilizing factor. In 1947 only 8.5% of the Iraqi population was regarded as literate; but since then education has considerably expanded. The emergence of technically trained persons is not only essential if the wealth of Iraq is to increase, but highly desirable on political grounds. A high birth rate (30–33 per 1,000), and a low death rate (8–12 per 1,000) strikingly reduced during the mid-20th century, means that population is increasing by about 2.5% annually, and thus could double in less than 50 years. With only 20% of potentially cultivable land in use, and a relatively assured income from oil royalties for a number of years, this population surge can be accommodated (one of the few middle eastern territories where this is now the case), but development depends on a favourable political situation.

Of a total working population of approximately 2,000,000, it was estimated that 1,560,000 were farmers or herders (160,000 nomadic); 105,000 in industry (14,000 in the oil fields and refining); 200,000 in commerce; 55,000 in transport; 20,000 in catering trades; and the remainder in professional or government service. Women would seem to provide 25%–30% of the labour force in agriculture, and 15% in industry. Under the monarchy organized labour was virtually nonexistent. The announced policy of the republican government was the encouragement of trade unions, and by the early 1960s the General Federation of Labour Unions claimed 50 affiliated unions and a membership of 250,000. The General Federation of Peasant Societies, founded 1959, claimed more than 730 affiliated societies.

3. Welfare.—Iraqi life has a certain dualism; in some respects ways have changed little since Ottoman days when sharp class distinction, with extreme poverty the lot of the majority, and inefficient, bureaucratic and unsympathetic methods of rule tended to prevail. Since World War II, however, major changes have occurred; 1954 saw the enactment of a comprehensive labour law which sanctioned and encouraged co-operation movements, extended provision for educational and cultural improvements, and laid down minimum wage rates for workers. Trades unions came into existence unofficially about 1924 and became legal in 1944; some have since been dissolved by governmental action and others infiltrated by Communist sympathizers. The law of social security (1956) formulated a plan of national insurance, covering old age, illness, death and unemployment; but its provisions need time to become fully operative.

4. Justice.—At the start of mandatory rule, the existing Ottoman civil and commercial law codes were retained, and the penal code replaced; after 1945 both the civil and commercial laws were in turn altered. There are now three types of court: civil, religious and special; and in addition tribesmen are permitted to accept tribal justice. Trial by jury does not operate in Iraq. The civil courts are organized by *liwa'* into courts of first instance and appeal courts; personal status (marriage, divorce, inheritance, etc.) is dealt with by religious community courts; and the special courts deal with tribal land cases, political offenses, malpractices by officials, and the interpretation of the constitution and its legal implications. *Ad hoc* military courts are set up in the *liwa's* if deemed necessary.

5. Education.—Education developed considerably after 1920. Primary schools, then less than 100, now number about 2,000; and elementary education is in theory free and compulsory, though in fact only a minority of Iraqi children attend school regularly. Female education has progressed with the opening of mixed primary schools, but the over-all proportion of pupils is 4:1 in favour of boys. Most colleges of higher education are now co-educational, and technical institutes have been started since 1947. To co-ordinate the working of the various existing colleges of higher education the University of Baghdad was inaugurated in 1956. There has been much enthusiasm for development, leading to marked advance; but the abstract, didactic and theoretical nature of Iraqi teaching tends on occasion to obscure logical and critical thinking. Preoccupation with politics and a fear of overproduction of graduates have also been adverse factors. Many Iraqi students are sent abroad to study, mainly in the U.S., U.K. and Lebanon.

6. Defense.—At its creation, the Iraqi state was faced with both internal turbulence and the hostility of its neighbours; the British government moreover was disinclined to maintain a large British force within Iraq. Hence the creation of a strong Iraqi army (and also later an air force) was one of the earliest developments, and the army has remained a pillar of the state—the symbol of independence and power, closely influencing events, and in turn having the personal interest and support of the ruler. Compulsory national service was introduced in 1935, and the air force came into being in 1930. Training and equipment for defense were first provided by Britain, with some U.S. participation from 1954; and later Soviet assistance was obtained. The former R.A.F. base at Habbaniyah was evacuated in May 1959.

V. THE ECONOMY

Iraq is still overwhelmingly an agricultural country. Despite the richness and wide extent of petroleum deposits, the number of Iraqis actually employed by the oil companies is relatively small; and although oil revenues play a highly important part in development, they provide a much smaller percentage of the gross national product than agriculture and stock rearing. Manufacturing, very restricted before 1950, has increased significantly but is still on a small scale. More than 75% of Iraqis still live by agriculture or stock rearing, either directly or by handling the products.

1. Agriculture.—The 15-in. isohyet dividing Iraq into two climatic provinces (rain-watered agriculture and irrigated cultivation) also coincides approximately with the northern limit of the date palm, hence the country really comprises two agricultural regions. In one, the smaller, which takes in Assyria and Kurdistan, barley, wheat and Mediterranean crops (fruit, tobacco, nuts) are staples; in the other, where irrigation is essential, barley, dates and rice are the chief crops. Barley is the main cereal of Iraq, because of its tolerance of aridity and a saline soil, and also because, having a relatively short growing season, it is less likely to be affected by pests, the most widespread of which are the sunn pest, a small insect which appears in late summer and bores into the ear, and the locust, which arrives in swarms usually from Arabia. Yields of barley can be double those of wheat; native strains are not especially productive, but improvements have followed the introduction of foreign varieties. The principal areas of barley growing are the lower Tigris valley round Kut and the Shatt al Gharraf, the middle Euphrates zone from Nasiriyah to Samawah, and the Assyrian plains, especially round Mosul, Irbil and Kirkuk. Rice is grown extensively only in low-lying areas where irrigation is easily available. Under good conditions it produces over four times as much as barley or wheat per unit area planted, and it is thus the main cereal crop of lower Iraq. Specially good areas are the marshes round 'Amarah (Tigris) and two zones on the Euphrates, the Shamiyah area between Najaf and Diwaniyah, and from Nasiriyah as far as the head of Lake Hammar. Rice is also grown in small plots in the mountain valleys of Kurdistan, where it is much more a delicacy. Because of heavy demands on irrigation water the total area devoted annually to rice growing is restricted by law, but since World War II marked expansion has occurred, parallel with the enlargement of irrigation works. Wheat, like barley, is grown as a winter crop and more than 70% of Iraqi production is still from Assyria, where it is grown with or as an alternative to barley. Some production also occurs on the upper Tigris and Euphrates valleys. Two cereals of recent introduction are millet and maize (corn), both of which are summer crops and therefore useful as an element in rotation. Millet is used as an adulterant in human food and as animal fodder, while maize is still a new introduction.

Iraq produces most of the world's export supply of dates. The palms can tolerate extremely dry and sandy conditions, but bear best with a copious supply of water. A hot, long and bright summer is also essential; hence conditions along the lower valley of Iraq are ideal, and the southern Tigris and Euphrates, especially the Shatt al Arab round Basra, are the most productive areas.

The ground is dug over annually, and the female palms artificially pollinated in April. Harvesting begins in August, and many nomads arrive in the region as temporary labour. The finest quality fruit is produced only in moderate quantities; but more prolific palms carry up to 120 lb. of dates annually, of lower quality. Dates form an important, sometimes principal, article of diet (they keep well, provide sugar and do not easily carry human disease), and the stones of the date are used as animal fodder. *Arak* (a spirit) is distilled.

Cotton is grown in increasing quantities, though soil salinity is one distinct handicap, another being liability to attack by weevils and locusts. Quality is not outstandingly high, and levels of production have oscillated, reflecting world conditions, because until the 1950s there was little or no home demand. Now east Asia (Japan and Hong Kong) and Europe provide markets, with exports exceeding £1,000,000 annually, while a newly established home industry has further stabilized the position. Other crops are tobacco and vines, both for internal use only and largely within the hill country of the northeast. Nut trees are important in a few localities; and market gardening around the larger cities is increasingly important, reflecting rising standards of living and the new demand from such groups as oil-field workers. Experiments have been made with flax, jute, alfalfa, sesame, peanuts, potatoes, yams and clover. There is much individual variety in fruit and vegetable growing, especially in the rain-watered zone, though yields are sometimes less than in irrigated areas.

A number of wild crops are also important. Licorice grows along the banks of the principal rivers as far south as the Shatt al Arab, and the root is dried for export for tobacco curing and as a sweetmeat. Gum tragacanth is an exudation from a bush which occurs in drier steppe regions, and about one-half of world production, used in sauces and pharmaceuticals, comes from Iraq. The valonia oak, native to the higher, damper mountains of the north and east, produces an extract used in tanning.

2. Irrigation.—The problems involved are somewhat complex because of the time of flooding, at the season when many crops are partially grown. Excess water must be retained within the river between high banks. Variation in the level of the river beds means that in some parts free-flow irrigation is possible, while in others pumping is necessary. Stagnant water must be led back to the rivers as rapidly as possible, again by pumping if necessary, in order to avoid salination.

The largest river control project is that of the Wadi ath Tharthar, completed in 1956. A canal 40 mi. long leads from the Tigris at Samarra' to the basin of the wadi, which thus accumulates floodwater. The basin was expected to fill by 1966, but because of possible seepage and contamination by salt deposits it was not known whether the water would be usable for irrigation; there were, however, definite possibilities of generating electricity. A smaller project on the Euphrates employs similar methods; water is led off from the mainstream at Ramadi into two basins, at Habbaniyah and Hawr Abu Dibs. The Habbaniyah basin is definitely saline, so only flood control can be achieved. Other regulator dams are complete or under construction: on the Little Zab at Dokan —a high dam of 350 ft., with extensions at Batma, 'Udhaim and Kirkuk; on the Great Zab at Bekhme; and on the Tigris above Mosul. These are primarily for irrigation, with flood control and electricity generation as subsidiary features.

The earliest modern irrigation work was at Hindiyah (1913, enlarged 1922) which directs the Euphrates water into an older channel running through Hillah; and also on the Euphrates are the Musayyib project (1956) and smaller works at the head of Lake Hammar. At Kut on the Tigris a barrage completed in 1943 and three times the size of the Hindiyah dam will ultimately improve irrigation south and southeast of Kut; but a limiting factor there is the restricted volume of water available in summer. The entire low-season flow of the Diyala river below the Jabal Hamrin is now diverted for irrigation. Other irrigation works on a smaller scale are planned or in construction around Lake Hammar, the Shatt al Arab, Sulaymaniyah, Irbil and Mosul. Between £30,000,000 and £40,000,000 has also been spent on land drainage projects (to counter salination) and on windbreaks to prevent the silting up of irrigation and drainage channels. In all, more than £100,000,000 had been devoted to irrigation and flood control by the early 1960s, and it was planned to spend as much again.

3. Livestock.—This is proportionately much more significant than in many other countries of the middle east. Because of the extent of mountain, desert and even unirrigable stretches within the riverine lowlands, the boundary between cultivated and grazing land is far less sharp than, say, in Egypt; and alternation of the two kinds of terrain encourages herding in close proximity to cultivation. Within the steppe and mountain zones (Al Jazirah and much of Kurdistan) stock rearing is by far the most important activity; in occasional years exports of animal products can be as valuable as those from agriculture.

Sheep number 7,000,000–8,000,000 and are chiefly found in Al Jazirah, and the arid zones south and west of the Euphrates; but south Assyria and the Gharraf areas are also important. There are four breeds: the Arabi, chiefly found in the lowlands; the Karadi (Kurdish), larger and fatter but with coarser wool; the Tartar (fat tailed) and the best meat producer; and the Awassi, a cross between the first two. There is usually a well-developed seasonal migration of sheep. During winter and spring they move into the arid areas, where a flush of grass occurs until about May–June; in summer they are brought back into the riverine lands where they are kept either near marshy tracts or on fallow cultivated ground where their manure is valuable. In Kurdistan transhumance is practised.

Goats (2,000,000–3,000,000) occur mainly in the hillier parts of the north and east, and in the drier areas. They furnish milk, meat and hair valuable for tent cloth and for Arab clothes which, when well made, are waterproof. Cattle are kept, mainly in riverine areas, for milk (meat is rarely eaten) and as draft animals for plowing and the operation of irrigation wheels. Camels are still bred in considerable numbers in the deserts; formerly their main use was for transport, but increasingly they are slaughtered for their meat and hides. Camels do not thrive in the swampy lowlands; there water buffalo are numerous, and about 80% of the total in Iraq are found in the four southern *liwa's*. Donkeys are the principal beasts of burden, and mule breeding is important in Kurdistan. As elsewhere in the middle east a few horses are kept, but definitely as an exotic luxury.

There has long been a trade in animals with neighbouring countries. Formerly they were driven westward to market in the Levant using a circuitous route along or close to the Euphrates. But with the advent of through railway connection, and above all, the motor truck, live animals are increasingly transported for sale in Syria, Lebanon and Jordan. Wool is exported to Europe mainly for use in carpets; it is of lower quality than Australian wool.

4. Forestry.—In 1955 a forest law was passed. Forest land had been greatly reduced by cutting for fuel and the grazing of animals, and only 2,800 sq.mi. of woodland, much of marginal quality, could be said to exist in Iraq. There had hitherto been little concern for woodland, but various 20- and 50-year plans were then drawn up, with the aims of doubling present forest areas, and of creating tree avenues on certain main roads. The poplar is well established in parts of the northeast, and in drier sandier areas eucalyptus was introduced with some success. A forest police was started, and extension of woodland was given importance as a protection against soil erosion and the silting of irrigation canals, and for the provision of building timber, practically all of which must now be imported.

5. Oil.—Overwhelmingly the most important mineral resource in Iraq is petroleum, which is now exploited in the northeast, north and south of the country. The first field to be developed was at Kirkuk (1927), which lies on a lowland embayment between the Zagros and the Mesopotamian plain. In this area there is a fold structure, the Pusht-i-Kuh, running parallel to the main Zagros, which dies out to northwest and southeast, where two enclaves of lower ground occur, one in Iran which forms the Masjed Soleyman oil field, and the other in Iraq, at Kirkuk. The geological structure is interesting. At Kirkuk the petroleum is held in Eocene-Miocene limestone about 1,000–2,000 ft. thick, termed Main limestone. Above lies an impermeable complex of Miocene shales, salt and

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anhydrite which acts as a seal, and the whole series is folded into long anticlines and synclines striking northwest-southeast. A special feature is the continuity of porous rock series into the main Zagros farther east; hence considerable hydrostatic pressure within the rock is induced from rainfall at higher levels, producing in the oil region itself pressures of 2,000–3,000 lb. per square inch—a fortunate circumstance in that there is no need to pump the oil, which rises of itself in immense gushes. At Kirkuk there is an oil-bearing anticline 50–60 mi. long (a huge size for such structures, which are normally measured in yards) and only 38 wells are needed to tap the entire structure (*cf.* 25,000–30,000 wells in Texas). A much smaller field in the southern embayment (at Naft Khaneh, just inside Iraq) produces oil which is refined at Alwand near Khanaqin, and serves only the internal needs of Iraq, with no export. Deposits of petroleum also occur within the riverine lowlands (the bitumen at Hit has been exploited for 2,000–3,000 yr.), and oil fields have been developed at 'Ayn Zalah and Butmah (north of Mosul), and at Zubayr-Rumaylah near Basra. First discovered in 1939 but not productive until 1952, the Mosul field has a relatively small reserve of lower grade oil, held in Cretaceous limestone. The Zubayr field has been developed since 1949 and now ranks second to Kirkuk. Its reservoir rock is of Cretaceous sandstone, like that of adjacent Kuwait, at greater depth and only slightly folded into a very shallow anticline. Other petroleum deposits are known to exist in central Iraq, but these are "heavy" and sulfurous, and under present conditions are uneconomic to exploit.

Because of distance involved (about 4,000 mi. by sea from the mouth of the Shatt al Arab to the eastern Mediterranean) and Suez canal dues, it is normally cheaper to move oil from Kirkuk by pipeline, whereas oil from the Basra area is shipped by tanker. Two 12-in. pipelines were constructed from Kirkuk to the Mediterranean, running together as far as the crossing of the Euphrates at Al Hadithah. The lines then divided, one continuing via Palmyra, Syria, to Tripoli, Lebanon, the other via Ar Rutbah to Haifa, Israel. This latter was closed by the Iraqi government during the Israel-Arab war of 1947–48. It had been planned to construct a 16-in. pipeline to Tripoli and Haifa, and the Tripoli branch came into operation in 1949; the other remained unfinished. A 30–32-in. pipe was completed to Baniyas, Syria (about 40 mi. N. of Tripoli), in 1952, giving a transportation capacity of 14,000,000 tons annually. Because of the vulnerability of pipelines to political and other pressures, it is policy to diversify routes—hence the alternative terminal in Syria; and the possibility of a new pipeline via Turkey has been considered.

The entire oil production of Iraq (with the exception of the Khanaqin field formerly owned by the British Petroleum Oil company but after 1958 operated by the Iraqi government) is controlled by the Iraq Petroleum company (I.P.C.) and its two subsidiaries, the Basrah Petroleum and Mosul Petroleum companies. This group began before World War I as an Anglo-German group, known as the Turkish Petroleum company, but was reconstituted after 1918 and renamed, the shareholders being: B.P.O.C. 23¾%, Royal Dutch Shell 23¾%, Near East Development company (Standard Oil of New Jersey and Standard Vacuum of New York) 23¾%, Compagnie Française des Pétroles 23¾%, and the foundation of Calouste Sarkis Gulbenkian (*q.v.*), the original negotiator of the concession, 5%. The British government is a majority shareholder in the B.P.O.C., and the French government owns 35% of the rights in C.F.P. Under an oil agreement of 1952, Iraq receives 50% of the profits before deduction of foreign taxes and, as from Jan. 1956, the companies guaranteed a minimum annual output of 30,000,000 tons. In Dec. 1961 the Iraqi government announced that the combined concessions of I.P.C. and its associates, which had previously covered almost the whole country, would be restricted to an area of less than 750 sq.mi. (although allocation of additional areas could be authorized).

Other Mineral Resources.—These comprise (1) a deposit of brown coal at Kifri between Baghdad and Kirkuk, a few thousand tons of which are produced annually; (2) small-scale local deposits of potassium nitrate, gypsum and quartz; (3) rock salt

TABLE II.—*Oil Fields of Iraq*

Field	Date of development	No. of wells	Annual production (1962; bbl.)	Cumulative production to 1962 (000,000 bbl.)
Naft Khaneh	1923	2	1,095,000*	59†
Kirkuk	1927	38	258,900,115	2,503
'Ayn Zalah	1939	4	7,691,760	73
Zubayr	1949	23	24,978,604	317
Butmah	1952	4	1,951,580	18
Bai Hassan	1953	6	16,705,522	42
Rumaylah	1953	14	40,451,338	337
Jambur	1954	4	6,108,656	20

*1959 figure. †1960 figure.

which is exploited in a number of localities under government supervision as subject to taxation. Small deposits of copper, iron, chromium and manganese are known to exist, but there is no large-scale exploitation.

6. Industries.—These are on a small scale. Prior to 1940, there were little more than craft industries producing textiles, building materials (chiefly cement), food products and leather goods, together with a restricted amount of modern machinery. Since about 1940 attention has been given to industrial development, with some state participation in oil refining, asphalt, cement, and tobacco and food processing. Textile production (mainly cotton and rayon with some jute) is the most important activity, with a number of modern factories in Baghdad, Mosul and Basra.

Development.—Much economic improvement achieved in Iraq has been financed by the state, through a development board established in 1950. Some 75% of oil revenues received by the Iraqi state (these averaged about £75,000,000 annually in the late 1950s–early 1960s) are allocated to the board, together with further sums from taxation. Various economic development plans (5-, 6-, or 7-year) have been initiated, some for the improvement of communications (*e.g.*, better road surfacing and the conversion of metre-gauge railways to standard), some to education and some to flood control and irrigation.

7. Trade and Finance.—Domestic trading is of two kinds. Westernized department stores serve an exclusive small group of well-to-do people. However, most Iraqis use the traditional bazaars, retail trade being especially brisk in the holy cities. Peddlers and traveling merchants visit villages and tribal camps.

Foreign trade is dominated by petroleum, which by value accounts for about 85%–90% of all exports, and is at an annual level of about £100,000,000 ($280,000,000). Most oil moves untreated to Europe, with small but increasing amounts to eastern Asia and Africa. Other exports are mainly of agricultural and pastoral products, especially grain and flour (barley and wheat) to neighbouring areas (particularly Arabia, Jordan and Lebanon), with some export to the U.K. for malting purposes. Iraq is the largest world exporter of dates (about 80% of world sales); and there is a significant export of raw cotton, chiefly to Japan, Hong Kong, India and eastern Europe. Wool and hides are sold to Europe, and there is some trade in live animals with Jordan, Lebanon and Turkey. Production of oil continues to grow fairly steadily; but in contrast, exports of other products (dates excepted) tend to experience sharp annual fluctuations, reflecting the vagaries of climate within Iraq and changing world prices.

Capital goods (steelwork, machinery and vehicles) are the principal imports, followed by foodstuffs (sugar, tea, etc.) and textiles. By the early 1960s annual exports (excluding oil) averaged about £16,000,000, transit traffic (to Turkey, Iran and Arabia) £8,500,000, and imports £120,000,000, the balance being covered by petroleum exports and by subventions or loans from abroad chiefly for the armed forces. Main trade links have been with the U.K. (which takes about half of total oil exports and supplies 30% of imports), the Federal Republic of Germany and Japan. Some increase in trade with the U.S.S.R. was suggested after the fall of the monarchy, but, at least at first, was more putative than actual.

The unit of currency is the Iraqi dinar. I.D. 1 = £1 sterling; I.D. 1 = U.S. $2.80. The greatest single item in the revenue of the state is the oil royalties, about 40%–45% of the total. The remainder of the revenue is raised by taxes both direct and indirect. There are several foreign banks operating in Iraq and four government banks.

8. Communications.—Originally the rivers provided most of Iraq's means of communication, but they are greatly declining in importance. The railway system (now operated by the Iraqi State Railways administration) gradually developed: of standard gauge from Baghdad to Mosul and (in 1940) connecting Syria and Turkey; and of metre gauge from Basra to Baghdad, and on to Kirkuk. This was an inconvenient system, and plans were made to extend the standard-gauge line to Basra and the metre-gauge line from Kirkuk via Irbil to Mosul, and to change over to diesel haulage.

Flooding restricted road development for a long time. In 1950 there were only 1,500 mi. of surfaced roads, the rest being of earth and impassable in winter. By the early 1960s more than 4,500 mi. of roads and tracks had been developed for motor traffic, which increased greatly. Air-conditioned buses operate to Damascus and most of the pilgrim traffic from Iran is handled by motor coach. There are international airports at Baghdad and Basra, and a state-owned airline operates within Iraq and abroad, with pilgrim flights to Jidda. Air, rail and to some extent road services are integrated by a state board. Radio and television stations in Baghdad are a government monopoly administered by the ministry of guidance.

See also references under "Iraq" in the Index. (W. B. Fr.)

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IRBID, the third largest and the most northerly city of the Hashemite Kingdom of Jordan, lies on the northwest corner of a rich corn-growing plain, 40 mi. N. of Amman. Pop. (1961) 44,805. The houses are built of white limestone and black basalt, and part of the town covers a mound which represents the Early Bronze Age town of about 2500 B.C. A section of the ancient basalt town wall can be seen on the west. The town is an administrative and commercial centre linked by main road with Amman, Syria, and the desert road to Iraq. (G. W. L. H.)

IRBIL, also known as Arbil, Erbil or Arbela, an important foothill town in northeast Iraq, about 48 mi. E.S.E. of Mosul in 36° 15′ N. and 44° W.; pop. (1957) 34,751, largely Kurds. The long unbroken history of Irbil, attested by the accumulation of building debris which forms the high citadel mound, is explained by its position as a centre of communications and by the fertility of the countryside, which is for the most part adequately watered and produces good cereal crops. It is the commercial and administrative centre for the *liwa'* (province) of the same name, bounded west by the Tigris, north and south by the Great and Little Zab rivers, and east by the Iranian frontier.

The city was known to the Sumerians in the 3rd millennium B.C. as Urbillum, and later, as Arba'ilu, ranked among the principal cities of Assyria; it housed a famous shrine of Ishtar (*q.v.*), and Sennacherib (*q.v.*) dug a canal, partly underground, to supply it with water from the Great Zab. In Achaemenid times it lay on the royal road through Nineveh from Sardis to Susa and Alexander the Great defeated the last Achaemenid, Darius III, on this road about 31 mi. W. of Irbil (*see* Gaugamela, Battle of). Under the Parthians, Arbela became the capital of the petty kingdom of Adiabene, approximately the modern *liwa'* of Irbil; the city apparently retained its religious importance, since many Parthian kings were buried there. In the late Abbasid period it was a considerable town and a fine minaret of this era still stands in the plain below the deserted citadel, whose western side is skirted by the older part of the town; more modern buildings now extend across the plain. A tarmac road from Mosul to Kirkuk and Baghdad passes through Irbil, whence there is a branch through the Rawanduz gorge to the Iranian frontier. A metre-gauge railway runs from Irbil through Kirkuk to Baghdad.

(E. E. D. M. O.)

IRELAND, JOHN (JOHANNES DE IRLANDIA) (*c.* 1435–*c.* 1500), Scottish writer, theologian and diplomatist, whose treatise *The Meroure of Wyssdome* is the earliest extant example of original Scots prose, was educated at the University of St. Andrews. He left without taking a degree, and attended the University of Paris, of which he was made a licentiate in 1460. He lived in France till 1483–84, becoming a doctor of theology and being sent on several diplomatic missions by Louis XI. On the death of Louis he returned to Scotland and became private chaplain to James III. He was rector of Yarrow and sat in the Scottish parliament. When James died in 1488 he continued as chaplain to the young James IV, and wrote for his edification, in 1490, the work which is his chief claim to fame, *The Meroure of Wyssdome*, a hortatory and pious treatise on the value of wisdom to temporal rulers.

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(E. G. M.)

IRELAND, JOHN (1838–1918), U.S. Roman Catholic archbishop, a leader of the "progressive" clergy, was born at Burnchurch, County Kilkenny, Ire., on Sept. 11, 1838. In 1849 he was taken to the United States by his parents, who settled at St. Paul, Minnesota territory. After being educated in France for the priesthood, he was ordained at St. Paul in 1861. In the following year he accompanied the 5th Minnesota Volunteer Infantry south as chaplain. Subsequently he became rector of the cathedral at St. Paul.

At the request of Bishop Thomas Langdon Grace of St. Paul Ireland was appointed bishop-coadjutor with the right of succession in 1875. Nine years later he became bishop of the diocese, which was raised to metropolitan rank in 1888.

Ireland's liberal views gave him a wide influence and reputation both within and without the church, and he came to be looked upon as a leader of the "progressive" as distinguished from the "conservative" party in the clergy, principally in the Americanism, Cahenslyism and school controversies. By Europeans he was looked upon as the Catholic intellectual leader in the U.S. His ideas on social reform and the relation of the church to a democratic society were in advance of his time. He was prominently identified with the planting of Catholic colonies in the northwest, with the establishment of the Catholic university at Washington, and with the Catholic total abstinence movement. He published *The Church and Modern Society* (1896). Archbishop Ireland died at St. Paul on Sept. 25, 1918.

See James H. Moynihan, *The Life of Archbishop John Ireland* (1953).
(P. H. A.)

IRELAND, JOHN NICHOLSON (1879–1962), English composer known for his evocative works of literary and pictorial associations, was born at Bowdon, Cheshire, on Aug. 13, 1879. He entered the Royal College of Music, London, in 1893 where he studied with Sir Charles Stanford. Later he taught composition there; his pupils included E. J. Moeran and Benjamin Britten. His first important work was the song cycle *Songs of a Wayfarer* (1903–05). His piano pieces *Decorations*, including "The Island Spell" written at Jersey in 1912, are prefaced by quotations from the writings of Arthur Machen, the novelist and essayist, to whose fantasy and mysticism he was greatly drawn. *The Forgotten Rite* (1913), for orchestra, was similarly inspired by Machen. His symphonic rhapsody *Mai-Dun* (1920–21) evokes a vision of the prehistoric earthwork, Maiden Castle, in Dorset.

Ireland spent much time in the Channel Islands, where he wrote the piano suite *Sarnia* (1940–41). He also wrote a piano concerto, many picturesque or evocative piano works, among them the *London Pieces*, and songs on poems of Thomas Hardy, A. E. Housman, Arthur Symons and others. He died at Washington, Sussex, on June 12, 1962.

See N. Townshend, "The Achievement of John Ireland," *Music and Letters* (April 1943).
(E. LR.)

IRELAND, WILLIAM HENRY (1777–1835), Shakespearean forger whose faked manuscripts deceived many of the leading scholars of his day, was born in London, the son of Samuel Ireland, a dealer in rare books and prints. As a boy, he was much impressed by the career of Thomas Chatterton (*q.v.*). He was articled to a conveyancer in chancery at New Inn and so became familiar with ancient documents and handwriting. On a visit to Stratford in 1794 he encountered John Jordan, a wheelwright and amateur poet with a fund of Shakespearean anecdotes of doubtful authenticity. Jordan's romances and the elder Ireland's passionate desire to acquire Shakespearean relics probably inspired William to produce his forgeries, which he pretended to have obtained from a rich gentleman who preferred to remain anonymous. Later, he improved upon this story, claiming that one of his own ancestors had saved Shakespeare from drowning and had been rewarded by the poet with the gift of his manuscripts. These included Shakespeare's "Profession of Faith"; stanzas to Anne Hathaway; and a letter to Shakespeare from Queen Elizabeth I. In Feb. 1795 the elder Ireland held an exhibition of the precious documents at his home, and it was there, on Feb. 20, that James Boswell knelt and kissed the supposed relics. Ireland did not, however, enjoy universal confidence; some newspapers denounced his forgeries from the first.

The ludicrous failure of his "Shakespearean tragedy" *Vortigern* at Drury Lane theatre on April 2, 1796, and the publication of Edmond Malone's *An Inquiry into the authenticity of certain papers . . . attributed to Shakespeare* (1796) discredited him. He admitted his forgery in *An authentic account of the Shakespearian manuscripts* (1796), following this by his more detailed *Confessions* in 1805. His father died in 1800, probably broken by the shock of the whole affair. It seems likely that he was the victim of his son's duplicity. After some years of precarious existence Ireland succeeded in obtaining fairly regular employment from London publishers. He died in London on April 17, 1835. He never showed any shame at his conduct, and his effrontery is well illustrated by the title page to a collection of his forgeries: "The following pages contain the several Autographs &c produced by me, W^m H^y Ireland, during my fabrication of the Manuscripts which I wrote & attributed to William Shakespeare" (British museum manuscript Stowe 994, f. 1). The museum also possesses the elder Ireland's correspondence relating to the forgeries and numerous specimens of Ireland's work.

See G. H. Libbis, "Notes on Ireland," in *Notes and Queries*, vol. clx, pp. 201–204, 219–221 (1931), vol. clxii, pp. 236–239, 347–350 (1932).
(GD. B.)

IRELAND, an island of distinctive character to the west of Great Britain, is bounded on the northeast by the North channel, on the east and southeast by the Irish sea and St. George's channel, and on the west and south by the Atlantic ocean. Its greatest length north-northeast to south-southwest from Fair head (Antrim) to Brow head (Cork) is 306 mi. and from east to west 182 mi. Brow head is the most southerly point on the mainland, though there are islands farther south, and the most northerly point is Malin head (Donegal). The most easterly point is on the coast of the Ards peninsula (Down) and the most westerly Dunmore head in the Dingle peninsula (Kerry). Ireland averages 110 mi. in breadth and 220 mi. in length; its area is 32,595 sq.mi. The minimum distance from Great Britain is 13½ mi. between the Mull of Kintyre (Scotland) and Torr head. The narrowest crossings of St. George's channel are about 50 mi. in the south and 70 mi. in the north: from Holyhead to Dublin the distance is 65 mi. Ireland's history has been concerned with immigrations of settlers and would-be conquerors though it is now known as a land supplying many emigrants. It is part of the Atlantic fringe of Europe, and has been called "the last outpost of Eurasia." Many of its physical features bear an obvious resemblance to those of Great Britain, yet it is best regarded as a separate land, possessing a landscape molded by a different physical and human history. Since 1921, it has been divided into two political units, Northern Ireland (area 5,459 sq.mi.; pop. [1961] 1,425,462) and the Republic of Ireland (area 27,136 sq.mi.; pop. [1961] 2,814,703). There are separate articles on IRELAND, NORTHERN and IRELAND, REPUBLIC OF.

This article concerns subjects common to both countries and contains the following sections:

I. Physical Geography
1. Geology and Relief
2. Drainage
3. Coasts
4. Climate
5. Vegetation
6. Animal Life
II. Geographical Regions
III. The People
1. Racial Types
2. Language
3. Religion
4. Customs and Culture
IV. Archaeology
V. History (to 1921)

I. PHYSICAL GEOGRAPHY

1. Geology and Relief.—Conspicuous features of the physical landscape are the similar trend or alignment of many hills and valleys, and the extensive peneplains or erosion surfaces of fairly uniform altitude, about 2,000 ft., 800 ft. and 200 ft., with others, such as those at 600 ft. and 400 ft., which are less well marked. A third major characteristic is the prevalence of drifts due to the effects of the Quaternary glaciation of the country. Both the erosive and depositional work of ice have had considerable influence on the detailed physical features.

The older, often severely folded strata generally emerge at the surface in mountain areas round the margin of the land mass, with younger strata in the central lowland. The rim of rocks representing the main axis of folding in early Paleozoic (*i.e.*, Caledonian) times is seen in the northwest in County Donegal and in the north in the Sperrins on the borders of Tyrone and Londonderry where the mountains are composed of early Paleozoic and older strata folded along these axes. The west-east or Armorican trend is dominant in the southwestern peninsulas of Kerry and County Cork, where the strata include the Old Red (Devonian) Sandstones and Carboniferous shales and limestones. The mountains of the Dingle peninsula (Kerry) comprise the Brandon range, with Brandon mountain (3,115 ft.), and the Slieve Mish range, with Baurtregaum (2,796 ft.). The Macgillycuddy Reeks have Ireland's highest mountain, Carrantuohill (3,414 ft.). Inland from these peninsulas there are long west-east valleys extending into Counties Cork and Waterford, floored by Carboniferous rocks, between which anticlinal interfluves of Devonian sandstones rise as ranges, *e.g.*, Boggeraghs, Knockmealdowns and Galtees (Galtymore 3,018 ft.). An isolated peak (2,510 ft.) in County Mayo is the quartzite Croagh Patrick (*q.v.*).

In the central lowland a change occurs: rocks of Devonian and Carboniferous age are gently folded in a southwest-northeast trend, possibly because older mountain ranges, of Caledonian age, underlay the newer rocks when they were folded, *e.g.*, the Slieve Bloom and many ranges to the south of a line from Galway bay to Dublin. South of Dublin the Leinster chain extends for more than 70 mi. to County Waterford in a northeast-southwest direction. A vast anticlinal arch due to the intrusion of granite during the Caledonian mountain building, it is a fine upland as much as 10 mi. wide in places, with Lugnaquilla (3,039 ft.) in County Wicklow as its highest summit. Farther north, in County Down, the Mourne mountains were formed by a granite intrusion in Tertiary times; the highest point is Slieve Donard (2,796 ft.). The extreme northeast has Tertiary basaltic intrusions which form plateaus in County Antrim 1,000–1,500 ft. high, but floor the Bann valley.

Preglacial erosion surfaces have been widely recognized at various altitudes in Great Britain, reflecting a comparable history of erosion and uplift, and it might be expected that a similar pattern should occur in the adjacent land mass of Ireland. The recognition of such surfaces in Ireland is, however, difficult, for in many places they are covered by glacial deposits of varying thickness, *e.g.*, 50–100 ft.; and these in turn are frequently covered with postglacial peat bog of varying depth. In the south glacial deposits are generally thin or nonexistent, and vast stretches of the 200-ft. surface are visible, notably topping cliffs along the coast. There also appears to be an extensive surface at about 200 ft. in the central lowland, which is by no means the flat, featureless plain it is sometimes imagined to be. From Dublin roads and railways climb westward on to the 200-ft. level, but above this there appears to be a rise to an altitude of 400 ft. as, for example, in County Meath where there are large areas at this altitude, and it also occurs in some of the wide lowland corridors between the various uplands, such as that between Portlaoise (Maryborough) and Thurles. The 800-ft. surface is clearly marked in the lower parts of the west-east ridges of the south and also in many uplands, for example in County Donegal, where the peaks rise above it to 2,000 ft. or more. Another major erosion surface may exist at 600 ft., but it is possible that this is the higher ground from the 400-ft. surface, or lower ground from the surface at 800 ft.; these altitudes are not absolute, but rather are indicators of the general level of erosion surfaces which may be horizontal, but in other cases sloping. For example, in the Calary district of the Wicklow mountains there is thought to be an expanse of the 800-ft. surface, but in fact it slopes from 1,000 to 600 ft. Finally, the 2,000-ft. surface which exists on Slieve League, County Donegal, is thought to be of Devonian age, as on it there are Carboniferous beds. The other surfaces were probably cut during the Tertiary period: possibly the uplift of the land between them was associated with the Tertiary orogenic movements.

2. Drainage.—Rivers and lakes are an attractive element in the Irish landscape. Of these the greatest is the Shannon (*q.v.*), 161 mi. long, which with its various tributaries, such as the Suck and the Inny, drains one-fifth of the area of Ireland. Almost entirely a river of the lowland, it spreads into numerous lakes (loughs), such as Allen, Bofin, Ree and Derg. Most of the other rivers

F. M. SYNGE, FROM "IRELAND" BY T. W. FREEMAN. METHUEN & CO. LTD.

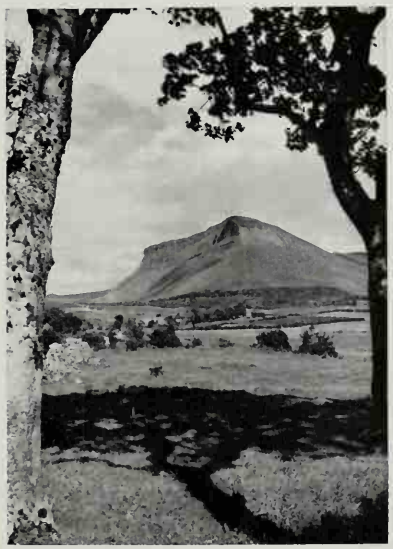
GEOLOGIC FORMATIONS OF IRELAND

IRELAND

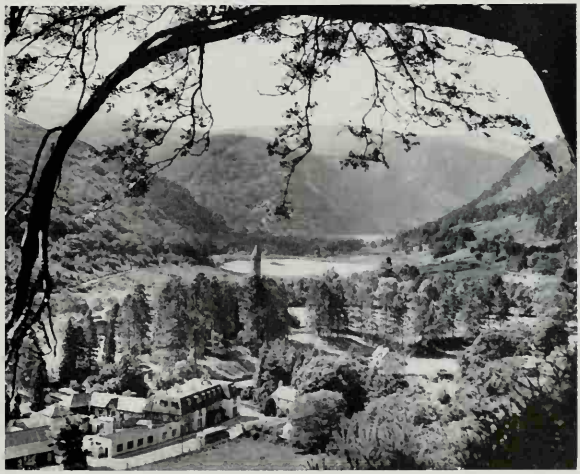
Pilgrims at a Station of the Cross on Croagh Patrick, a quartzite peak in County Mayo, site of a pilgrimage ascent on the last Sunday of July and, traditionally, where St. Patrick banished the snakes from Ireland

The White Rocks, chalk limestone cliffs along the northern coast of Ireland at Portrush, County Antrim, where many caves are accessible by boat in calm weather

View of Dublin, capital of the Republic of Ireland, along the banks of the River Liffey, spanned by the Metal Bridge. The towers of Christ Church Cathedral stand in the left background; the spire of the Augustinian church in John's Lane is on the right



Benbulben, the west summit of the Dartry mountains that rise in the moorland of eastern County Sligo

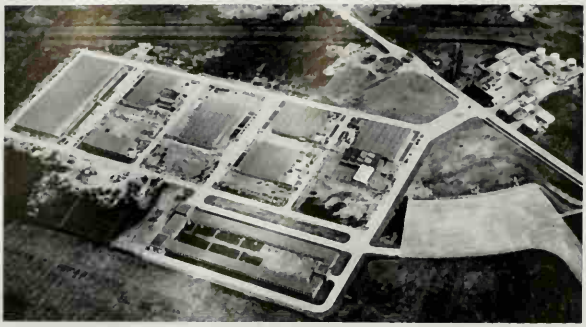


Vale of Glendalough, a glaciated valley in the Wicklow mountains, famous for ecclesiastical ruins including the 110-ft.-high Round tower shown in the centre

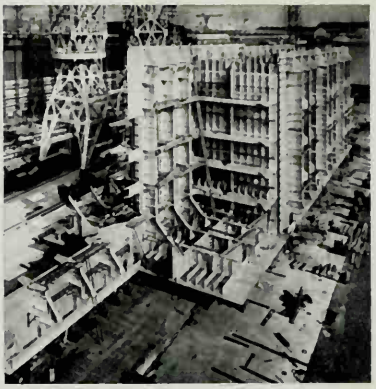
VIEWS OF IRELAND

BY COURTESY OF (BOTTOM LEFT AND RIGHT) IRISH TOURIST BOARD; PHOTOGRAPHS, (TOP LEFT) HORST MUNZIG FROM BLACK STAR, (TOP RIGHT) J. ALLAN CASH—RAPHO GUILLUMETTE, (CENTRE RIGHT) LOUIS GOLOMAN—RAPHO GUILLUMETTE, (BOTTOM LEFT AND RIGHT) BOPO FAILTE PHOTO

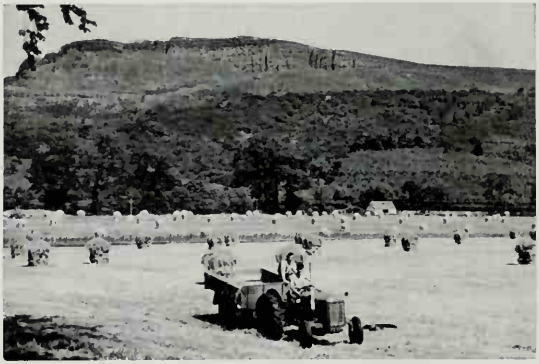
IRELAND



Aerial view of the Shannon industrial estate, Shannon Free Airport, County Clare, with factory zones in the foreground and housing area in the right background. Established in the duty-free zone with the aid of the Irish government, the industrial estate includes manufacturers from the U.S., Britain, the Netherlands, and South Africa

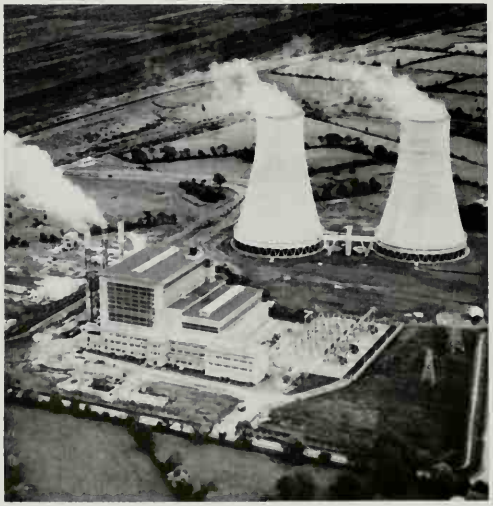


Large oil tanker under construction in the shipyards at Belfast, the leading industrial city and capital of Northern Ireland



Harvesting hay in the fertile lowlands below Benevenagh Hill near the northern coast of County Londonderry. Agriculture is important to the economy of Northern Ireland

Sheep grazing along the banks of the River Blackwater near Youghal, County Cork



Aerial view of the peat-fired electric station on the midland bogs at Ferbane, County Offaly. The station, one of the largest of its kind in western Europe, has a capacity of approximately 90,000 kw.

Islanders meeting a ferry steamer anchored offshore of Inisheer, one of the Aran islands in Galway bay. Passengers and cargo are landed by curraghs (small, skin-covered craft)

SCENES IN IRELAND

BY COURTESY OF (TOP RIGHT) HARLAND & WOLFF LTD., (CENTRE LEFT) NORTHERN IRELAND TOURIST BOARD, (BOTTOM LEFT) ELECTRICITY SUPPLY BOARD, DUBLIN, (BOTTOM RIGHT) DEPARTMENT OF EXTERNAL AFFAIRS, DUBLIN. PHOTOGRAPHS, (TOP LEFT) CAMERA PRESS—PIX FROM PUBLIX, (CENTRE RIGHT) CLAUDE JACOBY—PIX FROM PUBLIX

reaching the west coast are short though the Erne, flowing to Donegal bay, is 64 mi. long and loses its identity in the two Erne loughs. In County Galway, Loughs Mask and Corrib are joined by underground channels through the porous Carboniferous limestones. The short Laune river is the outlet for the famous lakes of Killarney (*q.v.*) to Dingle bay. To the south of Killarney all the rivers are swift-flowing mountain streams for the greater part, in some cases almost the whole, of their courses.

The pronounced west-east line of the mountains and valleys in the extreme south is reflected in the courses of the rivers. Of these the Bandon flows for 45 mi. to reach the sea at Kinsale (Cork). The Lee, rising only a few miles from the Atlantic coast, flows for over 55 mi. to Cork harbour, which it enters after dividing into two arms round the city centre. The Blackwater, 104½ mi. long, rises in the Carboniferous plateau country of Kerry and northwest Cork and flows into the sea at Youghal (Cork).

In Waterford harbour the three rivers, the Suir, Nore and Barrow, known as the "three sisters," meet. The Suir, 114 mi. long, rises in the Devil's Bit mountain. The Nore rises close to the Suir, but in its 87-mi. course runs southeast across the lowland to New Ross, County Wexford, where it is joined by the Barrow. This river rises in a peat bog of the central lowland and, like the Nore and the Suir, gradually finds its way into an entrenched valley course which it occupies until its junction with the Suir.

Rivers of the Leinster chain are mainly short swift-flowing streams, but two are of special interest. The Slaney, 73 mi. long, rises on the slopes of Lugnaquilla and enters the sea in Wexford harbour. No other river cuts through the Leinster chain. The Liffey rises 12 mi. from the sea but turns west to the edge of the central lowland and bends east through the city and its outskirts to Dublin bay. In the central lowland, north of Dublin, the Boyne rises in the Bog of Allen and flows for 70 mi. to the estuary near Drogheda (Louth): it is joined by its main tributary, the Blackwater, at Navan (Meath). Like many other Irish rivers, the Boyne occupies a gorgelike valley cut in the general lowland surface at 200–400 ft.

Belfast is divided into two by the Lagan, a short canalized river now known chiefly for the shipyards beside its dredged channel. In the northeast the glens of Antrim have short swift streams. The most famed of the northern rivers is the Bann, normally divided into two parts; the upper Bann rises in the Mourne mountains and flows to Lough Neagh, 25 mi. away, in a course that begins as a mountain stream but soon settles in a flood plain, and the lower Bann covers 33 mi. largely through peat bogs, to the sea. Lough Neagh (*see* NEAGH, LOUGH), 52 ft. above sea level, receives on its northern shore the river Main which flows parallel to the Bann, but in the opposite direction.

Lough Foyle is the outlet of the Foyle river, north of Londonderry; strictly the name Foyle applies to the 16 mi. of river from Lifford to the lough, but the whole drainage basin includes several streams draining the Sperrin mountains, as well as the Strule, the Derg and the Finn. Beyond the Foyle basin, in County Donegal, there are numerous short rivers, many of which run parallel to the mountain chains, there possessing a marked northeast-southwest Caledonian trend.

Glaciation.—This has been a major factor in the development of the Irish landscape, through the actions of ice and of meltwater, both in erosion and in deposition. The country was affected by two main glaciations, of which the earlier, or Eastern General, covered most of the country except for the southwest. The newer, or Midland General, extended as far south as a terminal moraine along a line forming the Shannon estuary to a point near Cahir, across the lowland to the western side of the Wicklow mountains, and spread into valleys on the north and east of this range and out to sea a few miles north of Wexford. Contemporaneously there was a separate ice sheet over Cork and Kerry, and various mountain glaciations, as in the Wicklows, where there are some fine glaciated valleys, such as Glendalough (*see* GLENDALOUGH, VALE OF). Various areas were ice-free, including the summits of the Macgillycuddy Reeks in Kerry, though these uplands had a corrie glaciation which has left strikingly sculptured forms. On the east coast an ice stream from Scotland and the Irish sea penetrated inland and southward for some distance.

The passage of ice removed much of the soil, particularly from areas in the west, and elsewhere left thick deposits, especially in the east. The removal of soil was severe in areas such as Connemara, where large expanses of bare rock are covered only by postglacial peat bogs and the mountains are almost bare of vegetation. Numerous erratic boulders were transported and later deposited by the ice, and as they can be traced by the rock type to the area of origin, the direction of ice movement is known. Equally striking are the extensive areas of bare limestone (karsts) in County Clare (the Burren), in the Aran Islands and in a belt of country to the north and south of Galway bay. By contrast, in the east there are places where glacial deposits are as much as 100 ft. thick, while in the Curragh (*q.v.*) the sands are 234 ft. thick. To a great extent the agricultural possibilities depend on the nature of the glacial deposits: well-drained ground and terminal moraines generally develop good soils under the damp Irish climate, but the one-time fens between them have become peat bogs. Long sinuous ridges, known as eskers, which may be due to deposition of sand and gravel by ice meltwater streams, are common in the lowland and generally have poor grassland or are wooded, while some have been quarried for sand and gravel. Interesting glacial features are the drumlins of which there are several thousand in the northern part of the lowland, *e.g.*, in and around Clew bay (Mayo), in the Erne valley and south Donegal, in a wide belt extending from County Sligo almost to Dundalk (Louth) and also in County Down and the Bann valley. These elongated whale-backed mounds have their steeper end facing the source of the ice which deposited them and so their alignment indicates the various directions of ice movement during glacial periods. These drumlins, said to cover one-eighth of the surface of Ireland, vary from a few hundred yards to a mile in length and are more than half as broad. In Cavan and Monaghan, and in south Donegal, these mounds dominate the scene, with lakes and bogs in the dips between them: in County Down they are small and in places so rounded that the countryside has been said to have a "basket of eggs" topography. Offshore, in Clew bay on the west and in Strangford lough on the east, the drumlins appear as a multitude of islands.

Ice meltwater, during various phases of the glacial period, carved channels and was impounded in lakes held up by ice. This is seen round the Wicklow mountains, where the ice front lay parallel to the mountain edge, and in consequence the meltwater, running in the same direction, cut overflow channels at right angles to the present drainage system. There are said to be at least 120 of these, including some over 100 ft. deep: some of them drained extensive meltwater lakes in which large deltas were deposited. Ice melting (at several periods) released large volumes of water, and many valleys now occupied by small streams were carved by these meltwater torrents. It appears that in this area the present river system is successor to a great meltwater system of drainage. In the lowland particularly, glacial erosion and deposition left large areas of indeterminate drainage with vast areas of fen in hollows between morainic and other land forms of glacial origin. During the drier early postglacial period these fens were better drained and had forests including oak, alder and willow, but during the succeeding wetter, cooler climatic periods, continuing to the present time, acid peat has accumulated on a large scale. Many of the smaller bogs have long since been cut away for fuel; since the beginning of World War II several large raised bogs have been exploited for domestic fuel or to supply power stations (*see* IRELAND, REPUBLIC OF: *The Economy*). In the west, bog has accumulated as a blanket extending over hills and slopes as well as hollows, but once this is cleared no soil remains: the area of bare rock in the west has been greatly extended by the cutting of this blanket bog. Blanket bog occurs where the annual rainfall exceeds about 40 in. and the air is frequently, if not invariably, damp.

3. Coasts.—The coasts of Ireland are as varied as the land behind them: many of the coastal waters are dangerous, hard to navigate and subject to heavy gales. The main harbours are all in river estuaries: the Norse invaders established Dublin on the

Liffey, Wexford on the Slaney, Waterford on the Suir, Cork on the Lee and Limerick on the Shannon. Belfast, on the Lagan, is of later date but owes its present deep channel and importance to dredging and river control; so does Londonderry on the Foyle. Along the northeast coast, the Antrim coast road runs along a raised beach (due to postglacial recovery of the land after glaciation and the rise in sea level during that period). In the extreme northeastern corner of Antrim there are spectacular cliffs composed of basalts and dolerites. Near Bushmills (Antrim) basalts form the Giant's causeway (*q.v.*), a fine exposure of hexagonal basalts with a coast walk in which a splendid series of basaltic rock forms may be seen. Lough Foyle has on the east extensive sand dunes and reclaimed land, and on the west the rocky coast line of Donegal. The Donegal coast is varied: there are some spectacular cliffs, such as those nearly 600 ft. high on Horn head, and the land is penetrated by the long inlets of Lough Swilly, Mulroy bay and Sheep haven. The west coast of Donegal has stretches of sand dunes alternating with cliffs; the finest feature is the quartzite scarp falling nearly 2,000 ft. into the sea from Slieve League. Off the coast there are numerous islands. Round Donegal bay there is a lowland formed of Carboniferous limestones covered with numerous drumlins but the main beauty lies in the back cloth of hills beyond the lowland.

From Sligo bay westward the coast is interrupted only by the inlet of Killala bay (Mayo) and has some fine cliffs. The west Connaught coast is marked by the Mullet, most of it a line of sand dunes protecting an agricultural area, and Achill (*q.v.*) Island, with quartzite scarps similar to that of Slieve League in Donegal. At the head of Clew bay there are scores of islands formed of drumlins, and here the scenic glory lies in the surrounding mountains. Between Clew bay and Galway bay there is an intricate coast with a large number of islands, and on the north shore of Galway the land merges gently into the sea, without cliffs. Galway bay has the three islands of Aran across its entrance (*see* ARAN ISLANDS), and on the south the flat coast of Clare where, near Black Head, there is a vast limestone pavement swept by the sea. But the most famous feature of west Clare is the 600-ft. vertical cliffs of Moher, in Carboniferous flagstones, and many lesser cliffs along the coast.

South of the flat shores of the Shannon estuary, Kerry has some fine cliffs, notably at Brandon head in the Dingle peninsula. Much of the long ramifying coasts of the southwest consists of an alternation of sandy bays and cliffed coasts. The south coasts are too varied for detailed treatment, but in general they consist of cliffs up to 200 ft. high, interrupted by inlets such as those forming the harbours of Kinsale, Cork, Youghal and Waterford, with some sheltered sandy bays at places along the coast. In the southeast Wexford harbour is the largest inlet, and the coast includes some long stretches of sand dunes and pebble ridges guarding marshes, with many miles of cliffs, some of which show glacial drifts over the rock beds. Here, as on the south coast, there are extensive sandy beaches and sheltered coves.

4. Climate.—Commonly described as "mild, moist and changeable," Ireland's weather shows an almost imperceptible temperature gradation from one season to another with rain a common element throughout the year, particularly in the west. Along the Atlantic coasts, where the mean monthly temperature for December to March is 7° C. (44° F.), there is little seasonal check to plant growth. This is especially so in such sheltered valleys as those round Killarney, where a rich evergreen vegetation includes laurels, rhododendrons, the Mediterranean arbutus, and holly, with oak and other deciduous trees. In the east winter temperatures are slightly lower, about 5° C. (42° F.), but sheltered gardens in Dublin may have an abundance of blooms even in December and January.

The rainfall over four-fifths of the country averages 30–50 in. per year, with much higher totals on mountains and in exposed places near the Atlantic. A particular hazard of the climate is the distribution of rain through the year; in many years heavy rains during the harvest period, especially in September, cause difficulties. The number of rain days averages 175 a year in the east, but reaches 250 in the wettest parts of the west.

The incidence of sunshine is relatively low, June being the sunniest month. Leinster, which is the sunniest region, has a daily average of seven hours sunshine during June (the maximum period); this decreases to two hours during December (the minimum period).

Winds are predominantly westerly and at times heavy gales can do considerable damage to shipping, particularly on the west coast. Equally, damage is done to standing crops by high winds, especially when combined with heavy rains. Though the frost incidence is lower than in Great Britain, occasional frosts in late April or even early May damage fruit and other crops, including early potatoes. Normally, early potato crops are successful, and in some years highly remunerative in parts of the west, including the Aran Islands. (T. W. Fr.)

5. Vegetation.—The Irish flora is essentially an impoverished version of the British flora: impoverished partly because Ireland is a smaller and less diversified island than Britain, and partly because it was isolated earlier than Britain in postglacial times. Some 15 species of higher plants are found in Ireland but not in Britain; these are mostly extreme Atlantic species which probably survived the last glaciation in western Ireland when they were exterminated elsewhere in northern Europe.

The natural woodlands of Ireland have been almost completely destroyed. The limestone plain, which was probably occupied originally by oak-ash-alder wood, is now converted to pasture and meadow. On siliceous rocks in the hills some fragments of the original oak-birch-holly-rowan wood remain, but most of the area it covered is now heathy moorland or rough pasture. This deforestation began in Neolithic times and was completed in the 17th century; modern reafforestation uses mainly exotic species of conifers. In the limestone Burren of County Clare alpine species such as gentians and mountain avens (*Dryas octopetala*) have spread in the absence of a shrub vegetation.

The more exposed mountain slopes and the western seaboard are too windswept to support trees. The present mountain vegetation of heaths, with crowberry, dwarf juniper, etc., is fairly natural, as is also that of the large bogs of the west and centre, where the deep peat is covered by bog cotton and other sedges, grasses such as *Molinia*, dwarfed heather and *Sphagnum* moss.

The equable temperature and high humidity, especially in the west, promotes rapid growth if shelter from the wind is provided, so that in sheltered situations an impression of subtropical luxuriance often prevails. This applies especially to ferns and mosses, which are much more abundant and luxuriant than in Britain. Round Killarney, for example, are woods of oak, arbutus, birch, holly and rowan with a rich ground flora of saxifrages, ferns, mosses and liverworts. (X.)

6. Animal Life.—This is very similar to that of Britain but contains fewer species in almost every group. The following larger animals are absent as breeding species: woodpeckers, voles, the common shrew, the mole and the greater horseshoe bat. Reptiles and amphibia are represented solely by the lizard *Lacerta vivipara*, smooth newt, natterjack toad and common frog. The last named, together with aliens like the brown rat, house mouse, house cricket and a number of other insects, has probably been introduced. The poverty of the number of species as compared with Britain is probably due to the severance of the land connection between them before the break of the land connection between England and France following the retreat of the ice in the postglacial period. A number of animals have a wider distribution in Ireland than in Britain (*e.g.*, Leisler's bat). As with the flora there is a small Mediterranean element in the fauna (*e.g.*, the Kerry slug, *Geomaculus maculosus*) and an American element (*e.g.*, the freshwater sponge *Heteromeyenia ryderi*), together with a number of arctic relicts. The isolation of the fauna has resulted in a number of differences between similar animals in Britain and Ireland. This is seen in the Irish breeds of the hare, stoat, jay and red grouse. (J. N. R. G.)

II. GEOGRAPHICAL REGIONS

The Northwest.—This area comprises Donegal, the Foyle valley and the uplands and lowlands of Sligo. Donegal's agriculture is restricted to lowlands and mountain valleys, and becomes richer

in the east toward the Foyle valley. Sligo has plateaus, deep valleys and coastal lowlands. Rainfall is high (40–70 in.) except in the north; the winters are mild (5° C. [41° F.] Dec.–Feb.) and summers cool (14.5° C. [58° F.]). The high rainfall and mild temperatures encourage a luxuriant plant growth though winds frequently limit tree growth on the coasts. Bogs are common where the drainage is poor. Oats, potatoes, grass farming, sheep and cattle form the basis of the economy; some of the agriculture is carried on as cottage farming.

Connaught and Clare to the Shannon Estuary.—This area has a similar climate to the northwest but is slightly warmer and wetter (rainfall averages between 40 and 60 in. with up to 100 in. in the mountains). Average temperatures are 6° C. (43° F.) in winter and 15° C. (59° F.) in summer. Tree growth is limited along the coastal strip by the strong winds which have also forced agriculture and settlement to sheltered places or have compelled farmers to build high walls round their fields. Agriculture is mainly pastoral with sheep predominating on the dry limestones and cattle on the better grasslands; sheep supply wool for Donegal and Irish tweeds. On the farms and cottage holdings potatoes and oats are the main crops.

The Southwest.—High rainfall (60–100 in.) and a relatively warm climate mark this region. Rainfall is not uniform and decreases to 50 in. in the lowlands. There is a pronounced winter rainfall maximum; rain falls on an average of three out of four days. Vegetation is luxuriant, verging to subtropical. There are extensive boglands in areas of excessively poor drainage and rich woodlands in sheltered, well-drained places. The soils are derived from Old Red Sandstone, limestone and superficial deposits. Agriculture is pastoral with the cultivation of oats and potatoes and some dairying, stock rearing and hog farming. Sheep are less numerous than in other areas.

The South and Southeast.—This region, extending northward to the Slieve Bloom, is marked by a rainfall of 30–40 in. in the lowlands, increasing to over 40 in. in Cork and Waterford. The winters are mild, 7° C. (44° F.), the summers comparatively warm, 15° C. (59° F.) July average. This area also has the highest sunshine average in Ireland. The lack of blanket bog has made extensive cultivation possible and on some farms one-third of the land is arable. The main crops grown are oats, barley, turnips, potatoes, beets and some wheat. Pasture for dairy herds and store cattle is excellent and farming is prosperous. Sheep are also grazed extensively.

The Central Lowland.—This is characterized by a much drier climate, receiving 30 in. or less rain per year. Temperatures vary according to exposure; in some areas winters are very mild. Agriculture is mainly pastoral as the soils are heavy, impermeable boulder clays and limestone drifts. These give rise to very rich grasslands, but crops can only be grown where the land is well drained. There are some famous stud farms in this area. Cattle are reared for beef and for dairying. The plain includes the major bogland area in Ireland and is the site of several peat-fired electricity stations. There are also hydroelectric projects; *e.g.*, Pollaphouca on the western edge of the Wicklow mountains in the Liffey valley.

The Northeast.—This is one of the most intensively farmed areas in Ireland. The climate is cooler than in other parts (4.5° C. [40° F.] winter mean) but becomes warmer along the coasts. The summer mean is 15° C. (59° F.). Rainfall varies from 30 to 60 in. according to location. Agriculture is dominated by grassland, both for pasture and for seed raising. Other crops are oats, potatoes and a little wheat and barley. The traditional flax growing had almost ceased by the early 1960s. Livestock includes pigs, sheep, cattle (store and dairy) and poultry. (T. W. Fr.)

III. THE PEOPLE

1. Racial Types.—The most distinctive anthropological feature of the Irish people is the combination of light eyes and dark hair. In samples taken from all Irish counties 40% were found to have blue eyes and a further 44% blue-brown. Hair colour is normally dark brown, but black hair is rare and declines to less than 1% in some areas: the highest proportion of dark hair is found in Waterford and Wexford. A broad belt of relatively light hair runs down the island from Londonderry to Cork, extending westward into Galway, and in this belt red hair reaches its maximum (7.5%) in Leitrim and Cavan. The mean stature of adult males is high (172 cm.; 5 ft. 8 in.): it is lowest on the east coast and highest in Kerry and Galway. The span-stature index is remarkably high. Heaviest mean body weight occurs in the west, especially in the westernmost peninsulas. Heads everywhere tend to be mesocephalic, the index ranging by counties from just below 78 in Meath and neighbouring counties to a little over 80 in Kerry.

Many attempts have been made to correlate these anthropometric variations with prehistoric and historic invaders. C. S. Coon discerns strong Upper Paleolithic elements in the populations of Kerry and Cork and claims that at least half of the genetic ancestry of the composite modern Irishman is to be referred to the survival of strains from the first Mesolithic inhabitants of the island. E. A. Hooton disputes this but thinks that Nordic-Mediterranean features—long headed, tall, dark haired types with mixed pigmentation—are basic and represent a prehistoric substratum. While there is little agreement as to origins most workers recognize at least six subracial types and all are agreed that post-Celtic settlers have had little effect on the composition of the population, though they strengthened certain pre-existing subracial types. It is paradoxical that the so-called Celtic type (of medium stature, long-headed, combining blue eyes with darkish hair) is most concentrated along the east coast, while the physical characters of the population group which has most successfully retained the Gaelic language—the Aran islanders—have been plausibly attributed to a strong admixture of blood from English garrisons in Cromwellian and later times.

2. Language.—The Gaelic language, once universally spoken but now generally replaced by English, is a member of the Goidelic branch of the Celtic tongues. Areas which preserve Gaelic as the language of the home are now few and scattered, being virtually confined to the westernmost peninsulas of Donegal, north Mayo, south Galway and Kerry. The official Gaeltacht (Gaelic speaking) areas of the republic are somewhat more extensive, since they include adjacent areas where the language has not entirely died out. It is the avowed policy of the republic to revive the use of Irish as a vernacular language in these adjacent areas, but it may perhaps be doubted whether this will be any more successful than the attempts which have been made, mainly through compulsory teaching in the schools, to restore the Irish language as the habitual medium of speech throughout the republic. (*See* also Celtic Languages; Irish Literature.)

3. Religion.—Religion enters deeply into the fabric of life in both parts of the island, and the churches exert a strong influence in social and educational affairs. Taking the island as a whole, the proportions of Roman Catholics (75%) and Protestants (25%) have remained fairly stable since the middle of the 19th century, despite heavy emigration and other demographic changes. Since political partition, in 1921, the greater part of the Protestants have been contained in Northern Ireland, where Roman Catholics and the two main protestant groups, Presbyterians and Church of Ireland adherents, are almost equally represented in the total population. Roman Catholics, however, are the largest single denomination in Northern Ireland, and whereas they are found in all parts of the province there are many districts in the republic where there are no Protestants. In fact only about 6% of the people of the republic are Protestant, mainly belonging to the Church of Ireland, and this percentage is declining steadily. The strongest Protestant communities are found in Dublin, Wicklow, Cork and the three Ulster counties of Donegal, Cavan and Monaghan. The political division of Ireland is not considered in the ecclesiastical organization. The Catholic primate of all-Ireland and the primate of the Church of Ireland have their seats at Armagh in Northern Ireland and the headquarters of the Presbyterians and Methodists are in Belfast.

4. Customs and Culture.—Many parts of rural Ireland, and especially the Gaeltacht, have preserved a strong tradition of oral literature from which the Irish Folklore commission has built up an extensive archive. Folk tales, fairy lore and calendar customs

are also richly represented in the collections, the quarter days marking the beginning of February, May, August and November (All Hallows) being especially important in the folk calendar. In the field of material culture, rural Ireland is no less rich in ethnographic survivals, which include the wheelless slide cars of Antrim, the hide currachs of the river Boyne, the seagoing currachs of the west coast, the rawhide shoes of the Aran Islands and the one-eared spade which is commonly used throughout the south of the island. In folk art Ireland has little to offer, decorative painting for instance being almost unknown. A wide range of skilled techniques in wood, metal and illuminated manuscripts is attested in early historic times, but the humble artifacts of the peasant, though often of great ethnographic interest, are for the most part strictly utilitarian. This material poverty contrasts strikingly with the vigorous development of nonmaterial forms of expression, in conversation, poetry, song and dancing. Country games which are found locally include skittles, handball and bowls ("hullet-throwing"). Other ball games which enjoy a wider popularity are hurley and Gaelic football. Attracting large crowds in the county championship games, they may be regarded as the national forms of competitive sport. As for rugby football and most games the island is not partitioned when international teams are selected.

(E. E. E.)

IV. ARCHAEOLOGY

The Mesolithic Age.—The human occupation of Ireland does not begin until a late date in the prehistory of Europe. The island seems to have been uninhabited throughout the whole of the Ice Age; at least no incontrovertible trace of an interglacial colonization had been found by the early 1960s. The earliest relics of man appear in the remains of a culture of Mesolithic affinities, evidence for which has been found at Cushendun, Larne, Rough Island and other places on the northeast coast of the country and also at other coastal sites in Counties Louth and Dublin. This culture has been divided into two phases, called Early and Late Larnian after the type site at Larne (Antrim). As the majority of the sites associated with the culture are secondary and as most of them are on beaches, the relics they have yielded consist entirely of implements of stone and flint. Early Larnian is characterized by microliths, scrapers and blades allied to those of the Mesolithic cultures of the adjacent areas of Britain. Its descent is probably to be traced to the British Upper Paleolithic and it may be roughly dated to 6000 B.C. Late Larnian is regarded as a local evolution of this culture and its equipment of flint tools tends to be of a more massive type. The people of both these phases were dependent for subsistence chiefly on hunting and fishing, supplemented by minor food collecting activities. It would seem that groups of these people survived in lakeside and riverside settlements until the coming of the Neolithic agriculturalists and pastoralists.

The Neolithic Age.—Radiocarbon datings suggest that the Neolithic culture was well established in the country before 2500 B.C. The surviving artifacts of the period are polished stone axes, leaf-shaped arrowheads, hollow scrapers and pottery vessels belonging to the general type of western Neolithic. The pots are simple round-bottomed bowls, plain or decorated; round-bottomed shouldered bowls, which may be either plain or ornamented; and a flat-bottomed ware of coarse texture. Habitation sites have been excavated at Lough Gur (Limerick) where houses, both round and rectangular in plan, were discovered. The economy of the inhabitants seems to have been based largely on cattle rearing and only to a minor extent on agriculture. The burials of the period include both single graves and collective tombs. The single graves generally consist of a stone cist, sometimes covered with a circular mound of earth. The collective tombs are the earliest of the Irish series of megalithic monuments and, from one of their most characteristic features, have been called court cairns. A typical tomb of this type has an open court giving access to one or more galleries, each containing two or more chambers, roofed with lintels and divided from each other by pairs of jamb stones which have, occasionally, a sill stone between them below. The court is bounded by orthostats and varies from a full circle to a segment of one. The whole tomb, excluding the court, was covered with a low cairn, more or less trapezoidal in plan. In distribution, these tombs are confined to coastal and upland districts in the northern half of the country, a pattern which has been

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(TOP, LEFT TO RIGHT) LEATHER SHIELD, LATE BRONZE AGE; BRONZE TRUMPET, LATE BRONZE AGE, AND GOLD LUNULA, EARLY BRONZE AGE; SHRINE OF ST. PATRICK'S BELL, C. 1100 A.D., TO HOLD A BELL ASCRIBED TO ST. PATRICK. (BOTTOM, LEFT TO RIGHT) TARA BROOCH, 8TH CENTURY A.D.; GOLD GORGET, LATE BRONZE AGE; BRONZE CAULDRON, LATE BRONZE AGE; GOLD COLLAR, 1ST CENTURY B.C.

interpreted as reflecting a settlement of incoming people arriving by sea on the western coast and gradually spreading eastward over the better drained and less heavily forested land. Cremation was the normal burial rite in these tombs and the scanty grave goods are in the full Neolithic tradition. The dispersal focus of these people is unknown and the ultimate derivation of their characteristic tomb undecided.

The Bronze Age.—The early Bronze Age, which seems to have begun some centuries before 2000 B.C., was a continuation of forces already at work in the preceding period, strengthened by fresh ones which made their appearance about that time. Of the latter, one of the most important was the Beaker culture. The Lough Gur site, already mentioned in connection with the Neolithic, produced considerable quantities of the very distinctive Beaker pottery and further finds of it have been made in megalithic graves in Derry (Londonderry), Tyrone, Sligo and Dublin. The beakers found are of mixed British and continental affinities and their presence presumably indicates an immigration of people. It is worth noting, however, that no burials of the kind typical of the British beaker tradition have been found.

A factor which may have contributed to the flourishing state of early Bronze Age culture in Ireland was the presence of gold. The metal is still to be found, although not in commercially remunerative quantities, in the gravels of mountain streams in County Wicklow. As no traces of ancient mining have been discovered, it is probable that the supply was won from the same alluvial gravels in early times. The large number of gold ornaments of the early Bronze Age which have been found in the country prove that considerable amounts of the metal were available. Among the earliest types of these gold objects are the lunulae: crescents of thin gold sheet, having the tips of the horns enlarged and bent at right angles to the plane of the crescent. An average specimen is about 8 in. in diameter. They are decorated with finely engraved geometric patterns, the ornament being restricted to the horns, except for a narrow band bordering the outer and inner edges of the wider portion of the crescent. A few have been found abroad but the great preponderance of those of Irish provenance points to an origin in Ireland. Another early gold object is a small disc of sheet metal bearing a cruciform design ringed by ornamental bands. They have generally been found in matching pairs and, since each is provided with two small holes in the centre, it is thought that they were originally attached to some backing material. From a later phase of the Bronze Age there are numerous torques made of gold bars and ribbons spirally twisted. They vary greatly in size, from specimens small enough to have been used as bracelets to ones large enough to have been worn as girdles. A characteristic ornament of the late Bronze Age consists of a thin round gold bar bent into a semicircle with a funnel-shaped expansion at each end. To the same period belong eight magnificent gold gorgets, all discovered in the region of the Shannon estuary. They are decorated with bold moldings enriched with *repoussé* work and attached to each of their terminals is a disk bearing a pattern formed of groups of concentric circles. Whatever the significance of their very limited distribution, these gorgets have definite north European affinities.

The weapons of the earlier phase of the Bronze Age included flat axes and small triangular daggers, and rapiers which appeared at a somewhat later stage. The axheads frequently bear geometrical decoration executed by punching and hammering. Some of the daggers were hafted by means of a tang, but more usually the handle was secured to the blade by rivets. The rapiers are long slender blades strengthened by a midrib and the halberds are broad, daggerlike blades which were mounted by means of rivets at right angles to one end of a long handle. As the Bronze Age advanced the flat ax was superseded by the palstave, an ax with a relatively narrow blade and a pocket on each side to accommodate the ends of a split knee-shaped handle, to which the head was further secured by lashing through a loop cast on the edge. Cast bronze spearheads of beautiful proportions were produced in a great variety of sizes by the native smiths. In the later part of the Bronze Age new types of weapons, based on imported models, replaced the long established patterns. The axhead was cast hollow to provide a socket for the end of the handle and the looped spearhead was replaced by one which was attached to the shaft by pegs or rivets passing through holes in the socket. An entirely new kind of weapon, a slashing sword with a leaf-shaped blade, appeared and to this phase of the period also belong the earliest shields discovered in the country. These are circular, with a central hemispherical boss surrounded by concentric moldings and were made of bronze, leather or wood. The art of the bronzesmith was not limited to the production of weapons alone for the existence of hammers, saws, chisels and gouges shows that he provided the tools for other craftsmen as well, although the only agricultural implement which he was called upon to supply was the sickle. The large cauldrons which he made for domestic use rank among the finest specimens of his workmanship. Their swelling contours are built up of comparatively small sheets of bronze fastened together with close rows of decorative conical-headed rivets and the stout everted rims are provided with two large ring handles by which the vessels could be suspended over the fire. He also cast the first musical instruments in the country of which there is any present knowledge, trumpets, both side- and end-blow, which imitate in shape and size the cattle horns which were their exemplars.

The megalithic tombs, which began with the court cairns of the Neolithic period, continued to be built in the Bronze Age but new types, representing several waves of cultural influence from abroad, made their appearance. Of these, the passage graves, although not the most numerous, comprise some of the most impressive monuments in the country. Roughly speaking, they extend across the central third of the country and are commonly grouped in cemeteries on hilltops or high ground. The most important of these concentrations are those beside the river Boyne and on the Loughcrew hills in County Meath and at Carrowkeel in County Sligo. The largest of all the tombs is the enormous tumulus of Newgrange on the Boyne. It covers an acre of ground and encloses a great cruciform chamber built of corbeled slabs of stone, many of which are decorated with spirals, chevrons and lozenges pecked into their surface. The chamber is approached by a linteled passage of massive stones and the whole mound, which is about 40 ft. high, is girdled round the base by a continuous curb of huge stones laid end to end. The mound was originally encircled by a ring of large standing stones, most of which have been destroyed. The Boyne group includes two other great tumuli which approach Newgrange in dimensions: that of Dowth containing two independent chambers, the stones of which bear decoration similar to that found in Newgrange, while the other mound, known as Knowth, has its curb profusely ornamented with a wide variety of patterns of this peculiar art. Further examples of it occur in the Loughcrew cairns, at Knockmany and Sess Kilgreen, both in County Tyrone, and in a tomb at Fourknocks, County Meath. Some of the patterns appear to be very schematized anthropomorphic motifs. The scanty grave furniture of those passage graves which have been excavated includes round-bottomed highly decorated pots of a kind known as Carrowkeel ware, small stone pendants shaped like hammers and mushroom-headed bone pins.

The wedge-shaped gallery grave, characteristic of the southern third of the country, has walls constructed of upright slabs which support a roof of horizontal capstones and, as the name indicates, the tombs are wider at one end than the other. They are frequently two-chambered, with a large compartment at the wider end and a smaller one behind it at the narrower end. While the grave goods of some show Neolithic survivals, the more common occurrence of beaker pottery and tanged-and-barbed arrowheads demonstrates that they are to be assigned to the earlier part of the Bronze Age.

A further kind of megalithic tomb is the portal dolmen. This is a single-chambered structure, usually narrowing toward one end, the entrance being flanked by two tall portal stones and the whole covered by a single capstone, often of enormous size, which slopes down from the tall portals to the rear of the tomb. They are found in the north and extend southward along the east coast but are rare elsewhere and seem to be wholly absent from the southwest.

Burial was, however, by no means confined to the megalithic tombs for one of the commonest Bronze Age graves is a stone cist of rectangular plan, constructed of four slabs set on edge and covered by a capstone, the entire structure being sunk in the ground. The body was either cremated or inhumed and a highly decorated pot, known as a food vessel, often accompanied by a slug-shaped flint blade, was usually deposited with the remains. Food vessels fall into two broad types, bowl- and vase-shaped, the former being the commoner. In late Bronze Age times a new kind of funerary pottery appears: a large wide-mouthed urn, tapering to a flat base. One type of urn is decorated with cordons and rudely executed incised geometrical ornament, the other with strips of clay applied to the surface to produce an encrusted effect. The urn may be enclosed in a protecting stone cist or merely buried in the ground and it is often found in an inverted position over the cremated bones.

The Iron Age.—There is no clear cut line of distinction between the end of the Bronze Age and the beginning of the Iron Age although the latter may be said to have begun about 500 B.C. and to have ended about A.D. 500. The Hallstatt or earlier phase of the continental Iron Age is represented in Ireland only by a few discrete cultural elements such as a small group of bronze swords and sword mounts and several bronze buckets or situlae. From the succeeding La Tène period the finds are more numerous and more culturally coherent. They include personal ornaments in gold, silver and bronze decorated in the style typical of the period; items of horse furniture, such as beautifully designed bronze bridle bits; long curved trumpets of riveted sheet bronze; iron swords, spearheads and tools; and a few carved standing stones, including those at Turoe (Galway) and Castlestrange (Roscommon). It is to this period that the immigration which introduced the Celtic speech must be assigned. The oldest written relics of this Celtic language are enshrined in the Ogham inscriptions, most of which appear to date from the end of the Iron Age (*see* OGHAM WRITING). Ogham stones are particularly abundant in the extreme south of the country and some are to be found in Wales and Scotland. In later centuries some of these pagan memorials were "christianized" by the addition of a cross, usually of the equal-armed type enclosed in a circle. Although the articles of actual Roman origin found in the country are relatively few in number, there is an increasing body of evidence to suggest that there was very considerable contact between Ireland and the Roman and romanized world during the latest phase of this period.

The Early Christian Period.—While there can be little doubt that small Christian communities existed in the country prior to the middle of the 5th century, it was not until the arrival of St. Patrick (*q.v.*) about that time that large scale conversion from paganism began and that the church became an integral part of the social structure. Christianity brought with it Latin learning and cursive writing and created the need for books, church buildings and their furnishings. The earlier Christian centuries were characterized by the development of an ascetic monasticism, leading to the foundation of numerous small monasteries which were frequently situated in islands off the coast or in then uninhabited tracts inland. One of the most inaccessible of these settlements was on the towering rock of Skellig Michael off the Kerry coast where the early stone-built beehive cells still exist in a remarkable state of preservation. A number of these monasteries developed into schools of learning of considerable size and importance, among them being Clonmacnoise in County Offaly and Clonard in County Meath. Many of the sites retained their importance down to the 12th century and were, in the time of the Viking incursions, provided with tall round towers which functioned as places of refuge, belfries and lookout points. About 100 of these towers remain in varying states of preservation. A typical example is about 90 ft. high, with a doorway at a considerable height from the ground and four windows immediately below the conical roof. Internally, it was originally divided by wooden floors into stories, each lit by a small window and communicating with the next by a ladder.

Also associated with monasteries and other ecclesiastical sites is a series of large carved stone crosses, ranging in date from the 8th to the 12th century. They vary greatly in size but an average specimen may be from 10 to 15 ft. high. It is set on a pyramidal base and at the junction of the arms and shaft the members are connected by four arcs which give a wheellike appearance to the head of the cross. The earliest of the group are to be found in the southeast of the country and two particularly fine examples are situated at Ahenny, County Tipperary. Such figure sculpture as they bear is confined to the base, the cross proper being entirely covered with ornament of which interlacing forms the staple. In origin, these earliest crosses seem to be gigantic enlargements in stone of metal prototypes. Various lines of development from this early type can be traced, the broad result of which was to lend increasing prominence to figure sculpture until a stage was reached when the cross was formally divided into a large number of panels, each illustrating an incident from the Old or New Testament, such purely decorative carving as was still retained being similarly apportioned into separate compartments. Perhaps the best example of this stage of evolution is the excellently preserved cross of Muiredach at Monasterboice, County Louth, which dates to the early 10th century. The iconographical plan on these later crosses shows a marked influence from contemporary continental religious art.

Evidence for other aspects of the artistic achievement of the period survives chiefly in metalwork and manuscript illumination. A large body of metalwork, both lay and ecclesiastical in origin, reveals the adaptation by Irish craftsmen of many techniques from Britain and the European continent. An instinct for design added to the superlatively skilful use of these techniques enabled them to produce many objects of outstanding craftsmanship. The Tara brooch, which dates to about the middle of the 8th century, may be taken as an example of these beautiful objects which have been found. It, like its fellows, consists of a long straight pin with a triangular top looped to a ring terminating in two large expansions, the outer edges of which complete the circumference of the circle of the head. The front of the head is divided into panels embellished with geometric and zoomorphic interlacing in filigree and set with studs of amber, and blue and red enamel. The back of the brooch is decorated in a different and older style with spirals, trumpet patterns and animal interlacements. The top of the pin is also elaborately ornamented and the lower end terminates in a stylized animal head. An even more remarkable 8th-century object is the large silver ministral chalice found at Ardagh, County Limerick. It is a wide two-handled cup with a stem and a broad circular base and measures seven inches in height and nine and one-half inches in diameter. Below the bronze rim is a band of small panels of gold filigree interlacements separated by studs of blue and red enamel. The handles are divided into panels in which gold filigree and glass mosaic plaques alternate, while their escutcheons are set with enamel bosses overlaid with a silver network. The stem, the upper and lower surfaces of the flange around the base and even the underside of the base itself all bear enrichments in a great variety of techniques and designs.

Among the other metalwork from the 9th to the 12th centuries are mounts of various kinds, pins, brooches, bells and numerous shrines and reliquaries for articles associated with the native saints. These last include elaborately decorated containers for bells, books, staffs and bodily relics. One of the latest of the series is the great processional cross from Cong, County Mayo, which was made about 1125 to enshrine a relic of the True Cross.

The style of the later pieces is influenced by Scandinavian art with which the country had been brought into contact by the Viking incursions. These began toward the end of the 8th century as raids on coastal settlements and monasteries but in the course of the succeeding century the intruders established themselves in a number of strategic places around the coast, the main centres being at Dublin, Wexford, Waterford, Cork and Limerick. Apart from such of the larger monastic centres as might have partaken of an urban character, the pattern of settlement in Ireland had hitherto been a completely rural one and these Scandinavian outposts formed the nuclei of the first towns in the history of the country.

Manuscript illumination parallels and complements the metalwork in early Christian art. The growth of the church called for

the multiplication of books for instruction, study and divine service and these were produced in the scriptoria of the monasteries. The benefits of letters were not, of course, restricted to purely religious texts and the native traditional literature in prose, saga and verse was also committed to writing, together with a large corpus of legal tracts and much else of a miscellaneous character, to produce the largest body of early vernacular literature in western Europe. Most of the manuscripts containing material in the Irish language are comparatively late, the oldest being no earlier than the 12th century, but, because of the existence of secular schools of learning with strong antiquarian propensities, they contain much matter which was already linguistically archaic when incorporated in the manuscripts. As might be expected, few of these manuscripts are decorated and the art of illumination is bestowed chiefly on texts destined for church use and ritual. The most famous of the Irish illuminated manuscripts is the *Book of Kells*, a copy of the four Gospels which can only have been made in one of two Columban foundations, Iona or Kells. It probably dates to the end of the 8th century. The earliest surviving illuminated manuscript is the *Book of Durrow*, dating to the second half of the 7th century. Irish missionary activity on the continent led to the dispersal there of books illuminated in Ireland or to the production in Irish continental foundations of books illuminated in the Irish style. In all these manuscripts the illumination is in great part confined to initial letters and is executed mainly in ribbon and zoomorphic interlacements of astonishing intricacy and wealth of invention. Representations of human beings are largely limited to figures of the four evangelists and even these are treated in an abstract and stylized manner (*see* also ILLUMINATED MANUSCRIPTS: *Ireland*).

There can be little doubt that the greater number of the buildings of the time, both secular and ecclesiastical, were made of wood, timber being readily available from the great oak forests which still covered large areas in most regions of the country. Building in stone was, however, practised for special reasons or in those places where timber was scarce. The defensive round towers mentioned above are an example of stone buildings erected for special purposes, and the beehive cells of Skellig Michael are an example of the resort to stone where wood was unobtainable. Dry-built beehive cells, most of them now ruinous, survive on early monastic sites along the west coast from Inishmurray, County Sligo to the Dingle peninsula, County Kerry. They are constructed of courses of flattish stones, each course slightly oversailing that below so that the diameter of the cell constantly diminishes as it rises until the final opening left is small enough to be closed with a single large stone. A more developed, but less stable, type of dry-built construction is to be seen in a small rectangular oratory, numerous in Kerry, in which the side walls are skilfully corbeled inward until they meet in a ridge above the centre line of the floor. The end walls have a slight inward batter and in one is a doorway with sloping jambs and in the other a small round-headed window. The only example standing intact is that known as the Gallarus Oratory, situated near the tip of the Dingle peninsula. When mortared stone churches began to be built, probably in the 9th century, this type of roof was in some cases retained and examples of it are to be found in churches at Killaloe (County Clare), Kells (County Meath) and Glendalough (County Wicklow). One of the last and certainly the most ambitious of these stone roofs is that of the 12th-century Cormac's chapel in Cashel, County Tipperary. The majority of the early mortared churches were, however, roofed in the orthodox fashion with rafters carrying thatch or shingles. Many of these structures show, in such details as gable barges and gable finials, the translation into stone of features proper to wooden buildings. The romanesque style was introduced sometime in the 11th century and appears to have been in fashion for about a hundred years, during which there were built a considerable number of churches, most of them, like their predecessors, of relatively small size, and in which some of the characteristics of the earlier buildings, like sloping door jambs, persisted. In these romanesque buildings decoration is concentrated chiefly on the doorways, of which the finest example is that at Clonfert, County Galway, and on the chancel arches, of which the most elaborate is that at Tuam in the same county.

If, in dealing with the early Christian period, attention has been concentrated on aspects of art and architecture which are principally ecclesiastical in context, it must not be thought that archaeology has nothing to tell about the life of the ordinary people of the time.

There were no urban centres and the economic basis of the society was cattle and corn. An overwhelming proportion of the cattle seems to have consisted of cows, and milk and its products appear to have constituted an extremely important part of the national diet. The land was tilled with the plow which was drawn by oxen harnessed to it by wooden shoulder yokes. The grain crops were oats, barley and wheat, in that order of importance, the grain from which was dried in kilns and ground in mills of the horizontal type or in rotary querns and eaten as porridge or bread. Sheep appear to have been bred principally for their wool and the only animal reared specifically for slaughter was the pig, the flesh of which was eaten fresh as pork or salted as bacon. Fish were taken with hooks, nets and spears or in weirs erected on rivers. Hunting, fowling and trapping supplemented the diet in a small way and large wooden deer traps have been found preserved in bogs. There is one representation of a deer caught in such a trap on a sculptured slab of the period from Banagher, County Offaly. Wool was spun with a wooden spindle weighted with a whorl of bone or stone and woven on a loom. The outer garment worn by both sexes was an ample woolen cloak called a *brat* which was fastened on the shoulder or the breast by a pin or one of the large brooches of the Tara type described above. The inner garment was a long linen tunic, called a *leine*, which was girded at the waist with a belt or *crios*. Shoes of rawhide or tanned leather were worn, at least by the upper classes and the higher professional ranks. A large number of these shoes have been found in bogs. Each is made from a single piece of leather, sewn with gut or thong. Some are provided with small ornamental tongues which lay on the wearer's instep and some specimens have these tongues delicately tooled with patterns which enable them to be dated to this period. The chief musical instrument was the harp and harpists are depicted in many scenes on the high crosses. Transport of goods by land, insofar as there was any need of it in a society composed of self-sufficient local communities, was by pack horse, for wheeled vehicles appear to have been few. In the earlier part of the period a chariot drawn by two horses harnessed to a central pole was in use, perhaps mainly as a vehicle of parade. If the scenes where it is depicted on the high crosses can be trusted to reflect contemporary life, it remained in use up to the 10th century, but there is no evidence to show when it finally disappeared. Sea transport was accomplished by currach, a wicker-framed boat covered with hides, propelled by paddles and sometimes fitted with a sail also made of hide. On inland waterways, the currach may also have been used but, to judge by the great numbers of them discovered in lakes and rivers everywhere in the country, the normal freshwater craft was the dugout, which remained in common use to the 17th century.

The houses of the time were built after the post-and-wattle technique but the data about them which can be gathered from the ancient literature are vague and very little has yet been discovered by excavation. Some, at least, of these houses were situated within the protected sites called ring forts, of which tens of thousands still remain. A typical ring fort consists of a circular outer ditch, the upcast from which was used to build a concentric bank around the margin of the enclosed level space, the bank being, no doubt, topped by a wooden palisade. Excavations carried out at Carrigillihy, County Cork, and at Lough Gur and Cush, County Limerick, show that a possible prototype was in existence in the country during the early and late phases of the Bronze Age and other excavated examples prove that it was a normal place of habitation down to medieval times. Larger defended habitation sites were often surrounded by a number of concentric banks and ditches. In parts of the country where surface stone was plentiful, the ring fort was replaced by a stone fort, commonly called a cashel: a circular enclosure ringed by a massive dry-built wall pierced by a single linteled doorway. Forts of this kind are espe-

cially numerous in County Clare and some of the most impressive examples are to be found in the Aran Islands, off the Galway coast, that known as Dun Oengus being the most formidable. Many ring forts are provided with complexes of underground chambers and passages called souterrains, which may have been used both as refuges and storerooms. Souterrains also occur where no visible indications of former habitation remain but these may have been connected with unprotected wooden dwellings long since vanished.

Advantage was also taken of the relative security afforded by islands in rivers and lakes as dwelling places, and artificial islands, called crannogs, were extensively made to supplement the limited number of natural sites. Crannogs vary greatly in size but all consist of material mounded up on the lake bottom on rafts of brushwood and held in position by rows of piles driven in round the perimeter and through the mass itself. There is some evidence that the custom of constructing them goes back to Neolithic and, perhaps, even to Mesolithic times, while they are well attested from the Bronze Age. They were commonly inhabited during the early Christian period and they were, in some cases, tenanted up to the 16th century. Partly because they have been undisturbed by agriculture and other activities and partly because of the preservative effect of their waterlogged soil, such crannogs have yielded exceedingly numerous and varied finds. Among the richest hitherto investigated are those of Lagore (County Meath) and Ballinderry (County Offaly).

With the arrival of the first Anglo-Norman invaders in County Wexford in 1169 this outline of the archaeology of Ireland may be brought to a close for with that event a new era opens in Irish history marked by a rapid decay of many of the native arts, the introduction of new styles in architecture and the imposition of the feudal system on much of the country. (A. T. Ls.)

V. HISTORY (TO 1921)

Earliest Inhabitants.—The earliest-known remains of human habitation in Ireland are assigned by archaeologists to the period of the transition between the early and the late Stone Age. This period, it is held, was preceded by intense glacial conditions, covering the whole island and extending also over Britain as far south as the estuaries of the Severn and the Thames. The Neolithic and early Bronze periods which follow are well represented in Ireland, but their data belong rather to archaeology than to history. The later Bronze Age in Ireland, though it has no documents, native or extraneous, has left evidences sufficiently abundant and vivid to be considered historical. To it belong numerous tombs of massive structure, surmounted by great tumuli of earth or stones, the stone slabs in some of them being carved with a great variety of designs, symbolic or ornamental—evidence of a settled population under opulent rulers. Bronze was abundant. There were rich copper mines, but no tin mines, and the tin which was needed to make bronze must have been an article of import, no doubt from Cornwall, during the whole of the Bronze Age and later. The distinctive feature of this period in Ireland was the production of native gold, of which it is certain that there were comparatively rich deposits in the Wicklow mountain region. Irish gold ornaments of the Bronze Age have been found in various parts of Britain, in northern France and in Luxembourg, Hanover and Denmark. In Ireland the principal finds have been in districts far away from the gold-producing region. Finds of the ancient apparatus of bronze founding are likewise recorded in places far away from copper mines and from seaports through which tin could be obtained. The facts point to a development of commerce, internal and external.

To the Celts of Gaul, and through them to the Greeks, the ancient inhabitants of Britain and Ireland appear to have been known by the common name of "Pretani." The two islands, Albion and Iverne (Hiberio, thence Eriu, Eire), are called in Greek the Pretanic Islands. In Latin and first, so far as is known, by Julius Caesar (d. 44 B.C.), the name "Brittani" (becoming later Britanni and Brittones) is substituted for Pretani and used distinctively of the people of the larger island, to which the name "Brittania" (Britannia) was given. "Pretani," represented in early Irish by "Cruithin," was the name of the people who in later times are known as Picti, Picts (*q.v.*). Hence it may be inferred that during the later Bronze Age the Picts were the chief people of Ireland as well as of Britain, and this inference is amply confirmed by ancient Irish traditions.

Celtic Colonization and Civilization

Arrival of the Celts.—During the historical period Ireland was a Celtic country, deriving its civilization either directly from the continent of Europe or indirectly from the continent through Britain (*see* CELT). The extent to which Celtic civilization spread indicates extensive colonization and it thus becomes important to try to determine when the Celts came to Ireland. Many distinguished scholars have provided answers to this question: linguists such as D'Arbois de Jubainville, Sir John Rhys, Thomas Francis O'Rahilly, Julius Pokorny; archaeologists such as Joseph Déchelette, Henri Hubert, Adolf Mahr; historians such as Camille Jullian and John MacNeill. No two of those mentioned agree among themselves and the differences are irreconcilable. The first great problem concerns the Picts. If these were a Celtic people, Celtic colonization is likely to have taken place 1,000 or more years before the Christian era. Though this is possible it cannot be said to be probable. The evidence in favour of a Celtic origin for the Picts is linguistic (*see* CELTIC LANGUAGES); there are clear traces of the use among the Scottish Picts of what philologists call a P-Celtic language cognate with Brythonic and Gaulish. On the other hand the evidence is equally clear that another language, apparently not a member of the Indo-European family, was employed in Pictish inscriptions down to the collapse of the independent Pictish kingdom in the 9th century A.D. There is also political and social evidence pointing to the existence among the Picts of the principle of matrilinear succession, an institution foreign to the Celtic states of the European continent and to the Celts in Ireland. Nor does the earliest stratum in Irish literature lend support to the theory of common origin; for there the distinction between the Irish and the Picts is so sharply drawn that it is difficult to visualize the two as mere divergent branches from the same Celtic stem. A likely explanation, put forward with convincing argument by Kenneth Jackson ("The Pictish Language," in *The Problem of the Picts*, edited by F. T. Wainwright, 1955), is that a section of the Picts in Scotland had adopted, perhaps at a quite remote period, the Celtic language spoken by their neighbours.

Traces of another language group, Q-Celtic, are rare in continental Europe. In the period of the Roman conquest of Gaul the language spoken by the various peoples was P-Celtic. The same holds true of Britain. Assuming that so striking a peculiarity is very ancient, the Q-Celts who traveled from the continent to Ireland and ultimately imposed their rule on the whole island must have migrated some centuries before the beginning of the Christian era. We know that migration on a large scale was taking place along the Danube and to the south and east in the 5th century B.C. It is likely that a corresponding movement toward the west resulted in the Celtic colonization of Ireland in the same century. In corroboration of this date two facts deserve mention. The way of life of the Celts in Ireland and the way of life of the Celts of Gaul, as described by Julius Caesar, are so very similar that the separation cannot properly be placed too far back in time. On the other hand, the historical memory of the Celts in Ireland, which reached back to the beginning of the Christian era, knew nothing of Gaulish origins. Even in the conservative field of religion the pantheons of the Celts of Gaul and of the Celts of Ireland were no longer the same. The lapse of time between colonization and the earliest remembrance in Irish Celtic tradition must therefore have been considerable. As a suggested date for the migration, the 5th century B.C. is sufficiently close to the time of Caesar's Gaul (1st century B.C.) to explain the substantial unity in civilization and sufficiently removed to explain forgetfulness of the circumstances of migration. No greater precision can be achieved from the archaeological evidence.

Celtic Institutions.—Like their forebears on the continent the Celts in Ireland established themselves in small states. The com-

mon term for each of these states in Old Irish was *tuath*. Over the people of each state was the elected leader who bore the title of *rí*, "king." The constitution was completely monarchic. In Gaul, before the Roman conquest, a number of states had become republics ruled by presidents; in Ireland there is not the slightest hint of any such change. The king governed his people, gave judgment in cases of dispute, a task in which he was assisted by professional lawyers (*brithemain*), and commanded the military forces. Round the king stood his council (*airecht*) of nobles. They and the freemen of the state came together at regular intervals in an assembly (*aenach*) to discuss matters of common interest and to determine policy. A well-known territorial unit was the *tricha cét*, corresponding, Giraldus Cambrensis says (*Topographia Hibernica*, iii, 5), to the Welsh *cantref*, 100 households (*villae*). There was a common law (*urradas*) and the occasional special law (*cáin*) passed by an assembly or promulgated by a king. A freeman had full franchise in his own *tuath*, but was a noncitizen (*deorad*) elsewhere, though with rights beyond those of the foreigner (*allmurach*) or the outcast (*muirchuirthe*). Common jurisdiction (*cairde*) between states could be established by mutual agreement.

Among the Celts every freeman struggled to maintain the maximum of personal independence and the states, however small, strove desperately to achieve and maintain political independence. But this proved to be impracticable; for self-protection the small states had of necessity to gather themselves into groups and accept the hegemony of a superior king.

About the beginning of the Christian era the groups had taken permanent shape and appeared as five major states, the Five-Fifths (*cóic cóicid*) of Ireland. These were Ulster (Ulaid), Meath (Mide), Leinster (Laigin), Munster (Muma) and Connaught (*q.v.*; Connacht or Connachta). The last-named is also called in early documents the Cóiced nOléccmacht and this may have been the original name. Ulster had its chief fortress or centre of rule at Emain Macha (Navan Fort) near Armagh. Meath had as its centre, or capital, Temuir (Tara); Leinster a central stronghold at Ailend, in Kildare; Munster a similar stronghold known (probably by analogy with the more famous capital of Mide) as Temuir Érann, near Ardpatrick in Limerick; Connaught its centre at Crúachu (Rathcroghan) in Roscommon.

Among the landed freemen the noble (*flaith*) was distinguished by the possession of greater wealth and by a following of clients (*céli*). *Flaith* means both "lord" and the state of being a lord or nobleman. The *céle* rendered service to the lord at least to the extent of acknowledging dependence on him and accompanying him as a mark of honour. It is not clear that the term *céle* connoted of necessity economic dependence on the *flaith*, but that such a relationship was known is beyond question. There were *céli* who received from the *flaith* capital in the form of cattle and who paid interest at a fixed rate until the capital was paid back. Such *céli* were *saerchéli* (free tenants) or *daerchéli* (the legally unfree) according to the conditions on which the capital was lent. To the *daer* class belonged the *aithech* ("he who pays rent") and those beneath him in the social scale. While the position of the *aithech* was conceived as low, there were rich farmers (*briugaid*) whose social standing was almost that of a *flaith*. A disadvantage of their position was the obligation to provide hospitality on a generous scale; at times, indeed, to supply provisions to a whole army. In the inferior world of service was the *gilla* (personal servant) and the *inailt* (housemaid); and at the bottom of the ladder the man slave (*mug*) and the female slave (*cumal*).

The Druids.—Druidism (*q.v.*), known only in transalpine Gaul, Britain and Ireland, but not recorded in Britain outside Anglesey and the northern Pictland, is unlikely to have originated in Ireland. The druids may be described as an association of professional wise men, philosophers in the early Greek sense, claiming to be experts in all the higher branches of knowledge. They professed special knowledge of the gods, the other world, the future life, the form and measurement of the earth, the movements of the heavenly bodies, the history of men; and they were accepted as authorities in matters of religion and law. They also claimed occult and prophetic powers. In the Roman world, after their suppression by the state, and in Ireland, after its conversion to Christianity, they were chiefly remembered as soothsayers and magicians. The notion that they were the priests of a particular religion is of modern growth. In Christian Ireland the druids continued to exist, but with a change of name and with limited scope. They were called *filid*, a name which in time became restricted to the meaning of poets (*see* IRISH LITERATURE: *Gaelic Literature*) but which originally, signifying seers, denoted one of the functions of the druids. They no longer had authority in matters of religion but they long continued to practise occult rites of divination. As exponents of learning they were largely displaced from the ground covered by the Latin teaching of the ecclesiastical schools, but remained for long the authoritative exponents of the national history, literature and law. In Gaul, notwithstanding the division of the country into so many independent states, the druids formed a single society, with annual conventions and an elected president. In Ireland the *filid* did not present this organized form, but they maintained an effective unity through a long course of centuries. They provided a single code of law for the whole country. They followed a common literary usage in writing and in minutely regulated rules of prosody which they all accepted. What Caesar tells of the long course of education of the Gallic druids and of the instruction given orally and in verse is paralleled in the *filid*. Like the druids, they enjoyed civil immunities. Their persons were sacred. The influence of druidism remained operative and distinctive in Irish history throughout medieval times. It can be traced in the conversion of the Irish to Christianity, in the development of the monastic schools, in Irish law, in the form and content of Irish literature, and in lasting pedantic tendencies; but its most important effect was the forging of a national consciousness in no way dependent on political cohesion.

The Septs and the Early Monarchy.—In the sagas of the Ulster cycle (*see* IRISH LITERATURE: *Gaelic Literature*) strong rivalry is suggested between the Ulster and the Connaught kingdoms, but the queen of Connaught, Medb or Maeve, was herself a Mide princess and the chief political feature of the early Christian centuries was the rise of the midland dynasty to a position of great strength. The steps in this advance are not easy to follow, since the sources are literary rather than historical, and the exploits of Conn (*q.v.*) of the Hundred Battles and Cormac Mac Art (fl. *c.* A.D. 275) who figure as powerful kings of Ireland in the Mide genealogical tree, may be little more than poetic inventions. That there was, however, such an advance is abundantly clear. The Ulster kingdom was reduced in extent and in status and even threatened with complete annihilation. In the 4th century A.D. princes of the Mide dynasty made an incursion into mid-Ulster. They were entirely successful. The result was the formation of a new kingdom, known as Airgialla, independent of the Ulster kings. About the same time princes of the Mide dynasty are found ruling in Crúachu, the capital of Connaught. As the fortunes of Mide prospered, the prestige of Tara rose. In the early 5th century the midland kingdom reached the pinnacle of glory. Its ruler then was Niall of the Nine Hostages (d. 405), a man renowned beyond any of his predecessors for energy and ability. Under his direction the western portion of Ulster was occupied and colonized by his sons, Eogan, Conall and Enda. Their descendants were henceforward supreme in Ulster and the kingdom established by Eogan and his descendants, the Cenél nEogain, which was generally called Ailech after a great stone fortress that overlooks Lough Foyle near Derry, ranked as a leading state in the country.

At the same time the other sons of Niall, moving east and west from a centre near Kells, established themselves as princes across the midland kingdom "from the Shannon to the Irish sea," Conall occupying the Tir Conaill (modern Donegal) and Enda taking land farther east. Niall's brothers ruled in Connaught. His relatives ruled in Airgialla (Oriel), the new kingdom in mid-Ulster. Within that territory lay Emain Macha, the ancient capital. With it the Ulaid lost their whole kingdom save an eastern strip, the modern counties of Antrim and Down and about a third of Louth. There they were to remain, mindful of their

former greatness, doggedly defending their local autonomy, to the days of Shane O'Neill (d. 1567) and beyond.

To the chroniclers Niall of the Nine Hostages was king of Ireland (*Rí Érenn*). The title marks the conclusion of a process of unification, first the gathering of innumerable small *tuatha* into five major states; next the control of the northern states (Leth Cuinn, Conn's Half) by the dynasts of Mide and a similar control of the southern states (Leth Moga, Mog's Half) by the dynasts of Munster. In the last-mentioned kingdom (*see* MUNSTER) the Eoghanachta (not connected with Niall's son) had succeeded the Érainn as the ruling population group. They had moved to Cashel (*c.* 400) and made the great rock their chief fortress and the symbolic capital of the Munster state. They had crossed the Shannon and deprived the Connaught kingdom of the region later known as the county of Clare. They had established princes of their house who became the ancestors of ruling septs in Limerick, Cork, Kerry, and even beyond the sea in Wales. Despite this outburst of activity, or perhaps because of it, since it meant urgent preoccupation with the affairs of southern Munster, they allowed the predominant place in Ireland as a whole to go unchallenged to Niall of the Nine Hostages and his descendants. It is to be noted that the title of king of Ireland did not give the ruler who bore it administrative or legislative rights over the country; it did, however, confer immense prestige, reflected generally in the size and strength of the king's army. Niall's nephew Nathi (d. 428) and his grandnephew Ailill, both kings of Connaught, were kings of Ireland also but with the defeat and death of Ailill at the hands of Niall's direct descendants in the battle of Ocha (482 or 483) the claim of Connaught collapsed. It was to be revived by the O'Connor kings of Connaught in the 12th century.

Meanwhile, no fewer than 42 of Niall's descendants became kings of Ireland—an extraordinary roll of honour. They maintained their supremacy against several attacks. For instance, Domnall Brecc, king of Dalriada, crossed from Scotland to Ireland in 637 to assist the Ulaid in an attack on the Uí Néill. They were utterly defeated by the king of Ireland, Domnall, son of Aed, son of Ainmire, in the battle of Mag Roth, somewhere in the southern half of Down. Two branches, the Cenél nEogain, of the northern Uí Néill, and the Clann Cholmáin of the southern Uí Néill, alternated as kings of Ireland from 734 to 1002, a fact which suggests a formal arrangement between the two septs. The Leinstermen resented their hegemony but were unable to shake it off, though they won more than one important battle in the field. When the power of the Eoghanachta was widely and firmly established, they became restive in their position of formal subservience, little as the high kings interfered with their government or restricted their exercise of independence. A challenge was thrown down once in the 8th century and once again in each of the two following centuries but always without success.

Rural Economic Development.—The Irish laws point to a large development of rural industry in the period in which they were first written, preceding the Norse incursions. They deal minutely with the enclosure, subdivision and fencing of lands for tillage, the measurement and valuation of land, the management of crops and domestic animals, and innumerable details of husbandry, including milling, dyeing, spinning and weaving, dairying, malting, meat curing, etc. The principal crops were wheat, barley, oats, flax and hay. Dyestuffs were grown. Irish hounds were in high repute. St. Patrick, in his escape from captivity, joined a company of Irish traders whose chief merchandise was hounds. Watermills were owned and worked jointly by landholders.

Irish Raids and Migrations.—From about the middle of the 3rd century, Latin writings bear constant evidence of Irish raiding expeditions, and the older Latin name Hiberni or Iverni is almost wholly replaced by a new name, Scotti. Linked with the Scotti are found the Atecotti, a Celtic word meaning "the very ancient folk," and probably distinguishing the Irish of pre-Celtic origin from the dominant Celts. Irish tradition fully reflects the evidence of Latin writers. As the Roman power weakened in Britain, Irish raids were followed by migratory settlements. Irish dynasties sprang up in Wales and lasted there for centuries. In the 5th century, the kings of Dalriada, a small kingdom in the northeastern angle of Ulster, extended their power over the Irish settlers in Argyll and the neighbouring islands, their descendants ultimately, in the 9th century, becoming kings of Scotland. Niall of the Nine Hostages has been identified with "the Scot" who, in Claudian's poem *De consulatu Stilichonis* (ii, 251), "mobilized all Ireland" against Roman Britain. In his reign St. Patrick was carried to Ireland as a captive. At the head of a later expedition, Niall was killed at sea by a Leinster prince. His successor, Nathi, heading another raid, died on the continent.

Early Christianity

The Early Missionaries.—Quite apart from the thousands of enslaved Christian captives, there is evidence of Christianity in Ireland before the first Roman mission arrived there. In 429, at the instance of Palladius, deacon of the Roman church, St. Germanus, bishop of Auxerre, was sent by Pope Celestine I to combat the Pelagian heresy in Britain. It was doubtless in answer to an appeal made through Germanus that, in 431, "Palladius himself was sent, their first bishop, to the Scots believing in Christ." Apparently, after a short stay in Ireland, Palladius went to northern Britain, where he soon died. Very shortly afterward (the traditional date is 432), Patrick, a disciple of Germanus, was sent as bishop to Ireland. He was a Briton, son of a decurion under the Roman government, and probably a native of some small town near the river Severn. He was carried off as a captive (*c.* 401) in the reign of Niall and became a slave in northeastern Ulster. After six years he escaped. His mission in Ireland succeeded rapidly. He was favourably received at the court of the high king, Loiguire, son of Niall. In 439, doubtless in answer to a request sent to Germanus, three bishops were sent to his assistance, Secundinus, Auxilius and Iserninus. Patrick chose for his own see Armagh, beside the ancient Ulster capital. Secundinus had his church near Tara, the seat of the high king; Auxilius, near Naas, also a royal seat in Leinster; Iserninus, driven out at first by Enda, king of Leinster, was restored later by Enda's son Crimthann, a Christian convert, and fixed his see at Aghade, near Rathvilly, where Crimthann lived. There is evidence that Patrick chose Baislec (Basilica Sanctorum), near Crúachu, the capital of the kings of Connaught, as the see of a bishop for that kingdom. (For the conflicting views concerning the life of St. Patrick, *see* PATRICK, SAINT.) In the story of St. Patrick's reform of Irish law one might see an influence transformed by tradition into an event. A druid foretold to Loiguire: "He shall free slaves, he shall raise up men of lowly kin." In the written laws, two centuries later, a slave class no longer existed. St. Patrick's epistle condemns the enslavement of Christians. The earlier racial distinctions between conquerors and conquered survive only in antiquarian tradition, and all become known by the name Goidil (Gaels) or Fir Erenn (Men of Ireland).

Irish Monasticism.—Though monks and monasteries were to be found in Ireland in the days of St. Patrick their place was altogether secondary. A great change took place in the course of the 6th century, so great that by the year 600 the church in Ireland had become monastic in organization. Why this happened is not easy to explain. The monastic ideal appealed obviously to the religious vein in the Irish character, and the loose monastic system, based on a multitude of independent foundations, was in harmony with state institutions. Daily experience tended to show that this was the mold within which the church could grow and prosper. The influence of monasteries from Britain, such as the Candida Casa at Whitern in Galloway, the Llangarvan of St. Cadoc and later the Menevia of St. David, increased this tendency. A patriarch of monasticism in its typically Irish form was St. Finnian (d. *c.* 589) of Clonard. Among his disciples who became in their turn founders of distinguished monasteries were St. Columba (*q.v.*; Derry and Durrow), St. Ciaran (Clonmacnoise) and the two Brendans of Clonfert and Birr (*see* BRENDAN, SAINT). St. Congall's monastery at Bangor in the Ards of Ulster was hardly less important. Convents of women were relatively few compared with communities of men, but the foundation of St. Brigit (*q.v.*) at Kildare was of high repute. Beside the community of women lived a community of men, ruled by a bishop, and for Mass and

for the divine office the two communities used the same church, divided only by a high partition wall of wood. Kildare was thus a double monastery, the one example of its kind in Ireland.

Though there was variety in detail there was so much similarity in the practice of the Irish monks and nuns that it is possible to speak of an Irish monastic observance. Its characteristics were severity in the discipline of the body and zeal in the cultivation of the mind. This is the justification for the title *insula sanctorum et doctorum*. The Venerable Bede bears eloquent testimony to the reputation enjoyed by the Irish schools of the 7th century, and to the hospitable reception given there to students from other lands. While the abbot represented ecclesiastical power, the bishop held the highest ecclesiastical dignity, for to him were reserved the supreme episcopal functions, such as the ordination of priests and the consecration of churches, and his "honour-price" was equal to that of a king. The *Fer Léginn*, "man of learning," was president of the monastic school.

Scholarship and Missions.—In these schools the language especially prized was Latin. Not only the works of the Fathers of the Church but the secular classics were held in high esteem. Greek texts, on the other hand, were scarce, and those who could claim a deep knowledge of that language were few. Noteworthy in this connection is Johannes Scotus Erigena, a teacher in the Frankish kingdom under Charles II the Bald. Erigena translated various neoplatonist treatises from the Greek, wrote poems in that tongue, and composed a philosophical and theological work of remarkable quality, which he called *De divisione naturae*. Poetry in the native classical metres is found in the Irish language about the year 600. An older form of rhythmical alliterative verse, curiously similar in structure to verse in ancient Latin, is found scattered through the sagas. The new syllabic poetry, usually called *dán dírech*, of which specimens survive from the end of the 5th century, was based on the Latin hymn poetry of the early Christian centuries. Though its construction was rigid there was room for variety; 44 different metre forms have been noted. From the early 7th century onward Irish written literature in prose and verse is extensive. In art, too, especially in metalwork and in illumination of manuscripts, progress was marked. Architecture remained backward and cramped, no doubt because of the tradition of political unrest: a noble and spacious building would be too tempting a target for an invading army.

The Irish proved to be zealous missionaries. From the island of Iona, St. Columba directed the evangelization of the pagan Picts of Scotland. Success in this field was absolute. Until the time of St. Margaret (d. 1083), queen of Malcolm III, the church in Scotland was an offshoot of the church in Ireland, hardly distinguished from it in spirit, organization and customs. Iona also sent missionaries to England, first to Northumbria, then to Mercia, East Anglia and even as far south as Wessex. The work of these was impeded by the Paschal controversy. Ireland had received its method of computing the Easter date (the cycle of Augustalis) from Britain. This system differed from the Alexandrian cycle, followed by the Roman missionaries of the 7th century, and which was accepted in the southern half of Ireland *c.* 632. It was not accepted in the north, however, the part of Ireland to which Iona belonged. A clash between the archaic Irish system and the Alexandrian system led to the withdrawal of the Irish clergy and monks to Iona from Northumbria after the synod of Whitby (663 or 664). While the churches of northern Ireland adopted the Alexandrian cycle in the late 7th century, Iona did not submit until 716. Even then the reason for submission was not the conviction that the Alexandrian system was mathematically correct but the desire to be in harmony with the apostolic see.

Norse Invasion and Settlement

The first appearance of the Northmen on the Irish coast is recorded in 795. Thenceforward there were frequent plundering raids, sometimes far inland. By degrees the Norse took possession of all the islands of Scotland, of Caithness, Argyll, Galloway and of the Isle of Man. In 838 they seized and fortified two ports, Annagassan, between Dundalk and Drogheda, and Dublin. About the same time a fleet under a Norse leader, Thorgest (Turgeis), passed up the Bann to Lough Neagh. He afterward sailed round to the Shannon and took possession of Lough Ree in like manner. Thorgest was captured in 845 and put to death by Maelsechlainn, king of Mide, who in 846 became king of Ireland. Large invading forces were defeated in 847. The turning point of these invasions was reached in the reign of Aed Findliath, high king from 862 to 879, who forced the Northmen to abandon all their stations in the northern parts of Ireland. At the same time the Norse kings of Dublin reached the height of their power, waging war in England and Scotland, and so disturbing normal life in Ireland that in 873, 876 and 878 the high king was unable to hold the national assembly of Tailtiu. Waterford in 914 and Limerick in 920 were occupied by the Northmen without opposition. In 917 Niall Glúndub, high king, endeavoured to dislodge them from Waterford but was defeated and forced to withdraw. In 919 Niall led an army against Dublin, and in a battle where the Phoenix park now lies he was defeated and killed. The permanence of the Norse settlements in Dublin, Waterford and Limerick became assured. Landed colonies spread out from Dublin and Waterford. Without quite abandoning piracy, the vikings became traders in close intercourse with the Irish, and their commercial towns formed a new element in the life of the country, typified in Wexford, which did not appear in warfare until the siege of 1169. The combination of war and commerce led to a recrudescence of slavery, and imported slaves are mentioned in the *Book of Rights* (about A.D. 900).

About 964 Mathgamain, king of Dal Chais, one of the petty kingdoms of Munster, became king of Munster, displacing the ancient Eoghanachta line. In 968 he defeated the Norse of Limerick and captured their city. In 976 he was captured and put to death by two Eoghanachta princes, one of whom, Mael Muaid, then became king of Munster. In 978 Mael Muaid was defeated and put to death by Brian, brother of Mathgamain. Brian, having gained the kingdom of Munster, steadily increased his power. His claim to suzerainty over Leinster forced the Leinster king into close alliance with the Norse of Dublin. In 999 their united forces were defeated by Brian at Glenn Máma, near Dublin, and they agreed to become his allies and supporters. In 1002 Brian became king of Ireland by the submission of the high king Maelsechlainn II. The Irish and Norse accounts agree in bearing witness to the high character and good government of Brian. The kings of Dublin and Leinster, however, chafed under his authority. In 1013 Sigurd, earl of the Orkneys, had for a Christmas guest the Norse king of Dublin, Sigtrygg, and a compact was made between them. Sigurd was to gather from all parts the greatest possible host of Northmen and to bring them before Easter to Dublin, where they were to be joined by the forces of Dublin and Leinster to give battle to Brian; if they were victorious, Sigurd was to have the kingdom of Ireland. Brian learned of these preparations and met the Norse army at Clontarf, near Dublin, on April 23, 1014. The Northmen and their Leinster allies were defeated and Earl Sigurd was slain, but a viking chief, who had taken refuge in a wood, sallied out in the rear of the Irish army and killed Brian in his tent.

Though the battle of Clontarf removed the prospect of a Norse conquest, it brought a period of unsettlement. All the chief dynasties had lost their prestige, and, except in Connaught, new rivalries and fresh pretensions to power, based on force and careless of tradition, arose everywhere. Brian's son Murchad, who had already gained a reputation hardly less than his father's, had fallen in the battle. Of the sons who survived, none was able to sustain Brian's power. Maelsechlainn was restored to the high kingship and held it until his death in 1022. After him for half a century there was no acknowledged king of Ireland.

Then followed the period of the high kings "with opposition," *i.e.*, not acknowledged by a minority of the provincial kings: Toirdelbach (Turloch, d. 1086), grandson of Brian, and his son Muirchertach (d. 1119), kings of Munster; in opposition were Domnall Ua Lochlainn, king of Ailech, who died in 1121; Toirdelbach Ua Conchubair (Turloch O'Connor, d. 1156), king of Connaught; Muirchertach Ua Lochlainn (d. 1160), king of Ailech; and Ruadri Ua Conchubair (Rory O'Connor, d. 1199), king of

Connaught, who lost his power as high king to Henry II of England in 1175. The centralized feudalism established in England by William the Conqueror had some influence on the policy of these kings. One after another they sought, for the most part without success, to set aside ancient tradition and exercise direct authority outside their hereditary jurisdictions. Thus Toirdelbach Ua Conchubair in 1118 divided Munster into two coequal kingdoms; in 1125 he deposed the king of Mide and appointed three kings in his stead; in 1126 he made one of his sons king of Dublin and Leinster; and in 1129 he built the first castle in Ireland, commanding the passage of the Shannon at Athlone.

The last effort to establish Norse domination was made by Magnus II, king of Norway, who in 1098 restored the Norwegian sovereignty over the Scottish islands, Cantire and the Isle of Man. In 1103 he landed on the Ulster coast, and was slain by a local levy while endeavouring to bring a "shore-killing" of cattle to his ships.

The period of political ferment which followed the success of Brian over the ancient chief dynasties was also a period of new growth in religion, literature and the arts. The movement for religious reform, mainly in the direction of a Catholic uniformity and the removal of abuses in matters of ecclesiastical discipline and observance, was led by Gillebert, bishop of Limerick, and Cellach (Celsus), bishop of Armagh and primate, in the beginning of the 12th century, and by the successor of Cellach, Maelmaedoc Ua Morgair, better known as St. Malachy (*q.v.*). The outstanding feature of the abundant literary output of this time is enthusiasm for ancient national tradition. It became customary to compile tomes, each forming a kind of library of traditional lore, comprising sagas, poems, genealogies, etc. A number are still extant.

(J. J. Ry.)

First Centuries of English Rule

The Anglo-Norman Invasion.—As early in his reign as 1155, Henry II of England had through his envoy, John of Salisbury, received from Pope Adrian IV the grant of Ireland "as an inheritance," on condition that he should reduce to order the Irish church and state. The so-called "bull," *Laudabiliter*, which defines this grant, rests on the sole authority of Giraldus Cambrensis; how far it is genuine is one of the puzzles of history, but the general submission of the Irish to Henry in 1171–72 would imply that some such papal privilege had been issued.

Henry had to put his project aside for the time, and, when the invasion came, it was a feudal one and directed from south Wales, where there were many Normans looking for land and adventure. The first invaders, Maurice Fitzgerald, Robert FitzStephen, Raymond "le Gros" de Carew and others, were sons or grandsons of the famous Welsh princess Nesta and vassals of Richard de Clare, 2nd earl of Pembroke (*q.v.*), called "Strongbow" in Irish tradition.

Their opportunity came when Dermot Mac Murrough (*q.v.*), king of Leinster, expelled by his enemies, decided to seek aid in England and arrived in Bristol in Aug. 1166. He was referred to Henry, found the king in France, was graciously received and given permission to raise forces in Britain. Returning to Wales, he won Strongbow over by the offer of his daughter's hand with apparently the succession to Leinster. He also enlisted "the sons of Nesta" in his cause, and they found volunteers among the Welsh and Flemings of south Wales and Pembroke. Returning to Leinster, where his son Donal Kavanagh, whom Giraldus calls illegitimate, was holding out for him, he held his ground until successively Fitzgerald, FitzStephen, Raymond and finally Strongbow himself arrived, the latter landing at Waterford in Aug. 1170 with 200 knights and 1,000 men-at-arms.

The successes of Dermot, backed by these professional fighters, were rapid; Danish Waterford was taken, the marriage of his daughter Eva and the earl celebrated, and by a rapid march Dublin also was captured and a relieving force under the high king scattered, late in 1170. Leinster and Ossory were reduced, but the death of Dermot the following May made the situation difficult. The Irish regarded his son Donal as the true heir, but Strongbow considered himself king of Leinster, and in feudal theory he was, in virtue of his wife, lord of the province. But he was hemmed up in Dublin in midsummer by a national levy raised by Roderic (*q.v.*; Ruadri, or Rory O'Connor), king of Connaught, and though this attack was repelled it was uncertain whether he could hold his own. Therefore when Henry, fearful lest a new Norman state should arise across the Irish channel, resolved to come to Ireland, Strongbow placed his conquests at his suzerain's feet.

Henry landed near Waterford on Oct. 17, 1171, with an imposing army, but a conquest in arms was not necessary, and in fact the peaceful submission of the Irish leaders was prompt and widespread. The king marched to Lismore and Cashel and finally to Dublin, where he spent the winter, leaving Ireland on April 27, 1172. In this short period he managed to set up the rough essentials of a government. At Dublin and elsewhere he received the homage of all the kings of Ireland except those of Connaught and Ulster. To Strongbow he granted the land of Leinster; he confirmed the Geraldines and others in their fiefs, and annexed to the crown the Danish kingdom of Dublin. He gave the capital to "the men of Bristol," took the Ostmen (the Danes) under his protection and appointed as governor of the colony Hugh de Lacy, 1st lord of Meath (*q.v.*). He did not scruple to confer the whole of Meath on De Lacy, though its native king, O'Melaghlin, had recently submitted, and the grant illustrates the inevitable clash of feudal and Irish law. Meanwhile during the winter the Irish bishops met at the synod of Cashel and, after enacting various reforms, declared (according to Giraldus): "Divine offices shall be celebrated according to the forms of the English church, for it is just and right that as Ireland has received her lord and king from England, she should accept reform from the same source." This of course was an inspired assurance of the task with which the papacy had commissioned Henry. The submission of the church was complete, at least in theory. Christian, bishop of Lismore and papal legate, was on Henry's side; Laurence, archbishop of Dublin, and the native prelates of Armagh, Cashel and Tuam were also present.

Meanwhile the adventurers were attacking Desmond, though its king had submitted to Henry; De Lacy was organizing Meath, and John de Courci (*q.v.*) conquered in Antrim and Down a principality for which he could show no royal patent. Strongbow enfeoffed many Normans with land in Leinster, giving the barony of Naas, for instance, to Maurice Fitzgerald. Strongbow died in 1176, leaving only a daughter, who later married William, the earl marshal, and brought to him "the land of Leinster." Ulster and Connaught were unconquered, and in 1175, by the treaty of Windsor, Henry acknowledged Roderic as king of Connaught under him.

English Overlordship.—At the Council of Oxford in 1177 Henry created his son John *Dominus Hibernie* and granted Desmond to Robert FitzStephen and Milo de Cogan. Eight years later (1185) John himself visited Ireland. A fresh series of grants was made, and William de Burgh and Theobald Walter "le Botiller" got wide lands in north Munster and Theobald de Verdun about Dundalk. The resentment of the Irish was shown in the assassination (1186) of Hugh de Lacy, and the lesson was taken to heart later in John's reign when Cathal Crovderg O'Connor, brother of Roderic, was confirmed in the kingdom of Connaught and Donnchad O'Brien in that of Thomond west of the Shannon.

Under John the lordship of Ireland was united with the English crown, and to this king belongs the credit of first establishing a civil government at the expense of the Norman adventurers. He dispossessed De Courci and gave the earldom of Ulster to Hugh, brother of Walter de Lacy, earl of Meath; but he soon repented of making this family too great, and in a personal campaign in Ireland in 1210 expelled them both. During his short stay in Dublin he organized a permanent government under a justiciar, and "with the common consent of all men of Ireland ordained that the laws and customs of the realm of England should be kept therein."

After his defeat over Magna Carta (1215), John had to restore the De Lacys, and the feudal caste under Henry III bent its energies upon the subjection of Ireland. When Richard de Burgh got a grant of all Connaught despite the claims of Felim O'Connor, conquered it and divided it among his followers (1235), and Maurice Fitzgerald acquired a claim to Tyrconnell, a complete conquest seemed probable. But during this period two great native dynasties arose in Ulster, the O'Neill and O'Donnell (*qq.v.*), and they repelled the Norman attacks, finding a new and potent weapon in

those professional fighters, the *galloglaigh* or galloglass ("foreign soldiers"), Hebrideans of mixed Gaelic-Norse blood who now began to flock into the north. On Connaught, however, the De Burghs kept firm hold, leaving to the O'Connors only a few cantreds of Roscommon. The power of this family was increased when in 1264, after the extinction of the De Lacys, Walter de Burgh, already lord of Connaught, was created earl of Ulster. The native Irish, though only partly successful, now broke the spell of Norman victory. Brian O'Neill was elected high king and raised a Gaelic confederacy, but was defeated and slain at Downpatrick in 1260. The MacCarthys overthrew a colonial army at Callan in 1261 and thenceforth ruled undisturbed over southwest Munster, their chief taking the name MacCarthy More. When Edward I granted (1276) to Thomas de Clare the "land of Thomond," later County Clare, Turloch O'Brien took up arms, and the De Clares were finally expelled in the war which ended in 1318.

In the early years of Henry III the central government was steadily built up. Magna Carta was sent over, the whole framework of English law was introduced, and Ireland had an administration under the justiciar and a parliament of peers and prelates, while the county organization was extended over the planted areas. An Irish exchequer was organized in 1200, and an Irish chancery in 1232.

Great numbers of the Gaels had fallen under Norman lords, and while some were already villeins (*betaghs*) under the old system, and remained so on the new manors, many of the colonists tried to reduce all Irishmen to the same level. Those living among the English and suffering from a denial of English law strove to procure it, but though the government was not unwilling the colonists opposed emancipation. The Irish who lived under brehon law (*q.v.*) had less desire to exchange it for English law, but under the pressure of the new domination they naturally aspired to have its legal advantages. The chiefs especially sought to have their tenures legally established under the crown, a benefit which, except in a few minor cases, had been denied them. To reconcile and blend two peoples so far apart in language and tradition was a huge task which only a resident monarchy could have achieved.

Under Edward I a second attempt was made to create a real central authority, and a series of justiciars, of whom John Wogan, who held the office from 1295 to 1307 and from 1308 to 1312, was the ablest, extended the area of common law and did something to reduce the feudal liberties. The baronial interest, however, was too strongly entrenched, and Edward had to placate it, giving "the land of Decies and Desmond" to Thomas, head of the Munster Fitzgeralds. In 1297 knights and the common clergy were included in the Irish parliament, and nine shires and five liberties sent representatives. In 1300 the towns also sent deputies, and thus Ireland received a legislative body which lasted till 1800. It was an Anglo-Irish assembly in which the native people had no spokesmen.

A series of disasters then shook the ill-founded state to its very base. Fresh from his victory at Bannockburn, Robert I the Bruce dispatched his brother Edward to win the crown of Ireland, which a league of Irish chiefs under Donal O'Neill, *Rex Ultonie*, offered to him. When Edward Bruce landed with an army of veterans near Larne in May 1315, almost all the natives rose in arms, and not a few of the older Anglo-Norman settlers joined him. He defeated Richard, the "red earl" of Ulster, at Connor. On May day, 1316, he was crowned king of Ireland on a hill near Dundalk.

The English cause was at last saved; Bruce failed to take Dublin, Felim O'Connor, at the head of a great Irish confederacy, was defeated and slain by a colonial levy at Athenry in Aug. 1316, and a new viceroy, Roger Mortimer, put spirit and energy into the government. Bruce himself was overwhelmed at Faughart, near Dundalk, by an army under John de Bermingham, and fell in the battle (Oct. 1318). Little or no vengeance was taken, and Mortimer was instructed to admit the aggrieved Irish to English law and liberty, an edict again without much effect.

The Irish Revival.—For a time all seemed fair, and the peerage between 1316 and 1329 was strengthened by the creation of new earldoms: that of Kildare (1316), given to John, head of the Leinster Geraldines (*see* FITZGERALD); that of Desmond (1329), given to Maurice, head of the Munster Geraldines; and that of Ormonde (1328), given to James Butler (*see* BUTLER). In Ulster the power of the earls then covered the whole coast from Carlingford to Derry. But an element of discord was found in the older colonists, who resented the dominance of the great lords, claimed that succession should go to heirs male instead of heiresses who conveyed lands to English absentees, and began to form clans of their own (*naciones et cognomina*). In 1333 the young earl of Ulster, William, was murdered by his own tenants, the Mandevilles, near Belfast, leaving only a daughter who later was married to Lionel, duke of Clarence. The O'Neills became supreme in mid-Ulster and the greater part of Antrim and Down, where they founded a new state, Clandeboy.

Connaught was at the same time lost to the English interest. Two cousins of the murdered earl, Ulick and Edmund de Burgh, seized on the family lands and founded, respectively, the Burkes of Clanricarde and Mayo, known to the Irish as MacWilliam Uachtair, "the upper MacWilliam," and MacWilliam Iochtair, "the lower MacWilliam." Though they maintained a certain English tradition of law and land tenure, spoke French and boasted their continental descent, they were obliged amid so Irish a population to speak Gaelic and marry Irish wives. As a result of such events an Irish revival alike in arms, language, law and civilization displayed itself in every part of the island, and the Gaels recovered large parts of Ulster, the midlands, Connaught and Leinster. Even in the latter province the Mac Murroughs became the terror of the lowland English, and the descendants of Donal Kavanagh resumed the title "king of Leinster."

Efforts to Restore Effective English Control.—Only a great army led by the king in person could have reconquered Ireland, and the young Edward III had thoughts of going there, but he soon abandoned Ireland for Scotland and France. The colony dwindled, and an Anglo-Irish parliament at Kilkenny in 1341, summoned without leave by the earl of Desmond, expressed its resentment against "the English by birth" who misgoverned Ireland, and complained of the decay of the revenue and the loss of a third of the land to the Irish. The capacity of this "middle nation," "Irish to the English and English to the Irish," to turn into temporary rebels was often to puzzle English rulers.

Finally a royal prince was sent, and Lionel, duke of Clarence (*see* CLARENCE, DUKES OF), ruled as viceroy for six years (1361–67). The Statutes of Kilkenny (1366) are the chief memorial of his rule. These enactments defined the "English" or "obedient" land as the counties and liberties of Louth, Meath, Trim, Dublin, Carlow, Kildare, Kilkenny, Wexford, Waterford and Tipperary. The decay of the colony was attributed to a general lapse into Irish language, law and usage, to intermarriage and fosterage and to the maintenance of Irish bards. Therefore the English were forbidden to make such alliances with the Irish or to use brehon law, and, along with the Irish who dwelt peaceably among them, were ordered to take English surnames, speak English and follow English law and custom.

The purpose of these statutes was to preserve as large an area as possible for England at the cost of abandoning the rest. The king's sovereignty over the whole island was not renounced, but the independent Irish were thenceforth treated as "Irish enemies," outside the pale (*q.v.*) of English law and loyalty and unable to plead in or profit by the civil courts, to marry or to purchase, possess or inherit land among the English. Up to the end of the 16th century the chiefs were held to have no right to their lands except by prescription and usurpation. But nothing could recall the "degenerate English" from friendly intercourse with the *meri Hibernici*, the native Irish. The old Gaelic civilization, badly shattered in the 13th century, recovered much of its strength in the 14th, and its music and poetry, the charm of its women, its ancient language and the aptness of its law laid an irresistible spell on the long-established settler families.

The marriage (1368) of Lionel's only daughter, Philippa, to Edmund Mortimer, 3rd earl of March and lord of Trim, carried to him the earldom of Ulster, and this great lord went to Ireland as viceroy in 1380, but died prematurely (*see* MORTIMER). Buying off the more powerful Irish chiefs by paying them "black rents" to keep the turbulent clans in order was now the poor device of

the colonists, whose most dreaded foe was Art Mac Murrough, king of Leinster. More than anything else, this chief's activities brought about the first royal visit since 1210. Richard II arrived at Waterford in Oct. 1394 with a large army, attended by Roger Mortimer and other peers, and stayed in Ireland till May 15, 1395. His general policy for the "Irish enemies" was to secure their homage and confirm them in such lands as they had not "usurped," but with one exception; Art Mac Murrough and his Leinster *urraghts* or vassals were to be induced to evacuate Leinster for other parts of Ireland and leave the province open to a new English plantation. This was achieved in both cases on paper; almost all the ruling chiefs, headed by Niall O'Neill, *Princeps Hibernicorum Ultonie*, came in and did liege homage and entered into indentures with the king. But on Richard's departure Mac Murrough refused to fulfill his extraordinary bargain. Roger Mortimer, 4th earl of March, left behind as viceroy, was slain by the Wicklow Irish in 1398, and Richard in fury hurried over to Ireland again in 1399. His armies could do nothing against the light-armed Irish in their forests, and the king returned to England.

There is little of importance to record of the dwindling "English land" during the Lancastrian period (1399–1461). An occasional strong viceroy, such as John Talbot, afterward 1st earl of Shrewsbury (*q.v.*), could do little against the "Irish enemy," the "degenerate English" and the "English by blood," who resented government from Westminster. A hope of uniting the Celts and the English was found in Edmund Mortimer, 5th earl of March and 7th earl of Ulster, who went to Ireland as viceroy and received the homage of O'Neill and other chiefs but died of the plague in 1425. The old English and the Gaels transferred their affections to his nephew, Richard, duke of York, and in the wars of succession in England were almost to a man for the White Rose.

The Rule of the Great Earls.—In reality three great earls then ruled Ireland. The greater part of counties Limerick, Cork, Kerry and Waterford with their towns had come under the absolute rule of the earls of Desmond; James "the White," 4th earl of Ormonde, had extended the power of the Butlers in Tipperary and Kilkenny; and the earls of Kildare were dominant in Leinster. The three families worked together, dominated the Dublin government in spite of an "English interest" headed by Talbot, took the lead of an Anglo-Irish home rule party and built up a rampart of feudal independence that later took the Tudors almost a century to break down.

"Aristocratic home rule" till 1495, and indeed till 1534, when Garret Og, 9th earl of Kildare, was finally detained in England, may be written over Anglo-Irish history. The Wars of the Roses were to the old English an occasion to secure colonial independence. Richard, duke of York, who became lord lieutenant in 1447 and was in Ireland from 1449 to 1450, played up to the enthusiasm that was at once displayed for his person and name. All Ireland believed him to be the true heir to the English crown and greeted with enthusiasm the hereditary claimant, who in return was expected to rule Ireland by Irish ideas. Hence, when he arrived as a defeated refugee in 1459, the Irish parliament greeted him almost as a king, but proceeded to declare that the land of Ireland was bound only by the statutes of its own estates. When his son Edward ascended the English throne (1461), Ireland seemed to have the king of its choice, and the earldom of Ulster was merged in the crown. James, 5th earl of Ormonde, taking the Lancastrian side, was executed (1461) after the battle of Towton, and his house attainted. His two brothers, successively earls, spent their lives in England, and a junior branch of the Butlers took practical possession of the Ormonde lands.

King Edward IV had little love for an oligarchy which ruled Ireland under the guise of Yorkist loyalty, and all Ireland was appalled when a new viceroy, John Tiptoft, earl of Worcester, got Thomas, earl of Desmond, attainted "for treasons alliances and fosterages with the Irish enemies" and had him beheaded (1468). But Edward was not in a position to go further; after this exhibition of bloodletting, the government had to be left to the Anglo-Irish, and Thomas, earl of Kildare, ruled as deputy till his death in 1477. Under his son, Gerald, called by the Irish "Garret More" (the Great), the Kildare supremacy reached an almost royal height. Although only deputy for English princes who bore the empty titles of lords lieutenant, Gerald was, in effect, actual ruler of Ireland. The old English were for him, his sister was wife to the Irish chief Conn O'Neill, various daughters of his married Irish chiefs, and the Dublin parliament was at his beck and call. He had the revenues of Ireland and the appointment to offices; these went to his supporters and Irishmen ruled Ireland. So things stood when Richard III fell at the battle of Bosworth Field (1485).

(E. Cu.; A. Gw.)

The Tudors

The Kildare Ascendancy.—The battle of Bosworth Field (Aug. 1485), which substituted Tudor for Yorkist rule in England, had no apparent effect in Ireland, where the ascendancy of the Fitzgerald earls of Kildare, established more than ten years previously, had passed (1477) from Thomas, 7th earl, created lord deputy in 1471, to his son Garret More (Great Gerald). The king's power continued to be exercised largely through dynastic alliances with the great Gaelic and Anglo-Irish lords of O'Neill in Ulster, MacWilliam Burke in Connaught and Fitzgerald of Desmond in the south. The junior branches of the Butlers in Leinster were dependent on Kildare, just as the senior branch, then absentees in England, were dependent on the king. Among the minor lords of the English pale some opposition to Kildare might occasionally be built up. A greater degree of independence showed itself in the towns, and those in the southeast relied upon their contact with England to assert themselves from time to time.

The fiction of the king's power was preserved by appointing an absentee lieutenant from whom the earls of Kildare held as deputy. But the deputies had inherited a tradition of independence from the preceding era in which Richard duke of York had ruled Ireland, though the authority of Henry VI was partly recognized. Edward IV had not broken this by his appointment of Worcester and the execution of Desmond. The southern Fitzgeralds thereafter withheld their allegiance and maintained their independence by foreign intrigues, thus imitating those in Ireland who had supported the Yorkists during the Lancastrian period. Nevertheless, when Kildare gave recognition and support to the pretender Lambert Simnel (*q.v.*), Henry VII proved sufficiently strong to check but not to displace him. The defeat of Simnel at the battle of Stoke (1487) confirmed the result of Bosworth Field and made it clear that an Irish army was no more likely to be successful in invading England in 1487 than in 1460, when Richard of York had made the bid for power which ended in his death at Wakefield. Although Kildare was too careful to recognize the next pretender, Perkin Warbeck, Henry VII in 1494 decided to remove him and attempt to rule through Sir Edward Poynings (*q.v.*). With this appointment a struggle began between the new English absolute national monarchy and the old style Ireland with its habits of qualified allegiance and of pride in independence.

Poynings was primarily a soldier but he was expected to be an administrator and a legislator. Within the English pale he succeeded, with the help of some of the Butlers of Ormonde, in driving the king's enemies from the field. He subdued Kildare but could not reconquer the Irish of the north, and he left the west and south alone. As an administrator he inaugurated reforms in the king's government, but at such a cost that Henry could not maintain them unless he was prepared, and he was not, to send annual subsidies from England. As a legislator, Poynings was able to secure, by the Statutes of Drogheda, better known as Poynings' law, the extension to Ireland of the public statutes of England and to provide for nullification of parliamentary proceedings in Ireland which had not previously been approved in England by the king and council. The importance of Poynings' work was not immediately recognizable, as Henry decided (1496) to restore Kildare and adopt the less ambitious policy of sealing off Ireland from his dynastic enemies by a matrimonial alliance. Kildare married Henry's cousin, Elizabeth St. John, and it was understood that he would accept the Poynings' legislation.

After 1496 Kildare continued to rule Ireland, extending his own power and weakening that of the other great lords, but observing his understanding with the Tudors. On his death (1513) the

deputyship passed to his son, Garret Og (Young Gerald), 9th earl of Kildare, who continued to dominate the country. Confronted by an English monarchy increasingly absolute and engaged in an increasingly dangerous foreign policy, Kildare was not as effective as his father had been in maintaining the peace in Ireland and he was temporarily replaced (1520–22) as viceroy by Thomas, earl of Surrey. After Kildare was restored, James, 10th earl of Desmond, intrigued with the emperor Charles V; Henry VIII thus became convinced that Kildare had lost the power to keep Ireland neutral, and when the divorce (1533) of Catherine of Aragon made the danger of imperial intervention particularly acute, the king decided on a new viceregal policy in Ireland and summoned Kildare to England (Feb. 1534). There were thereafter no Irish-born viceroys for more than a century.

The Reformation Period.—Rumours that Kildare had been executed precipitated the rebellion (June 1534) of Lord Thomas Fitzgerald (*q.v.*), called "Silken Thomas," which in a way facilitated the transition to the new system. Silken Thomas had raised the issue of the king's breach with Rome; his execution (1537) and the destruction of the Fitzgeralds caused a revival of the power of the Butlers of Ormonde and Piers Butler, earl of Ossory (1528–38), helped to secure the enactment of the royal supremacy by the Dublin parliament of 1536–37. As a further step in getting rid of the pope, a complaisant parliament recognized Henry VIII as king of Ireland (1541). Confiscation of monastic property, as well as of the lands of the rebels, provided the necessary capital to pay for most of the costs of the expanded administration. But it inaugurated the beginning of a new era in corruption by encouraging officials to fan the flames of revolt in the hopes of obtaining grants of the rebels' confiscated land.

Inevitably, this loss of land drove the religious orders and the Anglo-Irish into the arms of the Gaelic Irish, thus weakening the old racial rivalries of medieval Ireland. Against a persecuting English administration the Gaelic Irish were now to find sympathy among their erstwhile enemies, the Anglo-Irish, as well as among the religious who now no longer felt that 12th-century papal approval of the Norman conquest of Ireland obliged them to preach acquiescence in English rule.

Sir Anthony St. Leger (*q.v.*), lord deputy (1540–48, 1550–51, 1553–56), then began a conciliation policy by which outstanding lords were persuaded, in return for new titles and grants of land, to renounce the pope and recognize the king. Its success, however, depended upon a series of efficient governors and disciplined administrators, and to convert elective chiefs into hereditary nobles, to transfer their palatinate powers into offices delegated by the crown proved in the long run beyond the competence of the English sent to Ireland by the Tudors and the Stuarts. Moreover, the temptation to condemn for religious conservatism and by legal technicalities to deprive of their lands those who had recently submitted to Henry's omnicompetent state was not often resisted. The champions of the older ways among the Gaelic Irish and among the old English families thus found it easy to foster discontent. St. Leger's success was all the more remarkable because the first Jesuit mission to Ireland arrived in the north in 1542, with credentials from Rome addressed to O'Neill. Fear of royal displeasure probably encouraged the Irish to urge the papal envoys to depart; but it is equally clear that the extreme measures of St. Leger's successors merely provoked a reaction against the Dublin government in which the Anglo-Irish increasingly took part.

Under Edward VI (1547–53) the Dublin authorities carried out a forward policy in religion as well as in politics. Protestantism, however, got no support except from English officials, and serious defections followed, including that of George Dowdall, whom Henry VIII had appointed archbishop of Armagh and who then refused to condone the abolition of the Mass. In Ossory, Bishop John Bale provoked such hostility as a reformer that he went in fear of his life, and fled on the accession of Mary I (1553). The restoration of Catholicism under Mary revealed the strength of resentment in Ireland against Protestantism. However, there was no persecution and the few heretical officials were privately permitted to hold services in their own homes. As in England, the papal jurisdiction was restored, but otherwise the Tudor canons of authority were observed. The pope was induced to recognize the conversion of the Tudor Irish lordship into a kingdom. The laws restricting appeals to Rome, or petitioning for benefices without royal consent, were strictly enforced. And finally Mary gave statutory approval for the plantation of Leix, Offaly, and other Irish lordships of the central plain which were shired and called Queen's county and King's county in honour of Mary and of her husband Philip II of Spain. In all this her viceroy was Thomas Radcliffe, earl of Sussex (*q.v.*), lord deputy (1556–59), who was soon to restore the state's authority over the church as lord lieutenant (1559–66) for Elizabeth I.

The Elizabethan Settlement.—Foreign affairs determined the speed of the Elizabethan church settlement in Ireland as well as in England. The Acts of Supremacy and Uniformity (1560) were passed, but fear of driving the inhabitants of the pale into alliance with the Gaelic Irish and perhaps with the Spanish made the government lenient in enforcing their terms. Only five bishops appear to have been asked to take the oath of supremacy; of these two refused. Political affairs continued to receive the main attention of the administrators, so that the new Protestant church was wholly unequipped to resist the forces which the Counter-Reformation was shortly to launch against it. This was perhaps inevitable in an Ireland no more than superficially conformed to royal obedience; but the seriousness of the situation can be seen in the three great rebellions which took place in the course of the reign, those of Shane O'Neill (1559), of the Fitzgeralds of Desmond (1568–83) and of O'Neill (Tyrone) and O'Donnell (1594–1603).

Shane O'Neill.—The first of these rebellions, that of Shane O'Neill, fully exposed the weakness and later the folly of the government. O'Neill's father, Con Bacach (the Lame), having submitted in 1541, had been made earl of Tyrone, the succession rights of his illegitimate son Feardorchadh (Matthew) being recognized. Shane, a younger son, established his martial superiority in his father's old age and won the support of the greater part of the influential people of the lordship against Feardorchadh. He was elected O'Neill on his father's death (1559) and soon afterward Feardorchadh was killed. O'Neill then demanded recognition by the Dublin government according to the laws of primogeniture, as Feardorchadh had not been born in wedlock, and he insisted that neither of the latter's sons, Brian (d. 1562) and Hugh, had claims to the earldom or to the junior title of baron of Dungannon. The Dublin government was not prepared to yield but when O'Neill took the field could not defeat him. Faced with a possible combination against her Dublin administrators, Elizabeth invited O'Neill to London to negotiate (1561–62).

The queen was obviously taken by the personality of O'Neill, but the opportunity for a statesmanlike settlement was lost. Instead a hollow arrangement was made; O'Neill was to be "captain of Tyrone" and was encouraged to expel the Macdonnell (MacDonald or MacConnell) migrants from Scotland whose chief Sorley Boy Macdonnell (*q.v.*; Somhairle Buidhe) had successfully established himself in Antrim. Matters became worse after O'Neill's return (May 1562); the Dublin administration condoned underhand moves against him and he, having routed the Macdonnells as well as the loyal O'Donnells of the northwest, attempted to secure support from Mary, queen of Scots, and from Charles de Lorraine, cardinal of Lorraine. On the advice of Sir Henry Sidney (*q.v.*), lord deputy (1565), a firm policy with O'Neill was then adopted, but the government was saved from a serious situation only through the defeat of O'Neill by the O'Donnells and his murder (1567) by the Macdonnells.

By a sweeping act of attainder, passed by the Dublin parliament of 1569, the lands of the O'Neills and even of loyal Gaelic lords were declared forfeit. In a wave of enthusiasm for colonization, questionable adventurers like Sir Warham St. Leger, Sir Peter Carew, Walter Devereux, 1st earl of Essex, and Thomas Smith, son of the queen's secretary, were permitted to attempt substantial plantations in Munster, Leinster and Ulster. The folly of this policy was seen when, in defiance of the recent attainder which had declared the name extinguished, the O'Neills' election of Turloch Luineach as their chief was given constructive recognition by the government; Butlers and Munster Fitzgeralds also combined

forcibly to resist the Carew-St. Leger actions. The only gleam of statesmanship shown by Sidney in these years was that he managed to avoid a major combination against the government over its religious policy. The Butlers were induced to submit, the planters were given but a limited support and a partial return was made to the earlier policy of conciliating the Gaelic Irish by restoring some favour to Hugh, baron of Dungannon, and avoiding a head-on collision with Turloch Luineach. When the Ulster plantation plans of Smith and Essex could not be carried out against Irish resistance the queen wisely decided they should be dropped. The pardon of the Butlers pacified Leinster but in Munster the earl of Desmond's cousin James Fitzgerald (*q.v.*), called "Fitzmaurice," attempted to make the war one of religion. Wisdom dictated a lenient policy and Sir John Perrot (*q.v.*), president of Munster (1570–76), was permitted to pardon the rebels. Sidney was allowed temporarily to retire (1571) but Sir William Fitzwilliam, who succeeded him as lord deputy (1572–75), proved inefficient yet oversevere, so that Fitzmaurice fled (1575) to the European mainland for support for a Catholic crusade. He returned in July 1579 with papal approval but with negligible equipment.

The Desmond Wars.—Although neither Spain nor France supported Pope Gregory XIII's plan for a holy war in Ireland against Elizabeth, the government was extremely apprehensive. But the earls of Desmond and Kildare gave Fitzmaurice no support and he was surprised and killed (Aug. 1579). Fitzmaurice was perhaps a small military loss; his work as an idealist was largely done and it was his removal that perhaps induced Gerald Fitzgerald, 15th earl of Desmond (*q.v.*), to join the enterprise and assume its direction. As a military commander Desmond was wholly deficient; although his prestige may have won over many in south Munster, his mediocrity may well have influenced outstanding figures in the north and west to stay outside the movement. Meanwhile Lord Grey of Wilton, deputy from 1580 to 1582, and Lord Ormonde defeated the rebels and massacred (Nov. 1580) a force of Italians and Spaniards at Dún an Oir (Golden Fort), Smerwick, County Kerry, on the plea that, as papal soldiers, they had no international status.

The end of the Desmond rebellion gave the government the opportunity to confiscate more than 300,000 acres in Munster and initiate more stringent proceedings against Catholics. But the plantation was not a success. Persecution of Catholics was sporadic. The most deplorable case was the torturing and hanging in Dublin, in 1584, of Archbishop Dermot O'Hurley of Cashel, who was captured in the pale soon after his arrival from Rome. Such actions inevitably encouraged co-operation between Catholic missionaries and Irish rebels, and were carefully avoided by the government in time of war. A more statesmanlike attitude was displayed in regard to Connaught land titles. When Perrot was lord deputy (1584–88) the western landowners were induced to compound their state obligations. In theory, as successor to the earls of Ulster and lords of Connaught the queen was entitled to feudal as well as regalian dues. The composition was an evaluation and division among landowners of these obligations, and it was a step in the process of converting to English tenures a great part of the country where the rights of the crown had not previously been recognized and where the title of the possessors of the land was extremely dubious. Perrot was less successful in handling the 1585–86 parliament and once again the government's anti-Catholic program was defeated by the opposition. He was perhaps even more unfortunate in alienating Archbishop Adam Loftus by an unsuccessful plan to convert St. Patrick's cathedral, Dublin, into an Irish university. His enemies had him recalled as an intriguer with Philip II, but although he died in the Tower (Sept. 1592) his guilt is more than doubtful. The return of Fitzwilliam as lord deputy coincided with the descent of the Armada (1588). Fitzwilliam was subsequently accused of precipitating the Tyrone war by his ineffectiveness in dealing with corrupt and tyrannical officials, but, as in the case of Perrot, the evidence is not conclusive.

The Tyrone War.—The origins of the O'Neill war remain in doubt. Hugh Roe O'Donnell and Hugh, earl of Tyrone, inaugurated as the O'Neill in 1593, certainly resented the extension of the royal administrative system, but the religious issue was probably more important. For a generation, but from very small beginnings, exiled Catholics had been trained as missionaries in the continental colleges of the Counter-Reformation. Among those who returned to Ireland the majority considered that a temporal victory over Elizabeth was essential if Catholicism was to be saved. A few, indeed, thought otherwise and preferred because of traditional loyalty to England to work in the pale and eschew the political enterprise. Attacks on notable prelates like Edmund MacGauran the primate, killed (1593) despite the protection of Hugh Maguire, lord of Fermanagh, and of Hugh Roe O'Donnell, strengthened those who called for a holy war against Elizabeth. Again there was an appeal for Spanish aid.

The outbreak of hostilities in Ulster in 1594 was at first confined to the northwest, where O'Donnell and Maguire tried to drive out the English troops. The intervention of Hugh O'Neill was expected if not inevitable. Since the inauguration as the O'Neill of Turloch Luineach he had maintained himself precariously and with little support from Dublin. As baron of Dungannon he was regarded in Gaelic Ulster as the queen's O'Neill. His loyalty in the Desmond rebellion was rewarded with the re-creation in his favour of the earldom of Tyrone (1585) at the time of Perrot's parliament. Tyrone realized that the less able Turloch Luineach exercised as O'Neill far more influence in Ulster than his own title brought him; and when the old man died in 1595 Tyrone had himself inaugurated as O'Neill in the traditional manner. His participation with his brother-in-law O'Donnell proved decisive in the north and west and the English were routed both in Ulster and in Connaught. A more intimidating combination thus threatened Dublin than even in Shane O'Neill's time. Discontent in the pale because of arbitrary exactions and exclusion from offices assured O'Neill of much sympathy. It was said that he knew of Dublin castle decisions before they were known in the city. In Aug. 1598 the defeat and death of the queen's marshal, Sir Henry Bagnall, seriously intimidated the Dublin administration; they were, however, severely censured by the queen for whining to O'Neill for mercy. Resentful of O'Neill's alleged ingratitude, Elizabeth became impatient of negotiations with him, and finally sent Robert Devereux, earl of Essex, to Ireland (April 1599) to subdue him. But Essex lost his reputation by his inglorious progress through the country and by the celerity with which he returned to England (Sept. 1599) after a private conversation with O'Neill.

Before Charles Blount, Lord Mountjoy, arrived (Feb. 1600) to replace Essex, the Irish leaders had concluded negotiations with Pope Clement VIII and with Spain. The former was quite prepared to accord crusading indulgences to the Irish Catholic forces, but would neither permit the excommunication of the queen's Catholic supporters nor entrust his legatine authority to a Spanish subject, even though he agreed to appoint Mathew de Oviedo, a Spanish Franciscan, as archbishop of Dublin. The dwindling resources of Spain, moreover, precluded Philip III from affording more than a minute force under Juan del Aguila to aid the Irish rebels. Aguila occupied Kinsale, and was besieged (Nov. 1601) by Mountjoy and his president of Munster, Sir George Carew. O'Neill marched south to relieve Aguila but, although he could move without impediment across the country he could not win the support of the Anglo-Irish towns or of many of the Anglo-Irish of Munster. A rash attempt to surprise the English lines by night proved disastrous (Dec. 24, 1601). The Irish were defeated and the Spaniards surrendered. O'Donnell returned to Spain with Aguila to try to get more reinforcements. O'Neill held out in Ulster for over a year but submitted a few days after the queen's death.

Viewed generally, Elizabeth's Irish policy had the distinction of having reduced the country to obedience for the first time since the invasion of Henry II. But the cost was a serious one. The loyalty of the Irish was perennially strained over the religious issue, so that rebellion in 1641 was almost inevitable when England was embarrassed by the second Bishops' War in Scotland. Economically the towns and the countryside were seriously exploited by the new administrators and planters, while the queen's expenditure was substantially increased. The poverty of the crown, which was a serious factor in the 17th century conflict with parliament, was at

least in part due to commitments over Ireland. (R. D. Es.)

17TH AND 18TH CENTURIES

James I, 1603–25.—On the religious question the policy of James was a guarded toleration. The royal prerogative was still supreme, especially in Ireland, and a series of viceroys, such as Arthur, Lord Chichester (1604–15), exercised it in the interests of that large majority which it seemed then almost hopeless to convert. The opposition of the Catholic party, led by the lords of the pale and the lawyers, was constitutional and loyal; it was impossible to debar recusants from parliament, even if the oath of supremacy barred them from government, and in the older towns this party was so strong that until 1624 each one had a Catholic mayor. Could James and this moderate element have had their way all might have been well, but the Counter-Reformation spirit on one hand and the Puritan on the other made plain sailing difficult. The established church in Ireland was for strong measures, and, on the other hand, when James proposed a simple oath of allegiance for recusants, by which they should repudiate the supposed right of the papacy to depose heretic kings, two papal briefs in 1606 declared the proposed oath unlawful for Catholics.

The Plantation of Ulster.—Though the earls of Tyrone and Tyrconnell had been restored in 1603, their new position was full of difficulties; Ulster was now shireland, subject to sheriffs and garrisons hateful to its ancient lords, and Tyrone, involved in disputes with bishops, officials, grantees and his former vassals, complained that strong forces at Dublin were against him. The Anglo-Spanish peace of 1604 and the personal union of England and Scotland under James also changed the political scene to Tyrone's disadvantage. And so in Sept. 1607, along with Tyrconnell and nearly 100 more chiefs of the north, he left Ireland forever. The "flight of the earls" was a mortal blow to the Catholic interest and the old Gaelic tradition. Celtic Ulster was subsequently to become the most British of the provinces, and the lament over the "flight of the earls" in the *Annála Ríoghachta Éireann* (*The Annals of the Four Masters*) can be regarded as the swan song of the Gaelic world. When the *Annals* were published in 1636 the Gaelic writers were already falling silent; and by the 18th century only the Irish language, itself then little used by the gentry, remained as a visible memorial of a world that went back 2,000 years (*see* IRISH LITERATURE; *Late Period*).

A plantation of Ireland was then urged on the ground that, without a strong Protestant population, neither would the state be safe nor the state church have congregations. The earls and their adherents were found guilty of treason, and by legal processes six counties were declared escheated. By the final plan (1609) the escheated lands were divided between undertakers, servitors and natives. Undertakers, mainly English, were to lease only to English and Scottish tenants and to take the oath of supremacy. Servitors, mainly Scots, might take Irish tenants, but if so their rents to the crown were increased. Native Irish grantees were to pay quitrents twice as large as the undertakers, but need not take the oath. Of these a good number received grants of thousands of acres, and several junior branches of the O'Neills and Magennises, etc., survived as large landlords, though no longer as Irish chiefs. But the colonists entered upon the best lands, and the lesser ranks of Irish were reduced to the position of tenants at will, for Sir John Davies, the attorney general, found, by a most iniquitous decision, that they had had no freehold rights under their attainted lords. The town of Derry was given to the City of London, and the London companies received grants which gave them almost all that county.

The practical success of the plantation was great as land hunger in the Scottish lowlands and in the western counties of England created a ready supply of immigrants. For the first time a large part of Ireland was not merely owned by alien landlords but was tilled and farmed by Scottish and Protestant farmers. The Irish population was numerous in the mountainous parts, and its natural disaffection was kept alive by hopes that Tyrone or another would return.

The success of the Ulster plan led to plantations in north Wexford, Longford, Leitrim and elsewhere, where, though the natives were treated with more equity, again the object of the crown lawyers was to find that most of the Irish were not freeholders but tenants at will. The new English were dominant; adventurers and speculators such as Richard Boyle, earl of Cork, and other moneyed men displaced the old aristocracy; 39 new boroughs, carefully rigged, could be counted to offset the old towns, and several of the old Irish had become Protestant.

In the parliament of 1613–15, summoned by Chichester to ratify the Ulster plantation, the government engineered a small majority, partly through the new close boroughs, but the minority could claim that it spoke for 21 counties and 28 ancient boroughs in this first general representation of the kingdom. After failing to get its choice as speaker, the opposition petitioned the crown, and James saw a deputation of old English peers and commoners who complained of religion, the new boroughs and the rigging of elections. James is said to have thoroughly enjoyed himself and declared, "What if I had created 40 noblemen and 400 boroughs?—the more the merrier," and, as regards religion, "the pope is your father *in spiritualibus* and I *in temporalibus* only; you are but half-subjects and therefore only entitled to half privileges." The upshot was that 11 boroughs were disfranchised; James spoke some fair words and continued the laissez-faire policy on religion; and parliament voted a large subsidy. The recusants, though called "old English Irelandized," were, in fact, loyalists with a religious grievance, but they had their left wing, and this veered steadily toward armed protest. It was during these years that the Counter-Reformation made headway, especially in the towns. From 1618 onward a Roman Catholic hierarchy came into residence, eventually to emerge in 1642 into the full political daylight.

Charles I, 1625–49.—With the second Stuart came the idea of raising men and money in return for religious concessions. The deputy, Lord Falkland, was allowed to promise various concessions, known as "the graces," such as that Catholics might practise at the bar and that where land titles, like those of the Connaught gentry under the Composition of Connaught, were lacking in legal confirmation, 60 years' possession was to be held good against the crown. From agents of the Catholic party Falkland secured a pledge of subsidies amounting to £120,000. But when the agents reached London they found a strong antipapist spirit there, under pressure of which Charles gave way. He dropped "the graces" but exacted the subsidies, though no parliament was called to ratify them.

To make Ireland first prosperous and then to use it in the royal interest against Puritan opposition was the idea of Thomas Wentworth, later earl of Strafford, lord deputy from 1633 to 1640. He set himself to break the power of the great and the monopolists, making the court of Castle Chamber into a Star Chamber for Ireland. While he wrested power from the anti-Irish clique in Dublin, he had no sympathy with Irish or Catholic complaints and looked on religious concessions merely as policy. Similarly, his aim in making Ireland rich and prosperous was that out of a surplus revenue he might enrich his royal master, and the first-rate army that he raised largely from Catholics and natives was destined, if need be, to serve in Britain. Among his strongest measures were extracting subsidies of £50,000 from parliament and then denying all but the least important of "the graces"; forcing the juries of Connaught to find a title there for the king, with a view to a fresh plantation; and attacking the London companies. But the policy of "Thorough," as Strafford called it, ultimately failed and when he was assailed in England all the interests he had offended in Ireland joined in the general impeachment that brought him to the scaffold in May 1641. His army was disbanded and the control of the government passed under Puritan lords justices.

A rising in Ulster was almost inevitable. The Irish there had local leaders of the old stock, such as Sir Phelim O'Neill, and still more abroad, where Owen Roe O'Neill, nephew of Tyrone, was in Spanish service. In the south the native party found a leader in Rory O'More, who planned a union of the old English, with their religious grievances, and the Irish who had lost vast estates. A plot to seize Dublin castle failed, but the rising in Ulster was general (Oct. 1641) and thousands of colonists were murdered, died of ill-treatment or fled.

For the suppression of the Irish war the English parliament at once voted an army, but in order to find the money offered to the adventurers or subscribers of £1,000,000 the pledge of 2,500,000 ac. of profitable lands which were to be confiscated. Naturally, the dread of confiscation, coupled with a belief that the Puritans meant to extirpate their religion, drove more and more Irish to arms. A Catholic confederacy was formed at Kilkenny in May 1642 "to defend religion and the king against sectaries, and establish the Catholic religion as fully as at any time since Henry VII"; soon Richard Preston, earl of Desmond, and Owen Roe arrived from abroad, the first to lead the confederate armies, the second the Ulster forces.

The story of the next seven years is a complicated one. Though the confederation of Kilkenny organized a Catholic parliament and government, it did not succeed in welding together the parties of which it was composed. So while the Irish, whose chief figure was Owen Roe O'Neill, commanding an Ulster army, and the old English, supported by Preston, commanding a Leinster army, debated at Kilkenny, parliamentary armies operated in the north and south and Dublin was held by James, marquess of Ormonde, commanding an army of Protestant royalists. The confederation gained some recognition abroad, and in 1645 John Baptist Rinuccini, archbishop of Fermo, arrived as an accredited papal nuncio. Negotiations took place between Ormonde and the confederates which led first to a cessation of fighting and then to active peace proposals. It was hoped that Irish troops would eventually come to the aid of Charles. The negotiations were protracted because of religious issues and the future of the plantations. The first Ormonde peace was signed in 1646, only to be condemned almost immediately by Rinuccini and the Catholic hierarchy, whose position had been greatly strengthened by O'Neill's victory at Benburb in the same year. By that time the king's cause was already lost and Ormonde, preferring "to surrender Dublin to English rebels than to Irish ones," handed over the capital to Col. Michael Jones, the parliamentary commander, and left Ireland in 1647. During the second phase of the Civil War in 1648, new negotiations were opened which led to the signing of the second Ormonde peace in 1649. It was this which caused Rinuccini to leave Ireland. By then however the royalist cause was hopeless and the confederates in isolation were able to put up little resistance to Oliver Cromwell later in 1649. By 1652 all Irish resistance was over. (*See* also CIVIL WAR, ENGLISH.)

The Cromwellian Regime.—The detailed history of the Cromwellian land settlement itself has still to be written, though the general outlines are fairly clear. The Cromwellian government needed to provide more than 2,000,000 ac. of land to fulfill its debts. For this purpose, an act was passed in 1652 by the terms of which all Irishmen who could not prove themselves to have supported the Commonwealth were liable either to the death penalty, loss of property or both. Connacht was reserved for the "innocent"; the rest of the country was to be divided into an English pale from which the Irish were to be excluded. Ten or more counties were to meet the claims of the "adventurers" and the army and the remaining counties were to meet all other debts. Charles Fleetwood, commander in chief and lord deputy, was determined that the plans to transplant the population should be carried out. However, little resettlement had taken place by May 1654. A further attempt was made in 1655, backed up by force, including transportation to Barbados, but it proved impracticable. As a result, a change to a milder policy occurred and Henry Cromwell succeeded Fleetwood as deputy in Sept. 1655. Sir William Petty finished the Down survey in 1656 (so-called because it was the first survey to be put down on maps). By 1658 the claims of the army and the adventurers had been satisfied; a new landlord class had been created which was to remain for over two centuries.

While all this was happening, large numbers of soldiers left Ireland for the continent. The exiles also included clergy. Bitter disputes broke out among them, between the old English and the Ulster Irish as to which was responsible for the failure of the Confederation of Kilkenny. Rival historical accounts appeared, one by the Anglo-Irish Richard Bellings blaming the nuncio, others such as the *Aphorismical Discovery* criticizing the Machiavellian policies of Ormonde and his supporters. (H. F. KE.)

Charles II and James II.—With the Restoration, Ormonde, who had been raised to a dukedom, returned to Ireland as lord lieutenant in July 1662. Roman Catholics hoped to be rewarded for their support of the royalist cause, but Charles II, although acknowledging their help, also had obligations to those Cromwellian officers who had joined in inviting him back. Characteristically, Charles made promises to both: Cromwellians should keep what they had, Catholics should recover what they had lost. Ormonde's comment was that a new Ireland would have to be discovered. The Irish parliament passed the Act of Settlement (1662), embodying both promises and setting up a court of claims to select Catholics who were qualified to recover their lands. The act was unworkable, but the deadlock was broken by further legislation, the Act of Explanation (1665), which obliged Cromwellians generally to surrender one-third of their holdings to form a pool from which Catholics could be partially compensated. The Restoration settlement satisfied neither side. Cromwellians resented having to surrender part of their acquisitions; Catholics were discontented with the fraction they had recovered, particularly as policy and influence favoured the "old English" nobility at the expense of the native Irish and lesser claimants generally, most of whom recovered nothing.

In spite of English restrictions on cattle exports and colonial trade, Ireland's economy flourished in Charles II's reign. Catholics, excluded from public life, prospered in trade and commerce. For most of the reign their religion was tolerated in practice, although the "popish plot" scare resulted in a bout of persecution, a notable victim being the Roman Catholic archbishop, Oliver Plunket, who was executed in 1681.

A new situation arose with the accession of the Catholic James II in 1685. Ormonde was recalled and his successor, the king's brother-in-law the Protestant earl of Clarendon, was soon replaced by the Catholic earl of Tyrconnel (*see* TYRCONNEL, RICHARD TALBOT, Earl of). Protestants were purged from the army, the administration and the judiciary and Catholics appointed in their place. There was talk of "driving a coach and six through the Act of Settlement." Protestants became alarmed and an exodus to England began.

The Jacobite War, 1689–91.—When the Revolution of 1688 drove James from the throne of England, Tyrconnel continued to rule Ireland in his name. In March 1689 James crossed to Ireland from France and was welcomed by Catholics, largely because they expected him to restore their lands. Only Londonderry and Enniskillen—Protestant cities of refuge in the north—acknowledged William of Orange as king. James, with a realization of English opinion, was reluctant to interfere with the land settlement. But under pressure from his Catholic supporters he summoned a parliament in Dublin, the "patriot parliament," which repealed the Act of Settlement and passed an act of attainder subjecting some thousands of Protestants to the penalties of treason if they did not acknowledge James. These acts provided the basis for a wholesale retransfer of land from Protestants to Catholics, but their effectiveness depended on a Jacobite victory.

Londonderry withstood a siege of 105 days, during which the garrison was reduced to near-starvation. Enniskillen conducted a spirited and successful defense. James withdrew his forces from most of Ulster, leaving the way open for a Williamite army under the veteran marshal Friedrich, duke of Schomberg, who achieved little. In 1690 William himself came to Ireland with an international army. The battle of the Boyne on July 1, 1690, was of European significance as a gain for the Grand alliance in its struggle against Louis XIV, who supplied James with money, arms and 7,000 French troops (*see* GRAND ALLIANCE, WAR OF THE). But the Boyne was not an overwhelming military victory; the Jacobite army was scattered, not destroyed. It was, however, politically decisive. James returned to France, leaving William in control of Dublin and most of the country. The Irish Jacobites continued to fight, hoping to get terms that would secure their estates and obtain toleration for the Catholic religion. They found a leader in Patrick Sarsfield, who rebuffed William at Limerick and succeeded in prolonging the war until 1691, by which time William

had returned to England. William's Dutch general, Godard van Ginkel, afterward earl of Athlone (*q.v.*), who captured Athlone, won the decisive battle of Aughrim on July 12, 1691, and negotiated the surrender of Limerick.

The treaty of Limerick (Oct. 3, 1691), which brought the war to an end, consisted of two documents: the military and the civil articles. The former provided that those of the Irish army who wished should be transported to France and several thousand men under Sarsfield took advantage of these terms, forming the nucleus of the Irish regiments that earned distinction in the French service during the 18th century. The first of the civil articles promised the Roman Catholics of Ireland "such privileges in the exercise of their religion as are consistent with the laws of Ireland or as they did enjoy in the reign of Charles II." The phraseology was vague and it would be hard to say what privileges the laws of Ireland allowed to Catholics. But the terms of the article did not prepare Catholics for a multitude of fresh restrictions. The penal laws were specially resented as a breach of the treaty. The second civil article, which was kept in the main, promised pardon and restoration of lands to the garrison and inhabitants of Limerick and to other garrisons still holding out at the end of the war. Sarsfield stipulated that the terms should also cover all those under the protection of the Irish army in certain western counties. This clause was omitted from the signed copy of the articles, was restored by William, but finally omitted when the Irish Protestant parliament partially ratified the articles in 1697. This also was resented as a breach of faith, although the consequences seem to have been of little practical importance. The estates of those who were not protected by the treaty or by special pardon were confiscated, reducing Catholic holdings in Ireland from approximately 22% to 14%, a figure that was to be even further reduced in the course of the following century. William's generous grants from these estates to his Dutch supporters and in particular his grant of James's private estate to his mistress, Lady Orkney, incurred the censure of the English house of commons. He was forced to agree to an Act of Resumption (1700), by which his grants were cancelled and the estates sold as a contribution toward the expenses of the war in Ireland.

Protestant Ascendancy and Penal Laws.—The end of the war left the Protestants dominant politically, economically and socially, but they were apprehensive of a Stuart restoration and the revival of Catholic claims. They sought to secure their position by penal laws that imposed crippling restrictions on Catholics. Catholic bishops were banished and registration, together with the unpalatable oath of abjuration, was imposed on priests. A Catholic could not keep a school, be a guardian, carry arms without licence or own a horse worth £5. Catholics were prevented by law in 1704 from buying land; they could not lease it for more than 31 years and the rent payable had to be at least two thirds of the annual value of the property; estates of inheritance had to be partitioned among all a man's sons, by the system known as gavelkind, unless the eldest son conformed to the established church. A sacramental test, which excluded Presbyterians also, was imposed on holders of public office. Most Catholic landowning families conformed but the majority of Catholics remained faithful to their religion. Although Ireland was undisturbed by the Jacobite rebellions of 1715 and 1745, the penal laws bred deep resentment and their economic and social effects were disastrous for the country.

Protestants also had their grievances. England imposed commercial restrictions, notably the prohibition on the export of woolen goods to foreign countries. The English parliament claimed the right to legislate for Ireland, a claim specifically made in the Declaratory act (1719), and the English house of lords was the final court of appeal for Irish cases. More and more of the higher posts in church and state went to Englishmen. Irish rents were spent in England by absentee landlords. In consequence, a spirit of "colonial nationalism" grew up, fostered by such men as William Molyneux, whose *Case of Ireland's Being Bound . . .* (1698) opposed the legislative claims of the English parliament. Jonathan Swift's *Drapier's Letters* (1724)—a scathing indictment of William Wood's halfpence—succeeded in putting a stop to a bad piece of jobbery. Bishop George Berkeley's *The Querist* (1735–37) also drew attention to the misfortunes of the peasants and the evils of the system of landownership.

The Irish parliament was an unrepresentative body, exclusively Protestant in membership and in the main elected by small Protestant corporations; such Catholic electors as there were lost the franchise in 1727. Until 1768 the life of the Irish parliament was limited only by that of the monarch; its legislative program was strictly controlled by the English government through Poynings' law of 1494. It normally met for a few months every second year, when "undertakers" used their powers of patronage to get the money bills passed. (J. G. Si.)

Growth of Irish Parliamentary Opposition.—An active parliamentary opposition emerged in the Irish house of commons after 1750 and twice the government was seriously embarrassed. The duke of Dorset, as lord lieutenant, was faced with stiff opposition from 1753 to 1755 over the government's disposition of the revenue surplus, and Lord Townshend, viceroy from 1767 to 1772, experienced great difficulties with his augmentation bill. The American Revolution greatly influenced Irish politics; there were obvious analogies, political and constitutional, between Ireland and the rebellious colonies and from the outset there was considerable sympathy for them in Ireland, especially among the Presbyterians in the north. In 1778 a great shift occurred in the balance of power in Ireland. A large proportion of the forces maintained by Ireland had been sent overseas and, with a French war impending, it was clear the country was inadequately defended. The Irish Protestants promptly started to organize for defense. Volunteer corps were rapidly formed all over Ireland and soon far outnumbered the government's military forces. In 1779 Henry Grattan and Henry Flood (*qq.v.*) demanded free trade and their demand was reinforced by a volunteer demonstration in Dublin. The British government yielded in Dec. 1779; the restraints on Irish trade were swept away and Ireland was admitted to the colonial trade. But these concessions were too late to avert further demands. The delegates of the Ulster volunteer corps, meeting at Dungannon in Feb. 1782, demanded the repeal of the Declaratory act and Lord Rockingham's government hastily gave way. The Declaratory act was repealed and Poynings' law drastically amended so that bills which passed the Irish parliament were transmitted unaltered to England and, if they received the royal assent, returned to Ireland, under the English great seal. At the same time the custom of passing an annual mutiny bill was adopted and the Irish judges were given the same tenure of office as judges in England. This meant that they were no longer removable at the pleasure of the crown. There was a buoyant feeling in Ireland that the country was entering on a progressive and prosperous era and the growing consciousness of Ireland's nationhood, together with the liberal temper of the age, led to the abolition of many of the Catholic disabilities in 1778 and 1782, especially those affecting the exercise of religion and the possession of land.

After the constitutional changes of 1782 Ireland was theoretically an independent kingdom, sharing a common crown with Great Britain. But in practice the Irish executive was still controlled by the British government and by the use of patronage the Irish executive had considerable influence over the Irish parliament. In the winter of 1783 a volunteer convention in Dublin agreed on a plan of parliamentary reform which Flood immediately presented to the house of commons. The house of commons promptly rejected it and the leaders of the volunteers, men of property and standing, quietly accepted their defeat. The convention dissolved and the volunteer movement rapidly declined.

The Irish parliament made considerable efforts to promote the economic development of the country but the unsatisfactory nature of Anglo-Irish relations was soon shown by the debates over the commercial propositions and the regency crisis. In 1785 William Pitt introduced a plan providing for free trade between Great Britain and Ireland. The Irish house of commons accepted it; but at Westminster, under pressure from British industrial interests, several amendments were made, whereupon the Irish house rejected the entire plan. George III became insane in 1788 and a Whig ministry seemed probable in England. When the Irish parliament

met majorities in both houses rejected the government's plan of appointing a regent by act of parliament; instead, they proceeded to request the prince of Wales to assume the regency. Though the prince was in fact the regent designated by the British bill the implications of the Irish parliament's action were that it could appoint a different regent from Great Britain.

The influence of the French Revolution was soon felt in Ireland and both the Catholics and the radicals bestirred themselves in the early 1790s. The British government, faced by a major European war, was anxious to encourage Catholic loyalty and it forced the reluctant Irish administration to pass a comprehensive Relief act (1793) which granted Catholics the franchise, admission to the University of Dublin and to most civil offices. They were still debarred from parliament, from the highest posts in the public service and from the judicial bench. The government attempted to conciliate and influence Catholic opinion in 1795 by founding the seminary of Maynooth to provide, partly at the expense of the state, facilities for the education of the Catholic clergy.

Rebellion and Union.—The revival of Irish radicalism was signified by the publication of pamphlets by Theobald Wolfe Tone (*q.v.*), who strongly urged the Irish Catholics and radicals to form an alliance with the object of winning complete emancipation and parliamentary reform. Societies of United Irishmen—radical political clubs—were founded in Belfast, Dublin and elsewhere in 1791, advocating complete emancipation and a plan of parliamentary reform which included equal electoral districts and universal suffrage. The Dublin society, which vehemently supported these views, was suppressed in 1794.

It seemed likely, in 1794, that the Whig opposition would control the Irish administration. As a result of the coalition between Pitt and the "old Whigs," Lord Fitzwilliam was appointed lord lieutenant. The new viceroy made it clear that he was going to rely on the advice of the Irish Whigs and that he would support Catholic emancipation. His colleagues in England considered him to be impetuous and Fitzwilliam's recall after only six weeks in Ireland was a severe shock to moderate liberal opinion there. During 1795 an alliance between radicals and discontented sections of the working class brought a new association of United Irishmen into being; it was secret and organized on military lines and aimed at a radical reform of parliament and "a national government." Agrarian discontent was rife and many of the Irish peasantry who had formed secret societies of their own joined the new society. But in the north of Ireland agrarian strife took a sectarian form, the Catholic "defenders" clashing with the Protestant Peep-of-Day Boys, and the Orange society, founded in 1795, which was strongly conservative. A large French expedition sailed for Ireland in 1796 under the command of Gen. Lazare Hoche, together with Tone, who had gone to France at the beginning of the year to obtain help for the United Irishmen. Storms scattered the fleet and, though some ships reached Bantry bay, no troops were landed.

The Irish government, threatened by internal conspiracy and foreign invasion, displayed an unconciliatory determination, passing an Insurrection act in 1796 and suspending the Habeas Corpus act. During 1797 Gen. Gerard (afterward 1st Viscount) Lake confiscated private arms in the north and suppressed the *Northern Star*, the very lively radical newspaper published in Belfast. In the early months of 1798 the tension greatly increased; the United Irishmen were preparing for rebellion and the government was desperately trying to break their organization. The government managed to arrest a number of the radical leaders in the spring but in May the rising broke out. Only in east Ulster and Wexford was the rising widespread. The rebels in the north were defeated at Antrim and Ballinahinch; while the Wexford men defeated the government troops in some engagements but failed to take New Ross and Arklow. By the middle of June large forces of government troops under General Lake were concentrated in Wexford and the rebels were defeated at Vinegar Hill (June 21, 1798). The rebellion was almost over when a small French force landed near Killala; it won a victory at Castlebar but was soon surrounded and captured.

The rebellion brought the Irish question forcibly to the attention of the British cabinet, and Pitt decided that the best solution was a union. The Irish parliament was to be abolished, Ireland being henceforth represented at Westminster by 4 spiritual peers, 28 temporal peers and 100 members of parliament. A union, Pitt argued, would both strengthen the connection between the two countries and provide Ireland with opportunities for economic development. It would also, he thought, make it easier to grant concessions to the Catholics, since they would be a minority in a united kingdom. Naturally the union met with strong resistance in the Irish parliament but the government, by paying careful attention to the personal objectives of the members, and by providing generous compensation to the owners of boroughs which were being disfranchised, secured a majority which carried the union on Aug. 1, 1800. (R. B. McD.)

The Union (1800–1921)

Resistance to Pitt's campaign for a legislative union had been so strong in the Irish parliament that the measure was carried only by the undisguised purchase of votes, either by cash or by the bestowal of honours. But opposition to it among the landowners and the lawyers did not last long, and after a few years the agitation for a repeal of the union was being generally opposed, even by those who had protested vehemently against the extinction of the Irish parliament. On the other hand, the support for the union which Pitt and Castlereagh had gained from most of the leading Catholics was quickly lost. Bishop Francis Moylan and others had used their great influence on behalf of the union, in expectation that Pitt would redeem his promise to introduce Catholic emancipation at once by an act of the joint legislature in London. The Catholics had already gained important concessions since the establishment in 1795 of the Royal Catholic college at Maynooth as a national seminary for training Irish priests. They could no longer be educated in France and the Low Countries, since the Irish colleges there, which had kept the Catholic Church supplied with priests for generations, had been suppressed under the Revolutionary penal laws. The bishops had been appalled by the antireligious campaign in France, and they had also seen the Irish regiments of the French army disbanded, their officers enlisting in other armies to fight against revolutionary France. Pitt had not only endowed Maynooth but had given active help to the French clergy who escaped from imminent danger of death. He had promised to admit the Irish Catholics to full civic rights, which the ascendancy in Dublin had persistently denied to them; and they had little sentimental regard for the Irish parliament, which was determined to uphold Protestant domination.

But Pitt's failure to carry out his promises produced a sense of betrayal and humiliation and the Catholic Church had no further sympathy with the new experiment. Wolfe Tone's attempts to bring a French expeditionary force to assist a national uprising had been actively opposed by the Catholic bishops, who dreaded revolutionary ideas. But Robert Emmet's abortive rising in Dublin in 1803 (*see* Emmet, Robert), though it had much less chance of success and was little more than a local riot, had a stronger sentimental appeal. The promised emancipation of the Catholics had been withheld because the king considered that their admission to parliament would be a violation of his coronation oath. Pitt had resigned the premiership as a gesture of loyalty to his promises, but he soon returned to office and refused to raise the Catholic question again.

Economic Effects of Union.—While the hopes of the Irish Catholics had thus been defeated, the economic and social consequences of the union for Ireland were soon found to be disastrous. Dublin ceased to be the metropolis in which the landowners had their town houses and their lavish social life. Many activities that had been connected with the Irish parliament either ceased or languished when London became the political and social centre. The most gifted and most public-spirited members of the community who were still elected to parliament now had to spend most of their time in London, while those who were no longer legislators soon tended to become absentee landlords. Trade and industry declined rapidly, especially in Dublin, and the sudden increase of absenteeism had an unexpected effect upon Irish agriculture when prices rose abnormally during the Napoleonic Wars.

Ireland's population in 1800 was 4,500,000. Of these, fewer than 500,000 were Protestants and about 900,000 were dissenters, who were chiefly in the eastern half of Ulster. Almost all the landowning class was Protestant, and Catholics had not been allowed even to buy land until the recent relaxation of the penal laws. The great majority of the 3,150,000 Catholics were either labourers or tenant farmers who held their land on short leases without any security of tenure or protection against increase of rents if they improved their holdings. When the landlords became absentees, they left their estates in the hands of agents who had no social responsibility and were concerned only with extorting the utmost profit from the land. A swift rise of prices during the Napoleonic Wars made it more profitable to multiply the small holdings, by dividing the estates, and so increase the rent rolls.

With no alternative occupation the competition for small holdings was extremely keen, and the landlords were not required to provide farm buildings or even cottages. Any young labourer who could build a miserable hut for himself could therefore attain at once all that could be expected by any tenant farmer. While high prices continued, the subdivision of farms increased everywhere, with rents steadily rising and no outlay of capital on improvements. There was no inducement to delay marriage until later in life, and the population rose very rapidly with young marriages and large families. The standard of living was low. On smallholdings of less than ten acres it was scarcely possible to grow any crops other than potatoes, which provided the only food for a whole family throughout the year. Even milk and butter were luxuries seldom seen. Any small crops of grain had to be sold to pay rent and tithes which were exacted regularly; and the few cattle or pigs which could be kept on the little holdings were the chief source from which such payments had to be met.

Catholic Emancipation.—The Catholic peasantry and labourers, who formed the bulk of the population, suffered acutely when prices fell after the Napoleonic Wars. Dublin declined rapidly after the extinction of the Irish parliament, and many industries in all parts of the country decayed. But a new Catholic middle class was slowly emerging, since the mitigation of the penal laws. Education was no longer forbidden, and churches could be built without breach of the law. There were no Catholic secondary schools, however, and the merchants and others who had formerly sent their sons to school in France sent them to the few Catholic colleges which had been opened in England, since they found refuge there from the Revolution. Catholics were already admitted to Trinity college, Dublin, and they could become lawyers and doctors. The young barristers who had benefited from these new advantages became the most active leaders of the demand for full civic rights.

Among them was Daniel O'Connell (*q.v.*), who had been at school in Douai until the French Revolution and had completed his legal training in London. One of his uncles, Gen. Count Daniel O'Connell, had been the last colonel of the disbanded Irish brigade in France, and Daniel had been brought up in County Kerry by another uncle who had for years conducted a flourishing contraband trade with the continent but had become a loyal government supporter since the Revolution. Among the young Catholic barristers who infused new life into the Catholic committee, Daniel O'Connell soon displayed outstanding gifts of popular leadership and great courage in asserting the Catholic claims. He had imbibed the new doctrines of democracy and equality and also the nationalism which had spread since the French Revolution. His attempts to revive and broaden the agitation for Catholic rights brought him into collision with the authorities at Dublin castle, but he showed great skill in confining his agitation to strictly constitutional demands. By exploiting his legal rights as a defending counsel, he converted the law courts into a platform for political agitation.

Grattan had continued at Westminster to press for Catholic emancipation, but he and other Protestant reformers were prepared to make concessions which O'Connell as a fervent Catholic would not accept. Sympathy with the Catholic grievances was widespread in England, and by 1815, when O'Connell had created a really formidable popular agitation in Ireland, emancipation probably would have been carried in the house of commons if the Catholics had agreed to a government veto upon the appointment of Catholic bishops. But O'Connell objected so vehemently to any government interference with religious matters that he preferred to allow his agitation to collapse. His nationalism also was so intense that he regarded repeal of the union as being more important than Catholic emancipation, which he knew that an Irish parliament must concede. His defiant methods and his democratic claims aroused alarm among the Protestant landowners who had formerly resisted the union but now feared that an Irish parliament would be overwhelmed by a Catholic majority.

O'Connell's personal magnetism and his unrivalled success as an advocate had brought new energy to the popular movement. In 1823 he revived the Catholic agitation, with the help of some brilliant younger leaders, by forming a Catholic association which was financed by subscriptions of a penny a month. A concerted revolt against payment of tithes to the established Church of Ireland was developing widely, and the demand for emancipation assumed a wider aspect, with O'Connell as the national leader asserting the people's rights against an oppressive system. Although sympathy with the Catholic claims was then widespread in England, George IV refused to allow the question to be raised. In 1826 the peasantry in Waterford showed its independence by voting against the powerful Beresford family on its own domain. In 1828 O'Connell himself stood for Clare, as a Catholic who would not take his seat until the anti-Catholic oath was abolished. His triumphant election compelled the duke of Wellington and Sir Robert Peel to carry the Emancipation act of 1829, which admitted Catholics to parliament and to most public offices.

Demand for Repeal of the Union.—When the Whigs had obtained power in 1830, O'Connell attempted to agitate by similar methods of mass meetings and popular organization for repeal of the union. His efforts were defeated by vigorous repression, and for about ten years he gave the Whigs a chance to fulfil their promises of enlightened reforms. But the house of commons had neither the time nor the knowledge to attend to Irish problems, which required drastic remedies, and the ascendancy still controlled Dublin castle and kept Catholics out of almost every office. Property, as well as land, was still mainly in Protestant hands, and the Catholic population was more impoverished than ever, while its numbers continued to expand. By 1841 there were about 8,200,000 people in Ireland, and the increase had been chiefly in all the overcrowded and infertile counties of the west. Destitution had become so prevalent that landowners were already doing their utmost to encourage emigration and to reduce the number of holdings.

After a decade of disappointment O'Connell decided to revive the repeal agitation in 1840. It came to life swiftly when the Young Ireland leaders, Charles Gavan Duffy and Thomas Osborne Davis (*qq.v.*), founded the weekly newspaper the *Nation* and threw their energies into organizing monster meetings in all parts of Ireland. Action in parliament was disregarded, while the popular demonstrations assumed a more definite character. A climax was reached in Oct. 1843 when Peel mobilized troops and artillery to suppress the monster meeting arranged at Clontarf, outside Dublin. O'Connell and the principal leaders were tried for seditious conspiracy and imprisoned, but were soon released after an appeal to the house of lords. O'Connell's method of popular agitation within the law had proved unavailing, and his strength became broken by age and the disease which caused his death in 1847.

The Great Famine.—The younger leaders demanded a bolder policy of revolt, and open friction between O'Connell and the Young Ireland movement had developed before the country was suddenly confronted by national famine in 1846. The potato crop, which was as indispensable to the people as rice in India, failed everywhere as a result of the blight, which was still an unknown disease. In 1846 and 1847 the blight was more general and devastating, and, with typhus following upon famine, vast numbers died. Emigration became the sole hope of escape, and there was a catastrophic decline of population. Every little farm had to support a family, but without potatoes the people could not survive. Out of less than 700,000 holdings, about 300,000 were smaller

than 3 ac. and another 250,000 were between 3 and 15 ac. Attempts to relieve the universal distress were ineffective. Large supplies of maize (corn) were imported by the government and by charitable agencies, and many temporary programs of relief work were organized to provide employment. Subscriptions poured in from the United States and other countries. But emigration was the chief escape from death by starvation and pestilence, and the population, which had risen to about 8,500,000 by 1845, had fallen by 1851 to 6,550,000.

O'Connell's cautious policy after his release in 1844 had made the Young Ireland leaders restless, while the popular agitation died down. The great famine intensified their conviction that unless the union was repealed there could be no constructive improvement. There was then a much wider difference between the economic conditions and needs of the two countries, and Irish needs were overridden or ignored, even when famine was depopulating the country. Young Ireland demanded that the export of grain and cattle should be forbidden while the people starved, and that the state should finance new industries and railways to give employment. But these demands conflicted with the sacred principles of free trade and private enterprise, and the house of commons generally ascribed Irish misery to the results of political agitation. In desperation the Young Ireland leaders began preparations for an armed rising to achieve national government. They were encouraged by the bloodless revolution in Paris which overthrew Louis Philippe early in 1848. But the government forced a premature outbreak in August, and the leaders were either deported as convicts to Tasmania or escaped to the United States.

Rise of Fenianism.—For about 20 years after the great famine, political agitation was subdued, while emigration continued to reduce the population every year. The landowners had also suffered severely from inability to collect rents, and there was a wholesale transfer of estates to new owners. Their first concern was to reduce the number of smallholdings and to substitute grazing for tillage on larger, consolidated farms. Evictions were widespread, and cottages were burned down at once by the landlords to prevent other impoverished tenants from occupying them. The flow of emigrants to the United States was encouraged by invitations from relatives and friends who were already there. And in England, also, the new industrial cities and shipping centres attracted large settlements of hopeless and embittered exiles from Ireland. Among them, both in the United States and in England, the Fenian movement spread widely as a secret revolutionary society which aimed at securing Ireland's political freedom by exploiting every opportunity to injure English interests. Fenianism became a serious menace when it was reinforced by many Irish-Americans who had served on both sides in the American Civil War. W. E. Gladstone at last recognized the necessity for drastic Irish reforms, and in 1869 he disestablished the Protestant Church in Ireland. The next year he introduced the first Irish Land act which conceded the principles of secure tenure and compensation for improvements. In 1870 the Home Rule association was founded by Isaac Butt (*q.v.*), a prominent Unionist lawyer who had been converted by the famine experience to the necessity for Irish self-government.

A return of bad harvests in 1879, however, brought new fears of famine, and the Land league was founded by Michael Davitt (*q.v.*). The son of an evicted tenant, he had become a Fenian as a young labourer in England and had spent years in prison there. His Land league soon gathered wide support for its program of fixity of tenure, fair rents and free sale. A formidable agrarian agitation developed when Davitt was joined by Charles Stewart Parnell (*q.v.*), a young landowner and member of parliament in the Home Rule party, which soon elected him as its leader in place of Butt. Parnell and Joseph Bigger had adopted a new policy of persistent obstruction at Westminster to compel attention to Irish needs. Their skilful and determined tactics brought parliamentary business to a standstill and galvanized the new popular agitation in Ireland. Gladstone was forced to introduce his Land act of 1881, which made large concessions including the "three F's"—fixity of tenure, fair rent and free sale of the tenant's interest; and its new rent tribunals soon insisted upon wholesale reductions of rent.

The Fenian revolutionary movement in the United States and in England agreed to support Parnell's dynamic leadership of the Home Rule party, which then aimed at forcing either Liberals or Tories to concede national government. In 1886 Gladstone introduced a Home Rule bill, but it was defeated and the Liberal party was split. Parnell, however, had created such a formidable movement, with widespread support from the United States and in England, that he seemed likely to succeed, until he was suddenly involved in divorce proceedings brought by his colleague Captain William O'Shea. Gladstone then announced that his nonconformist followers would not co-operate further if Parnell retained the leadership, and in Ireland the Catholic Church also insisted on his retirement. But Parnell refused to resign, and his party was bitterly divided when he died in Oct. 1891, fighting vehemently as leader of the minority.

The Nationalist Revival.—Gladstone introduced his second Home Rule bill in 1893; the house of commons passed it by 301 to 267, but the lords rejected it by 419 to 41. It became evident that the lords would always resist home rule, and nationalist hopes were further discouraged by the party split. Ireland's population had declined to 4,700,000 by 1891, and emigration continued to reduce it. But a new phase of nationalist revival then began, with a cultural and economic program. There was a revival of the Irish language, led by Douglas Hyde, and the co-operative movement in agriculture, fostered by Sir Horace Plunkett, coincided with a movement for Irish industrial development and with a general policy of creating an Irish Ireland. Anti-English feeling and a concentration upon internal progress, without regard to Westminster, were fostered by the centenary of the 1798 rebellion and by the pro-Boer demonstrations during the South African War. A new party called Sinn Féin (Ourselves Alone) was founded in 1900 by Arthur Griffith (*q.v.*), who ridiculed dependence upon the British parliament and demanded that the Irish members cease to attend it and form a national council in Ireland.

Conservative Reforms.—Around the close of the century Arthur Balfour had initiated a new Tory policy, designed to "kill Home Rule by kindness," by introducing constructive reforms in Ireland. The Congested Districts board carried out a general improvement of the uneconomic smallholdings in the west. A new department of agriculture and technical instruction gave much practical aid under Plunkett's direction. The Local Government act of 1898 abolished the grand juries and entrusted local affairs to elected councils. In 1903 George Wyndham (*q.v.*), as Irish secretary, was enabled to carry the Land Purchase act. It offered generous inducements to the landlords to sell their estates to the Land commission, which was to collect terminable land annuities instead of rent. The response was immediate and overwhelming, and the Irish land question was settled at last by transferring ownership of the land to the occupying tenants on easy terms.

The Third Home Rule Bill.—In 1900 the two rival wings of the Nationalist party were at last reunited by consent, when John Dillon as leader of the larger section agreed to serve under the Parnellite John Redmond. But hopes of carrying Home Rule were still distant while the lords' veto remained, though the party continued to press for an Irish parliament, with increasing support in England and the dominions. The Liberals' triumph in 1906 revived hope, but it was soon disappointed by the meagre offer of an Irish councils bill, which was at once rejected. Other reforms, however, including the National University act of 1907, were obtained; and in 1909 Redmond seized his chance of demanding a Home Rule bill when Lloyd George's radical budget provoked a collision with the house of lords. H. H. Asquith promised Home Rule if the Nationalists would support his campaign against the lords, and in 1911 the passage of the Parliament act seemed to assure the eventual success of a Home Rule bill. Popular enthusiasm had revived after years of despondency; a new generation, free from the inhibitions of old grievances and already accustomed to the responsibilities of local government, looked forward to a new era of opportunity in public service and in scope for employment at home. Nearly all the most important positions in the civil service and industry and commerce were still largely reserved

for Englishmen or for members of the old Protestant ascendancy. Even in the professions advancement had usually been the reward of service to the Unionist party and to Dublin castle.

Redmond, however, had unexpectedly achieved the balance of power between the rival parties at Westminster which had been Parnell's ambition. The two elections of 1910 had each returned a Liberal ministry dependent upon Irish Nationalist support. But they had abolished the lords' veto, and Home Rule had become part of the Liberal and Labour programs in England. Under the Parliament act, the Home Rule bill of 1912 was apparently ensured of enactment after two years' delay if it passed the commons a second time during the same parliament.

Opposition in Ulster.—The Unionist party adopted unexpected methods to defeat its progress. Andrew Bonar Law replaced A. J. Balfour as its leader in 1911, and he gave full support to the threats of defying parliament by armed resistance in Ulster. Thousands of Ulstermen signed the Ulster covenant of resistance to Home Rule (1912) and Sir Edward Carson (*see* CARSON, EDWARD HENRY CARSON, Baron), as leader of the Ulster Unionists, announced that a provisional government would be formed there to defeat Home Rule. Both Carson and J. H. Campbell represented Dublin university at Westminster, but every other Irish constituency outside Ulster had returned a Nationalist, almost without an exception, for many years. Even in Ulster, 16 of the 33 members were Nationalists, and a by-election for Derry city in 1912 was won by a Home Ruler, so that the province had a majority against the union. The Ulster Unionists for some time proclaimed their intention of defeating Home Rule for all Ireland by defying its operation; but they gradually fell back on a demand for exclusion of all Ulster from its scope. Redmond's claim that there was "no Ulster question" implied that even among the Ulster members there was then a majority for Home Rule. But his claim hardened the Protestant and Unionist resistance in the heavily populated counties around Belfast. Down, Antrim, Armagh and Derry all contained large Unionist majorities and were predominantly Protestant or Presbyterian. Donegal, Cavan and Monaghan had strong Home Rule majorities, and Tyrone and Fermanagh each had a small total majority for Home Rule.

No serious consideration had been given to separate treatment for Ulster, but the Unionists claimed exclusion for the whole province. They organized the Ulster volunteer force, for which the veteran Field Marshal Lord Roberts chose Gen. George Richardson as commander in chief. Arms for the Ulster volunteers were soon imported in defiance of the law, while Bonar Law and most of the leading English Unionists gave full encouragement to Carson's whirlwind campaign inciting to disorder. At Westminster, Redmond had apparently won the political game by the accepted rules, but the Unionists were openly organizing defiance of parliament in Ulster. They were boasting of active sympathy among most of the serving officers in the army. Their boasts became formidable when all officers in the cavalry brigade at the Curragh, led by Gen. Hubert Gough, suddenly announced in March 1914 that they would resign if called upon to move into Ulster. Mobilization orders had not even been issued, but there had been raids on war office depots in Ulster and reinforcements were needed, before Carson achieved a spectacular success in landing a large cargo of arms from Germany at Larne on April 24, 1914. The Curragh mutiny was followed by the resignation of Col. J. E. B. Seely as war minister, and Asquith personally assumed control.

BELFAST TELEGRAPH

SIGNING OF THE ULSTER COVENANT OF RESISTANCE TO HOME RULE IN BELFAST, SEPT. 28, 1912

(Front row from left to right) the marquis of Londonderry, Sir Edward Carson (signing) and Captain James Craig, later Lord Craigavon, first prime minister of Northern Ireland

The Irish Volunteers.—Before these sensational incidents, the Ulster volunteer movement had provoked inevitable countermeasures among the Nationalists. Faith in the efficacy of parliament had been rudely shaken by Carson's successful defiance. The younger Nationalists, especially in Ulster, considered Carson's aggressive realism more effective than Redmond's patient negotiations. In Nov. 1913 the Irish volunteers were launched in Dublin, to counteract the Ulster volunteers. They spread swiftly, especially in Ulster, and still more after the Curragh episode in March. Redmond was convinced that the Home Rule bill would become law that autumn and that only a European war could delay its operation. But the threats of civil war in Ulster were reinforced by large cargoes of imported rifles, and the British army's readiness to enforce order in Ulster was seriously in doubt. The Irish volunteers were gaining such support among the younger Nationalists that Redmond found it necessary to assume control of an unconstitutional movement which he instinctively distrusted. In May 1914 the Irish volunteers agreed to expand their former provisional committee, which consisted mostly of unknown men, into a larger directorate composed chiefly of Redmond's supporters.

By the early summer Ireland was thus confronted with the prospect of civil war, while the rival volunteer forces collected arms wherever they could. The outlook was so menacing that in July the king convened a conference of leaders on both sides at Buckingham palace to find an agreed solution. Carson's earlier efforts to prevent an Irish parliament were then reduced to demanding exclusion of Ulster, and the issue had been narrowed to a definition of the area for exclusion. Redmond had agreed reluctantly to a strictly temporary exclusion of those counties which had Unionist majorities. He would not concede Tyrone or Fermanagh or Derry city, and he insisted on exclusion only for a short period. After several days the conference reached a deadlock and reported its failure to agree.

Meanwhile a small cargo of arms for the Irish volunteers had been bought in Belgium and was brought secretly into Dublin bay at Howth on July 26. A parade of Irish volunteers unloaded the cargo but was challenged by military and police on returning to Dublin. An armed collision on the Dublin quays resulted in many civilian casualties. The Ulster volunteers had run their cargo at Larne with impunity, and this discrimination against the Nationalists aroused fierce popular resentment. Redmond obtained the adjournment of the house of commons in protest, but events swiftly eclipsed the crisis in Ireland when the Germans invaded Belgium on Aug. 3.

World War I.—When Sir Edward Grey announced the declaration of war, Redmond intervened to promise full Irish sympathy. He made an immediate offer that the Irish volunteers of both forces (renamed the national volunteers) would defend the coasts of Ireland and that all troops could be withdrawn. Soon afterward he undertook an open campaign to encourage recruiting for the Irish regiments in the British army. Great numbers of young Irishmen enlisted rapidly, and three new Irish divisions were recruited, one of them in Ulster. But Redmond's assurances that the Irish recruits would serve together soon led to bitter disappointment. Lord Kitchener, who had become war minister, had a deep distrust for Irish regiments, and he refused even a distinctive flag to the southern Irish divisions, though the Ulster division was allowed even to elect its own officers. Redmond's protests were unavailing, and the first enthusiasm for war service was soon deadened by official discouragement. But the flow of recruits continued steadily until it was computed that more than 200,000 had gone from Ireland without any measure of conscription.

Kitchener's attitude had also stimulated the more extreme Nationalist wing of the Irish volunteers, who had protested against Redmond's recruiting campaign, and they seceded as a separate force. Military repression, by censorship and by prosecutions for alleged seditious behaviour, soon increased disaffection. The original organizers of the Irish volunteers had consisted largely of recent recruits to the old Fenian Irish Republican brotherhood (I.R.B.), which had been lately revived in the United States. The Irish Republican brotherhood had discerned new prospects of

anti-English intervention in case of war in Europe, and Carson's successful defiance of parliament had stimulated anti-English feeling in the United States. The supreme council of the Irish Republican brotherhood had decided, immediately after war broke out, that the long-delayed opportunity for an armed rising in Ireland must now be seized. Steps were taken to solicit help from Germany, and arrangements were made for regular secret instructions to Ireland from the United States. Membership of the secret Irish Republican brotherhood was very restricted, and its influence was not recognized until long afterward. Before the end of 1914 full plans had already been made for the revolutionary outbreak which took the country by surprise on Easter Monday, 1916.

Redmond's national volunteers were then almost moribund, because the more active members had either gone to war service or seceded. The republican Irish volunteers, more active though less numerous, had been drilling intensively with a view to serious action. They were ostensibly led by Eoin (John) MacNeill, though the I.R.B., which had planned an insurrection, kept him in ignorance. The I.R.B. had been in touch with Sir Roger Casement (*q.v.*) during his futile mission to Germany and knew that he had obtained only a small cargo of obsolete arms. Before Casement was arrested in County Kerry after landing from a German submarine on April 21, 1916, and the German arms ship was sunk at sea, they had planned to rise on Easter Sunday, April 23. But MacNeill forestalled them by cancelling all mobilization orders, and only about 2,000 out of the small total force available were actually engaged on Easter Monday, when the general post office and other parts of Dublin were suddenly seized. For a week Dublin was paralyzed by street fighting until bombardment or fires compelled Patrick Pearse (*q.v.*) and his colleagues to surrender.

Asquith went at once to Ireland for a short visit, and announced openly that the former system of government there had completely broken down and a new departure was necessary. Lloyd George was appointed to attempt a final settlement by negotiating with both Irish parties. Each interpreted his offer differently and agreed to temporary concessions which were repudiated when the truth became clear. Redmond had persuaded the Ulster Nationalists to accept exclusion for six counties for six years only, while Carson had surrendered his claim to the three western counties of Ulster on condition that the rest got permanent exclusion. Bitter feeling had been aroused by the prolonged succession of executions and the deportation of a great number of political suspects. Redmond had vainly insisted that only a few exemplary sentences should be imposed, for what he described as an un-Irish conspiracy, inspired and financed by Germany. Lloyd George's part in the negotiations only strengthened the growing sense of betrayal, while the Home Rule act was still in abeyance. Sinn Féin candidates were put forward at by-elections and received overwhelming support. Popular sympathy with Sinn Féin was immensely increased by Lloyd George's decision to apply conscription to Ireland early in 1918. A general surge of protest was supported by a resolution from the Irish bishops at Maynooth, who denounced conscription in Ireland as being morally unjust. When this protest prevailed, Sinn Féin gathered momentum everywhere. At the elections in Dec. 1918 it captured almost every seat which had formerly been held by Redmond's party.

P. A.—REUTER PHOTOS LTD.

THE RUINS OF THE DUBLIN GENERAL POST OFFICE, AFTER IT WAS SHELLED DURING THE EASTER RISING, 1916

The Growth of Republicanism.—Irish influence in the United States had grown steadily since the great famine, and bitter memories still inspired anti-English sentiment even during the war. The Nationalist revival in Ireland was being harshly repressed, and, though the Home Rule bill had been enacted late in 1914, a suspensory act delayed its operation till the war ended. In a fast-changing world, Asquith's act seemed utterly inadequate. Sinn Féin was demanding an independent republic, claiming the right of national self-determination which Pres. Woodrow Wilson asserted to be the Allied war aim. Increasing pressure from the United States compelled Lloyd George to make new efforts; but the Irish convention which he appointed in 1917 to frame an Irish constitution by consent contained no representation of Sinn Féin. Many of the new members elected at the end of 1918 were then in prison for political agitation, and the Irish-Americans soon organized support for Ireland's representation at the peace conference at Versailles.

Agitation in Ireland intensified, and the Irish volunteers began to conduct guerrilla war against the military and armed police. As the Irish Republican army (I.R.A.) they soon engaged in widespread ambushes and attacks on barracks and convoys, and the government retaliated with ruthless reprisals. A large proportion of the Irish police resigned, and they were replaced by recruits from England, who became known as the Black and Tans, from their temporary uniforms. A new force of auxiliary police, recruited wholly from demobilized officers who lacked other employment, was organized under Gen. Hugh Tudor. They undertook a campaign of reprisals, culminating in setting fire to a large part of Cork, after similar outbursts in Balbriggan and other towns.

This open competition in violence soon brought deep discredit upon British rule, and a wave of protest arose in England, as well as in the United States and the dominions. The *Times* of London joined vigorously in denouncing the excesses of the crown forces and put forward a constructive solution in proposing dominion status for a new Irish parliament. Lloyd George made yet another attempt by carrying the Government of Ireland act of 1920, which was to establish two Irish parliaments, with equal though very limited powers, one for southern Ireland and one for the six counties of northern Ireland. There was to be a joint council representing both Irish governments, which was to propose future extensions of independent authority when opportunity arose. But Sinn Féin refused to bring the southern parliament into operation, though it contested the elections and won 73 of the 102 Irish constituencies, including every seat outside Ulster except the four allotted to Dublin university. The Northern Ireland parliament was brought into being, though the Ulster Unionists protested that they preferred to remain within the union. King George V went to Belfast and formally opened the new parliament on June 22, 1921. He had been deeply concerned over the chaos in Ireland, and his speech contained a deliberate appeal for reconciliation. Gen. Jan C. Smuts and other dominion statesmen had been urging a settlement on the lines of offering dominion status and had gained the king's support. Within a week Lloyd George offered a truce to Eamon de Valera (*q.v.*) as the Sinn Féin leader and invited ne-

gotiations which were soon opened and resulted in the Anglo-Irish treaty of Dec. 1921. For the subsequent history of Ireland, *see* IRELAND, REPUBLIC OF: *History;* IRELAND, NORTHERN: *History.* *See* also references under "Ireland" in the Index. (D. G.)

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IRELAND, CHURCH OF. The Church of Ireland (embracing both the Republic of Ireland and Northern Ireland), in communion with the Anglican Church, traces its episcopal succession from the pre-Reformation church in Ireland. The beginnings of Christianity in Ireland are difficult to establish but it is more than likely that contact with the western shores of Britain had led to considerable evangelization before the coming of Patrick (*c.* 432), the patron saint of the country. The facts of the life of Patrick himself are not readily separable from the legend that surrounds them and it is likely that much that has been attributed to him was the work of other men. Undoubtedly, however, someone of the name came to be the "bishop of the Irish people." (*See* PATRICK, SAINT.)

Early Church.—The early church was monastic, without parochial or diocesan divisions or central government. What authority there was lay in the hands of the abbots, and the powers of bishops were limited to their purely spiritual functions. At a very early date the monasteries became centres of learning with a reputation extending far outside Ireland. Latin, doctrinal and moral theology and the Bible were chiefly studied, and a high standard in craftsmanship was attained. Many examples exist of the work of the monks in leather and precious metals; and their illuminating of manuscripts, particularly copies of the Scriptures, culminated in such masterpieces of the art as the Book of Durrow and the Book of Kells. The most celebrated of the monastic schools were those at Clonard, County Meath (founded by Finnian); Bangor, County Down (Comgall); Moville, County Down (Finnian of Moville); and Clonfert, County Galway (Brendan). (*See* also CELTIC CHURCH.)

The influence of these monasteries upon Britain and the continent of Europe from the latter part of the 6th century onward is attributable not only to their reputation as teaching centres but to the fact that from time to time companies of monks detached themselves to wander in search of places in which to practise their ascetic rule. It was this "wandering for the love of Christ" rather than any conventional missionary zeal that took Irish monks not

only to Britain but deep into Europe, probably to Iceland and possibly, even, to the coast of North America. Of these *peregrini* St. Columba and St. Columban (*qq.v.*) are typical as well as probably the most influential.

Columba, who was of royal blood, studied under the two Finnians at Moville and Clonard and later himself established monasteries in a number of places including Durrow, County Offaly. About 563 he left Ireland with 12 companions and settled on the island of Iona (*q.v.*), off the western coast of Scotland. There he established a monastery which was to become the base for the conversion of a large part of Scotland and, eventually, of northern England.

Columban went, about 590, by way of Britain to Gaul, where he settled in Annegray in the Vosges mountains. Later he built a permanent monastery at Luxeuil. A man of strong personality, he quarreled with the French bishops, withdrew to Switzerland and subsequently to Italy, where he died at his monastery of Bobbio. Other Irish monks who made their mark on the continent were Gall in Switzerland, Fergal in Austria, Disibod in Germany and Fursey in France. This missionary activity by Irish monks was most intensive during the 7th century but continued for the succeeding two or three centuries. During this latter period the work of Johannes Scotus Erigena, theologian and philosopher, and Dicuil, a geographer who described journeys by Irishmen to Egypt and Iceland, is notable.

The Irish church was proud of its independence of Rome and clung firmly to its own usages in preference to those adopted by the rest of Christendom. Its method of calculating the date of Easter was maintained in face of protests from advocates of the Roman calendar until 704. Even after this the Irish church did not submit to any real jurisdiction from Rome (as in the appointment of bishops and archbishops) until the 12th century.

The Norse invasions, beginning at the close of the 8th century, precipitated a decay of culture and learning in Ireland. Many of the old monasteries had fallen into secular hands, and about the middle of the 12th century St. Malachy (*q.v.*), friend of St. Bernard, introduced a new monastic system based on that of the Cistercians. The weakness of an unco-ordinated ecclesiastical organization became evident, and the influence of Rome, through Canterbury, began to be felt for the first time. English bishops, chief among them Gilbert of Limerick, possessed themselves of the most important sees. About 1110 Gilbert held a synod at Rathbreasail which divided Ireland into 25 sees subject to the primacy of Armagh. Subsequently the pope sent legates to assist at the bringing of the Irish church into conformity with the rest of western Christendom, and the synod of Kells (1152) created four provinces with Armagh, Dublin, Cashel and Tuam as archbishoprics. The final step in the process of reform was taken at the synod of Cashel (1171–72), when obedience to Rome was accepted. There, also, regulations were made for baptism and marriage, tithes and papal tribute. The native liturgies were abandoned and the usage of the English church was adopted.

The medieval history of the church in Ireland follows that of the country as a whole. Most of the country was only at intervals made conscious of English overlordship, and the tribal kings continued to wield authority. In the church, Englishmen were appointed to the more important positions, the native orders were gradually replaced from abroad, but most of the secular clergy were Irish and retained something of the old Celtic spirit. It is possible that had this remnant of independence been considered and fostered at the Reformation the Church of Ireland might have become the church of the majority. In the event, a quite different course was followed. The native Irish were antagonized and came to look on the attempt at reformation as a political expedient and a weapon of conquest (*see* IRELAND: *History*).

Reformation.—The Reformation period began with the passing in 1537 of the Irish Supremacy act, which asserted the English king's supremacy in the Irish as in the English church. But it was a very superficial Reformation: the dissolution of the monasteries was only partial, and scant knowledge of English meant that liturgical changes were few. No attempt was made to win the mass of the Irish people to Reformation principles, nor were the differences of religious outlook of succeeding English sovereigns brought home to the Irish as they were to the people of England. At Mary I's accession five bishops either abandoned or were deprived of their sees; but the Anglo-Irish who remained faithful to the Reformation were not subjected to persecution such as would have been their fate on the other side of the Irish sea. Again, under Elizabeth I, although two bishops were deprived for open resistance to the new order of things and stern measures were taken to suppress treasonable plotting against the constitution, the uniform policy of the government in ecclesiastical matters was one of toleration. James I caused the Supremacy act to be rigorously enforced, but on political rather than religious grounds. Charles I sold concessions to Irish Roman Catholics, taking little interest in the progress of Irish Protestantism. The earl of Strafford, however, inaugurated a period of rigorous high Anglicanism, to be followed, under Cromwell, by strictness in the opposite direction, but still toward the strengthening of English rule. In this period James Ussher, appointed archbishop of Armagh in 1625, stands out for successfully defending the independent character of the Irish church against the reforms of William Laud, archbishop of Canterbury. (*See* USSHER, JAMES.)

On the accession of Charles II, the church was strengthened by the translation of John Bramhall (the most learned and zealous of the prelates) from Derry to the primatial see of Armagh and by the consecration of 12 other bishops, among whom was Jeremy Taylor (*q.v.*). In 1658, largely through the work of William Bedell, bishop of Kilmore, the Bible had been printed for the first time in the Irish language, an event that fell just a century too late.

The stricter penal code introduced by the English government (1702–15) made the church more unpopular. The English government for political reasons tended to choose Englishmen for many Irish bishoprics, and the consequent involvement of higher clergy in state affairs proved very weakening to the church. In 1703, at the request of the clergy, the Irish convocation met after a 37-year interval and tabled many necessary reforms. To William King, bishop of Derry and subsequently archbishop of Dublin, was mainly attributable the reorganization of the work of the church, and the impulse he gave it was felt all through the 18th century. This was also the period of Jonathan Swift and George Berkeley. The later 18th century saw the Irish parliament asserting its independence, and at the same time there arose an atmosphere of reform within the church, stimulated by new pride in its missionary heritage and by a rising evangelical movement. Schools and charitable institutions were founded. Roman Catholics and Presbyterians alike received more tolerant treatment, but the privileged position of the Church of Ireland minority remained a grievance. The Church of Ireland perhaps for the first time began to take its place as an independent national church, but, once again, political considerations were to hinder development.

Disestablishment.—The Act of Union of 1800 was passed as a remedy for the disaffection that had culminated in the rebellion of 1798. By it the parliaments of England and Ireland were united and the church became a part of the United Church of England and Ireland. But the dissatisfaction felt by the majority of Irishmen because of the continued existence of the established church in a privileged position became increasingly plain as the years passed. Discontent was increased by the fact that the church drew its tithes largely from Roman Catholic tenant farmers. In the 1830s the agitation against this privilege became strong enough to be known as the tithe war. The census of 1861 showed that less than one-eighth of the population belonged to the established church, four-fifths being Roman Catholics. Once this was made clear, the passing of the Act of Disestablishment was only a question of time. Introduced by William Gladstone and passed in 1869, it became law on Jan. 1, 1871.

The church was thus suddenly thrown on its own resources and called on to reorganize its ecclesiastical system as well as to make provision for its future clergy. The spirit of the church of that time is shown by the fact that in 1865, with disestablishment imminent, the foundation stone was laid in Cork for an elaborate cathedral for that diocese. Many other cathedrals and churches were restored during the 20 years following the passing of the act.

Polity and Worship.—A convention of the bishops, clergy and laity was summoned in 1870, and its first act was to declare the adherence of the Church of Ireland to the ancient standards and its determination to uphold the doctrine and discipline of the Catholic and Apostolic Church, while reaffirming its witness, as Protestant and Reformed, against the innovations of Rome. Under the constitution then agreed on, the supreme governing body of the church is the general synod, consisting of the bishops and 208 clerical and 416 lay representatives of the several dioceses, whose local affairs are managed by diocesan synods. There are two primatial sees, Armagh and Dublin. Under the 1959 legislation diocesan bishops are elected by an electoral college representative of all dioceses of the province in which the vacancy has occurred. Failing such election, appointment passes to the house of bishops. Private patronage of benefices is almost nonexistent, and appointments are made by boards of nomination composed of diocesan and parochial nominators under the chairmanship of the bishop.

The Book of Common Prayer was twice revised after 1662—in 1878 and in 1924–26. Changes were slight, but criticism was directed against the "Constitutions and Canons Ecclesiastical" by which are forbidden the placing of the cross on the altar, the making of the sign of the cross by clergy or laity (except where ordered in the baptismal office) and bowing to the altar. There is a high degree of uniformity in ceremonial throughout the church.

The finances are controlled by the Representative Church body, to which a sum sufficient to provide life annuities for the then existing clergy (2,043 in number) was handed over by the Church Temporalities commissioners in 1870, together with £500,000 in compensation for private endowments. The annuities provided were subsequently commuted for a capital sum. So skilfully was this fund administered, and so generous were the contributions of clergy and laity, that the total assets of the Representative body amounted in 1960 to almost £14,000,000. Church of Ireland membership was approximately 500,000, or less than one-eighth the combined population of the republic and Northern Ireland.

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IRELAND, NORTHERN, the six northeastern counties of Ireland, enjoying a measure of self-government within the United Kingdom of Great Britain and Northern Ireland. Established by the partition of the island following the Government of Ireland act of 1920, Northern Ireland comprises the counties of Antrim, Armagh, Down, Fermanagh, Londonderry and Tyrone, together with the county boroughs of Londonderry and Belfast, the capital city and seat of government. The area is 5,459 sq.mi., or about one-sixth of the whole island, but the population, 1,425,462 in 1961, is nearly one-third of the total. The population density (260 per sq.mi.), while little more than one-third that of England and Wales, greatly exceeds that of the Irish republic and reflects a more industrialized economy. The frontier with the Republic of Ireland, "the border," is about 250 mi. long, following a tortuous course across the Caledonian grain of the landscape. The seacoast, in many places rocky and picturesque, forms the boundary on the north and east from Lough Foyle to Carlingford Lough, both of which have long been points of entry, far outstripped in importance, however, by Belfast Lough. Northern Ireland contains all the counties of the historic province of Ulster (*q.v.*) except Cavan, Donegal and Monaghan and is often referred to as Ulster. Most of the province was colonized during the plantations of the early 17th century, and Scots settlers in particular, continuing to move in during the 18th century, have contributed to the character of this part of Ireland. The physical geography, geology, people, archaeology and history up till 1921 are described in the article IRELAND. (X.)

HISTORY

The first parliament of Northern Ireland was opened by King George V on June 22, 1921, the first prime minister being Sir James Craig (*see* CRAIGAVON, JAMES CRAIG, 1st Viscount), who took office at the head of a Unionist government, which had to deal with a disturbed country, troubled by bombings, shootings and incendiarism. From the close of 1921 there was civil war in the Irish Free State, and this overflowed into Northern Ireland, making the years 1922 and 1923 very turbulent. During 1922, in the course of these disturbances, 232 persons were killed in Northern Ireland, including two Unionist members of parliament, and nearly 1,000 were wounded. Extensive damage was done to property.

In accordance with the agreement which the United Kingdom government had made with the Free State, a boundary commission was established to investigate possible frontier changes between the Free State and Northern Ireland. The commission failed to agree and presented no report; negotiations were then opened between the governments concerned. A tripartite agreement was signed in 1925 between the governments of the United Kingdom, the Free State and Northern Ireland, agreeing to maintain and respect the existing frontier.

A new phase in political affairs opened in 1932 with the advent of Eamon de Valera to power in the Free State. Tension arose in Northern Ireland with his policy of growing dissociation from the United Kingdom and the commonwealth and his substantial repudiation of the binding character of the 1925 agreement. His tariff policy also made the frontier between Northern Ireland and the Free State into a formidable economic barrier and rendered any possibility of being merged in the Free State extremely alarming to many interests and classes of people in Northern Ireland whose prosperity depended upon a flourishing export trade. The government of Eire, as the Free State then came to be called, made emphatic irredentist claims upon Northern Ireland.

During the same period Northern Ireland suffered from serious industrial depression and a recession of the export trade, while unemployment remained in the neighbourhood of 70,000 over long periods.

The Unionist party, standing for the maintenance of the union with Great Britain, gained a strong majority at every general election in Northern Ireland, whether for the parliament of Northern Ireland or for the province's representation at Westminster. Though united on this issue, the Unionist party allowed and experienced differing opinions in its ranks on a good many other issues. Sir James Craig (created Viscount Craigavon in 1927) was prime minister until his death on Nov. 24, 1940, when he was succeeded by John Miller Andrews, formerly minister of finance. In May 1943 Andrews was succeeded by Sir Basil Brooke (who was created Viscount Brookeborough in 1952).

The strategic importance of Northern Ireland, covering Britain's main shipping route, providing a landing place for the U.S. forces and filling the gap created by Eire's neutrality, was very great and was emphasized by Winston Churchill, Gen. Dwight D. Eisenhower and other war leaders. In addition the agricultural and industrial resources of the province were very valuable. Belfast constructed 600,000 tons of merchant shipping, a tenth of the output of the whole United Kingdom, as well as doing extensive admiralty work, including the building of six aircraft carriers, three cruisers and several other large ships, making a total of 140 warships of all sizes and 123 merchant ships. Northern Ireland produced other strategic materials and weapons, and because of its industrial importance Belfast was the target of several destructive air raids.

Postwar Developments.—In the period following World War II, Northern Ireland adopted schemes of social insurance, free health services and other aspects of the welfare state as they were introduced in Great Britain. Though a policy of nationalization was denied, steps were taken to unify a number of public services under newly created public authorities. Road transport had already been treated in this way in 1935, and the principle was extended to rail transport and electricity. As new types of public service came into being, it became necessary to amend the Gov-

ernment of Ireland act, 1920, in the United Kingdom parliament. New legislation was necessary to empower the government of Northern Ireland to proceed with its scheme of social insurance and state health services. But the essential principles of the 1920 act remained, and this amendment was only a natural development of the original principle that the government of Northern Ireland should control its own local affairs and welfare services.

In 1949 Eire, as the Republic of Ireland, withdrew from the commonwealth. To meet various legal problems arising from this, the United Kingdom parliament passed the Ireland act, 1949. This act contained the following provision: "It is hereby declared that Northern Ireland remains part of His Majesty's Dominions and of the United Kingdom and it is hereby affirmed that in no event will Northern Ireland or any part thereof cease to be part of His Majesty's Dominions and of the United Kingdom without the consent of the Parliament of Northern Ireland." Northern Ireland thus acquired something in the nature of federal status within the United Kingdom. This further cleavage with the Irish republic led to a revival of Irish Republican army (I.R.A.) outrages; in 1954 army barracks in Armagh and Tyrone were raided and incidents continued in the following years (the chief targets being communications and government or military installations), but after 1960 I.R.A. activities declined. By contrast the general election of March 1958 for the Northern Ireland parliament gave a clear Unionist victory of 37 out of the 52 seats, and in the United Kingdom elections the following year all 12 members returned to Westminster were Unionists. However, at a by-election in Nov. 1961 for one of the Queen's university seats, a Liberal member was returned for the first time.

Although the total value of trade rose steadily during the early 1960s, the primary industries of agriculture and shipbuilding suffered a long period of unfavourable conditions. The liner "Canberra" was launched in 1960 at Belfast, but conditions were generally unfavourable to shipbuilding, and the shelving of the Cunard line project for another "Queen" liner which might have been assigned to Belfast accentuated the situation. Unemployment was a constant problem, and at times over 40,000 men were out of work, although the average level was considerably lower. The government made serious efforts to meet these changing conditions by encouraging the development of light industries in Northern Ireland, which did bring about a diversification of economic activity. In 1961 the government economic advisory council was set up under Sir Douglas Harkness, permanent secretary to the minister of finance. (Hu. S.; X.)

POPULATION

The population of Northern Ireland has shown an increase at each census since 1891, when the figure stood at 1,236,056. At the 1961 census, a preliminary figure of 1,425,462 was recorded.

More than half the population lives in cities and towns. The boundary of Belfast is very restricted, and a "Greater Belfast" extends considerably into Antrim and Down; the inclusion of this area would bring the city's population to more than 500,000. Londonderry is the only other city with a population of more than 50,000. The following towns had populations of more than 10,000 in 1961: Newtownabbey, Bangor, Portadown, Lurgan, Lisburn, Larne, Ballymena, Newtownards, Newry, Coleraine and Carrickfergus (*qq.v.*).

Area and Population of Northern Ireland

Counties and county boroughs	Area (sq.mi.)	Population 1961			
		Urban	% of total	Total	Density (sq.mi.)
Antrim	1,176	113,353	41.4	273,923	232.9
Armagh	512	49,379	42.0	117,580	229.6
Belfast County borough	28	416,094	100.0	416,094	14,860.5
Down	952	82,600	30.9	267,013	280.5
Fermanagh	715	7,438	14.4	51,613	72.2
Londonderry (excluding county borough)	814	20,186	18.1	111,565	137.1
Londonderry County borough	4	53,744	100.0	53,744	13,436.0
Tyrone	1,261	27,353	20.4	133,930	106.2
Total	5,462	770,147	54.0	1,425,462	261.0

Religion.—About two-thirds of the population is Protestant and one-third Roman Catholic. In 1961 there were 498,031 Roman Catholics, 413,006 Presbyterians, 344,584 Church of Ireland, 71,912 Methodists and 97,929 others in Northern Ireland. (*See* also IRELAND: *The People.*)

ADMINISTRATION AND SOCIAL CONDITIONS

British antecedents, Protestant religion and economic interest caused a large proportion of the population of Ulster to resist all proposals for Irish self-government in the later 19th and early 20th centuries. The Government of Ireland act, 1920, was an attempt to give a measure of self-government to Ireland but at the same time to give the Ulster community guarantees against being placed under the rule of the predominantly Roman Catholic and nationalist majority in southern Ireland. The act set up two legislatures: one in Dublin for the 26 counties of southern Ireland and one in Belfast for the 6 counties of Northern Ireland. These two subordinate governments were to deal with local affairs, and all Ireland was to remain within the United Kingdom and to continue to send representatives to the United Kingdom parliament at Westminster. A common council of representatives from both north and south was to provide a link between Northern and southern Ireland and a means of discussing matters of common interest and extending co-operation.

This plan was accepted as a compromise in Northern Ireland but rejected in southern Ireland, which ultimately received dominion status as the Irish Free State in 1922. With modifications appropriate to these changed circumstances, the Government of Ireland act, 1920, as amended by the Irish Free State (Consequential Provisions) act, 1922, continued to be the basis of the constitution of Northern Ireland.

Constitution.—The essential feature of the constitution is that the province forms an integral part of the United Kingdom of Great Britain and Northern Ireland. Northern Ireland returns 12 members to the United Kingdom parliament and has a liaison agent (for government departments) in London, but within its own area a large range of legislative and administrative functions is delegated to the government of Northern Ireland. The formal source of executive power and the representative of the sovereign in Northern Ireland is the governor. The governor summons, prorogues and dissolves the parliament of Northern Ireland, gives the final assent to its legislation and fulfills other functions performed by the sovereign within the larger field of the United Kingdom constitution.

The parliament of Northern Ireland meets in the Parliament building at Stormont. There is a house of commons of 52 members elected by universal adult franchise from single-member constituencies, with the exception of the university constituency, which has 4 members, and there is a senate or upper house of 26 members, of whom 24 are elected by the house of commons on the principle of proportional representation. Each elected senator holds office for eight years, and half the seats in the senate are vacated every four years. The two other senators are the lord mayor of Belfast and the mayor of Londonderry, who become senators ex officio. The house of commons has a maximum life of five years. Members of parliament receive salaries. Each house elects its own speaker. Legislation going through the Northern Ireland parliament takes a course similar to that in the United Kingdom parliament, with the usual readings and committee stage in each house, but a finance bill can be passed by the commons alone. The houses can meet together in joint session in the event of a deadlock, but this has never occurred.

There is a prime minister of Northern Ireland and a small cabinet of ministers. A minister is permitted to introduce business, answer questions or make a statement in either house, but he can vote only in the house in which he has a seat. Ministers represent the following departments: finance, home affairs, labour and national insurance, education, agriculture, commerce, health and local government. The functions of these departments indicate the range of functions delegated to the parliament of Northern Ireland. A wide range of other subjects is entirely reserved for control and legislation by the United Kingdom parliament, in-

BELFAST TELEGRAPH

THE NORTHERN IRELAND PARLIAMENT BUILDING AT STORMONT, BELFAST; DESIGNED BY SIR ARNOLD THORNELY AND ERECTED IN 1928–32.

cluding the main forms of taxation, problems affecting the crown and succession, decisions about peace, war or neutrality and the armed services, relations with foreign powers or with other parts of the commonwealth, titles of honour, treason, extradition, naturalization, aliens, customs and excise, navigation by sea or air, post office, submarine cables, radio, lighthouses, coinage, weights and measures, trade-marks, copyright and patents. In these and some other matters, unless the exclusion of Northern Ireland is specially provided for, the province is legislated for in the United Kingdom parliament like any other part of the United Kingdom. Northern Ireland, for example, came under all food-rationing regulations which applied to the rest of the United Kingdom during and after World War II.

Political Parties.—After the general elections of May 1962, 34 of the 52 seats in the Northern Ireland parliament were held by the Unionists, who are affiliated to the Conservative and Unionist party in Great Britain and pledged to maintain the constitutional position of Northern Ireland within the United Kingdom. Because of the existence of heavy unemployment, the development and the diversification of industry in Northern Ireland are the most important of the Unionist party's domestic policies.

The Nationalists, who won nine seats, have the political objective of a united, independent Ireland. In pursuance of this policy, the Nationalists are supported by four other members: Independent, Independent Labour, Republican Labour and Eire Labour. The Northern Ireland Labour party, which is not to be confused with any of the above, held four seats. It is recognized by the speaker of the house of commons as the official opposition because the Nationalists, the biggest numerical group on the opposition benches, have refused to fill the role. The party supports Northern Ireland's constitutional position as part of the United Kingdom but is critical of the government's economic and social policies. The Liberal party returned one member.

Local Government.—There are five main types of local government authority in Northern Ireland. There are 6 county councils: Antrim, Armagh, Down, Fermanagh, Tyrone and Londonderry; the 2 county borough councils of Belfast and Londonderry; 9 borough councils, in Ballymena, Bangor, Carrickfergus, Coleraine, Enniskillen, Larne, Lurgan, Newtownards and Portadown; 25 urban district councils for various smaller towns; and 31 rural district councils. These bodies are elected by householders and owners of property in the areas which they serve. With the exception of rural district councils, they have power to levy rates. They work under the supervision of the ministry of health and local government.

Other Administrative Bodies and Public Services.—In addition to the local government bodies, there is a variety of boards and authorities established to do special administrative work or to organize public utility services. Most of these work under the supervision of one of the ministries. Thus the attention of the ministry of commerce is given to several administrative bodies, including the Ulster Transport authority (which is responsible for administering the whole road and rail transport system of the province, with the exception of municipal passenger transport and the work of private road haulage firms in Belfast and Londonderry), the Northern Ireland Electricity board and the Tourist board. Three agricultural marketing boards (for pigs, milk and seed potatoes) have been established under Northern Ireland legislation.

Other administrative bodies are associated with the work of the ministry of health and local government. Two are concerned with health services: the General Health Services board and the Hospitals authority. The Northern Ireland Housing trust builds workers' houses and co-operates with local authorities or acts as agent for them in the building of houses. It is financed by advances of capital from the ministry of finance. Other public administrative bodies include the Belfast Harbour commissioners and the Belfast City and District Water commissioners. Several public bodies established under the United Kingdom government also operate in Northern Ireland, including the British Broadcasting corporation and British European Airways. A number of steamship routes from Northern Ireland to Great Britain are operated by British railways.

Living Conditions.—The growth of Northern Ireland's industry after World War II, and the accompanying increase in prosperity, have meant a considerable rise in general living conditions. In the postwar years the standard of living is estimated to have increased by about 50%. The extent of the development is seen in the figures for firms employing 25 or more persons in the manufacturing industries, construction and services in which salaries and earnings of operatives have more than doubled since 1949.

Although employment continued to rise throughout the postwar years, the high birth rate, coupled with the reduction of labour requirements on the land due to greater mechanization in agriculture, has kept the unemployment figure in the region of from 6% to 9% of the total of insured workers.

In housing there has been a sustained and highly successful drive to provide new and modern living conditions for an expanding population. Since World War II well over 100,000 new permanent houses have been built by private enterprise, local authorities and the Northern Ireland Housing trust. In effect this means that since the war about one-third of the total population of Northern Ireland has been rehoused in modern dwellings.

Health and Social Welfare.—The general medical, dental, pharmaceutical and supplementary eye services are administered by the General Health Services board. These services are available without charge, save for the statutory charges common to the British National Health service, to all persons ordinarily resident in Northern Ireland. A hospital service is also available, administered by the Northern Ireland Hospitals authority.

Health authority services, including maternity services, immunization, aftercare and health education, are operated by municipal health authorities, who work in co-operation with the Hospitals authority and General Health Services board.

The county and county borough councils also act as welfare authorities in their respective areas. They provide residential accommodation for old people and others and are responsible for care of children, the blind and other handicapped persons. They co-operate with voluntary organizations and with the National Assistance board. The Assistance board gives grants and supplements, pensions and other national insurance benefits in cases of need and carries out certain work as agents for other organizations.

A comprehensive scheme of social insurance operates in Northern Ireland. Although separately financed, the plan is similar to that operating in Great Britain. It provides industrial insurance, unemployment benefit, sickness benefit, maternity benefits, retirement pensions and other allowances and grants. The scheme is administered by the ministry of labour and national insurance. Family allowances and noncontributory old-age pensions are also provided.

Justice and Police.—The superior courts in Northern Ireland, including the supreme court of judicature and the court of criminal appeal, are under the jurisdiction of the United Kingdom parliament. The supreme court has two main divisions, the high court of justice and the court of appeal, the former having in turn the three divisions of queen's bench, chancery and assize courts. From the court of appeal there is possibility of further appeal to the house of lords in certain matters, including, by leave

of the court, certain cases regarding the validity of acts passed by the parliament of Northern Ireland.

The inferior courts, dealing with minor civil and criminal matters, are under the jurisdiction of the parliament of Northern Ireland and are the concern of the ministry of home affairs. There are five county court judges, two of whom act as recorders of Belfast and Londonderry. County courts, which have a criminal as well as a civil jurisdiction, are held in 23 towns. Petty sessions courts are normally composed of a single resident magistrate, except in a few cases where two must adjudicate.

The police force, the Royal Ulster constabulary, is under the ministry of home affairs. The strength of the force is approximately 3,200. There is a special constabulary with a small permanent staff of about 100, its ranks being filled by citizens doing part-time training. Its total strength is usually about 10,000.

Education.—The statutory system of education is organized in three progressive stages: primary, secondary and further education. Primary and secondary education is provided in grant-aided schools that are attended by all but a small number of children. Primary schools provide for children under 11, and after this age those who fail to qualify for a scholarship to a grammar school, or who do not wish to attend a grammar school, proceed to intermediate schools. Secondary intermediate schools make possible the teaching of a wide variety of subjects, while technical intermediate schools provide specialized courses with emphasis on science and mathematics. All grammar schools provide an academic type of secondary education. There are many scholarships in higher education, and extensive technical education facilities are also available. There are two general training colleges for teachers which are financed by the ministry of education and students' fees. Three other teacher-training colleges are in operation, two operated by the Belfast County Borough Education committee for training of teachers of art and of domestic science, and the third, operated directly by the ministry of education, provides a three-year course for women teachers of physical education.

Queen's university, Belfast (founded as Queen's college in 1845; university status 1908), is a self-governing university. It receives parliamentary grants and also grants from local government authorities. It has about 4,500 students. Magee University college, Londonderry (established 1865), provides courses leading to the arts and economics degrees of the University of Dublin and Queen's university, Belfast. (X.)

THE ECONOMY

Despite considerable industrial development, Northern Ireland is mainly an agricultural country; agriculture ranks first both in the value of its output and in the number of people it supports. Many of the raw materials of industry are imported, and this imposes a burden on production costs. The continued concentration of manufacturing industry in the coastal towns is therefore to be expected. Nevertheless, expansion of population in Belfast and surrounding districts raises many planning problems not only for the metropolitan area but also for the remoter parts of the interior which are being depopulated.

Agriculture and Forestry.—The system of landholding, which replaced the notorious short tenancies of earlier times, was established by various Land Purchase acts between 1869 and 1925. Under them the land was sold to the occupiers, and most of the 74,000 holdings still pay land purchase annuities to the Northern Ireland government. Despite emigration and amalgamation, holdings are very small, nearly 60% being under 30 ac. Less than 6% exceed 100 ac., and only 1 farm in 14 employs permanent agricultural labour. The small family farm is a legacy of former subdivision, a custom established by tradition and persisting down to the Great Famine of 1846. The flax acreage, once extensive, has declined and now amounts only to a few hundred acres, though production was greatly expanded during World War II. Mixed farming is the rule. A large proportion of the crops grown goes to feed livestock and poultry, and farm incomes depend mainly on the sale of livestock and livestock products, including dairy produce. Oats, hay and potatoes are common crops, but wheat and barley production is mainly confined to relatively dry lowlands, such as the Ards peninsula in County Down. Barley production, however, is on the increase. Grass seed and seed potatoes for export are important cash crops, particularly in the Lough Neagh lowlands. North Armagh specializes in apples and soft fruits. Poultry, increasingly kept under the deep litter system, number over eight per head of the human population. There are approximately 1,000,000 cattle, and both sheep and pigs, whose numbers have been more variable, had reached about the same figure by the early 1960s.

The small owner-occupied family farm, now partly mechanized, is well adapted to quality production. With government inspection and marketing schemes, farm products have gained a high reputation for reliability. The main exports, in order of value, are fat and store cattle, eggs, bacon, milk products, potatoes, poultry, wool and fruit.

Only 1% of the land area of Ulster was classed as forest or productive woodland, mostly associated with landlords' demesnes, until after World War II. Reforestation on any scale was frustrated by the small size of the landholdings and by the joint ownership of many mountain grazings. A forestry policy, however, is being vigorously pursued by the ministry of agriculture. Over 1,500 men are now employed in the forestry service, and it is planned to expand the planted acreage in the 65 state forests. Much marginal land on the lower slopes of the hills can most profitably be utilized in this way, and considerable benefits are likely to accrue to employment and amenities in rural areas.

Fisheries.—Northern Ireland possesses both inland and sea fisheries of considerable value. The principal salmon fisheries are in the tidal portions of the rivers Foyle, Bann and Bush and at several stations along the coast. Trout and pollan are netted in Lough Neagh, and eels are caught there and in Lough Erne, but the bulk of the eel catch, which is marketed in London, comes from weirs on the lower Bann. Small fishing fleets operate from the harbours of Ardglass, Portavogie, Annalong and Kilkeel in County Down, taking whiting with the seine in winter and herring with the trawl in summer. Prawns (scampi) are caught between seasons. Inshore trawling and line fishing for plaice, skate and cod are pursued on the north coast of County Antrim.

Tourism.—The tourist industry has received statutory support since 1948 and has profited from the province's possession of such natural phenomena as the Giant's Causeway (*q.v.*), as well as from its wealth of antiquities and legends. Efforts have been made to improve tourist facilities and to attract a greater variety of visitors, the bulk of whom now consists of family parties from Scotland and northern England. An increasing number of visitors from North America are attracted in the search for ancestral homes, Ulster having contributed many emigrants in pre-Revolutionary times. The annual value of the tourist trade is estimated to be about £11,000,000.

Industry.—The textile industries, among which linen is traditionally the strongest, are the most varied and widely distributed of Northern Ireland's manufacturing industries. Most of them are located, however, in Belfast or within a 30-mi. radius of it. Flax, once home grown, is now imported from Belgium, the Netherlands and the Baltic lands. Spun rayon cloth has largely taken the place of linen, and cotton cloth as well as various mixtures are produced. The finishing trade, including bleaching, dyeing and printing, is well developed and attracts unfinished cotton and rayon goods from Great Britain. In addition there are other textile products of many kinds, both long-established manufactures, such as ropes, woolen goods and poplin, and new developments, such as viscose rayon yarn, hosiery and carpets. The Belfast ropeworks produces all classes of cordage, twines and fishing nets and has a large export trade. About 100,000 workers are employed in the textile industries, a declining proportion, now less than half, being in the linen industries, which have a capacity of 600,000 spindles and 23,000 looms.

The manufacture of clothing is carried on in many centres, notably Belfast and Londonderry, which specializes in shirts and pajamas. The industry employs about 25,000 workers. Among other long-established industries are tobacco, whisky and mineral water (soft drink) manufactures. Second only to the textile industries

in importance are shipbuilding and engineering, employing about 50,000 people, the largest single unit being the shipyards of Harland and Wolff at Belfast. The output capacity is of the order of 200,000 tons per year, and well over 100,000 tons of merchant shipping are normally produced, in addition to admiralty contracts. The aircraft industry, established on an adjacent site in 1937, employs about 8,000 workers. Other engineering manufactures are textile machinery, ventilation plants, turbines and agricultural machinery. The scope of the industry has been expanded to include a variety of precision and light-engineering goods, such as radios and electrical products and accounting machinery. The need for diversification of industry has been recognized since 1932 by government acts enabling capital grants and other forms of assistance to be given to new industries. Government-built factories, for instance, are provided and let at low rents. In 1955 the Northern Ireland Development council was established with the object of attracting new industries to assist in reducing unemployment: it is directing its attention particularly to industrialists in the United Kingdom and North America.

Mining and Power.—Small quantities of coal are mined, mainly near Coalisland, where, however, fire clay is a more important product. Extensive deposits of iron ore and bauxite, contained in the Tertiary interbasaltic beds of County Antrim, have been worked spasmodically, but they are of poor quality. Quarrying, for roadstone, limestone and granite and for sand and gravel, is an expanding industry, and among rare minerals valuable deposits of diatomite are worked in the lower Bann valley.

No large-scale hydroelectric schemes have been promoted in Northern Ireland, though the Erne loughs supply power to the Republic of Ireland. Hence, power production depends almost entirely upon imported supplies of fuel, which is a critical factor in production costs. The Electricity board and the Belfast corporation are the principal electricity distributing agents, operating to the requirements of the Northern Ireland Joint Electricity committee. An oil-burning station near Londonderry, opened in 1961, brings the available generating capacity to nearly 700,000 kw.

Trade and Finance.—For fiscal purposes Northern Ireland is part of the United Kingdom, and since customs entries are not required for cross-channel goods, the value of this trade can only be estimated. Moreover, these estimates, insofar as they are obtained from the returns of coastwise trade with Great Britain, include goods in transit from countries abroad through Great Britain and are therefore inflated. They are inflated also by the value of goods in transit to and from the Irish republic. In the early 1960s imports continued to exceed exports (in 1960 exports were valued at £334,301,000 and imports at £369,945,000). About 7% (mainly livestock) of the value of imports and 4% of the value of exports were accounted for by trade with the Irish republic. The principal imports were manufactured goods, fuel, raw materials, cereals and tobacco; the chief exports were textile goods, ships, machinery and farm produce, including livestock.

Three banks—the Belfast Banking Co. Ltd., the Northern Bank Ltd. and the Ulster Bank Ltd.—have their head offices in Northern Ireland. Business is also transacted by several other banks having their head offices in London, Dublin and Cork. The three Northern Ireland banking companies, as well as the Bank of Ireland, the Provincial Bank of Ireland Ltd. and the National Provincial Bank Ltd., issue their own notes.

As part of the United Kingdom, residents in Northern Ireland pay the same income tax and customs duties as those in Great Britain and use the same coinage. The bulk of the taxation is imposed and collected by the government of the United Kingdom, which makes certain deductions covering the cost of the armed services and reserved services (the administration of the post office, inland revenue, etc.) and remits the balance (the residuary share of reserved taxes) to the Northern Ireland exchequer. A Joint Exchequer board, consisting of a chairman appointed by the queen and a representative of her majesty's treasury and of the ministry of finance for Northern Ireland, determines the amount and allocation of the residuary share. The Northern Ireland parliament has control of taxation in such matters as death duties, stamp, motor vehicle and entertainment duties. It also raises money from time to time for capital purposes by means of stock and savings certificates.

Transport and Communications.—Northern Ireland is well provided with a close network of public roads, nearly all of which are maintained by local authorities with the assistance of grants from the road fund. The ministry of home affairs is directly responsible for the 380 mi. of trunk roads which carry through traffic. Much-needed improvements are in progress on these and many other roads. There are 2,688 mi. of main roads. The Transport act (Northern Ireland) concluded a series of enactments by which the Ulster Transport authority has become the sole public transport undertaking in the province, besides Belfast, which operates a municipal bus service. The railways have long been in financial difficulties, and altogether since 1920 over half the lines have been closed, leaving about 340 mi. open for traffic. The former Great Northern railway, linking Belfast with Dublin, is operated by the Ulster Transport authority as far as the border with the Irish republic. The high cost of public transport is a critical factor in the economic life of Northern Ireland, but more serious are the heavy sea transport charges which must be met by those industries which both import their raw materials and export their finished goods. Belfast has daily passenger and cargo services to Glasgow, Heysham and Liverpool, and regular freight services to Aberdeen, Ayr, Bristol, Cardiff, Dundee, Greenock, Leith, London, Manchester, Middlesborough, Newcastle, Preston, Stornoway and Swansea. There are daily services from Larne to Stranraer, which specialize in passenger, cargo and car ferry services, and daily ferry and ferry container services are maintained to Preston and Ardrossan. The only other ports with regular cross-channel transport services are Coleraine, Londonderry, Warrenpoint and Newry.

The length of inland waterways now in use is negligible, the only route carrying any goods being the Lower Bann navigation, which has a diminishing amount of traffic between Coleraine and Lough Neagh. The last surviving section of the Lagan canal to be operated was closed in 1958; the Newry Inland, Coalisland, Upper Bann and Strabane canals were abandoned earlier.

Regular daily air services operate between Belfast airport (Aldergrove) and London, Manchester, Liverpool, Birmingham, Newcastle, Leeds, Edinburgh, Glasgow and the Isle of Man. Additional flights to such centres as Bristol and Cardiff are available during the summer months, and charter services are also provided. A freight container service to various English towns was begun in 1960. Much post-office mail is carried by air: surface letters go chiefly by the Heysham route and parcel dispatches by Heysham and Stranraer. The post office in Northern Ireland is a reserved service under the ultimate control of the Westminster government.

Northern Ireland receives the four national radio programs broadcast throughout the U.K.; it is also served by the BBC, Ulster and ITA television facilities.

See also GREAT BRITAIN AND NORTHERN IRELAND, UNITED KINGDOM OF, and references under "Ireland, Northern" in the Index.

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IRELAND, REPUBLIC OF (POBLACHT NA H-ÉIREANN), consists of the 26 counties of Ireland which became the Irish Free State, or Saorstát Éireann, in 1921 under an independent parliament, the *dáil*, with a governor general. In 1937 the country acquired a new constitution and the governor general was replaced

by a president. The 26 counties were then named Eire (Eng. Ireland) with the proviso that legislation did not apply to the six counties of Northern Ireland. At this time the link with the British Commonwealth was retained as "external association," but this was broken by the Government of Ireland act, 1949, when the 26 counties seceded from the commonwealth and became a republic (for the six counties *see* IRELAND, NORTHERN). The republic includes the whole area of the provinces of Leinster, Munster and Connaught, with three of the nine counties of the Ulster province, Cavan, Donegal and Monaghan. In 1921 it was intended that the border should be adjusted after an inquiry into the political sympathies of the inhabitants, but though a commission met, its findings were never published and the border consists of ancient county boundaries. The republic covers four-fifths of Ireland, 27,136 sq.mi.

For *Physical Geography, The People, Archaeology* and *History* (to 1921) *see* IRELAND. (T. W. Fr.)

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I. HISTORY

Establishment of the Irish Free State.—The intensive conflict which took place during and after World War I and is known in Ireland as the Anglo-Irish war resulted in the Irish peace agreement, which was signed in London by British and Irish plenipotentiaries on Dec. 6, 1921. The agreement provided that Ireland should thenceforward have the "same constitutional status in the Community of Nations known as the British Empire" as had the dominions of Canada, Australia, New Zealand and South Africa; "with a Parliament having powers to make laws for the peace, order and good government of Ireland and an Executive responsible to that Parliament." The new dominion was to be known as the Irish Free State. This peace agreement was ratified by the British parliament on Dec. 16, 1921, and became operative when it had also been passed on Jan. 15, 1922, by a meeting of the parliament of southern Ireland convened by Arthur Griffith. The new state included only 26 of the 32 Irish counties, as the northeastern area, known as Northern Ireland, was to decide whether or not it would accept inclusion in the dominion.

The peace agreement had been concluded between the British government and the representatives of an Irish government which it had previously refused to recognize. The Irish representatives held their authority from *dáil éireann* (the assembly of Ireland), which had come into existence in Jan. 1919. The general elections held at the end of 1918 had resulted in an overwhelming majority for Sinn Fein as the party which declared for an Irish republic. All members elected for any Irish constituency were invited to attend an assembly in Dublin on Jan. 21, 1919, but in fact only the Sinn Fein members attended. Acting as a constituent assembly for all Ireland, they then proclaimed the Irish republic in existence, and they elected a president and ministers. Eamon de Valera (*q.v.*) was then in prison in Lincoln jail, but was regarded as president designate. He was to be both national president and chief executive, as in the United States. But the immediate concern of *dáil éireann* in Jan. 1919 was to present Ireland's claim to national independence at the international peace conference which was then assembling at Versailles.

In the period of acute Anglo-Irish conflict which ensued, *dáil éireann* regarded itself as the constitutional legislature of Ireland. The British government did not accept that claim until it signed the treaty of Dec. 6, 1921, and agreed to the establishment of the Irish Free State. The negotiations had been begun in July between De Valera and David Lloyd George, but were soon entrusted to plenipotentiaries, who were appointed by De Valera but required to consult closely with him while the negotiations proceeded. The final agreement was reached in Downing street only after Lloyd George had delivered an ultimatum threatening "immediate and terrible war" if the terms were not accepted at once. Griffith, Michael Collins (*q.v.*) and E. Duggan then agreed to sign, and Robert Barton and Gavan Duffy added their signatures under protest. Their chief objections were to the prescribed oath of allegiance to the British crown and to the provisions which allowed Northern Ireland to remain outside the new state.

During the interval between the assembling of the first *dáil éireann* in Jan. 1919 and the conclusion of the treaty in Dec. 1921, the British parliament had in 1920 passed an act to establish two Irish legislatures, one for the 6 counties of Northern Ireland and the other for the remaining 26 counties. Both parliaments and their executives were to possess identical powers, much more restricted than had been conceded under the prewar Home Rule bill, which had been enacted in Sept. 1914, though its operation was indefinitely suspended. But under this Government of Ireland act of 1920, general elections were held in Ireland so that the two Irish parliaments should be brought to life. In the 26 counties every constituency except Dublin university returned a nationalist candidate; and even in Northern Ireland some seats were also won by Republicans. All except the four members for Dublin university refused to bring the southern Ireland parliament into operation, and it consequently never functioned. But the same Republican members who had been elected in 1920 assembled for the first time on Aug. 16, 1921, in the Dublin Mansion house, after the truce had brought an end to military hostilities. They then constituted themselves the second *dáil éireann*, and all members took the oath of allegiance to the Irish republic while negotiations were proceeding between De Valera and Lloyd George. Soon afterward plenipotentiaries, led by Griffith and Collins, were appointed by De Valera to conclude the peace agreement, which eventually fell short of the full Republican demands.

The Provisional Government.—Although the British parliament ratified the peace agreement on Dec. 16, De Valera immediately repudiated it, on the ground that the plenipotentiaries had departed from their instructions. In *dáil éireann* a long and bitter debate developed, and on Jan. 8, 1922, ratification was passed by a majority of only 64 to 57. De Valera at once resigned the presidency, and Griffith was elected to replace him, but by a majority of only two votes. A provisional government was then appointed under article 17 of the treaty, by a meeting to which all members elected in 1920 for the southern Ireland constituencies were summoned. Those who had opposed the treaty refused to come, and the provisional government was composed largely of men who were little known in public life. Griffith as president remained outside the government, as did Gen. Richard Mulcahy, who then became minister for defense. Collins, who had attained an almost legendary reputation and great popularity by his daring and energy during the Anglo-Irish war, was appointed head of the provisional government. The only minister whose name was well known was Eoin (John) MacNeill, who had long been prominent in the Gaelic league and as founder of the Irish volunteers. The others were still young men. In opposition to the government were De Valera and most of the active leaders of Sinn Fein. The armed forces were still nominally the army of the republic, and their allegiance was divided. The old police force was disbanded, and a new force, the civic guard, was formed at once; but it was to be unarmed.

Griffith and Collins desired an immediate general election to obtain a verdict for the treaty. But De Valera anticipated them by convening a full convention of Sinn Fein delegates, and in the

interests of maintaining national unity Collins then agreed to delay the election. There was still a dim hope of inducing Northern Ireland to come into the new dominion, and an attempt was made by the provisional government to negotiate with Sir James Craig (later Lord Craigavon), the Northern Ireland prime minister. But in Belfast fierce sectarian riots were raging, and these approaches had no success. In the meantime defiance of the provisional government began to spread, and De Valera proclaimed openly that only the Republican *dáil* had legitimate authority. Many of his followers were calling for renewed military action against the British government. Incidents of open defiance and violence became frequent, but Collins was always determined to avoid taking punitive action, though Griffith was believed to consider it necessary. Collins reached an agreement with De Valera, which was announced on May 20, that elections should be held on a basis of putting forward candidates representing both sides in the same proportion as in the existing *dáil*. A coalition government would then be formed after the elections, in which De Valera would have four seats and the protreaty party five. All parties were urged to refrain from proposing candidates other than those selected from this joint panel. Moreover, the election was not to be regarded as a verdict for or against the treaty. But this arrangement was out of touch with general feeling in the country. The Irish Labour party gave a lead in putting forward its own candidates. Many others also came forward, and at the June 16th elections, 34 members were elected who were not on the joint list, all of them being in favour of accepting the treaty. Of the panel candidates who were elected, 58 were protreaty and 36 Republican.

Although faced with this decisive defeat, the Republicans maintained that the republic was still in existence and refused to recognize any other authority than the Republican minority of the second *dáil*. The Irish Republican army (I.R.A.) soon took the law into its own hands, and large areas in the south and west were more or less under its control. Acts of violence and arson became more frequent, and the British government was soon accused in England of having let loose conditions of anarchy without protecting its friends. A crisis arose when Field Marshal Sir Henry Wilson was shot dead on June 22, on his own doorstep in London, by two Irishmen who had served in the British army during World War I. Drastic action to restore order in Ireland was demanded from London, and an open conflict became inevitable on June 28. The Republicans in Dublin seized the assistant chief of staff of the Irish army as a hostage and imprisoned him in the Four Courts, which they had occupied. The provisional government demanded his immediate release and besieged the courts. Serious fighting in Dublin ensued for a week, until Rory O'Connor, who had occupied the courts, blew them up before surrendering. British military equipment and munitions had been supplied to assist the government, and the conflict was assuming a new phase. Meanwhile De Valera, who had escaped to the southwest, was openly supporting the insurgents. Griffith and Collins decided that there could be no further compromise, and Collins assumed charge of the army as commander in chief. The strain had told so heavily upon Griffith that he died suddenly on Aug. 12. Then Collins rashly left Dublin to inspect the military operations in the south. On Aug. 22 he ran into an ambush in west Cork and was shot dead.

The provisional government had thus lost its two most prominent leaders within a fortnight, while De Valera was openly heading the insurgents in the west. The surviving ministers could not even appear openly without armed protection and were obliged to live at the central government offices which had been established in the college of science. Under the treaty the newly elected *dáil* was required to frame its constitution before Dec. 6, 1922, and the new constitution had then to be ratified also by the British government. The new *dáil* was therefore summoned to meet on Sept. 9, in the building of the Royal Dublin society, Leinster house, which later became the seat of both the *dáil* and senate. The building was for some time kept closely guarded.

Its first business was to elect a new president in place of Griffith. None of the acting ministers had yet attained a national reputation, but W. T. Cosgrave (*q.v.*) was older than most of the others, with active experience as a member of the Dublin corporation, and he had shown great competence and energy as minister for local government during the Anglo-Irish war. He was now chosen as president, and the *dáil* also elected a team of 11 ministers whom he proposed. It then had to pass the clauses of the constitution defining relations between the Irish Free State and the crown, and questions of imperial defense, which Griffith had already settled with the British government. In the absence of the Republican deputies, who refused to recognize the new *dáil*, the work proceeded swiftly, and the constitution was ratified both in Dublin and in London by Dec. 6.

Open conflict between the armed forces of the Republicans and of the Free State had ceased by the autumn, but public order and security were still being widely violated in many districts. Courts had not yet been formally constituted, and the new police, or civic guard, had to be organized and trained under great difficulties. Kevin O'Higgins, as minister for justice, insisted that the police must be unarmed, in contrast with the old royal Irish constabulary. They were consequently at a grave disadvantage in restoring public order while irregular Republican forces were still active. The government had to rely on military forces, which were hurriedly recruited until they exceeded 50,000 men. Under such conditions, trial by jury could not be expected to obtain convictions. The *dáil* authorized trial by court-martial, with drastic punishments. But the prisons were already filled with men awaiting trial for reasons which usually had some political pretext. Attacks upon life and property were still widespread, and agrarian outrages were reoccurring. The government decided that the unauthorized possession of firearms must be resolutely punished, and in November it was solemnly announced that four men had been tried, convicted and executed on the sole charge of having revolvers without licence. Other similar trials soon followed, and Robert Erskine Childers (*q.v.*) was likewise executed after he had been found to have a revolver. These executions were fiercely resented by the Republicans and embittered Irish politics for years afterward.

The Cosgrave Ministries.—By Dec. 6 the new Irish constitution had been ratified, both by the *dáil* and at Westminster. The new ministry had to test its own powers while labouring to restore confidence and good order. A crisis arose on Dec. 8, when the *dáil* met to choose a senate under the new constitution. One member of the *dáil* was shot dead and another wounded on their way to the meeting. The government decided upon immediate reprisals against the Republican leaders, and on the following day four of the principal insurgents, one from each province, were shot in prison without trial. They included Rory O'Connor, who had seized the Four Courts in June. Republican opposition to the government became more bitter than ever, but there was soon a lessening of organized resistance. More than 10,000 prisoners had been placed under restraint, and there had been about 50 executions. In May 1923 De Valera openly appealed to the Republicans to cease fighting and to conceal their arms. Soon afterward it was found generally possible to hold public meetings.

Confronted with the problems of civil war and with responsibility for reorganizing the country's normal life, the young ministers under Cosgrave's leadership displayed remarkable ability and energy. They were untrained either by office or by public experience, and they were regarded by their former Republican comrades as having betrayed their oath to the republic. But they received more encouragement than had been expected both from the conservative elements in Ireland and from the British government. At the outset they had applied to London, with success, for the appointment of an Irish nationalist as the first governor general of the Free State. They suggested T. M. Healy (*q.v.*), a veteran of Charles Stewart Parnell's agitation who in later years had shown his active sympathy with Sinn Fein. In approving his nomination, the British government went far toward creating a sense of cooperation and mutual confidence. It also showed its willingness to admit the wider implication of dominion independence, which the Irish ministers soon found other opportunities to press forward. But the first necessity was to restore public order and to bring the new constitution into operation.

The first senate was duly created, and Cosgrave gave generous representation to the former Unionists when he had to nominate half its membership. It elected as its first chairman Lord Glenavy, who as Sir James Campbell had been Sir Edward Carson's principal colleague in the campaign to resist home rule before World War I. But the Northern Ireland government was then headed by Sir James Craig, since Carson's retirement, and it had formally notified the British government that it would not join in the Irish Free State. By April 1923 the Free State had consequently been obliged to establish a customs system along the border of Northern Ireland and also in the Irish ports. Cosgrave was still finance minister, as well as head of the government, and the British financial system was still being operated, though preparations were being made for protective tariffs.

At the end of August, when order was generally restored and De Valera had instructed his followers to abandon armed resistance, the fourth *dáil* was elected, on a basis of adult suffrage for men and women. De Valera retained his personal following, and his party won 44 seats out of 128. Cosgrave's party did not secure half the total of seats; but as the Republicans refused to sit in the new *dáil*, Cosgrave had a majority among those who did attend, and on many issues he had general support from Labour and the others. The absence of any effective opposition party greatly strengthened the power of the new government to carry measures quickly, and it displayed great energy in the following years. In September the government sent its official representatives to attend the council of the League of Nations, and soon afterward the Irish ministers, headed by Cosgrave, took part in the Imperial conference in London. These contacts soon led to co-operation with several other dominions in pressing for a more definite recognition of sovereign rights.

An executive council of seven ministers with four other "extern" ministers was established after the elections of Aug. 1923. Ernest Blythe then became finance minister, and in December he succeeded in floating the first national loan of £10,000,000 at 5%, repayable in 20 years. Blythe courageously faced the unpopular task of collecting arrears of taxes and land annuities which had been withheld during the years of unrest. He reduced old-age pensions and made other unwelcome cuts in expenditure, and by introducing a protective tariff he caused new dislocation of trade which could not be expected to produce immediate benefits in increased employment.

Reconstruction and Progress.—Patrick Hogan, as minister for agriculture, had already completed land purchase by the tenant farmers. He introduced a licensing system for the export of butter and eggs which soon resulted in higher prices when it was found that a high standard was enforced and that regular deliveries could be ensured. He also provided long-term credits to farmers. His energy and knowledge of Irish agriculture, combined with great gifts of popular appeal, produced remarkable results, which were hastened by the skilful assistance of John Dulanty as trade commissioner in London. Other economic developments were inspired by bolder conceptions than had ever been attempted under British rule. The government was offered assistance by the Siemens company in Germany for introducing electric power on a national scale by harnessing the river Shannon. P. McGilligan as minister for industry and commerce accepted early in 1925 the German company's offer to undertake a full survey at its own expense on condition that Siemens would get the contract if the work proved economically desirable. Its report, after approval by an independent committee of international experts, was then adopted. The Shannon scheme provided for utilizing three lakes in stages, as reservoirs to meet future requirements. All three were brought into operation much sooner than had been foreseen, and the Shannon power was later supplemented by other similar sources. Another new enterprise was the introduction of beet sugar factories, under a scheme which provided a government subsidy of more than £1,000,000 to a Belgian firm which undertook to organize the industry.

Reconstruction proceeded vigorously in other directions also. Political control of the elected corporations in Dublin and Cork, and of some county councils, led to such conflicts with the government that it boldly suppressed the corporations, in disregard of their long association with the nationalist agitation. City managers were appointed, and they soon removed old abuses and reduced the prevalent corruption while introducing useful reforms. District councils were abolished and their powers transferred to the county councils; and the central government exerted its authority with increasing disregard for local objections. O'Higgins, the young minister for justice, was particularly high-handed in carrying out his reforms, and he enforced drastic and unpopular restrictions on the drink trade. He had created an efficient, though unarmed, civic guard, which replaced the old royal Irish constabulary with a much smaller and less expensive force. The unpaid justices of the peace were abolished and district justices for each area were appointed instead. The high court judges ceased to go on circuit, and circuit judges were appointed. Many of these judges were young men of outstanding ability who brought integrity and enthusiasm to their work.

The Ulster Boundary Crisis.—The Republicans, who still held more than 40 seats in the *dáil*, had repudiated the treaty mainly because it allowed Northern Ireland to remain separate. Collins had been convinced in his negotiations with Lloyd George that the treaty supplied a solution, by providing under article 12 that if Northern Ireland did not come into the Free State there must be a boundary commission to decide what areas were to remain excluded. Two of the six excluded counties, Tyrone and Fermanagh, contained clear, though small, majorities in favour of union with Ireland; and on the southern side of both Down and Armagh were substantial areas which had for years returned nationalist members. Collins, like most Irish nationalists, had assumed that when a boundary commission was set up these areas would all be withdrawn from Northern Ireland and that the remaining territory would be too small to continue as the basis of an independent legislature and government.

In 1924 Ramsay MacDonald's Labour government had taken office, and soon Cosgrave demanded that the commission be set up to "determine in accordance with the wishes of the inhabitants, so far as may be compatible with economic and geographical considerations, the boundaries between Northern Ireland and the rest of Ireland." The Northern Unionists quickly organized preparations to resist any interference, and Craig was soon threatening to revive the Ulster volunteers. Attempts to obtain a settlement by consent failed, and when Eoin MacNeill was appointed to represent the Free State on the boundary commission the Northern government refused to appoint a representative. The dispute was referred to the judicial committee of the privy council, which decided that legislation was necessary if a representative of Northern Ireland were to be appointed by the imperial government. An act for that purpose was accordingly passed, and MacDonald appointed a well-known Ulster barrister, J. R. Fisher, to represent Northern Ireland. As chairman, Judge Richard Feetham was brought from the Union of South Africa. During 1925 the commission conducted its inquiry in secret, but in November MacNeill resigned in protest when a London newspaper published a detailed anticipation of its report which suggested that the alterations would be small and even adverse to the Free State in important areas.

MacDonald then called a conference in London, which Craig attended, and a new agreement was made which left the existing boundaries intact in consideration of large financial concessions. Under article 5 of the treaty, Ireland had accepted liability for part of the United Kingdom's public debt in 1921, to be determined "in such proportion as may be fair and equitable, having regard to any just claims on the part of Ireland by way of set off, or counterclaims." This article, as well as article 12, was then canceled, while Ireland agreed to pay a revised claim in compensation for war damages, estimated at less than £5,000,000.

Removal of this uncertain but great financial liability was an immense help to the Irish government, but the agreement involved surrender of all hopes of compelling Ulster to come in. The agreement was vehemently opposed by the Labour party, as the *dáil* had not been consulted before it was made. The Republicans renewed their accusations that Ireland's national integrity had been sur-

rendered, and even the supporters of the treaty were shaken in their confidence. But the danger of collision with the Northern Ireland government was removed, and it at once disbanded two of the three branches of the Ulster special police force. The approach of another Imperial conference gave opportunities to press for fuller independence. Ireland was already actively participating in the League of Nations, and both at Geneva and in the Imperial conference collaboration with other dominions was pursued, to develop greater freedom from imperial control. Passports for Irish citizens were now issued from Ireland; the authority of the governor general in regard to diplomatic and other appointments was subjected to increasing restrictions; and the right of appeal from Irish courts to the judicial committee of the privy council was strongly contested. These and other matters affecting the implications of dominion status were considered, with growing support from Canada and South Africa.

Republicans in the Dáil.—By the spring of 1927, five years of intensive work had produced striking progress. Income tax had been lowered below the English rate to 3*s.* in the pound. The fourth *dáil* alone had passed nearly 200 acts, and a sense of security had been achieved. But there was a natural desire for change, and when general elections were held in June the smaller parties increased their strength. Cosgrave's party was reduced from 57 seats to 46 and could no longer command a majority, even while the Republicans remained outside the *dáil*. But Cosgrave agreed to form a new ministry. Among the other ministers, Hogan, McGilligan and Blythe had shown great abilities, but O'Higgins had made the strongest mark, especially at the Imperial conference and in Geneva. He became vice-president of the executive council. But his sardonic wit and provocative speeches had incurred intense resentment during the civil war. The old feuds were suddenly revived when he was murdered by gunmen outside his house on Sunday, July 10, 1927.

Cosgrave denounced his murder as a deliberate attack on the state. He took drastic powers by carrying the Public Safety act, which proclaimed all revolutionary societies as treasonable and gave power to arrest or deport suspected persons. The Republicans still refused to enter the *dáil* and continued their efforts to discredit the government from outside. Cosgrave decided to force them to come in by introducing a bill which prescribed an oath of willingness to enter the *dáil*, and also an oath of allegiance to the constitution, for every candidate at future elections. De Valera at last decided that he and his party would subscribe to the oath, but only after proclaiming that they regarded it as an "empty formula" which would have no binding force. He then led his followers into the *dáil*, and an agreement was reached with T. Johnson's Labour party, and with Capt. W. A. Redmond's National league, that they would outvote the government on a motion of no confidence. Johnson was to assume office with the support of the Republicans. The motion was debated on Aug. 16, but one member absented himself and Cosgrave's ministry was saved by the speaker's casting vote. He at once dissolved the fifth *dáil*. The two main parties gained heavily from their previous allies, and Cosgrave won 61 seats as against 57 won by the Republicans.

The sixth *dáil* assembled in Oct. 1927, and Cosgrave again formed a ministry, with support from the Farmers' party and independents. De Valera was now leading the opposition in the *dáil*, supported generally by the Labour party and the National league, and an alternative to the Cosgrave ministry could easily be formed. The government had exercised almost unchallenged authority and had introduced a great number of drastic changes, many of them unpopular. Economic conditions favoured them during the sixth *dáil*, until the general trade depression of 1930 began to affect Ireland also. Cosgrave's ministry, while introducing protective tariffs and encouraging the foundation of new industries behind the customs barrier, had relied chiefly upon trade with England. Agriculture had benefited from that policy and from taking advantage of imperial preferences in which the Free State shared. The economic crisis in England brought down prices for Irish produce, and unemployment was spreading. Discontent gave new life to the activities of the Irish Republican army, and Cosgrave introduced yet another amendment to the constitution to establish a military tribunal for political crime. De Valera opposed it, with increasing support, and in Feb. 1932 the general elections produced the seventh *dáil*, in which De Valera had gained enough seats to form a ministry, with the Labour party's support.

De Valera's First Ministry.—After ten years in office, Cosgrave had been prime minister longer than almost any other statesman in Europe. But De Valera had been the Republican leader since 1916, as the senior survivor of those who escaped execution after the rising. He had a definite program which appealed especially to the poorer classes, who felt that Cosgrave had chiefly encouraged the large farmers and the middle classes. With trade depression increasing, De Valera promised relief by wider social services, by reducing the high salaries of public officials and especially by his promise to withhold the land purchase annuities which were being paid to the British government. This promise was especially effective in the western counties, where the land annuities were the principal outgoings of the small farmers. At the same time he renewed his appeal to national sentiment by demanding the removal of the oath of allegiance and the abolition of the governor general as representative of the king.

De Valera's refusal to continue payment of the land purchase annuities produced an economic conflict with Britain which enabled him to press at the same time for abolition of the oath of allegiance. The annuities had been canceled by the Government of Ireland act of 1920, which never became operative, but Cosgrave's government had subsequently accepted liability for paying them as part of the financial agreement of 1926, which abolished all Irish liability for the imperial public debt in compensation for throwing over the promised adjustment of the Northern Ireland boundaries. De Valera claimed that this agreement was invalid because it was never submitted to the *dáil*. The British government insisted that the moneys were due and J. H. Thomas, as secretary of state for the colonies, retaliated by securing the imposition of tariffs on imported Irish cattle and farm produce. De Valera then imposed a similar punitive levy on English coal and other imports. The annuities were still collected, but for the Irish exchequer. An economic war developed with crippling results for the more prosperous Irish farmers, though the small farmers were less directly affected. Denmark and the dominions had new opportunities of capturing the English market from their Irish trade rivals; and at the Ottawa conference later in 1932, Ireland gained no benefit, whereas Cosgrave had always obtained sympathetic support at such conferences. Nevertheless the economic war had created favourable conditions for De Valera to pursue his deliberate policy of achieving full political and economic independence. A conflict with the governor general, James MacNeill, after the Eucharistic congress in June enabled him to demand MacNeill's retirement, and he then insisted successfully in asserting the right to nominate MacNeill's successor. The Viceregal lodge ceased to be the official residence, and D. Buckley, a veteran of the Gaelic revival who had taken part in the rising of 1916, became governor general, living in a modest house in south Dublin. By simple legislation De Valera abolished the oath of allegiance as prescribed by the treaty. While the economic war continued, protective tariffs were used with increased vigour to promote a general policy of achieving economic self-sufficiency. An offer by the British government to invoke arbitration on the disputed land annuities, by a commission which would include no members of the commonwealth, was rejected by De Valera, and the conflict became more intense. In Jan. 1933 he appealed directly to the country, and in the eighth *dáil* he had 77 seats instead of 70. The Labour party continued to support him.

Internal troubles increased with the growth of unemployment and the depressing effects of the economic war. Evidences of Communist influence began to appear, especially among the I.R.A. The Army Comrades association formed a new organization of national guards, led by Gen. Eoin O'Duffy, whom De Valera had dismissed from command of the civil guard. Demands from the I.R.A. for his dismissal had made De Valera's action appear as a weakening of his authority, and O'Duffy soon became prominent as leader of the Blue Shirts, which came into collision with the government. De Valera now invoked the Public Safety act against

O'Duffy's Blue Shirts and declared the national guard an illegal organization. While the economic war continued, De Valera exploited his opportunities for reducing any formal dependence upon the British connection. Cosgrave's government had already achieved notable advances toward full autonomy by gaining the support of other dominions at the Imperial conferences. Ireland had been actively represented in the League of Nations since 1923, and in Sept. 1932, shortly after assuming office, De Valera had been elected president of the League's council and had made a notable presidential address at Geneva. During the Spanish civil war he had supported the British attitude of nonintervention. But he had abolished the oath of allegiance and forbidden appeals to the judicial committee of the privy council. He had reduced the governor general's status to a minimum, and he announced his intention of framing a new constitution. The senate, which still represented chiefly the conservative elements, with a large proportion of former Unionists, was to be replaced by a more widely representative body. With continued support from the Labour party, De Valera had been pursuing his policy of self-sufficiency and extending the social services. Tension in the economic war was partly relaxed in 1935 when a coal-cattle agreement was negotiated, after much skilful diplomacy, by Dulanty as high commissioner in London. These agreements were renewed in 1936 and again in 1937.

Constitution of 1937.—De Valera proceeded to introduce his proposals for the new Irish constitution, "as if there were no relationship with the states of the British Commonwealth." His proposals were introduced when the British government was unexpectedly confronted with the constitutional crisis that resulted in the abdication of King Edward VIII. Under the Statute of Westminster each dominion was expected to ask the imperial parliament to enact a statute of abdication; but De Valera declined to make any such request. The *dáil*, however, passed an act accepting the abdication, and it authorized King George VI to act as a symbol of Ireland's co-operation in the commonwealth on such matters as the Irish executive council might refer to him for advice. De Valera had thus gained a direct opportunity for establishing his own conception of Ireland's special position as a state in "external association" with the British Commonwealth.

The new constitution gave effect to this general idea. It did not proclaim a separate and independent republic, but it abolished the title of the Irish Free State and substituted the word "Eire" (Ireland). The British government accepted these proposals, in spite of protests from the Northern Ireland government. De Valera held another election to secure approval of his proposals, and the new constitution was formally ratified by a plebiscite which was held concurrently with the elections. It became operative on Dec. 29, 1937. One symbolic change was that the former governor general was now replaced by a president, elected by the whole people, who was to be the nominal head of the state. The leader of the largest party in the *dáil* was to be prime minister. The first president, elected by the consent of all parties, was Douglas Hyde, a famous Celtic scholar who had been the chief organizer of the Irish language revival and president of the Gaelic league. As a Protestant, the son of a clergyman and a graduate of Trinity college, Dublin, his unanimous choice was regarded as evidence of good will toward the Anglo-Irish minority.

The Naval Bases.—Events in Europe were creating a new situation, which concerned De Valera directly in his dual capacity as prime minister and minister for external affairs. As president of the League of Nations council at Geneva in 1932 he had spoken gravely of the risks of war. The growing fears of a European war had a direct concern for Ireland, because the Anglo-Irish treaty had left certain naval bases in Ireland under British occupation. Cork harbour and Berehaven in the southwest, besides Lough Swilly in the north, were still occupied by the British fleet. In the event of war in Europe, this would involve Ireland inevitably as a participant. The Republican program, to which De Valera was irrevocably committed, demanded absolute independence and sovereignty for the whole island, which implied an unfettered freedom of decision. De Valera had insisted repeatedly, in all negotiations with London, that in the event of war Ireland would never give active support to England while partition continued. Because war was apparently imminent, Neville Chamberlain had to face the probability of renewed difficulties in Ireland if the British naval bases there became isolated. The new Irish constitution, evolved after several years of economic conflict, showed that De Valera was uncompromising in his claims to sovereignty but anxious to restore friendly relations. Chamberlain's government accepted the new situation in Dec. 1937 by announcing that the British and dominion governments "are prepared to treat the new constitution as not effecting a fundamental alteration in the position of the Irish Free State."

Anglo-Irish Agreement of 1938.—Chamberlain then invited De Valera to hold new discussions in London covering the whole position. Conversations were accordingly opened in Jan. 1938 and resulted in three agreements on April 25. The preamble announced that they had been made with the object of promoting friendly relations between the two countries, of facilitating trade between them and of reaching a final settlement of all financial claims. The agreements went far beyond the immediate dispute concerning the land annuities and the resulting economic war. They made a dramatic change by relinquishing British occupation of the Irish naval bases outside Northern Ireland. The treaty of 1921 had provided that until arrangements were made between the two governments for the Irish Free State to defend its own coasts, "the defence by sea of Great Britain and Ireland should be undertaken by the imperial forces." De Valera then claimed that Eire was prepared to undertake its own coastal defense, while Chamberlain recognized the obvious difficulties in maintaining isolated naval bases in case of war. Chamberlain decided to rely upon Irish good will in withdrawing the British naval forces. It was agreed that before Dec. 31, 1938, the United Kingdom would transfer to Eire the property and rights of the admiralty at Berehaven and also the harbour defenses there and at Cork harbour and Lough Swilly. This part of the new agreement was vehemently opposed by Winston Churchill, who was not then in office, on the ground that British naval defense would be greatly hampered by the surrender of the Irish bases.

Besides terminating the British naval occupation, the agreements provided for a settlement of the land annuities dispute and a cessation of the trade war. The original treaty had contained vague provisions for adjustment of financial claims on both sides, but these had been generally settled by the agreement of 1925 which abolished the Ulster boundary commission and canceled almost every outstanding financial liability except the land annuities. It was then agreed that, apart from a separate payment for damages to British property which had been agreed upon in 1925, Eire should pay £10,000,000 to the British government before Dec. 1938. This was to be a final settlement of all outstanding claims between the two governments. At the same time the British government was to abolish the special duties which had been imposed to collect the amount claimed for the land annuities. De Valera had utilized the abnormal situation to develop new Irish industries behind protective tariffs, and the money collected for land annuities was spent on subsidizing exports. The new agreements brought an end to such penal tariffs on both sides; but Irish trade was already beginning to follow a new pattern, and exports to Britain were prejudiced by the loss of preferential treatment.

Irish Neutrality.—The new Anglo-Irish agreements, much wider in scope than had been expected, enabled De Valera to appeal for a new verdict of popular approval. The *dáil* approved the new pact on April 29 with only one dissentient, and the general election on June 17 returned De Valera to power with a clear majority, having 77 votes against 45 for Cosgrave's Fine Gael, 9 Labour and 7 independents. On July 11 the last British troops were withdrawn from Cork harbour. Events in Europe were shaping rapidly, but Chamberlain had been fully aware that the Irish government might proclaim its neutrality in case of war. He had told the house of commons plainly, in explaining the agreements on May 5, that De Valera had attached primary importance to the question of partition, which the British government had considered itself unable to discuss. In a statement published on Oct. 18, shortly after Chamberlain's return from his visit to Hitler

in Munich, De Valera declared that "quite obviously the existing partition would be a grave danger to England in the event of that country becoming involved in a European war." He asserted that "we have definitely committed ourselves to the proposition that this island shall not be used as a base for enemy attacks on Great Britain," and that quite possibly "a united free Ireland" would be willing to co-operate with Britain to resist a common attack. But until there was a "united, free, independent Ireland," Irish support could not be expected. In the same interview De Valera expounded his own views on the possible settlement of partition. He agreed, though reluctantly, that Northern Ireland might keep its "local Parliament with its local powers," but that "the powers at present reserved to the English parliament shall be transferred to the all Ireland Parliament."

A series of bomb outrages committed by the I.R.A. in Belfast and in English cities during the following winter and spring aroused anger in England and compelled the Irish government to tighten its control by new legislation against subversive activities. But on April 16, 1939, De Valera announced that in the event of war he would try to maintain and preserve Irish neutrality. The extension of conscription in England raised the question of compulsory military service in Northern Ireland, and on May 2, 1939, De Valera protested against its application there. Two days later Chamberlain announced that Northern Ireland would continue to be exempted from conscription. When war came, De Valera at once announced that Ireland would continue its policy of neutrality. On Sept. 27 Sir John Maffey was appointed to the new position of United Kingdom representative in Eire.

World War II.—During the first phase of relative quiet, the Irish government was concerned chiefly with economic measures to meet the war situation and with the suppression of seditious activities by the I.R.A. In Jan. 1940 power was taken to intern persons suspected of activities against the state. But by May the need for serious national defense became apparent, and weekly conferences were arranged between the government and leaders of Fine Gael (United Ireland party) and Labour. All parties united in a recruiting rally in Dublin on June 16, and on June 29 Lord Craigavon, in response to urgent messages from Churchill and Franklin D. Roosevelt, promised co-operation with Eire for national defense. But the basis of co-operation was disputed, and De Valera announced on July 5 that Ireland must be both united and neutral. Craigavon then reported to the Northern Ireland parliament that De Valera had refused his offer of joint defense. On Nov. 7 De Valera again asserted that there could be no question of handing over ports in Eire as bases for Britain. His chief preoccupation, since the German occupation of France, had been the possibility of a German air-borne landing in Ireland, and Irish neutrality was jealously preserved to prevent any pretext for such attack. But in Jan. 1941 German bombs and magnetic mines were dropped near Dublin, and De Valera had to protest formally to Berlin. That same month it was made known that nine Irish ships had been sunk since the war began.

On April 13, in a broadcast, De Valera asserted that Eire would defend its neutrality by armed force. But in May the intention to apply conscription in Northern Ireland made him protest again, and on May 27 Churchill announced that it would not be applied. Four days later German bombers did serious damage in Dublin, but regrets and a promise of compensation were forthcoming from Berlin. A new situation arose after the United States entered the war in Dec. 1941; and while De Valera no longer feared invasion by either German or British forces, there was new pressure from the United States against his neutral policy. On Jan. 27, 1942, he protested strongly against the landing of U.S. troops in Northern Ireland, declaring that the Irish government had not been consulted; President Roosevelt replied by expressing amazement at the protest. On Feb. 3 De Valera appealed for the enrollment of an Irish army of 250,000 men "to maintain Eire's liberty." But the U.S. forces in Northern Ireland had been rapidly increasing, and on July 1 it was revealed that the United States had built a powerful naval base at Derry.

Lord Craigavon had died in Nov. 1940 and been succeeded as prime minister of Northern Ireland by J. M. Andrews. Andrews resigned in May 1943, and Sir Basil Brooke replaced him. In June, De Valera decided to appeal for a new mandate, and in the general election he lost his former clear majority, returning with only 67 seats. Cosgrave's Fine Gael also lost seats, and Labour came back with 17, while the Farmers and independents together had 22. But De Valera was re-elected prime minister in July, and in November he was still insisting that Eire should remain neutral. In Jan. 1944 Cosgrave retired from leadership of the chief opposition party and was replaced by Gen. Richard Mulcahy.

Pressure from the United States increased while preparations for the landings in Normandy were progressing. In March 1944, De Valera rejected a formal request by the United States for the removal of axis consular and diplomatic representatives from Eire "because their presence constituted danger to the lives of American soldiers and the success of Allied military operations." The British government then immediately suspended, for military reasons of paramount importance, all travel between Britain and Eire or Northern Ireland. But De Valera's neutral policy and his firmness in resisting pressures still commanded general support in Eire. A defeat in the *dáil* on the Transport bill gave him a pretext for holding another election, and he was returned with 76 seats and a majority of 14 over all other parties. On June 9 he was re-elected prime minister by 81 votes to 37.

His government was thus securely in office during the closing phase of the war. On May 13, 1945, Churchill in his victory broadcast made reference to the difficulties which had resulted from surrender of the Irish ports, and asserted that if necessity had arisen they would have been seized by the British navy. De Valera replied on May 16 with remarkable restraint, declaring that Churchill had, by resisting that temptation, advanced the cause of international morality. With the restoration of peace, Eire quickly attracted an immense number of visitors from England, and relations were entirely friendly. A new president was needed when Douglas Hyde's term expired in June, and Sean T. O'Kelly, one of De Valera's principal ministers, was elected by 565,000 votes to 453,000 for the Fine Gael candidate. In July De Valera declared in the *dáil* that Eire had been in effect a republic since the new constitution became operative in Dec. 1937.

Postwar Prosperity.—In supplying food and other exports to Britain during the war years, Eire had accumulated large sterling assets. The postwar influx of English visitors, who came eager to enjoy the abundant supplies of food, clothing and other rationed goods, added to these favourable balances. The country's new prosperity was reflected in the budget of May 1946, which reduced income tax by 1*s.* in the pound. There was a wave of inflation with prices rising fast, while trade required abnormally large purchases to replace stocks and to buy goods which had been unobtainable for years. Tourist development soon became one of the principal sources of income to meet the cost of such necessary imports. In 1947 tourism was estimated to have earned nearly £30,000,000, and forecasts by the travel organizations predicted that Ireland would soon rank next after France and England in tourist earnings. But this sudden influx of visitors, combined with heavy expenditure on capital and consumption goods, was producing serious problems. In Sept. 1947 De Valera went to London for talks on trade and finance with Prime Minister Clement Attlee and Sir Stafford Cripps. A restless spirit was growing in Ireland, after De Valera had been continuously in office for 15 years. A new party, Clann na Poblachta, formed by Seán MacBride, appealed specially to the new generation and to those who were tired of the old party rivalries. At two by-elections at the end of 1947 it presented its first candidates and won both seats. De Valera had threatened to appeal to the country if he were defeated, and in Feb. 1948 a new general election resulted in his resignation. His party was still by far the largest in the *dáil*, but the other groups combined unexpectedly under a new leader.

Interparty Government.—In the 13th *dáil* the number of members had been increased, by a redistribution of seats, from 138 to 147. De Valera refused to enter into any coalition with other parties, though his Fianna Fáil (Republican party) had won 68 seats and Mulcahy's Fine Gael had only 31. Labour's forces were split, with 14 seats held for the Labour party led by W.

Norton and 5 for National Labour. There were now 13 independents, among whom the ablest figure was James Dillon, who had been the only active advocate of Ireland's participation in the war. MacBride's new party, Clann na Poblachta, had put forward many candidates but won only nine seats. The Farmers' party held seven more. It was obvious that De Valera could easily form a coalition with a few of the smaller groups, but he refused all such approaches. Since Cosgrave's retirement, there had been no Fine Gael leader who commanded general support, and Mulcahy soon agreed to make way for any new leader who did not arouse hostile memories.

Urgent consultations with the independents and with MacBride's party resulted in agreement to combine under a new leader, John A. Costello. He had been attorney general and had close experience of imperial and international conferences, but with a large legal practice he had taken little part in political controversy. The desire for a change of government was especially strong among younger persons, who felt themselves excluded from all opportunity so long as De Valera kept his older colleagues in office. It was agreed quickly that an interparty government should be formed under Costello, without any formal coalition and with each party free to press for its own program. On that basis Costello secured 75 votes, after De Valera's nomination as prime minister had been outvoted, and the interparty ministry took office, with promises of reducing extravagant expenditure.

During the general election there had been little difference between the rival programs except that Costello's Fine Gael had openly declared its support for close relations with the British Commonwealth. MacBride's new party was regarded as the most adventurous, with its demand for a separate Irish currency and for an active policy to end partition. MacBride became minister for external affairs and his young colleague Noel Browne became minister for public health. McGilligan, the ablest survivor of Cosgrave's former team, became finance minister. Dillon, as the most important independent, took charge of agriculture. William Norton, the Labour leader, became deputy prime minister. But Costello's inexperience of leadership, which he had never desired, was soon reflected in nervousness about De Valera's intentions for the future. After 15 years in office he undertook a world tour, and his speeches in the United States, India and Australia suggested that he would revive the fuller demand for national independence and for ending partition. His prestige outside Ireland was so evident that Costello found it advisable to undertake a similar mission overseas, and he accepted an invitation to visit Canada in August. Until his departure there had been no rumour of any impending constitutional change. But in Montreal on Sept. 1 Costello made his first declaration of his new policy. After reviewing the constitutional developments in Ireland since the treaty of 1921 and the progressive stages of national independence, he claimed that Ireland's sovereignty was no longer in doubt but that the question arose whether the existing constitution was in a form "compatible with our national sentiment and historical tradition." It was plain that the new government proposed to forestall any intention by De Valera of demanding full independence as a republic.

On Nov. 17 Costello introduced in the *dáil* the Republic of Ireland bill, which proclaimed secession of the 26 Irish counties from the commonwealth and empowered the Irish president to exercise all functions concerning external affairs previously exercised by the British crown. The state was to be the Republic of Ireland, but the name "Eire" or "Ireland" would continue to be used. While the bill was in preparation urgent talks were held on Nov. 15 between Irish ministers and British and commonwealth leaders. MacBride then announced that as from Jan. 1949 there would be in Britain three categories of citizens: British, commonwealth and Irish. Attlee conferred with Sir Basil Brooke, the Ulster premier, and insisted that no change affecting the constitutional position of Northern Ireland be made without the consent of its people. Costello in introducing the bill proclaimed that it was "conceived in no spirit of hostility to the British people or the institution of the British Crown." He believed it would produce greater friendship between Great Britain and Ireland. The bill was not opposed at any stage and became law on Dec. 21. De Velera expressed his cordial support, regretting only that effective jurisdiction for the republic over the whole of Ireland could not yet be claimed.

The British government had shown its desire to assist in overcoming difficulties by declaring that Irish nationals would not be regarded as foreigners. But consequential legislation was necessary, and the Northern Ireland ministers pressed for new assurances in London. Brooke held a general election in Northern Ireland on Feb. 10, 1949, which produced an emphatic verdict for retaining the British connection. Labour lost 3 seats, and the Unionists now held 37 out of 52. But MacBride on Feb. 26 asserted again that Eire would not consider joining the North Atlantic treaty unless partition were first abolished. On April 17 the Irish republic was formally proclaimed in the Irish cities, and messages of good will were sent from King George VI and from Pres. Harry S. Truman. But in May Prime Minister Clement Attlee introduced the Ireland bill to provide for consequential changes. It expressly "recognised and declared that the part of Ireland heretofore known as Eire ceased to be part of His Majesty's Dominions" as from April 18, but clause (*b*) declared "that Northern Ireland remains part of His Majesty's Dominions and of the United Kingdom" and affirmed that "in no event will Northern Ireland or any part thereof cease to be part of His Majesty's Dominions and of the United Kingdom without the consent of the Parliament of Northern Ireland." This clause provoked great indignation in Ireland, as being a claim that the six counties should be permanently excluded from jurisdiction of the Irish parliament; whereas the Government of Ireland act of 1920, as well as the treaty of 1921, had contained provisions for united control. Large public meetings of protest were held in Ireland, and on May 10 the *dáil* unanimously voted a resolution by Costello protesting against the Ireland act. (The secession of Ireland from the commonwealth is discussed in COMMONWEALTH OF NATIONS.)

Within its first year Costello's government had thus unexpectedly severed relations with the commonwealth and apparently left less ground than ever for difference among the principal Irish parties. Partition remained the chief outstanding problem, but the cleavage with the Ulster parliament had been deepened by secession. With no clearly defined program, the interparty government was soon weakened by the competing claims of its component groups. Public expenditure rose rapidly to meet such demands, and heavy purchases to replace exhausted stocks were depleting the large sterling assets that had been accumulated during World War II. Ireland had obtained inclusion in the benefits of the European Recovery program to assist agricultural production. Dillon's ambitious scheme for land reclamation with U.S. aid promised big results over a long period; but his first success in increasing Irish exports of eggs and butter to England was not maintained when export prices fell, and the cost of imported fertilizers and maize (corn) was increased by the sudden devaluation of sterling. Internal discords in the ministry reached a crisis over Noel Browne's plan for free public health services under state control, which was strongly opposed by the Catholic bishops. Costello then repudiated Browne's proposals, and his narrow majority in the *dáil* was at once shaken.

The Elections of 1951, 1954 and 1957.—In May 1951 a general election was held, to clear the air. The new *dáil* that resulted scarcely differed in composition from the previous one, the interparty groups retaining 78 seats and Fianna Fáil gaining one, which brought its total to 69. MacBride's new party, however, had been split by a bitter feud with Browne, and some of the independents withdrew their support from Costello. De Valera then, though still refusing to enter any grouping, won promises of support outside his own party and was elected prime minister by 74 votes against 69. Taking office in June, he declared that the republic would continue to stand aloof from the Commonwealth of Nations and pursue a policy of neutrality. His ministry consisted almost entirely of his former colleagues, with hardly any attempt to enroll younger members; and in April 1954, by which time his party had been defeated in four out of five by-elections since 1952, he decided to dissolve the *dáil*. In the ensuing general election (May 1954), only 65 seats went to Fianna Fáil. On June 2, there-

fore, though Fine Gael had only 50 seats, Costello was elected prime minister by the interparty grouping, which gave him 79 votes against 66.

This second experiment in interparty government soon showed once more the difficulty of producing a coherent policy, while each of the smaller parties was liable to threaten secession if its special demands were not met. The new government's authority was, moreover, challenged by the increasing frequency of I.R.A. raids on British barracks and other posts in Northern Ireland. In Aug. 1955 there was a successful raid on Arborfield camp in England and arms and ammunition were stolen. Costello insisted vehemently that the final authority of the Irish nation resided in the *dáil*. The raids continued and produced embarrassing demonstrations of sympathy in Ireland with the raiders, where a more responsible attitude had been expected. Meanwhile economic conditions became unstable; although there was a budget surplus, a continual rise in imports threatened the national economy. The government imposed new import duties, ranging from 37½% to 5%, on some 70 commodities in March 1956 and also enforced restrictions on hire purchase (installment buying) to discourage private spending. In July similar duties were imposed on a further 100 items. Emigration, chiefly to Great Britain, had been growing steadily and the census reports showed a total emigration of over 200,000 in the previous five years, which was higher than at any time since the late 19th century. The population of the republic had declined to the lowest level yet recorded of 2,898,300.

Meanwhile the Labour party had gained courage from the successful reunion of the Congress of Irish Unions and the Irish Trade Union congress, after a split of 11 years. This reunion of some 400,000 members in more than 80 unions encouraged the Labour party to adopt a more independent attitude within the interparty government. MacBride, as leader of the small and diminished Clann na Poblachta, which had caused the collapse of the first coalition, had declined Costello's offer of a cabinet post in his second ministry. He was widely regarded as having contacts and sympathy with the I.R.A. and in Jan. 1957 he moved a vote of no confidence in the government, ostensibly in protest against its economic policies. Costello anticipated this conflict by dissolving the *dáil* on Feb. 12 and a general election followed on March 5. Labour refused to continue in the previous interparty front and each party put forward its own candidates.

This gave De Valera a clear advantage in claiming that only a strong and united party could provide effective government. His Fianna Fáil party gained 13 seats and an overall majority of 9 by winning 78 seats in the new *dáil*. Costello's Fine Gael party lost 9 seats and Labour lost 7, retaining 40 and 12 seats respectively. MacBride lost his own seat and only one of his Clann na Poblachta party was returned. Sinn Fein, however, by winning 4 seats, showed the extent of its support in certain counties, although its members refused to take their seats in the *dáil*, thus increasing De Valera's majority. The I.R.A. raids on the Ulster borders had become so defiant by July that De Valera invoked the Offences Against The State (Amendment) act of 1940 which authorized the internment of persons suspected of being concerned in illegal organizations. An internment camp was opened immediately at Curragh, county Kildare, where more than 100 young men were confined after arrest, including the entire national executive of Sinn Fein. De Valera then declared openly that force could not provide a solution of the problem of Irish partition. "Force," he said, "could not be successful, and it could in fact be disastrous, leaving behind a situation more embittered and uncertain than the present."

Notwithstanding these efforts to restore order, the I.R.A. raids continued at intervals in 1958. A new situation was imminent because of De Valera's personal difficulties in continuing as *taoiseach* (prime minister) because of increasing blindness and advancing years. Séan O'Kelly's second term of office as president of the republic was due to expire in June 1959 and De Valera's name was widely discussed as his successor. It was generally assumed, when he suddenly proposed the return to the British system of single-member constituencies, thereby abolishing proportional representation, that De Valera believed it would improve the prospects of Fianna Fáil when he retired from active leadership. This proposal provoked a growing tide of opposition in which the Labour party ultimately played a decisive part by organizing resistance to it. Meanwhile De Valera agreed to accept nomination for the presidency, though it was not offered to him without a contest. A referendum was held in June 1959 on two separate questions: the proposal to abolish proportional representation, and the election of a new president. The opposition groups mustered 417,482 votes for their candidate, Gen. Séan MacEoin, but De Valera was elected president with 538,058 votes on June 17. He was installed as president on June 25, having completed almost 50 years of active political leadership.

Lemass in Office.—Séan Lemass, his chosen successor, replaced De Valera immediately as *taoiseach*, having spent some years as minister for industry and commerce. This change of leadership was followed in the other principal parties. Gen. Richard Mulcahy resigned the leadership of Fine Gael and John Costello resigned as leader of the opposition. Both posts were filled by James Dillon, a contemporary of Lemass; while William Norton was replaced as Labour party leader by a much younger successor, Brendan Corish. Thus the older leaders who had dominated Irish politics for 40 years all retired in 1959, leaving a new situation in which Lemass and Dillon each brought new vitality to their parties, coupled with prestige, experience and notable gifts for public life. Lemass, who had for years been absorbed in the economic aspects of Irish revival, declared at once that he desired closer Anglo-Irish trade relations. He insisted also that the approach to reunion with Northern Ireland must be through consent on both sides. Dillon, with more flamboyant gifts of oratory and a long family tradition of patriotic service, had never disguised his desire to modify the obligations which had been imposed by the long efforts to enforce a revival of the Irish language. He relied on strengthening Irish agriculture, rather than developing new industries, to stop the drain of emigration and to raise the standard of living.

The first year of the new alignment produced little open conflict between the parties, while all were preparing the ground for the next elections. The most striking events of 1960 arose from the prominent part given to the Irish republic in the work of the U.N. The Irish permanent delegate, Frederick Boland, was chosen president of the assembly for the year and showed great ability and good humour in controlling the turbulent scenes which Khrushchev provoked in the assembly in New York. In the Congo operations also, the Irish military contingent gained distinction; two battalions were sent to form part of the international force organized by the U.N. A third battalion then replaced the first two and the Irish army's Gen. Séan MacEoin was appointed commander of all the international forces in the Congo.

In Oct. 1961 elections for the *dáil*, the Fianna Fáil lost its absolute majority (70 seats instead of 78) whereas the Fine Gael increased its members from 40 to 47 and Labour from 12 to 16. Lemass, who had dissolved the 16th *dáil* expressly to obtain a mandate for membership of the European Common Market, was re-nominated prime minister.

In 1962 the I.R.A. formally called off its campaign of violence as the means to enforce unification.

II. POPULATION

In 1961 the population of the Republic of Ireland was 2,814,703, a decrease of 2.9% since 1956 when it was 2,898,264. Between 1900 and 1961 the total population declined by about 10%. Estimated net emigration during the intercensal period 1956–61 was 215,641; the number of births exceeded the number of deaths by 132,080 whereas the total population declined by 83,561. A high proportion of the emigrants were women; the number of females per 1,000 males of the population was 989 in 1961, one of the lowest ratios in the world. Until World War I Irish emigration was directed mainly toward the United States, but after 1914 the flow was chiefly to Great Britain and of these a considerable number returned home permanently after an absence of some years.

The largest towns are Dublin, the capital, Cork, Dun Laoghaire, Limerick and Waterford (*qq.v.*). Towns with populations of over 10,000 are Galway, Dundalk, Drogheda, Sligo, Bray, Wexford,

Area and Population of the Republic of Ireland

Province and county	Area (sq.mi.)	Pop. (1956 census)	Density (per sq.mi.)	Pop. (1961 prel. census)	Density (per sq.mi.)
Leinster	7,580	1,338,942	176.7	1,329,625	175.4
Carlow	346	33,888	97.9	33,345	96.4
Dublin	356	705,007	1,980.3	716,156	2,011.7
Kildare	654	65,915	100.8	64,346	98.4
Kilkenny	796	64,089	80.5	61,670	77.5
Laoighis	664	47,087	70.9	45,062	67.9
Longford	403	32,969	81.8	30,642	76.0
Louth	317	69,194	218.3	67,284	212.3
Meath	903	66,762	73.9	65,106	72.1
Offaly	771	51,970	67.4	51,532	66.8
Westmeath	680	54,122	79.6	52,774	77.6
Wexford	908	87,259	96.1	83,259	91.7
Wicklow	782	60,680	77.6	58,449	74.7
Munster	9,316	877,238	94.2	848,368	91.1
Clare	1,231	77,176	62.7	73,710	59.9
Cork	2,880	336,663	116.9	330,106	114.6
Kerry	1,815	122,072	67.3	116,405	64.1
Limerick	1,037	137,881	133.0	133,025	128.3
Tipperary, North Riding	771	55,697	72.2	53,689	69.6
Tipperary, South Riding	872	73,718	84.5	70,090	80.4
Waterford	710	74,031	104.3	71,343	100.5
Connaught	6,611	446,221	67.5	419,221	63.4
Galway	2,293	155,553	67.8	149,800	65.3
Leitrim	589	37,056	62.9	33,468	56.8
Mayo	2,084	133,052	63.8	123,180	59.1
Roscommon	951	63,710	67.0	59,215	62.3
Sligo	694	56,850	82.0	53,558	77.2
Ulster (part of)	3,093	235,863	76.3	217,489	70.3
Cavan	730	61,740	84.6	56,597	77.5
Donegal	1,865	122,059	65.4	113,815	61.0
Monaghan	498	52,064	104.5	47,077	94.5
Total	26,600*	2,897,264	109.0	2,814,703	105.8

*Land area; total area 27,136 sq.mi.

Kilkenny, Tralee, Clonmel and Athlone.

The official languages of the republic are Irish (*see* CELTIC LANGUAGES) and English. The number who stated that they could speak Irish (Gaelic) in 1946 was 589,000, compared with 667,000 in 1936. Of these, 105,000 were in the Gaeltacht (Gaelic-speaking) districts, 83,000 in the districts which are partly Gaelic-speaking and 396,000 in the rest of the country. The teaching of Irish is an important feature of the educational system, and a knowledge of the language has gradually been made compulsory for most examinations. Enthusiasm for the language revival has, however, abated since the achievement of independence from Great Britain.

III. ADMINISTRATION AND SOCIAL CONDITIONS

1. Constitution and Government.—The 1937 constitution that replaced the original constitution of the Irish Free State (enacted in 1922) shows three main influences: Irish nationalism; English and Free State parliamentary traditions; and Catholic philosophy.

The preamble of the constitution invokes the Holy Trinity and, acknowledging the dependence of the people of the Republic of Ireland, declares that the purpose of the constitution is the promotion of "the common good, with due observance of prudence, justice and charity, so that the dignity and freedom of the individual may be assured, true social order attained, the unity of our country restored, and concord established with other nations."

The constitution declares the Irish republic to be a democratic state, sovereign and independent. The head of the state is the president (*Uachtaran na hÉireann*), who is elected for seven years by the direct vote of all citizens. Nominations are made by members of the *oireachtas* (parliament) or of the county councils. The president appoints the prime minister (*taoiseach*) on the nomination of the *dáil*, and on the nomination of the prime minister and with the previous approval of the *dáil* he appoints the other members of the government. He signs and promulgates laws. He can refer certain bills to the supreme court to test their constitutionality. He also has power to refer certain bills to a popular referendum upon petition of a prescribed percentage of the *dáil* membership. He is supreme commander of the armed forces. The president is advised by a council of state consisting of former presidents, former and incumbent prime ministers and chief justices, as well as of others, some of whom he may name.

The *oireachtas* consists of the president and two houses. The house of representatives (*dáil éireann*) consists of 144 members elected by adult suffrage under a system of proportional representation. The government, which consists of from 7 to 15 members, is responsible to the *dáil*. The maximum term of the *dáil* is seven years. The *dáil* alone can initiate money bills, and the *seanad éireann* (senate) may only make recommendations on them. *Seanad éireann*, an unsuccessful attempt to create a vocational chamber, is composed of 11 members nominated by the prime minister and 49 members who are elected by the *dáil* and the county councils from panels representative of the universities, culture and education, labour, industry and public administration and social services. The system of proportional representation is used in the election of a *seanad*, which has to take place within 90 days after a dissolution of the *dáil*. The *seanad* cannot veto legislative proposals and has but 90 days for the consideration or amendment of bills passed by the *dáil*.

The constitution recognizes the family as the unit of society with rights superior to all positive law. Divorce is practically forbidden. Private property is recognized as a natural right of man, but this and other personal rights may be limited by law out of consideration for the common good.

An interesting feature of the constitution is the enumeration of directive principles of social policy. The courts may not take cognizance of them in determining the application of laws. The principles, intended for the guidance of the *oireachtas*, include the right of every citizen to a decent livelihood, the establishment of families in economic security on the land, and the regulation of credit and of the distribution of property in the interests of the common good.

For the first three years after its establishment the constitution was amendable by ordinary legislation. Thereafter a popular referendum was necessary.

Local Government.—The Irish provinces, Leinster, Munster, Connaught and part of Ulster are no longer political divisions. They are subdivided into 27 administrative counties (*see* Table) and the four county boroughs of Dublin (*q.v.*), Cork, Waterford and Limerick. The department of local government supervises local affairs through the county councils, county boroughs and urban district councils. These bodies, elected by popular vote, have a system of local government combining a council with a manager; they are responsible for maintaining roads, water supply, sanitation, etc., and have authority to levy local rates.

Religion.—Under article 44 of the constitution, the special position of the Roman Catholic Church was recognized "as the guardian of the Faith professed by the great majority of the citizens"; recognition was also given to the Church of Ireland, the Presbyterian Church, the Methodist Church, the Religious Society of Friends, the Jewish congregations and "the other religious denominations existing in Ireland at the date of coming into operation of the Constitution." "Freedom of conscience and the free profession and practice of religion are, subject to public order and morality, guaranteed to every citizen." The state guaranteed not to endow any religion and not to impose any disabilities or make any discrimination on the ground of religious profession, belief or status. According to the 1946 census the number of persons of each religion in the republic was: Roman Catholics, 2,786,033; Protestant Episcopalians, 124,829; Presbyterians, 23,870; Methodists, 8,355; Jews, 3,907; Baptists, 462; others, 7,651.

External Relations.—An important change affecting the relations of the Free State with the Commonwealth of Nations occurred when Edward VIII abdicated on Dec. 11, 1936. An act was passed to remove from the constitution all reference to the king and to abolish the office of governor general. The Executive Authority (External Relations) act of Dec. 11, 1936, accepted the abdication of Edward VIII. It also provided that executive authority, which it vested in the Free State executive council, could, in certain circumstances, be exercised for the appointment of diplomatic representatives and conclusion of international agreements by the king. The king had ceased to be head of the state, but, by virtue of his recognition as the hereditary symbol of commonwealth co-operation, he might, on the advice of the Free State executive council, exercise certain powers concerning external relations. The new constitution enacted in 1937 did not alter the operation of these

provisions. Diplomatic representatives continued to be appointed by the king when advised by the Irish government, and the credentials of foreign diplomats accredited to Ireland were addressed to the king.

The Executive Authority (External Relations) act, 1936, was repealed by the Costello government in 1948 when the Republic of Ireland act was passed. Under this act the exercise of executive powers concerning external relations was transferred to the president acting on the advice of the government. The description of the state was declared to be the Republic of Ireland, but in accordance with the constitution, which was not affected by the act, the name of the state remained Ireland. The aim of the act was to clarify the constitutional position and to terminate association with the commonwealth. This aim was accepted by the commonwealth countries. The Ireland act, 1949, which was enacted by the British parliament, declared that from April 18, 1949, the state had ceased to be a British dominion; it did not, however, become a foreign country so far as British statutes were concerned, and its citizens did not become aliens in Great Britain. Australia, New Zealand, South Africa, Canada and Southern Rhodesia adopted legislation declaring Irish citizens to have the same rights and obligations as their own citizens.

2. Political Parties.—Since the establishment of Irish national government in 1922, the principal single party, Fianna Fáil (Republican party, also known as Party of Destiny), has been dominated by Eamon De Valera's leadership. The main difference between the Fianna Fáil and its rival Fine Gael (United Ireland party) has concerned Anglo-Irish relations, De Valera seeking to break the connection with England and pursuing a program of economic self sufficiency for Ireland by developing new industries. When De Valera's long tenure of office was broken in 1948 by John A. Costello's coalition government, which was expected to seek closer ties with the Commonwealth of Nations, Costello suddenly declared a republic in order to forestall any campaign for that purpose. Since that sudden departure, there has been no clear line of division between the two main parties, though Fianna Fáil attaches special importance to the revival of the Irish language. Both parties have sought cordial relations with Britain and both have approved Ireland's application for membership in the European Common Market. The Labour party has on a few occasions shown its capacity to cut across party lines but its strength has varied from 22 to 13 seats. Other small parties such as the Clann na Talmhan (Farmers' party) and independents have always won some seats; Sean MacBride's Clann na Poblachta (New Republicans), formed in 1947 with a policy to end partition and to found a separate Irish currency, made a strong appeal to young voters in 1948 but held only one seat nine years later.

3. Trade Unions.—With about 600,000 employees in the republic, excluding those in agriculture, about 330,000 are members of trade unions. There are over 100 unions, many of which have less than 1,000 members, but the Irish Transport and General Workers' union, which aims at including all trades in one big union, claims 150,000 members. About one-fifth of all trade unionists are nonmanual workers. For years there was acute rivalry and overlapping between the definitely Irish unions and the branches of British unions and this resulted in the formation of two separate organizations, the Irish Trade Union congress and the Congress of Irish unions. Negotiations and trade union policy were gravely hampered by this duplication, and in 1959 the two congresses were fused in the present Irish Congress of Trade unions which attempts to overcome the former difficulties. Irish unions, though allegedly fully independent of British unions, are in fact frequently subject to pressure when crises arise in Britain. Employers' unions in Ireland are few and are combined in the Federated Union of Employers which has its separate industrial sections and regional branches.

To supervise relations between workers and employers there are in some industries permanent joint negotiating bodies. Collective agreements usually determine wages, working hours and other labour relations. The Labour court was set up in 1946, consisting of five members, all appointed by the minister for industry and commerce. Its function is conciliation; it can summon witnesses on oath and require the production of documents, but it cannot enforce its directions or impose penalties. It usually acts on invitation during a dispute, but it often appoints an official conciliation officer to mediate before intervening directly.

4. Employment and Housing.—As a consequence of persistent efforts to create new industries with a general aim of economic self sufficiency, the workers employed in manufacture and construction have risen from about 159,000 in the mid-1920s to more than 265,000 in the early 1960s; while workers in agriculture, forestry and fishing have declined steadily from about 650,000 to less than 450,000—the decline has averaged 10,000 a year since 1951. Low wages in agriculture, and the lack of any attractive prospect on smaller farms, have been the main factors in causing emigration. Unemployment statistics show a favourable trend, falling from 8.6 of insured persons in 1941 to 5.7 in 1961. Wages have continued to rise, from a base of 100 in 1953 to 142 in Dec. 1960; agricultural wages rose in the same period from 100 to 118.

With postwar construction of many houses of modern type there has been a general improvement in housing standards. Grants are paid by the state to local authorities, public utility services and private persons for building and reconstructing houses.

5. Health and Welfare Services.—The comprehensive organization of social services began with the Irish Poor Relief act of 1838, which divided the country into poor-law unions and created the workhouse system of relief. In 1923 home assistance was substituted for workhouse relief. In 1851 free medical attendance became available for the sick poor in their homes or in dispensaries. Health services are now organized and directed by county medical officers. Grants from the Hospitals Trust fund, financed by the Irish Sweepstakes, provide a regular income for the building, reconstruction and repair of hospitals and dispensaries. Public hospitals provide treatment free or at a charge graduated according to means. For tuberculosis and some other diseases examination and treatment are free, and cash allowances are paid, in certain circumstances, to patients who are prevented by their illness from providing for their own maintenance and that of their dependents. The Social Welfare act of 1952 introduced a co-ordinated system of social insurance, superseding the previous national health, unemployment, and widows and pensions schemes. Under this act, social insurance is compulsory for all employed persons between 16 and 70, with the exception of certain categories. Manual workers in the building trade may be insured against the loss of employment resulting from bad weather.

6. Justice.—Law enforcement is the responsibility of the ministry of justice which also controls the police (*garda siochana*). Judges are appointed by the president on the advice of the government; they retire on pension at the age of 70. They are independent of the executive in the exercise of their judicial functions and are subject only to the constitution and the law.

There are four courts: the district court has civil jurisdiction up to £50 and minor criminal jurisdiction; the circuit court has civil jurisdiction up to £600 in contract and tort and £2,000 in equity (unlimited jurisdiction with the parties' consent) and extended criminal jurisdiction, and acts as a court of appeal for the district court; the high court has unlimited jurisdiction in civil and criminal cases and acts as a court of appeal for the circuit court; the supreme court acts as a court of appeal for the high court.

7. Education.—Elementary education, which is given in national schools, is free. Since 1922 the Irish language has been an essential feature of the curriculum in state-aided schools, and there is insistence on the desirability of teaching classes, so far as is practicable, through the medium of Irish. Attendance at some schools is compulsory for children between the ages of 6 and 14 years, and more than 40% of children between 14 and 16 years attend voluntarily, either in elementary or in other schools. The number of national schools in the early 1960s exceeded 4,800, representing a decrease of about 1,000 since the 1920s. Of the total number of teachers two-thirds are women.

Secondary education is given in private schools which, in many cases, are conducted by Catholic religious orders. Where state grants are paid, as is the general rule, the schools are open to inspection. In contrast with the falling numbers of pupils in

elementary schools, the number of pupils attending recognized secondary schools has more than doubled since the 1920s. There were about 500 recognized secondary schools in the early 1960s in about half of which instruction was either entirely or partly in Irish.

Vocational schools in cities, towns and some rural areas provide continuation and technical education. They are maintained partly from the rates (local taxes) and partly from state grants. There were about 90,000 students, nearly three-quarters of whom were over 16, in the early 1960s. Agricultural and veterinary education is provided in institutions managed either by the department of agriculture or by religious orders. Short courses in agricultural instruction are also organized locally by statutory county committees which receive grants from public funds. Higher agricultural education is given by the universities.

The oldest university in Ireland, the University of Dublin (Trinity college), was founded in 1591. The National University of Ireland, founded in 1909, has constituent colleges in Dublin, Cork and Galway and treats St. Patrick's college (1795), Maynooth, as a recognized college. University education is financed partly from state grants.

8. Defense.—The supreme command of the defense forces is vested in the president. The minister of defense is assisted by a council of defense consisting of the minister, his parliamentary secretary, the chief of staff, the adjutant general, the quartermaster general and the permanent secretary of the department of defense. The establishment provides for a permanent force of just under 13,000 officers and men, including the air corps and naval services. The reserve defense force (first and second line) numbers about 20,000 men. The first-line reserve is composed of officers and men who have already been trained during service in the permanent force. There is no compulsory military service. Minimum service is two years' permanent enlistment and six years in the reserve.

(D. G.)

IV. THE ECONOMY

A century ago Ireland depended mainly on agriculture, though there was already a growing linen industry in the northeast round Belfast; this area, now within the Six Counties, became the main industrial district of Ireland. From the foundation of the Irish Free State, industrial expansion was desired as a means of strengthening the national economy and of providing work for those who might otherwise leave as emigrants. There are considerable differences of opinion on the methods of achieving industrialization. The first clear effort in the 1920s was to develop home supplies of fuel and power through electrification, but from 1932, when the Fianna Fáil party under De Valera came to power, further legislation and loans resulted in an increase of industry and its widespread distribution over the country. This policy received some sharp criticism as economically unsound, especially in the case of assembly industries which depended on the import of manufactured parts: many British cars, for example, were conveyed to a port and, to qualify for the lower rate of taxation on Irish-assembled cars, were taken to bits, shipped across the Irish sea, and put together again.

Accurate assessment of the resources of Ireland has not always been a characteristic of publicists. Since the early 19th century the search for minerals has been pursued with considerable zeal, but the resources of coal and iron ore are slight and the deposits of other minerals, such as copper and lead, are inadequate for the support of any major metalliferous industry. In the earlier part of the 19th century, copper, lead and zinc were mined at various places in Ireland for export to Britain, but when overseas supplies became available at lower prices practically all the mineral workings ceased, though a few have been revived from time to time. Far more has been achieved in the provision of power, based on the harnessing of rivers, the successful use of peat after a long period of research, the allocation of the coal reserves at Arigna (County Roscommon) to a generating station, and the maintenance of plants at Dublin and Cork able to use imported fuel. In the 1920s it was feared that the power would not be adequately used, but the domestic and farm use has increased beyond all expectations and added to the amenities of life both in towns and in rural areas, where supply lines have been carried along remote country lanes to scattered farmsteads. A main purpose of electrification has been to encourage industrialization not only in Dublin and other ports but also in country towns to reduce emigration from the rural areas. Although a number of factories have been successfully established in quiet country towns, the emigration remains heavy and in the 1960s showed no sign of diminishing.

The only basic natural resource of the republic is land, which might indeed be regarded as the only permanent source of wealth. Though a distinction is commonly drawn between agriculture and industry, it is rightly said that agriculture is itself an industry, especially as methods become more and more scientific through the selective breeding of stock, the raising of new and improved strains of seed and the application of chemical fertilizers to soils. The use of modern machinery on the farm has made possible the reduction of manpower on the land, *e.g.*, by the installation of milking machinery and the increasing use of tractors. Since the 1880s co-operative creameries have been established in a belt of country extending from north Kerry through the counties of Limerick, Cork and Tipperary into Kilkenny, Waterford and Wexford, and also in the three Ulster counties of the republic, Donegal, Cavan and Monaghan. The advocates of creameries have never achieved their aim of making milk production with butter manufacture the main purpose of Irish farming, partly because on many of the small farms so few cows are kept that a regular daily milk supply cannot be guaranteed to the creameries. Within a radius of 60–70 mi. from Dublin much of the milk is sent to the large city milk suppliers, and in the summer their demand is increased by the tourist inflow and the large sales of ice cream. In much of the country stock raising remains the chief resource, with the meat markets of the cities or the export of live animals as the eventual source of profit. Traditionally, young animals are sold at fairs to farmers or dealers who take them on to richer pastures on larger farms, but as a system of buying and selling the fair is somewhat archaic and in some provincial towns, as in Dublin, auction marts have been established.

By the early 1960s efforts to establish a meat canning industry had had only a limited success. Equally, the production of bacon, though possessing a tradition of efficiency since the early 19th century, has not expanded to any significant extent: pig-keeping on Irish farms has been subject to sharp fluctuations and there has been only a small export of bacon in most years since World War II. Derivatives of the dairy industry, such as condensed milk, cream and cheese, have not achieved a significant place in the international market. Other agricultural staples include grains and flax, but the latter is hardly grown at all now, though it was in great demand by the Northern Ireland linen producers during World War II when overseas supplies were limited. The republic's policy has been to encourage the growth of wheat rather than to rely on imports. Barley is grown to supply malt to the breweries and distilleries.

1. Agriculture.—Before World War II the agricultural output was absorbed equally into three channels: the households and stock; supply of the home market; and export trade. During the war the exports declined to almost one-fifth, with the rest of the output shared about equally between the farms and the home market. Since 1945 the prewar division has appeared again.

Approximately two-thirds of the republic (11,796,300 ac.) is improved farmland; the remaining third consists of areas built up or used for some other nonagricultural purpose, of forests and woods, or of rough pasture, most of which is used for pasturing sheep and even cattle in some areas. In the early 1960s more than 600 sq.mi. owned by the forestry division of the department of lands had been planted. Of the improved farmland more than two-thirds is permanent pasture and over half the rest is in hay: hardly one-sixth, therefore, is under cereal, root and green crops. An increase in cropping is generally regarded as desirable, but though this was achieved during World War II under compulsory tillage legislation, virtually all the land then newly plowed was returned to grass afterward. Similarly more fruit trees, vegetables and other market gardening produce could be grown, as some suc-

cessful experiments have shown, *e.g.*, a jam-making firm near Dublin has established fruit farms and German farmers near Killarney have transformed some old pasture lands into orchards and fruit gardens.

Crops.—About one-tenth of the improved land is used for cereals, mainly wheat, oats and barley. Very little rye is grown, although it is a traditional crop in the west where rye straw is still used for thatching. This craft, however, is declining and slates or tiles are increasingly used as roofing materials.

Cereal cultivation has been encouraged since 1932 by bounties and by restrictions on certain imported foodstuffs. In 1932 there were only 21,000 ac. of wheat, but this increased to 255,000 ac. by 1939 and 662,000 ac. in 1944, when compulsory tillage legislation was in force. After 1945 the wheat acreage declined, but remained considerably higher than before World War II. By contrast very little wheat is grown in Northern Ireland, which relies on imported supplies. Oats and barley are traditional cereal crops in Ireland, subject to less fluctuation in area than wheat; the cereal crops are mainly sold to the mills, in many cases through agents in country towns, not unusually the grocers.

Root crops include potatoes grown for foodstuffs and also for the farm stock, with a limited, though important, growth for seed. Potatoes can be grown successfully on many types of land, including areas recently cleared by peat cutting. Turnips, mangels and other root and green crops, including kale cabbage, are grown mainly as fodder, but sugar beet cultivation has been fostered to supply the factories at Carlow, Mallow, Tuam and Thurles.

Livestock.—The main aim of Irish farming is the support of livestock. The number of cattle fluctuates between 4,500,000 and 5,000,000, of which about one-quarter are milch cows and the rest dry stock intended for fattening or export as stores—though many animals are now sent out as fat cattle, almost all of them to Great Britain. Government legislation has done much to improve the breeds, especially by stationing "accredited bulls" throughout the land. Traditionally Ireland is an exporter of butter but this trade has declined since World War II, partly through competition from New Zealand, Australia and Denmark and partly through heavier local consumption. Over 4,000,000 sheep are kept for mutton and wool, both of which are exported. Most of the sheep are kept in the mountains, but there are many farms west of the Shannon, notably in the counties of Roscommon, Galway and Clare, where sheep are raised on limestone pastures which have excellent grasses. Dealers from Dublin visit the towns and collect sacks of wool from the farmers, or buy from local agents; in some towns dealers organize temporary wool markets.

Pigs and poultry are cash resources on many farms, but neither has been consistently successful as a source of income. During the war years the lack of maize (corn) meal reduced the pig population to one-third of the prewar average of 1,000,000, but since then the 1939 level has been reached again. For a long time poultry-keeping for both eggs and table birds was a main contributor to the financial stability of many farms, especially of the smaller ones. Up to 1939 there were 20,000,000 poultry on the farms, but since World War II the number has decreased by one-third because of the decline of the export trade through the success of the British poultry industry.

2. Agricultural Holdings.—The republic has about 315,000 holdings and 240,000 farmers: the statistical disparity is due to a variety of causes, including the possession of more than one holding and the inclusion of sports fields or park lands around houses, and also to the ownership or even actual working of the land by people who do not list farming as their main occupation. In some parts of the country farmers rent patches of land under the conacre system, whereby small portions of land are leased for a single crop or for pasture. Though tenants may rent the same conacre fields annually they never buy them outright. The farms fall into three groups: small, 1–30 ac.; medium-sized, 30–100 ac.; and large, over 100 ac. Small farms are most prevalent in the west, particularly in Donegal, much of Sligo, central and west Mayo and west Galway. They are also found in Leitrim, which is often regarded as almost the poorest county in Ireland, and they are numerous in the counties of Monaghan and Cavan. On many of these small farms there are patches of oats and potatoes with some meadowland and pasture, and the stock consists of one or more cows, some sheep and some poultry. In some western districts, however, there are mountain sheep also. Many holders of these small farms can hardly maintain any reasonable standard of living if they depend solely on the land: almost invariably other sources of income are available. Some men work as labourers on larger farms, in neighbouring towns, or on the roads, either seasonally or permanently; others cut peat (turf) from the bogs for sale; and many are helped by remittances from emigrants. Government measures for the improvement of the poorest areas include plans for the encouragement of fishing, tomato growing in Donegal and Galway, the organization of peat-cutting and the extension of rural industries.

Medium-sized farms cover most of the central lowland south of a line from Galway to Dundalk, and are equally prominent in the mountain-studded lowlands of the south. In parts of the lowland, especially in the east, there are also many larger farms, and everywhere small farms are found. Medium-sized farms are prevalent in Kerry, which never underwent the minute fragmentation of land that characterizes most of the western areas. These farms are generally worked by the farmer himself, possibly with some family help: few farms of less than 70 ac. can support full-time labourers. Characteristically, most of these farms are "mixed," with an output of wheat (except in the wetter, western areas), foodstuffs such as oats, and vegetables such as potatoes, turnips and mangels. Many of the farmers are able to change their production according to the circumstances: they are, for example, the main suppliers of the creameries in the south and on the Ulster borderland. It is they who have supported new enterprises such as growing of wheat and sugar beet. But their main economic resource is cattle, reared for sale at the monthly fairs in the country towns or at auction marts now in some places replacing fairs.

Barely one-tenth of the farms are of more than 100 ac. These are not confined to any one area of the country, though they are most frequent in the east, particularly in Counties Dublin, Kildare and Meath, where many of them are used almost entirely for grazing animals intended for the fat stock markets or for export. But they also include a number of holdings that have a mixed economy similar to that of the medium-sized farms, some large dairy farms of considerable prosperity, and some fine sheep farms near the mountains.

In the mid-19th century an Irish countryman's main ambition was to own land, and by the end of the century the slogan was the "Three F's": fixity of tenure, the free sale of the goodwill of a farm in the event of a change of tenant (known in Ireland as "tenant right," *i.e.*, tenant's interest), and a fair rent. By a series of legislative acts from 1870 onward, the land was transferred to the people who farmed it. At first progress was slow but from 1903, when the Wyndham act made 195,000 tenant farmers (in the present republic) into purchasers, it was relatively swift. But there are still sharp economic problems. In 1955 the Land commission estimated that three-quarters of all the holdings in the country, with an annual valuation of £20 or less, were uneconomic. This figure includes many patches of land that are not farms in the sense of holdings sufficient to support a family, yet it makes clear the need for consolidation of small parcels of land to provide farms of larger size. In fact, this is happening constantly, for small farms are frequently united by legacies to relatives rather than by sale.

Government loans are available for improvements on farms, including the building of farm houses and outpremises. In many areas there have been substantial changes, not least the assignment of old cottages to become farm buildings as they are replaced by new houses, most of which now have electricity. But the stability of Irish farming depends mainly on external trade, virtually all of it with Britain. In the British market, produce such as Irish bacon, cheese, butter and canned meat can be sold only in competition with the highly efficient continental and commonwealth producers.

3. Fishing.—Fishing was far more prosperous before World War II than in the 1960s, and according to official statistics only

about 6,000 men are now engaged in sea fishing, two-thirds of whom are only occasional fishermen, depending alternatively on small farms or some other part-time occupation for their livelihood. The catch of sea fish includes herring, whiting, mackerel, cod and haddock; shellfish, chiefly crayfish and lobsters, are caught off the west coast, largely for export. There are no large fishing communities, but rather a small industry at various points along the coast, for example at Burtonport (Donegal), Dingle (Kerry), and Kinsale (Cork), where a cannery has been built. With government assistance several freezing plants have been built at various places to foster sea fishing. Many of the rivers are famed for salmon fishing, notably the Moy, the Blackwater and the Shannon, which has a salmon hatchery and also an eel fishery; fishery work is done on the Erne, Lee, Liffey and Clady. As a sport, angling has long been popular; both river and lake fishing are tourist attractions. At Kinsale shark fishing has become an exotic sport for the few.

4. Minerals.—In Ireland minerals are of minor significance. Some coal is mined in the Castlecomer field and at Arigna, where it is used for a power station. Peat is cut for domestic fuel and for power stations. In the Vale of Avoca (Wicklow) copper pyrites are mined. Intermittently, copper, lead, iron and zinc have been mined but generally without commercial success, though the search for such minerals continues. In the early 1960s Canadian mining companies were investigating a deposit at Tynagh, in the southeast of County Galway, where copper, lead, silver and zinc have been found. Other Canadian companies are prospecting in a wide area of the west and south of Ireland.

5. Industry.—During the 19th century efforts were made to establish factories in various Irish towns, but many enterprises were unable to compete with British producers. Numerous woolen mills, for example, could not maintain themselves against those of Yorkshire, though a few making suitings of fine quality have survived in County Cork. After 1800 linen spinning and weaving became a factory industry in the northeast, and in the 1850s Ulster acquired two more of its famous industries, shipbuilding in Belfast and shirtmaking in Londonderry and district. Dublin was far less fortunate in its 19th-century economic history, and the major provincial towns such as Waterford, Cork, Limerick and Galway saw little industrial expansion and remained virtually stationary in population at the time when industrial towns were growing rapidly in Britain and in the northeast of Ireland. Nevertheless, there were numerous industries in the rest of Ireland, such as flour and general grain milling in many country towns. Most of the small mills were eventually closed and larger mills built in the major towns, though some remotely placed mills still survive, for example in County Donegal and County Sligo. The brewing and distilling trade was severely hit in the mid-19th century by the total abstinence campaign of Father Theobald Mathew, and many of the local breweries then closed were never re-opened. In time both brewing and distilling revived but were concentrated in a few great enterprises, mainly in Dublin and Cork, though there are also distilleries at Kilbeggan (Westmeath) and Tullamore (Offaly) and a brewery at Drogheda (Louth).

Though the lack of industry was deplored in the late 19th century, there were some products of considerable distinction, such as the poplins from Dublin made of silk and wool, the handmade lace from Limerick, and Waterford glass. Fine suitings were made in County Cork and there was a continuing tradition of skilled craftsmanship in furniture, silver and footwear in the cities. The problem was that these products were expensive, and the cheaper, mass-produced goods were not made to any significant extent, and certainly not at competitive prices. From 1932, as noted above, tariffs gave some protection to home industries, of which of great variety were established throughout the country, and on this basis there are hopes of an expansion of the export trade in industrial products. For this Ireland has three advantages: an adequate labour supply, cheap power and land for factory sites, even if raw materials may not be available.

Capital has traditionally been exported from Ireland by investments in British and other overseas securities, but government policy is to encourage investment at home and also to attract foreign capital. In the earlier years of modern industrialization over half the capital for any incoming firm had to be found in Ireland, but new concerns are now offered substantial grants, liberal credit facilities and tax concessions, and the government is willing to take up equity interests in firms that require capital for expansion and development. Of overseas firms, the first major group to be established included many famous British and continental concerns supplying the Irish market, and the second included more than 100 factories founded since the mid-1950s partly to supply export markets. In the second group are several firms of the Federal Republic of Germany, but at Shannon airport, described as "the world's first free port of the air age," there are also Japanese, Southern Rhodesian, South African and Dutch firms, and the products include fabrics, transistor radios, pianos, electronic control mechanism, plastic buttons, wire mesh and precision fasteners for the aircraft and other industries. Some 1,500 men are employed in this "free port." At Killarney a German cranemaking factory has been remarkably successful and has given much-needed permanent employment in the town and district. Steadily, government planning, mainly through the efforts of the Industrial Development authority, has fostered industrial expansion to reduce the rate of emigration (still high) and improve economic conditions throughout the country.

The long-established and the newer industries together fall into five main categories, the first three of which are closely linked with agriculture while the last two could rank as consumer industries. These five groups are: the production of processed agricultural goods, such as butter, bacon, tinned meat and sugar; the manufacture of drinks, which includes distilling, brewing and malting; industries serving the farmers, such as milling and the making of machinery, farm tools and fertilizers; the manufacture of leather and clothing; and the production of miscellaneous consumer goods. It is in the last two categories that the advance has been most marked since 1932, and official statistics show that the total number directly engaged has more than doubled since that date. In 1931 there were 65,000 persons so engaged, but by the early 1960s the number had risen to more than 150,000, excluding the large number serving industry in various clerical, mercantile and other ways. One aim has not been achieved—the provision of new employment on a sufficient scale to offset emigration.

The first group, agricultural staples, includes creameries; bacon factories, in the main cities and in a number of provincial towns, some of which date back for more than a century; and the canned meat plants in Dublin, Waterford and Roscrea. Sugar beet production has already been mentioned. A curious postwar addition has been the manufacture of chocolate crumb, which is made from milk, sugar and cocoa. A laboratory for research work on food processing was opened in Carlow in 1962.

The second group includes whiskey (so spelled to distinguish it from Scotch whisky) and stout, both of which are significant exports; beer; cider; and mineral waters (soft drinks). The last-named have a large sale in Ireland for, contrary to general belief, a substantial proportion of the population never consume alcoholic drinks.

Industries serving the farmers are varied. The largest mills are in the major ports—Dublin, Cork, Limerick and Waterford—though there are others of considerable size in Galway city, in Sligo and in Donegal. Agricultural machinery is made at various centres and includes some old concerns such as that at Wexford, but though the output has increased considerably, hardly one-third of the demand is met from home manufacture. Tractors have become prevalent since World War II and are produced at the motor works in Cork. Firms making fertilizers have increased their production and depend on imported raw materials; the main centres are at Dublin, Drogheda, Wicklow and Cork.

Leather and clothing industries have been greatly expanded. They include woolen and worsted factories that date back to the 18th century, a few linen mills that are outposts from the industry of Northern Ireland (for example, in Drogheda and in Ravensdale near Dundalk), some new cotton mills, a sewing-cotton works at Westport, and a number of shirt factories in the east of County

Donegal, most of them allied to firms in Londonderry. The clothing industry, including hosiery and knitwear, employed about 30,000 workers in the early 1960s, more than twice the figure in 1930, and little clothing is now imported except for luxury goods; some materials and clothing are exported, notably Irish tweeds and hand-knitted sweaters. In the footwear industry there has been a similar growth, and old-established tanneries, such as those at Limerick, Tralee and Cork, have been supplemented by newer ones in various provincial towns. Many of the firms in such industries bear honoured names in Britain and a few are linked with continental European countries.

The last group consists of miscellaneous consumer goods, which have expanded considerably since 1930. This group includes the making of bread, confectionery, tobacco and paper; printing; furniture manufacture; and a widening range of metal and engineering trades. The first steelworks in the republic was established on Haulbowline Island, formerly a British naval base in Cork harbour, in 1938. At Cork there are the Ford motor works which began production in 1919, a rubber factory and a number of engineering works. A large oil refinery has been built at Whitegate beside Cork harbour. Since 1930 many light industries have been placed in various country towns: for example, razor blades are made at Carlow and Enniscorthy, enamelware at Tralee (as well as at Dublin), aluminum utensils at Nenagh, cutlery and ropes at Newbridge (Kildare), electric cables at New Ross, electric bulbs at Bray and water pipes at Balbriggan (Dublin).

The industrial developments in the republic since the 1930s are an interesting example of national planning with a social as well as economic purpose. Government assistance has been given on a scale that is generous in relation to the national resources. Not all the industries have been successful, nor has the industrial program solved the emigration problem. But much-needed employment has been given at a time when the numbers working on the land were diminishing, partly through the continued union of small farms into larger ones and partly through the replacement of workers by machinery. Without the electrification scheme, the industrial program could not have achieved even its existing measure of success.

6. Power.—When the Irish Free State government began its electrification scheme on the Shannon in the 1920s the fear was that the number of customers would be inadequate; but soon after the project was completed in 1929 the search began for other suitable rivers. In the early 1930s the demand was sharply increased by the industrial program, and by the early 1960s the number of units sold exceeded 2,400,000,000, most of which was for general domestic supply, industrial motive power and machinery on the farms; very little was used for traction as there are no electric railways or trams (streetcars). Although the consumption per head is less than in many other countries, several power stations have been built: on the Liffey at Pollaphuca and Leixlip, on the Lee at Inniscarra, on the Erne at Cliff and Cathaleen's falls and on the Clady in County Donegal. These hydroelectric stations provide 40% of the supply, and a further 29% comes from peat-fired stations, of which there are three on midland bogs at Allenwood, Portarlington and Ferbane, and several along the west coast from Donegal to Kerry. The remaining 31% of the power is supplied from plants using imported coal and oil at Dublin and Cork. The plant at Arigna uses local coal.

7. Transport and Communications.—After World War II the railways of Ireland were no longer profitable. The Dublin government in 1944 set up a state company, *Coras Iompair Eireann*, to run the Great Southern railway and the Dublin United Transport company, as well as lorry (truck) services throughout the country; in 1950 the Grand Canal company was added to C.I.E. By 1953 the Great Northern railway was facing immediate bankruptcy and was taken over jointly by the governments of the Republic of Ireland and of Northern Ireland. Under the Great Northern Railway act of 1958 the section of this railway which lay within the Republic was taken over by C.I.E. and the remainder transferred to the Ulster Transport authority. Also in 1958 the Transport act authorized the elimination of uneconomic transportation and many branch railway lines have been closed. There is, for example, no railway line west of Killarney, and all the railway lines west of Cork are in disuse; eventually there will be railway communications only between the main towns of the country, with stations at intervals of ten to twenty miles.

From 1944 the aim has been to integrate all transport services by train, bus and truck. Bus services normally connect with trains and use the station yards as parking grounds. Truck services run by C.I.E. penetrate roads of surprising remoteness. The tourist trade is encouraged by special services which include coach tours at charges including hotel costs and all meals, and one-day tours of Killarney and Connemara from Dublin, designed especially for people making only a short stay but wishing to have a glimpse of the west of Ireland. Another tourist development is a trip by boat along the Shannon by C.I.E. The number of private cars has steadily increased but in the early 1960s was only 1 for 16 of the population, though many farmers have vans.

Except in Dublin and its vicinity the roads of Ireland carry very little traffic: substantial improvements have been made by widening and straightening out difficult sections.

The air services with the heaviest traffic are from Dublin to London, Manchester, Glasgow, Liverpool and Birmingham; and, of the continental flights, to Paris and Lourdes (for pilgrims). Shannon airport has transatlantic connections (*Aer Linte*) and has added an industrial estate whereby participating companies are exempt from all tax on exports operations until 1983 and pay only nominal rates; profits can be freely repatriated. An airport was opened in Cork in Oct. 1961 for domestic services. Some cargo is taken by air, but it represents less than one-tenth of the overseas trade.

Telecommunications.—There are Atlantic cable stations at Knightstown on Valentia Island, and at Waterville in County Kerry. Several of the island communities off the west coast now have radio telephonic communication with the mainland. The ministry of posts and telegraphs also controls radio and television broadcasting. Radio Eireann permits limited advertising. Telefís Eireann, the republic's television service, was inaugurated New Year's Eve 1961.

8. Shipping and Ports.—Of the cargo trade, more than half is handled by Dublin, which has extensive quays on the river Liffey and a large basin with warehouses and a grain silo. Dublin handles about two-thirds of the imports and half the exports. Cork, with Cobh, the chief Irish port of call for transatlantic liners, has about one-eighth of the overseas trade; Waterford and Limerick have mainly coastal shipping. Other ports, such as Drogheda, Dundalk and Rosslare on the east, and Foynes and Galway on the west, are little used. The Irish merchant marine service is small but growing. The passenger services are from Liverpool to Dublin, Holyhead to Dun Laoghaire (Kingstown), and Fishguard to Rosslare and Cork.

9. Overseas Trade.—The adverse balance of trade, usually large in the 1950s (except in 1957 when there was a favourable balance with a surplus of £9,000,000), declined in the early 1960s. The value of exports and re-exports rose from about £151,000,000 in 1959 to more than £180,000,000, and although the value of imports was greater by about £30,000,000, the balance was met by invisible earnings, which included the returns from investments abroad (mainly in Great Britain), remittances from emigrants, pensions paid to senior residents from abroad such as former members of the British armed forces and repatriated Irish-Americans, and—increasingly significant—the profits of tourism.

In some years there have been efforts to restrict the imports of consumer goods, apart from those in normal tariff legislation, but normally at least half the imports are classified as "materials for further production." Of the exports more than half are agricultural, including live cattle, chilled beef and mutton, and horses. Other agricultural exports include raw wool, bacon, canned meat and—since World War II—chocolate crumb. The butter export is now slight and the sale for poultry and eggs has declined sharply. Many exports fluctuate from year to year but hopeful signs in the early 1960s were the increased sale of textiles and the opening-up of markets for various other consumer goods. The exports of beer and liquor, chiefly stout and whisky, remain fairly stable. Irish

farmers would undoubtedly welcome an expansion of exports of agricultural origin, especially of butter, bacon and canned goods, but in all these the British market is well supplied from continental and commonwealth sources. (T. W. Fr.)

10. Finance.—The gross national product (GNP) was £399,000,000 in 1950 and £649,000,000 in 1960. The increase in gross national product in real terms between 1950 and 1960 was about 18%, representing an average annual increase of about 1½%. Since there was some reduction in both total population and in the labour force during this period, real output per head rose by about 24% or approximately 2% per annum. Between 1950 and 1960 the proportion of national income arising in agriculture (including forestry and fishing) fell from 28% to 24%. The proportion generated in the industrial sector rose from 25.7% to 28.2% during the same period.

The average annual growth rate in GNP masks wide variations. There was a steady rise in real gross national product from 1950 until 1955, when a very large balance of payments deficit, necessitating corrective measures, occurred. Thereafter, real GNP fell, being more than 4% lower in 1958 than in 1955. The government's program for economic expansion was published in 1958. It was designed to increase national output, improve the competitiveness of Irish products in export markets and generate a dynamic of progress within the economy. This five-year program contributed to the improvement in the economic situation: in 1959 real national income rose by 4½%, and in 1960 by 5%, and this growth was maintained in the early 1960s. This improvement was achieved without any significant rise in internal costs and prices and without pressure on the balance of payments. It was associated with a substantial growth in exports, especially of manufactured goods.

Taxes are both direct and indirect. Direct taxation is levied upon income and profits, estates and motor vehicles, and also as stamp duties. Indirect taxes are customs and excise duties, and minor taxes. Local taxes, in the form of rates, are levied as in Great Britain by local authorities. In the early 1960s government revenue and expenditure were well in excess of £160,000,000 with a current deficit of more than £4,000,000 and a total capital expenditure of about £50,000,000. The capital liabilities were £176,300,000 in March 1951 against which were held assets valued at £95,700,000. By the early 1960s both liabilities and assets had about tripled. In 1950–51 the debt charged was £7,200,000 of which £5,300,000 was charged to taxation; the corresponding figures in the early 1960s showed a fivefold increase.

Banking and Currency.—The republic has its own currency. The monetary unit is the Irish pound, with the same value as the pound sterling. The principal circulating medium is the legal tender note convertible into British legal tender at the Bank of England.

The Central Bank of Ireland, established by the Central Bank act (1942) regulates currency and banking policies in consultation with the ministry of finance. Under the bank act, eight associated banks operate in the republic.

See also references under "Ireland, Republic of" in the Index. (W. J. L. R.)

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IRENAEUS, SAINT (*c.* 130–*c.* 200), a father, doctor and saint of the ancient church. Little is known about his life. His letter to Florinus, preserved in Eusebius' *Ecclesiastical History* (V, xx, 4–7), shows that he remembered the aged Polycarp, disciple of the apostle John. Irenaeus was therefore presumably born *c.* 130 in Asia Minor. He later went to southern Gaul as a missionary. In 177–178, now a priest, he was entrusted with a mission to Eleutherius, bishop of Rome, taking with him, according to Eusebius, a letter from the martyr church of Gaul interceding for the peace of the church, then disturbed by the Montanist controversy (*see* Montanism). On his return Irenaeus was consecrated bishop of Lugdunum (modern Lyons), in succession to Pothinus, who had been martyred in the great persecution at Lugdunum. About 190 he wrote a letter to Victor, bishop of Rome, protesting against the attempt of the latter by threat of excommunication to constrain the church of Asia Minor to abandon its traditional but peculiar date for Easter. Though Irenaeus supported the Roman usage, his letter is a strong plea for toleration. He apparently continued at Lugdunum till his death, *c.* 200. There is no secure foundation for the tradition that he was martyred. His feast day is June 28.

Works.—Eusebius (*Eccl. Hist.* V, xx, 1–4; xxvi) mentions a number of letters and works written by Irenaeus to defend the doctrine and unity of the church. Apart from the citations preserved in Eusebius all but two of these have perished. (1) Of his major work, *Adversus Haereses* ("Against Heresies"), written against Gnosticism, portions exist in the original Greek and the whole in an old Latin translation. (2) His *Demonstration of the Apostolic Preaching,* a handbook of Christian evidences long considered lost, was discovered in Armenian translation in 1904 at Erivan (now Yerevan), in Armenia.

Historical Interest.—During the 2nd century the amalgamation of elements of the secular thought of the time with the primitive Christian teaching increasingly produced heretical doctrine and the rise of schismatic bodies. The reaction of the church to this was a heightened consciousness of its own doctrinal and ecclesiastical authority, and an attempt to define more clearly its heritage of Scripture, doctrine, ministry and sacraments. Irenaeus is the leading surviving witness to this process during a very formative period.

Scripture.—Irenaeus shows the development of the authoritative canon of the New Testament, to the exclusion of other books. He quotes all the books except Hebrews, III John and Jude, and is the first writer to state that there are, and can only be, four Gospels, giving their traditional authorship (*Adv. Haer.* III, i, 1; xi, 8). He uses the apostolic writings as an authority in a manner almost indistinguishable from the original Old Testament Scriptures.

Creed.—Irenaeus frequently mentions the "Rule of Truth," and rehearses the main articles of belief in a manner reminiscent of the Apostles' Creed (*e.g., Adv. Haer.* I, x, 1); this indicates the development of a baptismal creed, for the exclusion of heresy.

Ministry.—The generally allowed allegorical interpretation of Scripture, which derived secondary "hidden meanings" from the text, enhanced the ever-present difficulty in establishing an accepted authoritative exposition. Heretics employed the same method to substantiate their positions. Irenaeus advanced the claim that the consensus of all the bishops of the churches of admitted and continuous apostolic foundation provided the sole safe guide to the interpretation of Scripture (*e.g., Adv. Haer.* IV, xxvi, 5; xxxii, 1). This disallowed the Gnostic claim of a succession of teachers possessing a secret tradition. Thus the primary interest of Irenaeus in the ministry is as a teaching medium, though he acknowledges the sacramental aspect.

The Roman Church.—Irenaeus points to the Roman Church, founded by the two chief apostles, as the eminent though not exclusive example of this principle of episcopal teaching authority (*Adv. Haer.* III, iii, 2). To Roman Catholic historians this is an important stage in the explication of the principle of papal primacy, to others an early but significant stage in the evolution of the papacy.

Theological Interest.—Irenaeus can employ elements of Greek thought, and thus expounds Christ as the Logos. His constructive thought, however, chiefly consists in the restatement and interpretation of biblical attitudes, in opposition to Gnostic mingling of Hellenic and eastern with Christian elements. In general, he both recalls Christian thought to its biblical origins and prefigures much later Catholic orthodoxy.

God and Creation.—Gnosticism taught that God is a remote Su-

preme Being; the material creation is essentially alien to him and has contact with him only through a long chain of subordinate "emanations." To Irenaeus God is the present, creative, active and personal God of the Old Testament (*e.g., Adv. Haer.* II, xxx, 9).

The Trinity.—The doctrine of the "Two Hands of God," the divine Son and Spirit, represents the immediate activity of God in the world, in creation, revelation and redemption (*e.g.,* IV, xix, 2).

The Atonement.—The incarnate divine Son undid the effect of Adam's disobedience by living as man a life of sinless obedience, culminating in his death (*e.g.,* III, xxiii, 1; V, xxi, 1). This victorious "going over the ground again" in reverse direction by the "second Adam" Irenaeus calls recapitulation.

Salvation.—Irenaeus can expound this as the restoration to mankind of "divinity," by virtue of the union of the human and divine in Christ (III, xix, 1). He also has a firm grasp of the New Testament principle that salvation is a moral change, appropriated by personal loving trust in Christ the Victor (I, xxv, 5; IV, xiii, 4).

Christian Hope—Irenaeus has a vivid expectation of Christ's visible Second Advent (III, xvi, 8) and of the earthly millennial Kingdom (V, xxxiii, 3–4).

Bibliography.—The best edition of the *Adversus Haereses* is that by W. W. Harvey (1857); Eng. trans. in the "Ante-Nicene Christian Library" (1868–69). Eng. trans. of the *Demonstration* are those of J. A. Robinson (1920) and J. P. Smith (1952); French trans. by L. Froidevaux (1959). *See* also "Saint Irénée," in *Dictionnaire de théologie catholique* (1923); P. Beuzart, *Essai sur la théologie d'Irénée* (1908); G. N. Bonwetsch, *Die Theologie des Irenaeus* (1925); F. R. M. Hitchcock, *Irenaeus of Lugdunum* (1914); J. Lawson, *The Biblical Theology of St. Irenaeus* (1949); W. Schmidt, *Die Kirche bei Irenäus* (1934); A. Houssian, *La Christologie de Saint Irénée* (1955); G. Wingren, *Man and the Incarnation* (1959); A. Benoit, *Saint Irénée, introduction à l'étude de sa théologie* (1960). (J. Ln.)

IRENE, the name of several Byzantine empresses.

Irene (*c.* 752–803), the wife of Leo IV, was originally a poor but beautiful Athenian. On Leo's death in 780 she became guardian of their ten-year-old son, Constantine VI, and co-emperor with him, though virtually holding supreme control for ten years. Her most notable act was the restoration of the use of icons in the Orthodox Church, a policy which she had always favoured, though compelled to conceal this during her husband's lifetime (*see* Iconoclastic Controversy). She had Tarasius, one of her supporters, elected patriarch of Constantinople (784) and then summoned a general church council. This met in 786 at Constantinople to restore the use of icons, but it was broken up by the iconoclast soldiers. Another council was then convened at Nicaea in 787, and the cult of images was restored. This was recognized as the seventh ecumenical council, and the Eastern Church was once more in communion with Rome (*see* Council).

As Constantine approached maturity he resented her autocratic sway and that of her favourite, the logothete Stauracius. An attempt to free himself by force was crushed by the empress, who demanded that the military oath of fidelity should thenceforward recognize her as senior ruler. Discontent at this moved the Asian troops of the Armeniakon theme to open resistance in 790 and they formally proclaimed Constantine VI as sole ruler. Irene was banished from court, but in 792 was allowed to return and her title of empress was confirmed. The rival factions, however, remained. Irene, by skilful intrigues with the bishops and courtiers, organized a powerful conspiracy against Constantine, who was arrested and blinded at his mother's order (797).

Irene then reigned alone as "emperor" (not empress) for five years. In 798 she reopened diplomatic relations with Charlemagne, and in 802 there was some question of a marriage between herself and Charlemagne; but according to Theophanes, who alone mentions it, the scheme was frustrated by Aetius, one of her favourites. An alliance between Constantine and Charlemagne's daughter, Rothrude, had already been proposed in 781, but this had been broken off by Irene. In 802 the higher officials and generals conspired against her and placed on the throne Nicephorus, the minister of finance (logothete). The haughty and unscrupulous empress was exiled to Lesbos, where she died in 803. Her zeal in restoring icons and her patronage of monasteries has given her a place among the saints of the Greek church. Her feast day is Aug. 9.

Irene (Irene Ducas) (*c.* 1066?–1120), the wife of Alexius I, is well known from the description of her in the *Alexiad* of their daughter Anna Comnena. She failed to persuade Alexius to divert the succession from their son John to Nicephorus Bryennius, Anna's husband, and when her *coup d'état* was forestalled by John she retired to the monastery which she founded in Constantinople.

Irene (d. 1161), the first wife of Manuel I Comnenus, was the daughter of the count of Sulzbach and sister-in-law of the German king Conrad III, who arranged her betrothal. The marriage was celebrated at Constantinople in 1146. The new empress, who had changed her earlier name, Bertha, for one more familiar to the Greeks, became a devoted wife; contemporaries remarked on the simplicity of her manner and appearance in contrast to the more sophisticated Byzantine ladies of that age.

Bibliography.—*First Irene:* J. B. Bury, *The Later Roman Empire,* vol. ii (1889); C. Diehl, *Byzantine Portraits* (Eng. trans., 1927); G. Ostrogorsky, *History of the Byzantine State* (1956); F. Dölger, *Byzanz und die europäische Staatenwelt* (1953).

Second Irene: See F. Chalandon, *Essai sur le règne d'Alexis I Comnène* (1900); G. Ostrogorsky, *History of the Byzantine State* (1956).

Third Irene: See P. Lamma, *Comneni e Staufer,* 2 vol. (1955–57); F. Chalandon, *Jean II Comnène et Manuel I Comnène* (1912). (J. M. Hy.)

IRENG RIVER (also known as the Maú River), rises in the Guiana highlands and flows south for about 124 mi. to join the Tacutú river, a tributary of the Rio Branco, in northern Brazil. From its source to its junction with the Tacutú, the Ireng forms the boundary between Brazil and British Guiana. It rises in an area of heavy forest, but emerges farther downstream to flow through a part of the Rupununi savanna. Diamonds have been found in the gravels along its valley. (P. E. J.)

IRETON, HENRY (1611–1651), English statesman and soldier, the son-in-law and close friend of Oliver Cromwell, was born at Attenborough, Nottinghamshire, in the autumn of 1611. Educated probably at Nottingham grammar school and at Trinity college, Oxford, and the Middle Temple, he was said by Anthony à Wood to have been "a stubborn and saucy fellow." When the Civil War came he raised a troop of horse which appeared in the thick of the fighting at the battle of Edgehill, but was afterward sent back to protect the county of Nottinghamshire where it had been raised. In 1643 Ireton became a major in a cavalry regiment which joined Oliver Cromwell at Grantham and fought in a small action at Gainsborough in Lincolnshire. Ireton became friendly with Cromwell who appointed him deputy governor of the Isle of Ely and an officer in his own cavalry regiment. In the summer of 1646 Ireton married Cromwell's eldest daughter, Bridget, by whom he had a son and three daughters. Meanwhile he served in the battle of Marston Moor in 1644, and later backed Cromwell in his quarrel with his commander, the earl of Manchester. In 1645 he was given his own regiment in the New Model army. At the battle of Naseby he was put in command of the left wing but was driven from the field by Prince Rupert. Later in 1645 he was at the siege of Bristol and was elected member of parliament for Appleby in Westmorland.

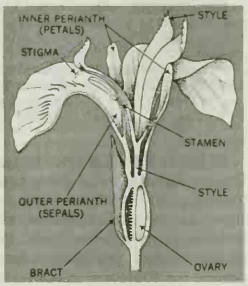
During 1647 Ireton emerged as a political leader with a mind of his own. He tried to act as mediator between the army and the house of commons and worked hard to negotiate a general settlement between Charles I, the parliament and the army. For this purpose he drew up a constitutional scheme known as the "Heads of the Proposals" which was submitted for discussion at a meeting of the council of the army held in the autumn of 1647. Ireton was both a firm believer in the claim of the army to be recognized as a political force and a strong opponent of the more democratic theories of the Levellers and the so-called "agitators" or agents of the common soldiers in the New Model army. In his view manhood suffrage would undermine the institution of private property, while he insisted that the engagements made by the army leaders must be kept. After the second phase of the Civil War Ireton turned against the king and was in favour of his being brought to trial; he was one of the signatories of Charles's death warrant. In 1649 Ireton was promoted major general and served under Cromwell in Ireland. When Cromwell left Ireland he stayed behind as

lord deputy and acting commander in chief. He died of fever after taking part in the siege of Limerick on Nov. 28, 1651, and was buried with some pomp in Westminster abbey.

Henry Ireton, though not a great soldier, was an able, devoted and selfless administrator. He was also the most profound political thinker on the Puritan side. It was said that "Cromwell only shot the bolts that were hammered in Ireton's forge," and Cromwell certainly suffered a public as well as a personal loss by his son-in-law's early death.

See R. W. Ramsey, *Henry Ireton* (1949). For Ireton's political speeches and ideas, *see* A. S. P. Woodhouse (ed.), *Puritanism and Liberty* (1938). (M. P. A.)

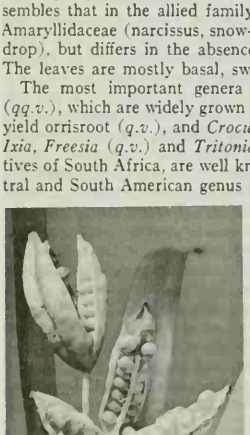
IRIDACEAE, the iris family of flowering plants, belongs to the order Liliales (or Liliiflorae) of the group of monocotyledons. It contains more than 1,000 species in about 60 or more genera, widely distributed in temperate and tropical regions and especially centred in Central America and subtropical Africa. The members of this family are generally perennial herbs growing from a corm, as crocus and gladiolus, or a rhizome, as iris; more rarely, as the Spanish iris, from a bulb. A few South African representatives have a shrubby habit. The flowers are hermaphrodite and are regular, as in iris and crocus, or with a symmetry in the median plane, as in gladiolus. The arrangement of flower parts is in groups of three and resembles that in the allied family Amaryllidaceae (narcissus, snowdrop), but differs in the absence of the inner whorl of stamens. The leaves are mostly basal, sword-shaped and overlapping.



FROM GROOM, "ELEMENTARY BOTANY," (G. BELL)

LONGITUDINAL SECTION THROUGH FLOWER OF IRIS PSEUDACORUS

The most important genera are *Crocus, Iris* and *Gladiolus* (*qq.v.*), which are widely grown as ornamentals; some *Iris* species yield orrisroot (*q.v.*), and *Crocus sativus* produces saffron (*q.v.*). *Ixia, Freesia* (*q.v.*) and *Tritonia* (including *Montbretia*), all natives of South Africa, are well known in cultivation, as is the Central and South American genus *Tigridia* (*see* TIGERFLOWER). In North America there are many native species of *Iris* and *Sisyrinchium*, especially in the east, and a few species of *Alophia, Calydorea* and *Eustylis* (a monotypic genus). *Sisyrinchium*, blue-eyed grass, is a new world genus extending from arctic America to Patagonia and the Falkland Islands; *S. angustifolium*, an arctic and temperate North American species, is also native in Galway and Kerry in Ireland. Other native British representatives of the family are: *Iris pseudacorus* and *I. foetidissima; Gladiolus illyricus*, a rare English plant; and *Romulea columnae.*


JOHN MARKHAM

SEED PODS OF IRIS FOETIDISSIMA

IRIDIUM, a chemical element, is a precious heavy white metal, one of the six platinum metals (*q.v.*). Its specific gravity, 22.56, is equaled by osmium; these metals are the densest terrestrial substances. With a melting point of 2,450° C., iridium is difficult to fuse. Its boiling point is estimated at above 4,800° C. The metal is hard and brittle; however, it becomes ductile and can be worked at a white heat, from 1,200° C. to 1,500° C. The chemical symbol of iridium is Ir, atomic number is 77 and atomic weight is 192.2.

In the massive state the metal is practically insoluble in acids and is not even attacked by aqua regia, which dissolves gold and platinum. Iridium is oxidized by a mixture of fused potassium hydroxide and potassium nitrate. Iridium crucibles are superior to those of platinum because of their resistance to carbon and phosphorus at high temperatures. However, their gradual loss in weight by air oxidation above 1,000° C. is greater than that of platinum.

Because of difficulties in preparation and fabrication, the pure metal has no important applications. The element's principal use is in the preparation of platinum alloys. Pure platinum is a soft metal and unsatisfactory for many uses. Alloyed with from 5% to 10% iridium, it forms a readily worked metal, much harder and stiffer and more resistant to chemical attack.

For ordinary purposes these iridium-platinum alloys are always used unless pure platinum is needed for special reasons. They are used for jewelry and surgical pins and pivots. With their superior resistance to the action of the high-temperature electric spark they are widely used for electrical contacts and sparking points.

The international prototype standard metre of length and kilogram of mass have been constructed from the alloy containing 90 parts platinum and 10 parts iridium.

Iridium has also been used as a major component of precious metal tips on gold fountain pens.

Iridium is generally obtained from the native alloy, osmiridium, but is always found in small amounts in platinum-bearing ores. Its discovery in the acid-insoluble residues of platinum ores was announced by Smithson Tennant in England in 1804. It was named by him in consequence of the various colours of its compounds. In metal preparation, osmiridium is heated with zinc to give an acid-soluble alloy. After separation of osmium as OsO_4 the platinum is removed by repeated fractional precipitations of the compound $(NH_4)_2PtCl_6$. The ammonium hexachloroiridate, $(NH_4)_2IrCl_6$, then crystallized, is decomposed to give sponge metal.

Iridium forms the oxides Ir_2O_3 and IrO_2 and important series of compounds with oxidation states +3 and +4. In many of these compounds it exists in complexes in which chloride, ammonia, water and other groups are bonded covalently to a central iridium atom. These complexes are of the inert type in that the groups are replaced slowly.

Iridium compounds decompose readily upon ignition, and the element in analysis is determined gravimetrically as metal. Strong oxidizing agents or electrolysis will give oxidation states higher than +4 of transient stability in water.

See also references under "Iridium" in the Index.

(D. S. MK.)

IRIGOYEN, HIPÓLITO (1850–1933), Argentine statesman and first president elected by broad popular suffrage, was driven from office during his second term in Argentina's first successful 20th-century revolution.

Born in Buenos Aires, Irigoyen became a lawyer, teacher, rancher and politician, and in 1896 he took control of the Radical party. His relentless effort to obtain free elections succeeded in winning from the conservative oligarchy the Sáenz Peña law (1912). Under this provision for the secret ballot, Irigoyen was elected president. During his term (1916–22) he and his Radical party followers in congress maintained Argentina's neutrality in World War I. Measures that regulated labour conditions were also passed, but these were not strongly enforced, and in 1919 a serious strike, in part politically inspired, was violently broken by the government.

Re-elected overwhelmingly in 1928, despite the opposition of his former close associate, Marcelo T. de Alvear, who had served as president from 1922 to 1928, the increasingly senile Irigoyen lost his grip on affairs. Corruption and stagnation within his administration cost him much support, which went over to the opposition formed by his long-time conservative enemies. The business depression that began in 1929 further weakened his position, and a relatively bloodless conservative-military coup in 1930 ended his career. He died in Buenos Aires.

Austere in much of his personal life, obscure in many of his public declarations, yet immensely popular almost to the end of his career, Irigoyen failed to implement in Argentina the democratic

reforms that he had tenaciously advocated before reaching power. (T. F. McG.)

IRINGA REGION, TANGANYIKA (TANZANIA), established in October 1963, comprises Iringa and Njombe districts and is bounded north by Singida and Dodoma regions, north and east by Morogoro Region, southeast by Ruvuma Region, southwest by Malawi, and west by Mbeya Region. Area 21,750 sq.mi. (56,333 sq.km.). Pop. (1957) 489,291. In Njombe District are the Uwemba Mountains (7,400 ft. [2,260 m.]), the Kipengere Range (9,715 ft. [2,961 m.]), and the Livingstone Mountains (9,600 ft. [2,930 m.]) whose precipitous slopes flank the eastern shore of Lake Nyasa in the Great Rift Valley. The eastern boundary of Iringa District follows the escarpment of the central plateau of Tanganyika (Archean granites) overlooking the Kilombero Valley. The Great Ruaha River crosses the district and forms the northeastern boundary. Coal reserves are found in Karroo deposits in the valley of the Ruhuhu River flowing to Lake Malawi along the boundary of Ruvuma Region. Rainfall, mainly during December–April, is more than 60 in. (1,500 mm.) on high ground where mists and frost (over 5,000 ft. [1,500 m.]) are common. The plateau, however, is hot and relatively dry. Regional headquarters are at Iringa. The largest tribe are the Hehe; there are small numbers of European settlers. Tea, coffee, and tobacco are grown in Iringa District; pyrethrum, wheat, and wattle (for tannin extract) in Njombe District. (J. M. KE.)

IRIS, a large genus of popular herbs of the family Iridaceae much grown for ornament. They have a petaloid six-parted perianth, an inferior ovary and only three stamens (the outer series), being thus distinguished from the Amaryllidaceae, which have six stamens. They are handsome showy-flowered plants, the Greek name *Iris* ("rainbow") having been applied on account of the hues of the flowers. The genus contains more than 150 species, widely distributed throughout the north temperate zone.

In North America there are about 30 native species, found chiefly in the eastern United States; among the best known are the lilac-to purplish-coloured blue flag (*I. versicolor*), which grows in wet places from Newfoundland to Manitoba and southward to Florida and Arkansas, and the western blue flag (*I. missouriensis*), native to wet soils from North Dakota and New Mexico westward to California and British Columbia.

The Eurasian *I. pseudacorus*, the yellow flag or iris, is common in Britain on riverbanks and in marshes and ditches. It was called the "water-flag" or "bastard floure-de-luce" by John Gerard in his *Herball* (1597); its flowers appear in June and July and are of a bright golden yellow colour. *I. foetidissima*, the stinking iris, gladdon or gladwin or roast-beef plant, is a native of England south of Durham and also of Ireland, southern Europe and north Africa. Its foliage, when bruised, has an offensive odour.

JOHN MARKHAM

YELLOW FLAG IRIS (IRIS PSEUDACORUS)

Iris florentina, with white or pale blue flowers, a native of the south of Europe, is the chief source of the violet-scented orris-root (*q.v.*) used in perfumery. *Iris pallida* and its relatives appear to be the origin of the large common blue iris of gardens, the bearded iris or fleur-de-lis and probably the Illyrian iris of the ancients. *I. pallida* and *I. variegata* have also been assumed to be the parents of the so-called German iris, better known as tall bearded iris; but these plants, long known as *Iris germanica*, are of very doubtful origin, never having been found as native plants.

The garden plants known as Spanish iris (*I. xiphium*) and English iris (*I. xiphioides*) are both of Spanish origin and have very showy flowers. The so-called Dutch irises are derived from *I. xiphium*. Along with some other species, such as the netted iris (*I. reticulata*) and the Persian iris (*I. persica*), both of which are fragrant, they are great favourites with florists. All these just mentioned differ from those formerly named in the nature of the underground stem, which forms a bulb and not a strict creeping rhizome as in *I. pseudacorus*, *pallida*, *florentina*, etc.

For many centuries, probably long antedating the culture of any of the above species, Japanese horticulturists were hybridizing what are today known as Japanese iris. Hundreds of named forms of these, in a variety of colours, are perhaps the showiest of all garden irises. They appear to be derived from *I. kaempferi* or its allies, a plant with a creeping rootstock, long leaves and, in the cultivated forms, very large flowers (six inches across in some varieties). The original species, which is wild in eastern Asia, was in ancient times developed by Japanese families or guilds, some of whom produced identical varieties but applied their own names to them. The hundreds of named forms are hence in much confusion, but the following appear to be reasonably accurate: Gold Bound and Morning Mists (white); Blue Belle and Blue Bird (blue), Pink Progress (pink) and Mahogany and Purple and Gold (reddish purple).

J. HORACE MCFARLAND COMPANY

HORTICULTURAL FORM OF TALL BEARDED IRIS

The iris flower is of interest because of the flower shape, which appears to prevent self-pollination and ensure cross-pollination by insect visitors. The flower parts are so ingeniously arranged that an insect bearing pollen from one flower will, in entering a second, deposit the pollen on the stigma; the pollen which it bears in emerging will not be rubbed off on the stigma of the same flower.

The rootstocks of irises may be planted shallowly in spring (in colder climates) or autumn in an open, sunny exposure and well-drained garden soil. Propagation is commonly by division of rootstocks just after the flowering period. Irises do not breed true from seed; however, seeds may be planted upon ripening and may germinate the following spring. Although irises thrive under a variety of conditions, mulching is desirable in cold climates.

There are large collections of iris at Washington, D.C., and at Cornell university, Ithaca, N.Y. The American Iris society has published a catalogue comprising thousands of varietal names, and the Royal Horticultural society has issued a schematic key for the whole genus, as well as a key for the tall bearded sorts. The keys are tables by which the plants can be identified on the basis of their relationships.

See N. L. Cave, *Iris*, rev. ed. (1959); Wilma L. Vallette, *Iris Culture and Hybridizing for Everyone* (1961). (N. TR.; X.)

IRISH LANGUAGE: *see* CELTIC LANGUAGES.

IRISH LITERATURE. Ireland is unusual in that it has two literatures, one in the native language and another in the language of the English conquerors. This excludes numerous writings in Latin, mostly theological and antiquarian (for which *see* LATIN LITERATURE: *Medieval and Renaissance Literature*), as well as some works in French, *e.g.*, the early poems of the Norman conquerors (*see* ANGLO-NORMAN LITERATURE). This article deals first with Gaelic literature and then with Irish writing in English, commonly called Anglo-Irish literature, and is divided into the following main sections:

I. Gaelic Literature
  A. Early Period
    1. Verse
    2. Prose
  B. Middle Period
    1. Bardic Verse
    2. The Fenian Cycle
    3. Other Prose
  C. Late Period

1. Verse
2. Prose
D. The Gaelic Revival
II. Anglo-Irish Literature
1. The Beginnings
2. The 18th Century
3. The 19th Century
4. The Literary Renaissance
5. The Moderns

I. GAELIC LITERATURE

The Celtic language spoken in Ireland from the earliest historic period, often described as Gaelic (or Goidelic, from Old Irish *Goidel*, a Brythonic loan word of which the modern equivalent is Welsh *Gwyddel*, "Irishman"), has no close connections on the continent of Europe, where evidence shows instead a connection with that form of Celtic of which the surviving Brythonic languages are representatives (*see* CELTIC LANGUAGES). Nor is it certain when Goidelic was brought to Ireland, but research suggests a date not long before the beginning of the Christian era.

The earliest evidence consists of sepulchral inscriptions in the Ogham alphabet (*see* OGHAM WRITING). These are found mainly in the southwest of Ireland, but there are examples from the rest of the country and from Wales, where small Goidelic colonies existed. These inscriptions, usually ascribed to the 4th and 5th centuries, show an archaic state of the language, phonologically very close to the early Brythonic of British and Gaulish inscriptions; its relation to the Irish found in the earliest literary sources may be compared with that between Latin and Old French. The alphabet in which these sources were written was the Roman one, introduced by the Christian missionaries in the 5th century. The precise date at which it began to be used for writing Irish is uncertain, for there are no extant examples before the 8th century, and even then only incidentally, in scribal notes and glosses. The language of the 8th- and 9th-century manuscripts, conventionally called Old Irish, provides an indispensable criterion for dating other material; the discovery in later manuscripts of linguistic forms considerably more archaic than those of the classical Old Irish period indicates that the compositions in which they occur belong to the 7th century or perhaps even the 6th. None of these later manuscripts, on which the knowledge of early Irish literature depends, is earlier than the 12th century, when the vernacular was already nearer to Modern Irish than to Old Irish. The preservation of the older literature is due to the piety and conservatism of monastic scribes.

All attempts to divide a literature chronologically are of necessity unsatisfactory; but the existence for more than 1,000 years of a literary class in Ireland allows certain landmarks to be established. Four periods may be recognized: (1) the early period, when the literature was composed by the order called *filid* and by churchmen and was preserved in the monasteries; this stretched from the earliest times to the 12th century and linguistically covered the whole field from archaic Old Irish to late Middle Irish; (2) the middle period, when the custody of the tradition passed to the lay and hereditary bardic order; this dated from the middle of the 12th century to the middle of the 17th and is linguistically late Middle Irish and classical Modern Irish; (3) the late period, when both literati and patrons had disappeared and the literature became purely popular and peasant; this continued from the middle of the 17th century until the end of the 19th, and during it the language, at first close to classical Irish, evolved finally into the dialects as they are known today; (4) the revival period, from the end of the 19th century to the present day.

A. Early Period

Irish literature was from the earliest times an aristocratic one, kept in the hands of a professional class, the *filid* (singular *fili*, etymologically "seer"); it has been suggested, with considerable probability, that *fili*, *bard* (originally apparently a lower grade of poet than the *fili*), *brithem* ("judge"), *senchaid* ("historian") and *druí* ("druid") all belonged originally to the same privileged caste. The *druí* was ousted by the Christian clergy, though he is still a prominent figure in the sagas; the other professional orders are ranked by the early laws together with the landowning aristocracy. The status and rewards of the *filid* are also set out—no doubt a necessary provision, for the extravagance of their demands is a recurrent theme and caused them to be severely censured as early as the assembly of Druim Cetta (modern Druim Ceata) in 575. Their duties were to know the sagas and genealogies and to compose encomiastic poems; that is, to serve the past and present glory of the ruling class. This function did not, however, prevent a considerable pride, even arrogance, in their calling, and they could enforce their demands by the threat of the lampoon (*áer*), which could not only take away a man's reputation but also damage him physically and even kill him. The laws set out penalties for the abuse of the *áer*, and the belief in its powers continued up to modern times.

1. Verse.—The earliest verse has not been well preserved, no doubt because of its considerable obscurity. For the official work of the *filid* it is necessary to rely on the fragments in the annals and genealogies and, above all, in the later treatises on metrics, where they often appear in very corrupt form. There are, however, two fairly long pieces in what must be regarded as a poetical style.

The *Fáeth Fiada* ("Cry of the Deer") is a rhythmical incantation traditionally ascribed to St. Patrick; although it is undoubtedly old it can hardly have been composed in the 5th century. There is less doubt about the *Amra* ("Eulogy") on St. Columba (*c.* 521–597); this, couched in rhetorical style, in short sentences linked by alliteration, is ascribed to Dallan Forgaill, who was chief poet (*rígollam*) of Ireland. This device of alliterative rhythmical prose is used again in the sagas, and the technical term for it is a Latin loan word, *retoric*. Probably the oldest metre in the strict sense of the word is that in which two half-lines are linked by alliteration—a system strikingly reminiscent of early Germanic verse. Another pattern that can be discerned is that of a heptasyllabic line with trisyllabic ending; this is found both in legal tracts and in the sagas. Rhyme is found from the 7th century onward. Although it is often a full rhyme, the requirement is only that there should be identity of vowel and syllabic length and that the consonants should belong to the same phonetic class—a system found also in early Welsh. At the same time the quatrain, with seven or eight syllables to the line and rhyme between the second and fourth lines, was derived from Latin hymn metres. Still later are found the first examples of a metre later to become the most popular of all—*debide* (literally "cut in two"); the quatrains consist of two couplets, and the rhyme between the two lines of each couplet is usually that of a stressed syllable with an unstressed one.

The official poetry consists, as must be expected, mainly of panegyric, elegy and similar products of the *fili's* relation to his patron. The incident in *Tromdám Guaire* ("Guaire's Oppressive Guests"), a late satire, where a king is made to say, after hearing a poem, "that is a good poem, for him who could understand it," may contain more than a grain of truth, for the poets often affected a deliberately obscure style, like the Provençal *trobar clus*. Naturally enough, it is their official rather than occasional work which tends to be preserved, but some fragments showing a genuine lyric note have survived to be collected and published in Irish and German by K. Meyer in *Bruchstücke der älteren Lyrik Irlands* (1919).

It must be assumed that the remarkable freedom from dialect variations found in Irish right up to the modern period was a result of the influence of the *filid*, and later the *baird*, but there is no evidence that their language was handed down otherwise than orally until the time when the *filid* are found in the monasteries. The whole written tradition is monastic, and the name of the Christian learning, *légend* (Lat. *legendum*), suggests a contrast in techniques. But from the beginning the church in Ireland not only tolerated but cultivated the vernacular in religious writing, and after the first few centuries it had completely superseded Latin in every field except the purely liturgical.

Religious Verse.—The official verse of the church is hardly more lively than that of the *filid*; for example, the *Félire* or "Calendar" of Oengus, composed about 800 and containing a quatrain for each day of the year. More interesting is the 10th-century *Saltair na Rann* (*Psalter*), a biblical history in 150 *debide* poems, which contains a great deal of strange learning. But it is not these ponderous works which constitute the real glory of Irish religious verse but

rather the personal note heard in the voice of the monk who asks forgiveness for his lapses in meditation, or the nun who asks God to grant her the nursing of the infant Jesus. The anonymous poets who composed such poems as these, as well as the famous address to Pangur, the white cat, were not *filid*, and they avoided the more complicated metres but had the immense advantage of using a language that had been cultivated for many centuries, to which they brought a freshness of insight denied to the *filid*.

Nature Poetry.—The happiest wedding of the literary tradition and religious feeling was in the nature poetry, hardly to be paralleled elsewhere in Europe. The native poetry had already shown, both in the lyrics in the sagas and in the seasonal songs, a remarkable sensitivity to natural beauty; perhaps because some of these were ascribed to Find Fili, later confused with the hero, this type of verse became associated with the Fenian tradition. That the *filid* could adapt their technique to new circumstances is shown by an 11th-century poem on the sea, where the preface, choice of theme and free use of kennings all suggest Scandinavian influence. The monastic movement in the Irish church provided a far stronger impetus to nature poetry. Exile from men, whether beyond the seas or to lonely places in Ireland itself, was held to be a bloodless but meritorious martyrdom, and the bare cells of the hermits brought them very close to earth and sky and their creatures. This almost Franciscan poetry would naturally have an especial appeal to monastic scribes, so that a considerable amount of it has been preserved.

Historical Verse.—Remembrance of the past was an important part of the work of the *fili;* indeed, some of the earliest poems are more metrical genealogy than anything else. As time went on and many texts became obscure and different traditions conflicted, the necessity for compendiums of information grew, and these were often couched in metrical form. They are especially numerous toward the end of the early period. In a long poem, *Fianna bátar i nEmain* ("The Warriors Who Were in Emain"), Cináed ua Artacáin (d. 975) summed up the saga material, while Fland Mainistrech (d. 1056) collected the work of the generations of *filid* who had laboured to synchronize the traditional history of Ireland with that of the outside world as it was then known. Equally important is the great collection, existing both in prose and verse forms, called the *Dindshenchus,* which, as R. Flower has well said, formed "a kind of Dictionary of National Topography, which fitted the famous sites of Ireland each with its appropriate legend." And, indeed, the development of a loose *debide* form, making rhyming easy, produced mnemonic verse on all sorts of subjects—hagiology, grammar, lexicography, metrics and law.

2. Prose.—*The Saga.*—The early Irish epic is a prose narrative, which usually, though not always, contains non-narrative passages in a heightened style, whether *retoric* or verse; these passages often take a dialogue form. E. Windisch first pointed out the resemblance between this and the type of epic found in early Sanskrit sources and suggested that the tradition went back to early Indo-European times. It seems at least to be common Celtic; whatever the date and origin of the poems that make up the Welsh *Gododdin,* they do not constitute an epic, and Sir Ifor Williams has seen in the scattered *englynion* of the early manuscripts the lyrics from an early saga cycle the prose of which has been lost. There are parallels for this in Irish; in the love tale *Liadain and Cuirithir* the prose consists of a few scattered and cryptic sentences, and the famous poem of the *Old Woman of Beare,* the Irish *Vieille Heaulmiere,* may also be a fragment of an old story. This does not imply a common Celtic literature but that the traditions of early storytelling in both languages were similar to what is found best preserved in early Irish. In saying this, the difficulties of interpretation arising from the conditions already mentioned must be remembered. The oldest sagas are in a language that suggests that they were first written down in the 7th and 8th centuries, but these versions probably represent nothing more than the attempts of monastic scribes to fix in writing stories that belonged to an oral tradition. Even these are imperfectly preserved, since there is no extant manuscript evidence earlier than the 12th century. The historical background to this is obvious; the Scandinavian invasions of the 9th and 10th centuries disrupted the entire Irish polity and seriously affected literary studies, as they did everything else. Not until the 11th century did life become sufficiently settled for the works of the past to be collected in the monasteries, and this antiquarian revival was both eclectic and uneven. The great codex *Lebor na Huidre* (*The Book of the Dun Cow*), written early in the 12th century, shows, both in the main text and in the later interpolations, older treatments of the saga material than those found in the *Book of Leinster,* written a few score years later. Only the shortest stories are preserved in forms approximating to the original; the rest abound in doublets, repetitions and conflations because of uncritical editorial handling of earlier material. The rhythmic prose used in the heightened passages of the older stories rapidly became unintelligible and was replaced in later recensions by longer poems in the syllabic metres.

It was the duty of the *fili* to know these stories (*scél*), both primary and secondary. Although in this function he may be described as a *scélaige,* he was really fulfilling the same office as the *senchaid;* that is, the preservation of the glories of the past. Occasionally the authenticity of the *scél* is guaranteed by bringing one of the old heroes into contact with later generations, whether it be the supernatural appearance of Cú Chulainn to St. Patrick, Senchán's evocation of Fergus mac Róig, or Oisín's miraculous survival. Although these stories tend to group themselves in cycles, they range over a period from the earliest fables to the 11th century, and in the catalogues—containing the titles of many stories now lost—they are arranged by type rather than by period, so that the headings are stormings, cattle raids, courtships, battles, voyages and so on.

Whatever the attitude of the storytellers and their hearers to these stories may have been, they must be regarded as almost completely unhistorical as far as personages are concerned; even those that relate to the 7th century usually fail to agree with the more reliable evidence of the annals. It is possible, however, that some of them may contain traditional material capable of historical interpretation. The oldest of them preserve for us a picture of a primitive and pre-Christian state of society—fighting from war chariots, the taking of heads as trophies, the privileged position of the druids, the force of tabu (*geis*) as a supernatural sanction—for which there is little or no evidence from historical sources. They are best paralleled by the classical descriptions of the continental Celts, and the preservation of a memory of them is a result of that conservatism of the Irish literary classes which made a 16th-century bard ignore the bow and the gun alike and send his patron into battle armed only with sword and spear. It is hard to arrive at any convenient division of these stories. The mythological cycle, so called because of the frequent references in some of the stories to immortal beings, cannot easily be separated from the cycle of the kings; all were of equal historicity from the storytellers' point of view and all are equally unhistorical from ours (*see* also Celtic Mythology). The most important cycle is that of the Ulaid, the people who gave their name to the modern province of Ulster. As so often happens, their days of power and influence were long over when the sagas took the form in which they are known today, and the problem of why their tradition especially should have been so much cultivated by the *filid,* and why it should have been so much neglected when the period of the *filid* came to an end, is still unsolved. But certainly the figures of Conchobar, king of the Ulaid; Cú Chulainn, the boy warrior; Medb, queen of Connaught; and Noísi and Déirdre, the doomed lovers, are outstanding both in early Irish literature and, even more, in that of the Anglo-Irish revival, and it is on elements from the sagas of the Ulaid that the nearest approach to an Irish epic was built—*Táin Bó Cúailnge* (*The Cattle Raid of Cooley*).

It is probable that even when first put together, in the 7th or 8th century, the *Táin* was not a very coherent work of art; it must be remembered that the oldest type of *scél* does not exceed a few thousand words and is striking chiefly for the laconic vividness of its narrative and the wit of its dialogue. There is little attempt at construction; the longer stories are no more than a chain of loosely connected incidents. *Táin Bó Cúailnge,* which would appear to be a conscious attempt to provide Ireland with an epic comparable to the *Aeneid,* shows this tendency carried *ad absurdum.* There

are dramatic episodes, such as Medb's dialogue with the soothsayer and Cú Chulainn's dealings with the Connaught scouts, but the long series of single combats becomes wearisome and the story tails off badly. Undoubtedly the finest section is that in which Fergus, an exile from Ulster, recalls for Medb and Ailill the deeds of Cú Chulainn's youth. This story of the boyhood of a hero abounds in convincing touches and is obviously the work of an accomplished artist, and it has been transmitted, by some fortunate chance, in a reasonably correct form. But the *Táin* generally is of less literary interest; its value for the literary historian lies in the fact that, as it was being continually worked over, it provides a kind of stratified record of the degeneration of Irish style. Just as the bare prose of the early period is replaced by bombastic alliterative passages, and the *retoric*, emotive in its obscurity, by longer and longer poems in clumsy *debide*, so the ruthless humour with which Cú Chulainn's early killings are described is replaced by the sentimentality of the fight between him and his boyhood friend Fer Diad.

The *Táin* collected around itself a number of ancillary stories, not the least important of which is that of its revelation to the *filid* in the 7th century by the ghost of Fergus. This may point to the date at which a number of tales of the Ulaid were first combined into an epic. Better known is the tragedy of Noísi and Déirdre, linked through their enemy Conchobar to the Ulster stories. In a modern form it became known as one of the *Three Sorrows of Storytelling*, being linked incongruously with a "mythological" story about the children of Tuireann and a late romance called *Oidheadh Clainne Lir* (*The Children of Lir*). It is, of course, known to the world through the work of the Anglo-Irish school, notably J. M. Synge and W. B. Yeats. Equally full of drama, but not so easily adapted to modern taste, is *Scél Mucce Mic Da Thó* (*The Story of Mac Da Thó's Pig*), which includes such primitive elements as the award of the best portion of meat to the leading champion, the boasting competition which ensues and the resolution of the contest by the production of a head just taken in single combat.

Although the early sagas exaggerate to the point of grotesqueness, there is little trace in them of the supernatural. This can hardly be explained by the monastic origin of the manuscripts; the few attempts to introduce Christian elements are easily detected interpolations, and it is more probable that pagan deities, as such, played comparatively little part in the stories, even in their oldest form. Immortals are found, certainly, especially in the stories ascribed to a period deep in antiquity; the Dagda, Lug, Manannán, Midir and Oengus are all beings of more than human stature, and some of them may, in name at least, be linked with Gaulish and Welsh gods and heroes. But they interfere little in mortal affairs and cannot be said to constitute any kind of pantheon; they live in dwellings (*síd*), which may be mounds or islands but in either case hide them from mortal eyes. In general, mortals may visit the *síd* only at the wish of its occupants, usually because a woman of the *síd* has fallen in love with a mortal man. Life there is eternal, but no mortal can return to the world without taking on the burden of the years he spent in the *síd*. If the pre-Christian Irish had a belief in the immortality of the soul, there is no intimation of it in the sagas.

One of the most delightful of these stories is *Imram Brain* (*The Voyage of Bran*), edited by K. Meyer and A. Nutt (1895), which describes a voyage to Tír inna mBan (the Land of Women). The same plan is followed in other *imrama* (which were to have their ecclesiastical counterpart in the *Navigatio Brendani; see* BRENDAN, SAINT), but the later tales tend to stress the marvelous rather than the supernatural. A story of the *síd* is *Tochmarc Étaine* (*The Courtship of Étain*, edited by O. Bergin and R. I. Best, 1938), which describes how Étaín, once a royal immortal, was reincarnated as a woman and married to Eochaid Airem. Her original husband, Midir, finds her again, wins her from her earthly husband at the gaming board and carries her back to the *síd*, where he holds her in spite of all attempts to rescue her. Nowhere are the unchanging delights of the other world better described than in the songs in which Midir reminds his lost wife of her former home.

Other Early Stories.—In this period stories with an origin outside the recognized tradition began to appear. An obviously exotic element is represented by *Togail Troí* (*The Taking of Troy*) and *The Story of Alexander*, which appear in the oldest saga lists, but the classical learning had comparatively small effect until the next period. The same is true of the stories of Finn; although K. Meyer demonstrated in *Fianaigecht* (1910) that the traditions go back to an early period, their real development was at the time when the *filid* were no longer in control. Later research would indicate that the "wild man of the woods" cycle associated with the name of Suibne Geilt had its origins in Strathclyde, where Irish and Brythonic literature must have been in contact at an early date; this mixture of hagiographical, saga and nature material is one of the most attractive stories of the later period. For a discussion of the Suibne story, *cf.* J. G. O'Keeffe, *Buile Shuibhne* (1913) and J. Carney, *Studies in Irish Literature and History* (1955).

Religious Prose.—Although Irish was used for didactic purposes from the earliest period (one of the most archaic pieces of prose is the fragment known as the *Cambrai Homily*), the material is mostly derived from Latin, and that belonging to the earliest period consists mainly of monastic rules, *exempla* to illustrate a moral and anecdotes about saints. The two latter types often show a style and humour worthy of the professional *scélaige*. At a later stage a number of homilies such as *In Tengae Bithnue* (*The Evernew Tongue*) appear; they are interesting, both linguistically and because their sources are often obscure, but of small literary value. The lives of the saints have little interest, either from the literary or the biographical point of view. Intended, no doubt, to be edifying, they are works of fantasy, incorporating with the passage of time more and more elements from folklore on one side and from the saga material on the other. The emphasis is always on the miraculous; it is the fact that they incidentally contain a great deal of information about everyday life in early Ireland that makes them so valuable today as social documents. Naturally enough, Latin and Irish traditions are mingled in this field, in which the standard works are those of C. Plummer, *Vitae Sanctorum Hiberniae* (1910), and *Bethada Náim nÉrenn* (1922). Another important type of religious work is the vision, the best known example of which is *Fís Adamnáin* (*The Vision of Adamnán*), whose soul is represented as leaving his body for a time to visit heaven and hell under the guidance of an angel. To what extent this type of Irish religious work, found also in Latin, may have influenced Dante is still a subject for speculation. Both the saints' lives and the visions tended to degenerate into extravagance and buffoonery—so much so that parodies on both were composed. The outstanding example is *Aislinge Meic Con Glinne* (*The Vision of MacConglinne*), which describes how a king possessed by a demon of gluttony is cured by the recital of the vision of a land of Cockaigne.

Speculative and Technical Writing.—Theory has always been at least as important as practice in Irish cultural life, and the *filid* built up for themselves a considerable body of academic speculation. Very little has survived, but there are obscure fragments on the nature of inspiration and the origin of language, combined with more practical instructions on matters of metrics and style. At an early stage this learning became interpenetrated with that of Latin, as the collection of texts gathered together under the title of *Auraicept na nÉces* (*The Scholars' Primer*) shows; and a full technical vocabulary was built up to deal with Latin, as well as Irish, grammar. In several very ancient texts the discussion of the art of the poet is mixed with questions relating to his legal status. As early as the 10th century the changes in the language had necessitated glossing and interpretation of the older texts; Cormac mac Cuilennáin, the bishop-king of Cashel (d. 903), compiled a glossary of archaic words with illustrations, etymologies (of the school of Isidore) and illustrative passages.

Just as important to the *filí* as the study of the language and literature was that of history and genealogy. J. MacNeill was the first to point to the immense amount of work that was done in adapting the Latin historical synchronisms to the legends and genealogies of Ireland. A synthetic history of the pre-Christian period was thus built up, and the genealogy of the leading families

carried back to Adam. The sequence of events depicted in a compilation such as the *Leabhar Gabhála* (*Book of Conquests*), with its Milesians, Fomorians, Tuatha Dé Danann and whatnot, has been a fruitful source of speculation to modern archaeologists and historians. Far more reliable are the annals kept in the monasteries from early times; these are generally agreed to be reliable from the 6th century onward.

Law and medicine were both important professions in ancient Ireland. By a curious chance, most of the knowledge of early medicine is due to legal men, for the only surviving material, apart from a few charms, is from legal tracts of the Old Irish period, which deal with the status and responsibility of doctors. No doubt medical knowledge was conveyed orally from master to pupil. The same may have been true of legal studies themselves at first, but there exist texts the language of which clearly shows that they were composed in the earliest period now known. Remarkably archaic in content as well as in language, they no doubt represent several traditions, but chief place was held by the *Senchas Mór* ("Great Old Law Book"), a codification given its authority by ascription to a commission sitting under St. Patrick. This must be regarded as an appeal to history of the same type as was used in the literature, and the real date of systematization must be placed several centuries later. Nevertheless, the oldest strata of the laws are now recognized as providing the best evidence not only of archaic Old Irish but also of social life in early Christian Ireland. The system, however, is merely a description of the legal relationships of a small landowning aristocracy. As life became more complicated, it appears to have broken down altogether, and the judges seem to have given their decisions as simple arbitrators, supporting their judgments with imperfectly understood tags.

B. Middle Period

The 12th century is a period of contradictions. On the one hand, the oldest surviving codices were being written in the monasteries, preserving the literature of many centuries earlier with remarkable fidelity; on the other hand was the gradual rise of a new literary order which, while elaborating the verse forms to a far greater extent than before, at the same time recognized the changes in language that had taken place and codified for poetic use a language that must have been very near the vernacular of the day. After the 12th century the hereditary bardic families became the custodians of Irish literature and continued in that function until the collapse of the Gaelic polity. R. Flower suggested that the bardic movement may have received its impetus during the reign of the centralizing Brian Bóroimhe (Boru) (941–1014), and this may well be true. The conditions were favourable, for the upholders of the older tradition had become almost completely identified with a church which was now doubly threatened by the Norman invasion and by the introduction of new orders of monks from abroad. Also, the language had evolved so far during the unsettled period of the viking raids that the older tradition must have become almost unintelligible; the *Book of Leinster Táin*, for example, swarms with fantastic and, one is tempted to say, unreal linguistic forms. The new bardic families were at first completely divorced from ecclesiastical influence, but soon they were sending their sons into the recently introduced orders, above all the Franciscans, who were to become by the end of this period the greatest custodians of the tradition.

1. Bardic Verse.—The bardic reform of verse was sweeping. The language was brought into conformity with the speech of the time, the large number of metres used by the *filid* was greatly reduced and, in compensation, a greater strictness in rhyme and lavishness in ornament—internal rhyme and alliteration—was insisted on. The scope of the verse became considerably less; the vast bulk that has come down is praise poetry, addressed either to the poet's temporary or permanent patron or to God. This arose naturally from the status of the new order of poets; being no longer associated with monastic foundations, they were dependent entirely upon patronage for the high standard of living which they claimed as their own right, for the bards were no less arrogant than the *filid* whom they replaced. After a course of training which lasted six or seven years, these journeymen poets were free to seek a temporary or permanent patron. It is no accident that they praise generosity as highly as bravery in their poems, which many of the chiefs had copied into family verse books (*duanaire*). There is a considerable monotony in these poems, for, though a chief must be described as victorious, it was considered prudent to avoid mentioning the details, lest the poet should wish to sell a poem to the defeated enemy at some future time. Nevertheless, there is often real poetic feeling in the earlier poems; but by the end of the period many poets were content to string together the clichés evolved through the centuries, with little regard for meaning as long as the metre was correct.

Modern taste finds little of interest in even the best of the official bardic poetry; it is the handful of occasional verse that survives that shows real worth. One of the earliest poets of the great bardic family of Ó Dálaigh, Muireadhach Albanach (*c.* 1214–40), has left, as well as a stirring defense of his action in killing a tax collector, an elegy on the death of his wife which is unsurpassed in Irish literature. Such gems are rare.

A new note was brought into Irish literature by the Gaelicized Norman invaders, that of the *amour courtois* or courtly love, and the combination of this exotic element with the wit and felicity of the bardic style has left a number of enchanting poems. No doubt there were once many, many more than those collected by T. F. O'Rahilly in *Dánta Grádha* (1926), but it was only by a fortunate chance that precious vellum was devoted to the preservation of such frivolities. A different kind of departure from praise poetry is the *crosánacht*, a poem in which the verse is frequently interspersed with humorous or satirical prose passages.

2. The Fenian Cycle.—The vast bulk of native prose of this period is concerned with the hero Finn and his war band (*fían;* hence "Fenian"). In spite of their comparative neglect in the 12th-century manuscripts, the stories about Finn, Oisín, Caoilte and the rest must have existed among the people for many centuries. J. MacNeill may be right in seeing in them the traditions of a subject race, for the proportion of folklore elements in them is far higher than in the aristocratic Ulster cycle. The outstanding work is *Agallamh na Seanórach* (*The Interrogation of the Old Men*), in which Oisín and Caoilte are represented as surviving the battle of Gabhra and living on until the time of Patrick, whom Caoilte accompanies through Ireland, explaining to him the origin of the names of the places which they visit—a technique no doubt borrowed from the older *Dindshenchus*, as is also the form of prose with verse passages. But whereas in the Ulster cycle the introduction of the hero of former times is merely a way of authenticating the story, in the Fenian stories it is used to introduce a note of nostalgia for past glory, so that in modern speech "Oisín after the Fianna" is the type of the survivor of a heroic period. No doubt this contrast reflects that between an old hierarchical society and one facing a rapidly changing and hostile world. The Fenian stories never received such careful literary treatment as did those of the older tradition, and the old form was soon abandoned for prose tales and ballads—the latter something of an innovation in Irish literature, though there are examples of metrical versions of prose sagas even in the Ulster cycle. The prose tends to degenerate into a bombastic and alliterative style, seen at its worst in *Cath Fionntrágha* (*The Battle of Ventry*). There are echoes of this style in the "runs" of the modern folk tale, where the Fenian tradition is supreme. The ballads are easier reading and may be regarded as the beginnings of popular, as opposed to professional, literature in Irish. The metres represent such a drastic simplification of the bardic technique that versification became even easier than in the English ballad, and a distinct change in theme can be seen as this literature passed into the hands of the people. St. Patrick still makes his appearance, but he is now a malevolent and hostile figure, starving and bullying the aged heroes who represent the pagan and warlike tradition. These ballads had an immense popularity among the common people; the collection made by James Macgregor, dean of Lismore, early in the 16th century, shows that the tradition of ballads about Oisín and Finn, on which James Macpherson (*q.v.*) was later to base his forgeries about Ossian and Fingal, was already flourishing.

3. Other Prose.—Retellings of the stories popular with the *filid*

of course continue to be found, but these steadily dropped out of favour. Sometimes they were combined with folk-tale elements, as was the case with the very old saga of Fergus mac Léti, which was rewritten, perhaps in the 14th century, to include a story of a people of tiny stature—the leprechauns of folklore. It has been suggested that Jonathan Swift may have heard some version of this and incorporated it in his *Gulliver's Travels*. A curious example of a saga technique being applied to a great historical personage is the *Cogadh Gaedheal re Gallaibh* (*The War of the Irish With the Foreigners*), which deals with the wars of Brian Bóroimhe; the style is bombastic and inflated, and it was to find many imitators, of which probably the worst is Lughaidh Ó Cléirigh's *Life of Aodh Ruadh Ó Dómhnaill*. Most important of all, a flood of translations from both Latin and English began. The stories of Marco Polo, Sir John Mandeville, Prester John and Guy of Warwick, as well as classical and Arthurian stories in their medieval adaptations, became well known in Ireland. The new religious orders were responsible for the translation of many spiritual and devotional works. There was also a considerable amount of technical writing. On the native side, the most important was the grammatical and metrical teaching which was set out in many elaborate tracts, giving examples of correct and incorrect usage. Legal science appears to have been moribund. From abroad came translations of medical tracts in large numbers. Continental teaching seems completely to have superseded the native tradition during this period. The churchmen made the experiment, remarkable for the time, of handling philosophical material in the vernacular; unfortunately very few of these tracts are extant and almost nothing has been published.

By the 15th century the printing press was beginning to make literature available to larger numbers in most European countries. In Ireland, however, in spite of the fact that Irish was the language of most of the country and that the literature was flourishing at that period, there was one fatal obstacle; the Irish did not control the towns, and so had no access to printing. Irish literature perforce remained an aristocratic one, the preserve of those who could afford to maintain the literati and supply them with the costly vellum, which was not replaced by paper until the end of this period. It is easy to understand that this literature had little effect on the masses of the people.

C. Late Period

It was during the reign of Elizabeth I that English policy first succeeded in breaking the power of the Irish and Anglo-Irish nobility, and the process was completed by the middle of the 17th century. The emigration or dispossession of this nobility entailed also the disappearance of the bards who were at once its dependents and propagandists—a fact well known to the English power, which persecuted the "rhymers" bitterly. Their eyes fixed on the past, the bards had shown no sign of interest in the renaissance of learning going on elsewhere; with their elimination the old tradition itself was doomed, and there were no learned men to found a new one. Indeed, from this time onward the Irish language itself began to slip from its position as the common speech of the country.

1. Verse.—The poets did not give up without a struggle. In the early part of the 17th century they were engaged in a long and heated poetic debate on early Irish history, and the tradition was to survive in Scotland, together with the native aristocracy, until after the 1745 rebellion. But bardic language and diction, unchanged for more than 400 years, were too difficult for poets who had not undergone the strict discipline of the schools. Without patrons the schools soon died, and hardly any correct bardic verse was written in Ireland after 1650. But just as the bards had taken over from the *filid* 500 years before, so a new school of poets took over from the bards. And just as the bardic measures had been in preparation for centuries before they established themselves as canonical, so the song metres which replaced them had existed for centuries among the people, though rigorously excluded from the vellums. The new poets abandoned the syllable counting by lines with a fixed number of stresses; the stressed vowels rhymed in patterns which might be very simple or, later, bewilderingly intricate, but simple vocalic assonance took the place of the earlier rhyme. The language of poetry moved consistently toward the language of the people, and this, combined with the freedom of the new metres, allowed the poets to speak with a new vigour. While they had little patronage, there was at least an increasing supply of paper, so that their works, still barred from the printing press, were able to be circulated freely among the literate. Naturally enough, the tone of verse throughout the 17th century was one of passionate defiance of the new regime. In it is found the first coherent expression of patriotism conceived as devotion to an abstract ideal rather than as loyalty to an individual—a concept of considerable importance in the later history of the country. But it must be admitted that much of the verse of this period represents a mere nostalgia for the past, the vain regrets of men who had been forced to exchange the pen for the spade.

By far the greatest of the poets of the song metres was Dáibhidh Ó Bruadair, who died at the end of the 17th century (works edited with translation by J. MacErlean, 1910–17). Ó Bruadair and Ó Raithile, of slightly later date, still had some patrons. After them the poetic tradition, while remaining, in Munster at least, extraordinarily subtle in craftsmanship, was preserved only among the common people and ceased to have any contact with reality, as the *aisling* ("vision") poetry, singing a Jacobite restoration, sufficiently demonstrates. But it had real vigour in such themes as satire and *pastourelle*, and these peasant poets maintained the literary tradition until the end of the 18th century. The last magnificent flowering of the Munster tradition was *Cúirt an Mheánoíche* (*The Midnight Court*), written by Brian Merriman, a Clare schoolmaster (translated by Frank O'Connor, 1945). Perhaps the best-sustained poem in Irish, it is an exercise on traditional themes, such as that of the *mal mariée*, in a metre that is an ingenious and successful adaptation of the heroic couplet to the Irish style. After it, Irish poetry became a matter of folk songs, and even these were produced less and less after the crushing blow inflicted by the great famine (1846–47) (*see* Ireland: *The Great Famine*).

2. Prose.—During the 17th century the tradition continued to produce a good deal of prose, mainly antiquarian and of inestimable value today, for the writers were able to draw on many sources now lost. By far the most important is *Annála Ríoghachta Éireann* (*The Annals of the Four Masters*), a compilation of all the available material on the history of Ireland to 1616, made under the direction of the Franciscan lay brother Michael O'Clery. Less readable, but also of great historical importance, are the genealogies compiled by Dubháltach Mac Fir Bhisigh. Geoffrey Keating (*c.* 1570–1646), who wrote a dignified yet simple prose based on the bardic language, produced the first historical (as opposed to annalistic) work in Irish in his *Foras Feasa ar Éirinn* (edited with translation by D. Comyn and P. Dinneen, 1901–08), as well as some fine verse in both the old and the new metres, and two spiritual treatises. A number of religious works, printed by the Irish Franciscans in Louvain, were smuggled into the country; it is significant that manuscript transcripts are more numerous today than printed copies. The earliest book to be printed was the Protestant translation of the New Testament (in 1603), but for obvious reasons this has exerted little influence.

An interesting development in prose style was the satire called *Páirliment Chloinne Tomáis* (*Parliament of Clan Thomas*), in two parts, probably of different authorship, one written before, one after, the Cromwellian wars. It appears to have been written by a representative of the bardic order, for it attacks with equal savagery the new ruling class and the native peasantry, using a style very close to that of the earlier *crosánacht*, but with the prose now predominating over the verse. It found several imitators, but the old tradition was by this time too attenuated for so aristocratic an attitude to be maintained.

The imaginative prose of the paper manuscripts was in general of a much more popular kind; it consisted mainly of developments of the Fenian themes or of romances in which themes drawn from Irish and foreign medieval literature were freely mingled with folklore and *fabliau* elements. As in the case of the song metres, there is reason for believing that these romances had a consider-

able tradition behind them before they appeared in writing. They were the form in which the people assimilated the literature circulating among the aristocracy. The circumstances of their transmission have caused a considerable divergence in the forms in which they are found; it may be for this reason that comparatively few of them have been published, let alone studied. With a public growing steadily more apathetic and less able to read Irish, there could be little hope for prose production. During the 18th and early 19th centuries the only books printed in Irish were a few catechisms and devotional tracts. The manuscript tradition was carried on by a few devoted scribes into the first half of the 19th century, when it all but died out. By the middle of the century there was no literary activity in Ireland and all but a handful of the speakers of the language were illiterate in it.

D. The Gaelic Revival

An antiquarian interest in the Irish language and its literature had begun early in the 19th century, and the publications of J. Hardiman, J. O'Donovan and E. O'Curry, especially the last-named's *On the Manners and Customs of the Ancient Irish* (1873), had caught the imagination of many of the educated classes, whose language of culture had for centuries been English. The Young Irelander Thomas Osborne Davis was probably the first to see how the restoration of the Irish language could be made a political force in a national movement, but the increasing interest remained for a time academic and did not turn to discussion of measures for the preservation or extension of the speaking of Irish until the establishment of the Gaelic league in 1893. This movement had its counterparts in every European country from Catalonia to Finland, but there were difficulties in Ireland unparalleled elsewhere.

The speakers of Irish had sunk to the status of a minority and, worse still, since the language of Irish nationalism had been English for more than 200 years, neither they themselves nor their English-speaking fellow countrymen looked on Irish as a prerequisite of separate nationhood. The curious result was that the revival in Irish came from the enthusiasm of antiquarians and nationalists, few of them Irish-speaking in origin, rather than from the Irish-speaking peasants themselves—a situation which still exists to some extent. The culmination of the revival movement was the situation in the Republic of Ireland, where Irish and English enjoy equality before the law and all schoolchildren must reach a given standard in both languages.

The revivalists were faced with a grave difficulty when they came to face the problem of writing a language that had lost its old standard and had split up into dialects. The classical bardic language was too archaic to be restored, and no Ivar Aasen or V. S. Karadžić came forward, as in Norway and Serbia, to form a new language on the base of the dialects. The inevitable result was that native speakers and learners alike wrote the language of their native or adopted parish, a situation that continued, although by the middle of the 20th century a standard evolved by government departments was being increasingly accepted. This might have happened naturally had there been more speakers in the province of Munster, where the literary tradition was best preserved. It was a Munster priest, Father Peter O'Leary, who gave impetus to the revival with a stream of novels, essays and translations of all sorts, and it was a Munster fisherman, Tomás Ó Criomhthain, who produced the finest book of the revival in his *An tOileánach* (*The Islandman;* translated by R. Flower, 1934). In the Ulster dialect there was some good writing by Séamus Ó Grianna ("Máire") and his brother Seosamh Mac Grianna. Connaught produced three good short-story writers in Pádraic Ó Conaire, Máirtín O Cadhain and Liam O'Flaherty (who also wrote in English).

In general the short story is the most successful as well as the most popular form. The novels demonstrate the national inability to handle the longer and more complex forms. The drama, lacking large urban audiences, consists mainly of translations and although some sensitive lyric poetry has been produced, notably by Máirtín Ó Direáin and Máire Mhac an tSaoi, no poet of Yeats's stature has emerged. (D. Ge.)

II. ANGLO-IRISH LITERATURE

It is impossible to dogmatize, as some have tried to do, about the limits of Anglo-Irish literature. It is enough to exclude on the one hand writers of Irish descent who have no direct connection with the country, such as the Brontë sisters, Edward FitzGerald, Edgar Allan Poe, Eugene O'Neill and T. E. Lawrence; and on the other, English writers domiciled in the country for a considerable time and showing decided traces of this in their work, such as Edmund Spenser and Anthony Trollope. Hard and fast boundaries cannot be drawn between a distinctive Irish literature in English and the contribution of Irish writers to English literature. The difference may be a real one, but it is too vague and uncertain to be taken into account here. The one type of writing merges into the other. All must count as Anglo-Irish literature, in whatever country and for whatever public it was originally produced. As to what constitutes an Irishman, one can only fall back on birth, early training and habitual residence.

1. The Beginnings.—Irish people take readily to writing in any language, perhaps more readily than they do to reading. Ireland's total output of literature must be enormous. It is therefore perhaps surprising that the first products of Anglo-Irish literature were so inconsiderable. It must, however, be remembered that until the 17th century the language of Ireland was Irish. The so-called Anglo-Irish were a small colony, a garrison holding a perilous outpost, constantly yielding linguistic as well as physical ground to the resurgent Gael; and even among the colonists English had to struggle for supremacy with Latin and French. A few manuscripts have survived, showing the existence of a vernacular poetry of no great originality or distinctiveness. The most striking example is the 13th-century satire *The Land of Cockaygne;* but it is hard to say if any work lacking local allusions was originally composed in the country.

The first notable Irish writer in English was Richard Stanyhurst, who contributed sections dealing with Ireland to Raphael Holinshed's *Chronicles* (1577) and attempted to write English quantitative verse on Latin models, with extraordinary results. From this time on, as the colony grew in numbers and importance and the conquest of the whole country was seriously attempted, the stream of Anglo-Irish writing began to swell, and gradually Gaelic as well as English names began to appear. In the next century there were Sir John Denham, author of the much admired *Cooper's Hill* (1642) and one of the pioneers of a smoother and more regular versification, Lord Roscommon (*c.* 1630–85), Nahum Tate (1652–1715) and Nicholas Brady (1659–1726) among minor poets; Lord Orrery (1621–79) among minor dramatists; and Sir John Temple (1600–77), father of the more famous Sir William, who may be mentioned among minor historians. But there was as yet no major name.

2. The 18th Century.—Writers of the first rank did not appear until the establishment of English as the predominant language, after the overthrow of the Gaelic culture and the arrival of hordes of new immigrants who were not so easily absorbed as their predecessors had been. But from then on, Irish writers of English were among the great. The first of these was Jonathan Swift. Irish-born of English parents and educated wholly in Ireland, he became a dominant literary figure in England. He returned to Ireland unwillingly as dean of St. Patrick's cathedral, Dublin, to become the idol of Ireland for his championship of a people he hated and loved, as he hated and loved all humanity, and to end as one of the great names in the literature of the world. Swift to the world at large means *Gulliver's Travels* (1726). Ireland has rather remembered his tracts on its own wrongs, such as the *Drapier Letters* (1724), among the first of a long series of such writings by Irishmen, which raised pamphleteering to the status of literature.

Nor does the dean stand alone at the beginning of the century. If Swift made politics literature, his friend George Berkeley, bishop of Cloyne, wrote philosophy which, apart from its importance in the history of human thought, is almost as admirable from the purely literary point of view as that of Plato. And it must not be overlooked that Bishop Berkeley was a convinced and admitted Irishman and a lover of his country, about whose welfare he ex-

pressed strong views in his *Querist* (1735–37).

Drama.—Perhaps the greatest contribution of Ireland to the literature of the English language has been neither in philosophy nor in politics, but in drama, especially comedy. Where would the English theatre be without William Congreve, George Farquhar, Oliver Goldsmith, Richard Brinsley Sheridan, Oscar Wilde and George Bernard Shaw? The first permanent theatre was established in Dublin in 1662, and from then on the swarms of Irish-born dramatic authors, both of native and of English stock, as well as of actors and managers, who established a reputation both in Ireland and in England defies enumeration. Here we are concerned only with the authors. Congreve, English-born but entirely Irish in rearing and education, is the greatest name in English Restoration comedy. Farquhar, coming from the north, though of Gaelic origin, has a gaiety and humanity all his own. Passing over Sir Richard Steele, a sentimental dramatist who is better-known as an essayist, and Thomas Southerne, a tragedian, we come to Goldsmith, who touched nothing that he did not adorn, or who was, if one prefers it, jack of all literary trades though perhaps entirely master of none, and who was the author of one supreme comedy, *She Stoops to Conquer,* said to be based on his own early experiences in County Longford. There were many successful minor Irish dramatists, including Arthur Murphy (1727–1805) and Hugh Kelly (1739–77), but their plays were the common repertory of the English-speaking theatre of the time. The few plays written especially for Irish consumption were of no particular merit.

Poetry and Prose.—Turning to poetry, mention must be made again of Swift and Goldsmith, and Thomas Parnell (1679–1718), a melancholy though not unpleasing poet, chiefly remembered for his "Nightpiece on Death," must not be forgotten. There were some minor poets, but on the whole Anglo-Irish poetry did not flourish till the romantic movement. As for prose, the novel was only just coming into existence. Goldsmith produced a major work in *The Vicar of Wakefield* (1766). Laurence Sterne was born in Ireland, though he did not live or work there. Political eloquence in those days grew into literature. Edmund Burke was a political philosopher and an orator whose speeches read better than they sounded. Sheridan was as great a parliamentary speaker as he was a dramatist. No less notable was the eloquence of John Philpot Curran (1750–1817), and some of the speeches on Irish themes by Henry Grattan (1746–1820) are among the greatest of their kind.

3. The 19th Century.—With the 19th century came a change. The old, conquered Ireland, prostrate for so long, was beginning to rise to its feet. The Anglo-Irish colony, too, was gaining self-confidence and feeling itself a distinct entity. Nationalism, liberalism and revolution were in the political air, while romanticism was beginning to affect the arts. Moreover, antiquarianism had begun to uncover the Gaelic past. This had never been wholly forgotten; even Dean Swift had translated a poem from the Irish. But Charlotte Brooke (1740–93), the daughter of Henry Brooke, himself a dramatist and novelist, was the first to make verse translations on a more extensive scale, and soon there were others. Native Irishmen and settlers alike began to feel a new interest in their country. Irish nationality, as it is known today, was born. Until this time there were for the most part merely books by Irish authors; thenceforth books about Ireland predominated. Of such books an enormous number was produced. The romantic movement and the discovery of Ireland's ancient tradition provided an incentive. Irish literature in English became more plentiful and more distinctive than ever before.

Poetry.—For the first time poetry came to the forefront. Anglo-Irish verse was definitely established by Thomas Moore. Moore was a most versatile poet and a singer of his own songs. In his *Irish Melodies* (1808–34) he attempted to solve the problem of setting English words to Irish airs, which was not so easy as it sounds. The result may not please the purist in folk song, but it was very singable as well as good poetry; as the matter of the songs was Irish, often vehemently so, the wrongs of Ireland were warbled in English drawing rooms with great ultimate advantage to the Irish cause. Nor did Moore's own people fail to appreciate him; he was a national hero as no other Irish poet has been. Quite apart from his songs, his oriental epic *Lalla Rookh* (1817) brought him wealth and fame.

Moore wrote in English. In order to be Irish, he did not think it necessary to write in dialect or to attempt the style of folk poetry, as did some of his contemporaries, such as J. J. Callanan (1795–1829), who wrote very free adaptations from the Irish. Another contemporary, however, George Darley (1795–1846), wrote in a most exquisite and scholarly style, and his work was mistaken for that of an Elizabethan or 17th-century poet. A slightly earlier writer was the Spenserian poet Mary Tighe (1772–1810), much admired in her own day, and with good reason, for her *Psyche* (1805).

In 1842 the patriotic organization known as Young Ireland, led by Thomas Osborne Davis, an eloquent and sincere writer in prose and verse, founded a new paper, the *Nation.* A large number of poets and prose writers attached themselves to it. Besides Davis himself, who died young and regretted in 1845, poets of merit were Thomas D'Arcy McGee (1825–68), Richard D'Alton Williams (1822–62) and Lady Wilde (1826–96). Another notable journal of the time was the *Dublin University Magazine,* which lasted for about 40 years and was probably the finest magazine ever produced in Ireland. Its politics were the direct opposite of those of the *Nation,* but it was mainly literary, and most of the best Irish writers contributed to it. Of its poetical contributors the most notable was James Clarence Mangan, an enormously prolific and most uneven writer of every kind of verse, including numerous translations from languages which he probably did not know of poems which did not exist. At his best, when inspired by his love of Ireland or by his own miseries, due largely to alcohol, he was one of the greatest poets of Ireland. He was much influenced by the German romantics and in turn influenced Edgar Allan Poe. Another notable poet was Sir Samuel Ferguson (1810–86), who wrote on Irish themes in a strikingly original way, inspired to some extent by Gaelic examples. Among other poets of a very poetical time were Denis Florence MacCarthy (1817–82) and Aubrey de Vere (1814–1902), who were more typical of their period. William Allingham wrote poems in ballad style and a long and interesting narrative in verse, *Laurence Bloomfield in Ireland* (1864). He later settled in England and became an associate of Dante Gabriel Rossetti. He adopted the Pre-Raphaelite manner, which links him with W. B. Yeats and the next period of Irish writing.

Prose.—Among novelists was Charles Maturin, whose *Melmoth the Wanderer* (1820) had a wide influence in Europe. Even better known was Maria Edgeworth, who in the course of a long and busy life produced many novels, always with some edifying tendency but none the worse for that. She knew well the Ireland of her day and depicted it with insight and humour in *Castle Rackrent* (1800) and in the tale *The Absentee* (1812). A landlord's daughter, she believed firmly that the solution of Ireland's troubles lay in the improvement of the outlook of its landlords. Novelists who wrote of country life mainly from the point of view of the tenant were William Carleton, a powerful storyteller though a poor stylist, whose masterpiece is *Fardorougha the Miser* (1839); and the immensely popular Charles Joseph Kickham, poet, Fenian and political convict, whose *Knocknagow* (1879) was for long Ireland's favourite reading. Other novelists of rural life were Gerald Griffin (1803–40) and the brothers John and Michael Banim. Lady Morgan wrote *The Wild Irish Girl* (1806) and other novels.

William Hamilton Maxwell (1792–1850) wrote lively stories dealing largely with sport. He inspired the better-known Charles Lever (1806–72). Lever, at one time editor of the *Dublin University Magazine,* wrote a long series of novels, lively and interesting, though often careless. He knew Ireland well and could write seriously enough of Irish matters; but as some of his best-known work is broadly humorous, he has been unjustly accused of ridiculing the nation. Another humorous writer, often mentioned with Lever though not his equal, was the versatile Samuel Lover (1797–1868).

Joseph Sheridan Le Fanu was a successful writer of a different kind. Owner and editor of the *Dublin University Magazine* in the

1860s, he wrote many novels and short stories, chiefly dealing with mystery, crime and the supernatural. He was perhaps the greatest Irish master of the ghost story. *In a Glass Darkly* (1872) contains the best of his work of this kind. *Uncle Silas* (1864) is his finest novel. He was also a poet, and there is a poetic quality about all his work which raises it far above the commercial thriller.

John Mitchel, author of the *Jail Journal* (1854), W. E. H. Lecky, the historian (1838–1903), and Edward Dowden, the critic (1843–1913), were all outstanding 19th-century writers in their several ways. Only the drama produced no great name.

4. The Literary Renaissance.—Toward the end of the 19th century a new movement in Irish literature became apparent. In fact, such changes came over literature everywhere. In the 1890s two Irish dramatists appeared, the first for a century: Oscar Wilde, son of Sir William Wilde, a fine writer on Irish antiquities, and Lady Wilde of the *Nation;* and George Bernard Shaw, who was two years younger than Wilde and outlived him by 50 years. Neither wrote of or for Ireland, but they were outstanding Irish dramatists in the old Anglo-Irish tradition. Perhaps they were the last of their kind; for a definitely Irish theatre was now arising, as part of a new, consciously Irish literary movement, known as the Irish literary renaissance.

The movement, which was closely allied with a new and strong political nationalism and with a revival of the Irish language, centred from the first around the greatest Irish poet, William Butler Yeats, Pre-Raphaelite, theosophist, modernist, but always a thorough Irishman. Though be contributed to the foundation of the first Irish theatre, the Abbey (*see* ABBEY THEATRE), his own dramas were few. He wrote some beautiful plays, but they were not easy to produce. His chief colleague at the Abbey was Lady Gregory, who not only took a leading place in the management but also contributed many plays, mostly peasant comedies. The greatest dramatic name of the movement was that of John Millington Synge, who wrote in a peasant dialect, largely of his own invention. His plays have great beauty and power, and his early death was an irreparable loss to Irish drama. Later, the theatre, founded for poetry and noble speech, became absorbed in realism, mostly rural realism. Lennox Robinson and T. C. Murray were the most important of the realists, and Sean O'Casey replied to peasant realism with his brilliant and moving dramas of the Dublin slums beginning with *The Shadow of a Gunman* (1922). Subsequently he left Ireland and attempted a kind of symbolical drama with less obvious success. Later dramatists continued to supply plays to the Abbey and its younger rival, the Dublin Gate theatre, and most modern Irish writers occasionally attempted drama. St. John Ervine wrote successfully for both the Irish and English theatres.

In poetry, besides Yeats, there was George Russell (Æ), mystic, patriot and agricultural reformer, who left a large quantity of beautiful if rather vague verse. Notable among their younger contemporaries were Padraic Colum, Austin Clarke, Seumas O'Sullivan (James Sullivan Starkey), F. R. Higgins and Oliver St. John Gogarty. The Republican movement which led to Irish independence had its poets, P. H. Pearse, Thomas Mac Donagh and Joseph Mary Plunkett, all executed in 1916 after the rising on Easter Monday of that year; and a strong sympathizer in Francis Ledwidge, a rural lyricist, who was killed in 1917 fighting for England in World War I. A writer who went his own delightful way was Lord Dunsany (1878–1957). He was not only a poet but a prolific and successful writer of novels, plays and short stories.

In the realm of the novel were the historical tales of Emily Lawless (1845–1913) and Standish James O'Grady (1846–1928), while Canon P. A. Sheehan (1852–1913) presented aspects of Irish life through the eyes of an Irish priest. By way of contrast there was George Moore, an imitator of French naturalism, who suddenly attached himself for a time to the Irish cultural movement; his delightfully impudent account of its leading figures in *Hail and Farewell* (1911–14) is on the whole more readable than his overcarefully written novels. James Stephens (1882–1950) wrote fanciful stories as well as verse of great charm. The excellent novels of E. Œ. Somerville (1861–1949) and Martin Ross (Violet Florence Martin; 1865–1915), some humorous, some tragic, must also be mentioned. But all of these are overshadowed by the amazing productions of James Joyce, who made himself and Dublin famous throughout the world and is without doubt one of the most significant literary figures of the 20th century.

5. The Moderns.—Of the writers born about 1900, Liam O'Flaherty produced a new and more violent type of fiction, stripping away many of the illusions which enveloped Irish writing, but probably creating a few of his own. When he was not writing sensationally for sensation's sake, his novels and stories were full of power. Brinsley MacNamara (A. E. Weldon), also a dramatist, wrote tales of the quiet midlands which were original and interesting. Frank O'Connor began as a poet, earned distinction as a novelist, but later wrote mainly short stories and articles. Sean O'Faolain was equally versatile. His biographical works are outstanding. Elizabeth Bowen and Kate O'Brien were popular women novelists. Their older contemporary, Stephen Gwynn (1864–1950) excelled in biography, history and many other kinds of writing.

See also ENGLISH LITERATURE and the other general articles mentioned there; there are also articles on most of the writers referred to above. *See* also references under "Irish Literature" in the Index. (LD.)

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IRISH MOSS (CARRAGEEN or KILLEEN), the name applied especially to the red alga *Chondrus crispus,* a small, tufted seaweed with thin fronds from two to ten inches long that grows abundantly along the rocky parts of the Atlantic coast of the British Isles, Europe and North America. The term is also used loosely for several other red seaweeds found associated with *Chondrus,* among which are a few species of *Gigartina.* Other names, expressive of the appearance of these seaweeds, are pearl moss, lichen, curly moss and jelly moss. In its fresh condition the plant is soft and cartilaginous, varying in colour from a greenish yellow to a dark purple or purplish brown; but when sun-dried and bleached it has a yellowish, translucent, hornlike aspect and consistency.

The principal constituent of Irish moss is a gelatinous substance, carrageenin or carrageen extract. Carrageenin for commercial use is extracted by boiling dried Irish moss.

In Europe, Irish moss used for the extraction of carrageenin is obtained from plants cast ashore. In the United States it is collected from shallow water and dredged with special rakes. Commercially, carrageenin is used chiefly as an emulsifying and suspending agent in pharmaceutical and certain food products. *See* ALGAE: *Utilization of Algae.* (G. M. S.; X.)

IRISH SEA, the area of water lying between Ireland and Britain, is connected with the Atlantic ocean by the North channel between County Antrim and Scotland (minimum width between Fair head and the Mull of Kintyre, 13 mi.) and by St. George's channel (minimum width between Carnsore point and St. David's head, 47 mi.). If St. George's channel is taken to include the whole area south of a line from Dublin to Anglesey, the Irish sea is roughly square, measuring about 100 mi. from north to south and 125 mi. from west to east. It is bounded by Scotland on the north, England on the east, Wales on the south and Ireland on the west. In the centre is the Isle of Man.

The sea is relatively shallow (less than 30 fathoms) in the eastern half, but there is an elongated trough between the Isle of Man and Ireland with depths reaching to more than 70 fathoms. The mean tidal range is 20 ft. on the Lancashire coast, 14 ft. around the Isle of Man and 10 ft. on the Irish coast between Strangford lough and Drogheda. Because of the semienclosed nature of this sea and the consequent small waves generated therein, much of the coast is low lying and composed of nonresistant materials such as boulder clay. In south Lancashire is one of the most extensive areas of sand dunes and one of the widest beaches at low tide to be found in Britain.

The estuaries are all partially drowned river mouths and afford evidence of the postglacial rise in sea level. Morecambe bay is largely infilled with sand, across which the incoming tide sweeps at high speed. Inland of most of the present coastline there is evidence of a postglacial sea level about 20 ft. higher than at present, with abandoned cliffs, infilled estuaries and raised beaches. (R. K. GR.)

IRKUTSK, an *oblast* in the Russian Soviet Federated Socialist Republic of the U.S.S.R., was formed in 1937. It covers an area of 296,486 sq.mi. in eastern Siberia. Lake Baikal lies along its eastern boundary and the Angara, the lake's outlet, crosses the *oblast.* A northward extension of Irkutsk occupies the upper valley of the Nizhnyaya Tunguska, while in the east is the upper part of the Lena basin. Most of this huge area consists of the rolling hills and broad valleys of the Central Siberian plateau and its eastern extension, the Patom plateau (Patomskoye Nagorye). In the south the *oblast* extends to the crest line of the Eastern Sayan mountains. Most of the region is covered by dense taiga coniferous forest, dominated by Siberian and Dahurian larch, with pine, stone pine, fir and spruce, the last two more especially on higher areas. Only in the south are there one or two small patches of forest-steppe and steppe. Soils are poor podsols, nearly everywhere underlain by permafrost. Climate conditions are very strongly continental.

Irkutsk has an annual temperature range of about 39° C. (70° F.). Winters are long and exceptionally cold, especially in the north and east, and summers are hot. Precipitation is low, about 12–14 in. a year. Thus the protective snow cover is thin and is often entirely swept away by strong winds.

The population, at the 1959 census, was 1,976,453, of whom 62%, or 1,227,829, were urban. The great majority were Russian (84%), with Ukrainian (11%) and Belorussian minorities. Buryats make up 4.8% and live mostly in the Ust-Ordinski Buryat National Okrug, just west of Lake Baikal. In the north live a few Evenki, while in the Eastern Sayans are a few hundred Tofy. Most of the population is concentrated in a narrow belt along the Trans-Siberian railway, which crosses the southern part of the *oblast,* where are the largest towns, Irkutsk (365,893), Angarsk (134,390) and Cheremkhovo (122,833).

The southern part along the railway and the Angara river is a rapidly developing industrial region, based on the Cheremkhovo coal field and iron ore deposits around Bratsk, together with salt and mica deposits. The large Irkutsk barrage on the Angara supplies hydroelectric power and a huge plant is scheduled for completion in the mid-1960s at Bratsk. Metallurgical and engineering industries have grown rapidly in the main towns. In the northeast, round Bodaibo on the Vitim, gold is obtained in large quantities. Over the rest of the *oblast* timber working is the only important industry, and this is highly developed. Agriculture is largely confined to the neighbourhood of the towns. Reindeer herding and hunting are carried on by the Evenki of the north. (R. A. F.)

IRKUTSK, a town and the administrative centre of Irkutsk *oblast* of the Russian Soviet Federated Socialist Republic, U.S.S.R., stands on the Angara river at its confluence with the Irkut, 66 km. (41 mi.) below the outfall from Lake Baikal. Pop. (1959) 365,893. The town was founded in 1652 by the first Russian colonists of the area and it became the main route centre of Cis-Baikalia. Its importance increased rapidly after the coming of the Trans-Siberian railway in 1898. It became one of the major industrial centres of Siberia, with emphasis on heavy engineering, electrical equipment and machine tools. Other industries include mica processing (from the Slyudyanka mica deposits near the southwestern end of Lake Baikal), timber working, the making of footwear, soapmaking and food processing (meat packing, tea pressing, etc.). Power for its industries derives from the neighbouring Cheremkhovo coal field and from the Irkutsk hydroelectric plant on the Angara, which started operating in 1956. The power station is of unusual design, with the plant built into the barrage itself and no spillways. The reservoir above the dam extends back to Lake Baikal and affords river communication with the lake and the navigable rivers which flow into it. By the 1960s shipping links downstream were possible to Bratsk after the filling of the Bratsk reservoir.

In addition to the Angara river and the Trans-Siberian railway, Irkutsk is joined to Krasnoyarsk and Ulan-Ude by motor roads, running parallel to the railway. Another road runs to Kachuga, at the head of high-water navigation on the Lena. There is also a major airport.

Irkutsk is one of the chief cultural centres of Siberia, although its pre-eminence in this respect has been usurped by Novosibirsk. There is the A. A. Zhdanov State university (1918) and the East Siberian branch of the Siberian division of the U.S.S.R. Academy of Sciences, as well as various scientific research institutions and higher educational establishments. At Listvyanka at the Baikal outfall is a limnological research station of the Academy of Sciences. (R. A. F.)

IRON ranks second in abundance among the metals and fourth in abundance among the elements. The earth's core is largely metallic iron, but in the crust the element has had an opportunity to react with other substances and the free metal is rarely found except in meteorites or disseminated as minute specula in basaltic rocks. Iron is a constituent of hundreds of mineral species; small amounts are found also in water, plants and blood.

Meteors are composed chiefly of iron, and tools and weapons were made from this by primitive man. The Aztecs had implements made of meteoric iron before the coming of the white man, and prized this metal above gold. In general use, however, bronze tools and weapons came long before iron ones, the smelting of copper being an easier process than that of iron. The metallurgy of iron is believed to have been developed in western Asia in the 2nd millennium B.C., spreading in waves that reached other regions at intervals centuries apart.

The Assyrians and Egyptians made considerable use of iron. In Gen. iv, 22, Tubal-cain is mentioned as an instructor of workers in iron and copper; and iron was utilized to make tools and weapons in the time of David. The Dorian invaders, who were the forerunners of the classic Greeks, were equipped with iron tools and weapons. Homer speaks of a ball of iron as the prize awarded to Achilles for athletic prowess. The Greeks obtained ores from the south coast of the Black sea, and the Romans from Spain and Elba; evidently there were earlier sources in India.

Igneous rocks contain an average of 5.01% of iron. The im-

portant ores are the oxides and carbonates from which the metal is obtained by smelting with carbon.

This is done commercially by blowing heated air through a mixture of ore, coke and limestone in a blast furnace under conditions where a maximum temperature of about 1,300° C. is reached. The crude metal obtained is called cast iron or pig iron and contains various impurities; carbon, silicon, sulfur, manganese and phosphorus are most important. Steel and wrought iron are made by oxidizing the impurities in pig iron with air or ferric oxide at high temperatures and collecting them in a suitable flux to obtain the required degree of purification. Commercial production and industrial uses of these materials are treated under IRON AND STEEL INDUSTRY, this article being limited to a general description of the properties of the element and its important compounds.

Iron, as commonly available, nearly always contains small amounts of carbon, which modify its properties. It may be prepared by passing hydrogen over purified iron compounds (the oxides for example) at high temperature or by electrodeposition from solutions of iron salts.

PHYSICAL PROPERTIES

Iron is tetramorphous. The delta form exists above 1,400° C., at which temperature there is a transition to gamma iron. The latter has a face-centred cubic lattice, is weakly paramagnetic and forms solid solutions with iron carbide (Fe_3C); this property is of importance in the preparation of steel. At 895° C. there is a transition to beta iron. This form is body-centred cubic, weakly paramagnetic and stable down to 766° C., where alpha iron is obtained. The body-centred cubic lattice is retained in this transition but alpha iron is strongly paramagnetic, indicating a definite change in electronic structure in going from beta iron to alpha iron. In the alpha form, iron is a soft, ductile, gray-white metal of high tensile strength.

Values for some of the physical properties of the pure metal are given in the accompanying table.

Physical Properties of Iron

Coef. expansion; cubic 0° to 100° C.	0.04355/° C.	Tensile strength annealed wire.	50–60 × 10^3 lb./sq.in.
Electrode potential $Fe=Fe^{2+}+2e$ 25° C.	+0.440 v.	Boiling point	2,735° C.
Ionization potential of gas atom	7.83 v.	Density 20° C.	7.86 g./ml.
Resistivity 20° C.	0.04100 ohm-cm.	Melting point	1,530° C.
		Radius of Fe^{2+}	0.75 A
		Specific heat (average 0° to 100° C.).	0.11 cal./° C.

CHEMICAL PROPERTIES

Iron, the metallic chemical element of atomic number 26, symbol Fe, has an atomic weight of 55.85, which represents a mixture of the isotopes 56, 54, 57 and 58 in that order of abundance. Radioactive isotopes with mass numbers 53, 55 and 59 have been prepared.

Iron is a member of the first transition series, in which the electrons in the third level increase from 8 to 18, and has the following outer electron arrangement: $3d^6$, $4s^2$.

The properties of iron are similar to those of the other transition elements, particularly cobalt and nickel. Iron is also related to ruthenium and osmium, the corresponding elements in the second and third transition series. In common with the other transition elements in this series, it readily loses its 4s electrons to form the +2 oxidation state shown in ferrous iron. The properties of ferrous ion are similar to those of the other +2 ions in the series and it resembles manganous ion, particularly, in the solubilities of its compounds. Ferric iron, the +3 oxidation state, is readily obtained and the ion resembles the chromic ion in the solubilities of many of its salts. The +4 state is realized in perferrite, FeO_3^{2-}, and the +6 state in ferrate, FeO_4^{2-}, both being obtained by the action of strong oxidizing agents in alkaline media. Only a limited number of ferrites and ferrates are known and the most important oxidation states of iron are the +2 and +3.

The Metal.—In accordance with the potential given in the table, metallic iron acts as a strong reducing agent. Solutions containing the ions of gold, platinum, silver, mercury, bismuth and copper are reduced by iron to yield the metal in each case. In contact with nonoxidizing acids, iron dissolves by reducing hydrogen ion to hydrogen gas, forming ferrous ion. Since the metal reduces ferric to ferrous ion, moderately strong oxidizing agents produce ferrous ion if the metal is in excess and ferric if the oxidizing agent is in excess. Iron combines directly with most of the nonmetals at moderate temperatures and may be made to "burn" in many of these cases because of the large amounts of heat evolved in the reactions. Upon immersion in concentrated nitric acid, which does not dissolve it, iron is made "passive" and will not dissolve in dilute acids nor in the metal ion solutions listed above. This phenomenon is shown by other transition metals such as chromium, molybdenum, cobalt and nickel in this series and by many other metals. In general, passivity is produced by the action of strong oxidizing agents, including anodic polarization, and may be destroyed by the action of reducing agents, by scratching the surface, or by specific agents in particular cases. It is apparently caused by the formation of surface oxide films and is useful in controlling corrosion.

Under the usual atmospheric conditions iron rusts to form hydrated ferric oxides. This process occurs in two steps: first, iron dissolves in the acid solution provided by the moisture and the carbon dioxide of the air to form ferrous ion and liberate hydrogen; second, oxygen from the air oxidizes the ferrous ion to form hydrated ferric oxides. The first step is slow with pure iron but is catalyzed by many impurities which facilitate the liberation of hydrogen from the metal surface. (*See* CORROSION AND OXIDATION OF METALS.) Iron reacts with steam to produce hydrogen and ferroferric oxide, or ferrous oxide if the temperature is above about 570° C. Ammonia acts on iron at high temperatures to form hydrogen and the nitride Fe_2N. Carbon dioxide is reduced by the metal at elevated temperatures to carbon monoxide with the formation of ferrous oxide.

Properties of Ferrous and Ferric Ions.—Ferrous ion is pale green in solution and in most of its hydrated salts. Solutions of ferrous ion are only slightly hydrolyzed since ferrous hydroxide is a fairly strong base. The electrode potential of the ferrous, ferric couple is −0.77 v. at 25° C., and solutions of ferrous ion are unstable with respect to air oxidation. Common reagents used to oxidize it to ferric are permanganate, dichromate, peroxide, bromine and nitric acid. Ferrous ion may be precipitated from approximately neutral solution as the sulfide, hydroxide, phosphate, arsenate, carbonate and oxalate; the ferricyanide may be precipitated from acid solution. In strongly acid solution ferric ion is yellow; as the acidity is decreased, hydrolysis occurs to an increasing degree, forming basic ions and colloidally dispersed hydrated ferric oxide, which colour the solution brownish yellow. There is little tendency to form acid ions even in strongly basic media although many compounds contain the +3 state as ferrite, FeO_2^-. Ferric ion is commonly reduced to ferrous by sulfide, sulfite, stannous chloride, zinc amalgam, hydroxylamine and iodide. It may be precipitated from weakly acid solution as the hydroxide, ferrocyanide, phosphate, arsenate, and by the formation of salts with many organic compounds.

In addition to forming simple salts, where the valence and the oxidation number are equal, ferrous and ferric iron form many complex compounds and ions in which the co-ordination number is six; that is, where there are six atoms or groups attached to the metal ion. Simple examples of such complex formation are ferrocyanide $Fe(CN)_6^{4-}$ and ferricyanide $Fe(CN)_6^{3-}$ ions.

The formation of complexes is common to almost all of the ions that have more than eight electrons in their outer shell and is associated with the existence of partially occupied orbitals of closely related energies that can be used to accept electron pairs from various atoms or groups. In the case of ferric and ferrous iron six pairs of electrons can be so shared by using the vacant 3d (two), 4s (one) and 4p (three) orbitals, giving the co-ordination number of six, independent of the oxidation state of the iron. Complexes are formed with iron in which the type of binding of the complexing groups is ionic as well as covalent. Ferric iron forms complex ions with such inorganic groups as water, ammonia, cyanide, fluoride, chloride and thiocyanate and with such organic ions as oxalate, citrate, tartrate, tannate and gallate, to mention

only a few. In addition there are an extremely large number of chelate compounds formed with organic molecules in which each of the organic molecules is bound to the iron through two of its atoms, making use of both valence and co-ordination bonds. Most of these compounds are very stable and are soluble in organic solvents but not soluble in water. Many of the organic reagents such as cupferron, orthophenathroline, 8-hydroxyquinoline and dipyridil, used in analysis for iron, form such chelate compounds; ferric and ferrous hemoglobin, so important in blood, are of this type. *See* Co-ordination Compounds.

COMPOUNDS OF IRON

Oxides, Hydroxides and Acids.—Iron forms three oxides: ferrous oxide, FeO; ferric oxide, Fe_2O_3; and ferroferric oxide, Fe_3O_4. It also forms ferrites, perferrites and ferrates which may be regarded as salts of the potential acids, ferrous, $HFeO_2$; perferrous, H_2FeO_3; and ferric, H_2FeO_4.

Ferrous oxide is a black pyrophoric powder readily soluble in acids. It may be obtained by reducing ferric oxide in hydrogen or by the action of steam, carbon dioxide or oxygen on iron at high temperatures.

Ferrous hydroxide is precipitated from neutral or basic, air-free solutions as a white flocculent material that is rapidly oxidized by air to become green and finally reddish brown as ferric oxide is formed. It readily absorbs carbon dioxide to form ferrous carbonate and is easily dissolved in acids.

Ferric oxide or iron sesquioxide exists in several anhydrous and hydrated forms including the important ores hematite and specular iron, the minerals limonite and goethite and iron rust. It is obtained as a steel-gray powder by igniting almost any ferric compound in air; when finely powdered, the ignited material appears brownish red. After ignition it dissolves extremely slowly in acids, hydrochloric acid in combination with a reducing agent being the best solvent. The finely divided oxide is used as an abrasive called "iron rouge" and as pigment, venetian red.

Ferric hydroxide is not simply characterized since hydrated ferric oxides of various structures and compositions are included by the name. It precipitates as a red-brown gelatinous material that is difficult to filter and tends to form stable colloidal dispersions that are usually positively charged. Among structures that have been characterized by X-ray patterns are alpha Fe_2O_3 hydrate, precipitated as a brown gel by the addition of alkalies to ferric solutions; beta Fe_2O_3 hydrate, formed by the hydrolysis of ferric chloride solutions; and gamma Fe_2O_3 hydrate, obtained under certain conditions when ferrous is oxidized to form ferric hydroxide. The freshly precipitated forms are readily soluble in acids but become more difficult to dissolve if they are partially dehydrated. There is only a slight solubility in strong bases with the formation of ferrite ion, FeO_2^-. Purified colloidal ferric hydroxide is used in medicine as "dialyzed iron."

Ferrites may be prepared by fusing ferric oxide with basic oxides to form such compounds as sodium ferrite, $NaFeO_2$. Magnesium ferrite occurs as the mineral magnoferrite and zinc ferrite occurs as franklinite; iron commonly occurs as ferrite in many complex minerals. The important mineral magnetite is ferrous ferrite, $Fe(FeO_2)_2$.

Ferroferric oxide, mentioned above as ferrous ferrite and magnetite, is always attracted by a magnet and is frequently magnetic; specimens in the latter case are loadstones. The compound is most simply obtained by passing steam over red-hot iron and is commonly observed as mill scale in the fabrication of iron and steel. It dissolves in acids forming ferric and ferrous ions in the ratio of 2 to 1 and a brown hydrated form may be precipitated from such a solution by the addition of alkali.

Perferrites of barium ($BaFeO_3$) and strontium ($SrFeO_3$) have been prepared by heating a mixture of barium hydroxide or strontium hydroxide and ferric oxide in a stream of oxygen. Water decomposes these compounds with the liberation of oxygen.

Ferrates are formed by strong oxidizing agents acting on iron ions in fused alkali or in concentrated alkaline solutions. Thus chlorine acts on a suspension of ferric hydroxide in concentrated potassium hydroxide to form an amethyst or purple-red solution of potassium ferrate. The addition of barium ion to this solution precipitates barium ferrate, $BaFeO_4 \cdot H_2O$, as a dark red powder. Barium ferrate is fairly stable. It dissolves in acetic acid to form a red solution, is not attacked by cold sulfuric acid but evolves chlorine and oxygen from cold hydrochloric acid.

Arsenides, Arsenites, etc.—Several iron arsenides occur as minerals; mispickel or arsenical pyrites, Fe_2AsS_2, is an important commercial source of arsenic. A basic ferric arsenite, $4Fe_2O_3.As_2O_3.5H_2O$, is obtained as a flocculent brown precipitate by adding an arsenite to ferric acetate or by shaking freshly prepared ferric hydrate with a solution of arsenious oxide. The last reaction is the basis of the application of ferric hydrate as an antidote in arsenical poisoning. Normal ferric arsenate, $FeAsO_4.2H_2O$, constitutes the mineral scorodite.

Carbides, Carbonates, Carbonyls, Cyanides.—The importance of the carbide Fe_3C, cementite, in the manufacture of steel is treated under Iron and Steel Industry. (*See* also Carbides.)

Ferrous carbonate, $FeCO_3$, occurs as the mineral siderite or spathic iron ore. It is precipitated from ferrous solutions, by the addition of a soluble carbonate, as a white flocculent material that rapidly oxidizes in air to become green and finally brown as ferric salts form. It is readily soluble in acids. Ferric carbonate cannot be precipitated from solution because of hydrolysis which leads to the formation of ferric hydroxide and basic carbonates.

Carbonyls of iron form an interesting group of compounds. Finely divided iron slowly reacts with carbon monoxide to form ferropentacarbonyl, $Fe(CO)_5$, which distills off at 120° C. It is a pale yellow liquid which freezes at −21° C., boils at 102° C., decomposes above 200° C. and is decomposed by air and moisture. When ferropentacarbonyl is dissolved in a base, the carbonate and the ion $Fe(CO)_4^{2-}$ form, the latter being the anion of the acid carbonyl hydride, $Fe(CO)_4H_2$. Carbonyl hydride is formed when the solution is acidified in the cold. Upon oxidation with hydrogen peroxide, carbonyl hydride yields $Fe_3(CO)_{12}$. In sunlight the pentacarbonyl loses carbon monoxide to form the nonacarbonyl, $Fe_2(CO)_9$, and upon heating the tetracarbonyl, $Fe_3(CO)_{12}$, is obtained. The nitrosocarbonyl, $Fe(CO)_2(NO)_2$, is also known. For the relation of these compounds to the other carbonyls *see* Carbonyls, Metal.

Cyanides.—The very stable complexes ferrocyanide, $Fe(CN)_6^{4-}$, and ferricyanide, $Fe(CN)_6^{3-}$, are formed in excess cyanide and are not decomposed even in strong acid solutions. The ferrocyanide, ferricyanide potential is about −0.4 v., so that the oxidation and reduction of these ions is easily accomplished by many of the common oxidizing and reducing agents. Sodium and potassium ferrocyanides are obtained as by-products in the distillation of coal, after absorbing the evolved hydrogen cyanide in iron oxide "purifiers." Potassium ferrocyanide is commonly called yellow prussiate of potash and the ferricyanide, red prussiate of potash.

Addition of ferric ion to a solution of ferrocyanide first yields soluble prussian blue, $KFeFe(CN)_6$, and then $Fe_4[Fe(CN)_6]_3$, which is the insoluble pigment prussian blue. Many metal ions such as zinc, uranyl and copper form insoluble ferrocyanides of analytical use. Ferrous ion forms a white precipitate, ferrous ferrocyanide. With ferricyanide, ferric ion forms a brown soluble ion and ferrous ion forms Turnbull's blue, $Fe_3[Fe(CN)_6]_2$, which is insoluble. In both ferrocyanide and ferricyanide, one of the cyanide groups can be replaced by other groups such as nitrite oxide, carbon monoxide, sulfite, nitrite or ammonia to form complex pentacyanides. The compound $Na_2FeNO(CN)_5$, sodium ferrinitrosopentacyanide (often called sodium nitroprusside), is used as a test for sulfide in basic solution where an intense blue colour is produced.

Blueprint paper is made by treating paper with ammonium ferricyanide and ferric citrate. Upon exposure to light the ferric ion is reduced by citrate to ferrous which then reacts with the ferricyanide to form insoluble prussian blue. The paper may then be developed by washing out the unchanged ferricyanide and ferric salts with water. (*See* also Hydrocyanic Acid.)

Halides of ferrous ion have the general formulas FeX_2, where X represents any of the halogens. They can be prepared by passing the halogen acid HX over metallic iron or by reaction of excess

metal with the halogen X_2 under controlled conditions. The anhydrous salts are very hygroscopic, form a series of hydrates and, with the exception of the fluoride $FeF_2.8H_2O$, are very soluble in water. The hydrated salts may be prepared by dissolving the metal in aqueous halogen acid solution from which the salts can then be crystallized. The anhydrous salts absorb ammonia to form ammoniates corresponding to their absorption of water to form hydrates.

Ferric iodide does not exist. The other ferric halides, FeX_3, can be made by the action of the halogens on the metal, and the hydrated salts can be crystallized from solutions made by dissolving freshly precipitated ferric hydroxide in aqueous halogen acids. The anhydrous salts are hygroscopic and are quite soluble in water. Ferric ion forms complex ions with the halides and many of the corresponding complex salts are known such as K_3FeF_6, $(NH_4)_3FeCl_6$, etc.

Pharmacopoeial forms of the halides include *syrupus ferri iodide*, a dilute solution of ferrous iodide, and *liquor ferri chloridi*, a strong solution of ferric chloride.

Hydrides of iron do not form as definite compounds but the metal does dissolve hydrogen and some of the other gases to form solutions. The solubility of hydrogen in iron increases from roughly 0.03 vol. of hydrogen per volume of iron at 400° C. to one volume per volume at the melting point. Iron is permeable to hydrogen at high temperatures. Electrolytic iron contains dissolved hydrogen which can be removed in a vacuum. (*See* also HYDRIDES.)

Nitrides, Nitrates, etc.—Several nitrides are known. A. N. Guntz obtained ferrous nitride, Fe_3N_2, and ferric nitride, FeN, as black powders by heating lithium nitride with ferrous potassium chloride and ferric potassium chloride, respectively. G. J. Fowler obtained a nitride, Fe_2N, by treatment of anhydrous ferrous chloride or bromide with ammonia at 460° C.; reaction of ammonia with finely divided reduced iron; or by the reaction of iron amalgam with ammonia at 420° C.; and also, in a compact form, by the action of ammonia on red-hot iron wire. It oxidizes on heating in air and ignites in chlorine; on solution in mineral acids it yields ferrous and ammonium salts, hydrogen being liberated. (*See* NITRIDES.) Ferrous nitrate, $Fe(NO_3)_2.6H_2O$, is a very unstable salt and is obtained by mixing solutions of ferrous sulfate and barium nitrate, filtering and crystallizing in a vacuum over sulfuric acid. Ferric nitrate, $Fe(NO_3)_3$, is obtained by dissolving iron in nitric acid (the cold dilute acid leads to the formation of ferrous and ammonium nitrates) and crystallizing, when cubes of $Fe(NO_3)_3.6H_2O$ or monoclinic $Fe(NO_3)_3.9H_2O$ crystals are obtained. It is used as a mordant.

Ferrous solutions absorb nitric oxide, forming dark green to black solutions which contain the ferronitroso ion, $FeNO^{2+}$. The reaction is utilized in the brown ring test for nitrates. Reddish-brown amorphous powders of the formulas $2FeCl_3.NO$ and $4FeCl_3.NO$ are obtained by passing the gas over anhydrous ferric chloride. By passing the gas into an ethereal solution of the salt, nitrosyl chloride is produced, and on evaporating over sulfuric acid, black needles of $FeCl_2.NO.2H_2O$ are obtained, which at 60° C. form the yellow $FeCl_2.NO$. Complicated compounds discovered by O. Pavel are obtained by the interaction of ferrous sulfate and alkaline nitrates and sulfides. Two classes may be distinguished: (1) the ferrodinitroso salts, *e.g.*, $K[Fe(NO)_2S]$, potassium ferrodinitrososulfide; and (2) the ferroheptanitroso salts, *e.g.*, $K[Fe_4(NO)_7S_3]$, potassium ferroheptanitrososulfide. These salts yield the corresponding acids with sulfuric acid.

Phosphides, Phosphates.—H. le Chatelier and S. Wologdine obtained Fe_3P, Fe_2P, FeP and FeP_2, but failed to prepare five other phosphides previously described. Fe_3P occurs as crystals in the product of fusing iron with phosphorus; it dissolves in strong hydrochloric acid. Fe_2P forms crystalline needles insoluble in acids except aqua regia; it is obtained by fusing copper phosphide with iron. FeP is obtained by passing phosphorus vapour over Fe_2P at a red heat. Fe_2P_3 is prepared by the action of phosphorus iodide vapour on reduced iron. Ferrous phosphate occurs in nature as the mineral vivianite, $Fe_3(PO_4)_2.8H_2O$. It may be obtained artificially as a white precipitate, which rapidly turns blue or green on exposure, by mixing solutions of ferrous sulfate and sodium phosphate. It is employed in medicine. Normal ferric phosphate, $FePO_4.2H_2O$, occurs as the mineral strengite, and is obtained as a yellow-white precipitate by mixing solutions of ferric chloride and sodium phosphate. It is insoluble in dilute acetic acid but dissolves in mineral acids. The acid salts $Fe(H_2PO_4)_3$ and $2FeH_3(PO_4)_2.5H_2O$ have been described. Basic salts have been prepared and several occur in the mineral kingdom; dufrenite is $Fe_2(OH)_3PH_4$. (*See* PHOSPHORIC ACIDS AND PHOSPHATES.)

Sulfur Compounds.—*Ferrous sulfide*, FeS, results from the direct union of its elements. It is best prepared by stirring molten sulfur with a white-hot iron rod; the sulfide drops to the bottom of the crucible. It then forms a yellowish crystalline mass, which readily dissolves in acids with the liberation of hydrogen sulfide "gas." Heated in air it at first partially oxidizes to ferrous sulfate, and at higher temperatures it yields sulfur dioxide and ferric oxide. It is unaltered by ignition in hydrogen. A black finely divided form results when ferrous salts are precipitated by ammonium sulfide.

Ferric sulfide, Fe_2S_3, is obtained by gently heating a mixture of its constituent elements, or by the action of hydrogen sulfide gas on ferric oxide at temperatures below 100° C. It is also prepared by precipitating a ferric salt with ammonium sulfide; unless the alkali be in excess a mixture of ferrous sulfide and sulfur is obtained. Magnetic pyrites or pyrrhotite has a composition varying between $5FeS.Fe_2S_3$ and $6FeS.Fe_2S_3$. It has a somewhat brassy colour and occurs massive or as hexagonal plates; it is attracted by a magnet and is sometimes itself magnetic. The mineral is abundant in Canada, where the presence of about 5% of nickel makes it a valuable ore of this metal. Iron disulfide, FeS_2, is found as the mineral pyrite, which is important as a source of sulfuric acid, and also as the mineral marcasite (*q.v.*); the formula of copper pyrites is $(Cu,Fe)S_2$. Pyrite may be prepared artificially by gently heating ferrous sulfide with sulfur, or as brassy octahedra and cubes by slowly heating an intimate mixture of ferric oxide, sulfur and salammoniac. It is insoluble in dilute acids, but dissolves in nitric acid with separation of sulfur.

Ferrous sulfate, green vitriol or copperas, $FeSO_4.7H_2O$, was known to and used by the alchemists; it is mentioned in the writings of Agricola, and its preparation from iron and sulfuric acid occurs in the *Tractatus chymico-philosophicus* ascribed to Basil Valentine. It occurs in nature as the mineral melanterite, either crystalline or fibrous but usually massive; it appears to have been formed by the oxidation of pyrite or marcasite. It is manufactured by piling pyrites in heaps and exposing them to atmospheric oxidation, the ferrous sulfate thus formed being dissolved in water and the solution run into tanks where any sulfuric acid which may be formed is decomposed by adding scrap iron. By evaporation the green vitriol is obtained as large crystals. Ferrous sulfate forms large green crystals belonging to the monoclinic system; rhombic crystals, isomorphous with zinc sulfate, are obtained by inoculating a solution with a crystal of zinc sulfate, and triclinic crystals of the formula $FeSO_4.5H_2O$ by inoculating with copper sulfate. By evaporating a solution containing free sulfuric acid in a vacuum, the heptahydrated salt first separates, then the penta-, and then a tetrahydrate, $FeSO_4.4H_2O$, isomorphous with manganese sulfate. By gently heating in a vacuum to 140° C., the heptahydrate loses six molecules of water and yields a white powder, which on heating in the absence of air gives the anhydrous salt. The monohydrate also results as a white precipitate when concentrated sulfuric acid is added to a saturated solution of ferrous sulfate. Ferrous sulfate forms double salts with the alkaline sulfates. The most important is ferrous ammonium sulfate, $FeSO_4.(NH_4)_2SO_4.6H_2O$, obtained by dissolving equivalent amounts of the two salts in water and crystallizing. It is very stable and is used in volumetric analysis. It is often called Mohr's salt.

Ferric sulfate, $Fe_2(SO_4)_3$, is obtained by adding nitric acid to a hot solution of ferrous sulfate containing sulfuric acid, colourless crystals being deposited on evaporating the solution. The anhydrous salt is obtained by heating these or by adding strong

sulfuric acid to a solution. It is sparingly soluble in water, and on heating it yields ferric oxide and sulfur dioxide. Many basic ferric sulfates are known, some of which occur as minerals. The iron alums are obtained by crystallizing solutions of equivalent quantities of ferric and an alkaline sulfate. Ferric potassium sulfate, common iron alum, $K_2SO_4.Fe_2(SO_4)_3.24H_2O$, forms bright violet octahedra.

Analytical.—The common qualitative tests for iron are: the formation of Turnbull's blue when a soluble ferricyanide is added to ferrous ion; the formation of prussian blue when ferric ion is precipitated by the addition of a soluble ferrocyanide; the formation of an intense red colour when a soluble thiocyanate is added to ferric ion. In the usual systematic scheme of qualitative analysis iron is precipitated as ferrous sulfide as a member of the ammonium sulfide group of elements.

Quantitative methods for the gravimetric determination of iron include precipitation as ferric hydroxide with ammonia and ignition to ferric oxide, precipitation by cupferron and ignition of the cupferride to ferric oxide. These methods require that the iron be previously separated from a larger number of other metals which would also be precipitated under the conditions required. Accurate volumetric methods for iron involve a reduction to the ferrous state by the use of stannous chloride or zinc amalgam and a titration of the ferrous iron using such oxidizing agents as permanganate, dichromate or ceric ion. A titration of ferric ion with standard titanous solution is sometimes made. Small amounts of iron are determined colorimetrically, and a large number of organic reagents are known which yield intensely coloured compounds; orthopenanthroline, which forms a coloured compound with ferrous iron, is commonly used in the colorimetric determination of small amounts of the element. The thiocyanate reaction is also of use in estimating iron colorimetrically.

Therapeutics.—Although elementary iron comprises only an estimated 0.004% of the average adult body weight, it is an essential element in the body. An intake of 10–20 mg. of iron per day appears to meet the normal metabolic requirements of the average adult. Red meats, egg yolk, carrots, fruits, whole wheat and green vegetables contribute most of the iron in the usual diet. The largest portion (about 55%) of total body iron is found in the red blood cells as an essential constituent of hemoglobin. About 20% of the total is stored in such organs as the liver and spleen, and in bone marrow, to be readily available for conversion to hemoglobin as needed. Except for a small fraction in blood plasma and some iron that is unassociated with hemoglobin in erythrocytes, the remainder is found as muscle hemoglobin, in striated muscle, and as "parenchyma iron" in striated muscle and in almost all other tissue.

Both ferrous and ferric iron form metalloporphyrins in which the iron atom is bound to the four nitrogen atoms in the centre of the flat porphyrin ring. The particular metalloporphyrin obtained from protoporphyrin and ferrous ion is heme, $C_{34}H_{33}N_4O_4$-FeOH. Heme combines with various proteins, presumably by the interaction of the iron atom in the heme with protein nitrogen atoms to establish the maximum co-ordination number of six for the iron. If the protein is globin the resultant molecule is hemoglobin, while other specific proteins give rise to such important enzymes as catalase, cytochrome, peroxidase and Warburg's respiratory enzyme. Hemoglobin, represented as Hb, reacts with oxygen to form oxyhemoglobin, HbO_2, in an amount that is proportional to the pressure of oxygen, until a maximum of about 1.36 c.c. of O_2 gram of Hb has reacted. This is an entirely reversible process and the oxygen taken up to form the equilibrium amount of HbO_2 at some particular pressure of oxygen will be given up by the HbO_2 if the oxygen pressure is reduced to its original value. It is by the use of this property that hemoglobin functions as an oxygen carrier in the body. (*See* also HEMOGLOBIN; PIGMENT, ANIMAL: *Tetrapyrroles.*)

The most important therapeutic use of iron is in the treatment of hypochromic anemias, which are commonly the result of an iron deficiency that impairs the formation of hemoglobin and may impair other functions of the red blood cells. Iron is of little value in the treatment of normochromic and hyperchromic anemias which are not caused by iron deficiency. Any of a large number of iron compounds may be used to supply the element in therapy, and inorganic salts are as effective as organic compounds for the purpose. Among the commonly used preparations are: reduced iron, *United States Pharmacopoeia* (*U.S.P.*); iron and ammonium citrates, *U.S.P.;* ferrous sulfate, *U.S.P.;* ferrous carbonate as Blaud's pills, *U.S.P.,* or as a mass of ferrous carbonate, *U.S.P.;* ferric pyrophosphate, *National Formulary* (*N.F.*); ferrous glutinate and ferrous gluconate.

Soluble ferric salts find a very limited use in the treatment of skin disorders. They are protein precipitants and can produce astringent and irritant effects on the skin and mucous membranes.

See also references under "Iron" in the Index.

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(E. F. O.)

IRON AGE. In Greek mythology, the Iron Age was the last of the "ages of man"; archaeologically, too, it was the final technological stage in the Stone-Bronze-Iron Age sequence. The full Iron Age, in which this metal largely replaced bronze in implements and weapons, began roughly about 1200 B.C. in the near east and in southeast Europe. Yet iron had limited use as a scarce and precious metal at least as early as 3000 B.C. There are frequent and widespread examples of the working of iron throughout the third millennium, but it was used in much the same way as copper and bronze. The objects may all have been of meteoric, or celestial, iron. Nowhere is there indication of an appreciation of the qualities of iron which differentiate it from bronze, though man was probably discovering these by experiment as well as by accident. In this early period a distinctive iron metallurgy seems to have developed about 1400 B.C. in Anatolia, and around the Caucasus mountains and the Caspian sea. The export of knowledge of iron metallurgy and of iron objects was rapid and widespread between 1200 and 1000 B.C. Although bronze continued to be used widely, it became the luxury metal while iron was used for mass production. With iron ore much more widespread and more plentiful than copper deposits, the ancient world rapidly converted to iron, even in places where copper or bronze had been used little or not at all. During the early first millennium B.C. important centres of iron metallurgy arose all across Europe. With the large-scale production of iron implements, especially for agriculture, came new patterns of more permanent settlement. Trade increased greatly also, promoting greater cultural uniformity. On the other hand, utilization of iron for weapons put arms in the hands of the masses for the first time and set off a series of large-scale folk movements that did not end for 2,000 years and changed the face of Europe and Asia.

See ARCHAEOLOGY: *The Iron Age in Europe; see* also references under "Iron Age" in the Index. (S. S. We.)

IRON AND STEEL INDUSTRY. Iron is the most useful metal of material civilization; it has made possible plants, tools, machinery and many of the products of the Industrial Revolution. It is principally used when alloyed with other elements, notably carbon; a moderate amount produces steel, an excess produces cast iron. Many special steels for particular uses have been devised that contain a proportion of other metals, such as manganese or chromium (resulting in manganese steel or chromium steel in these two instances). World production in the 1960s was about 250,000,000 net tons of pig iron and 325,000,000 net tons of steel, an increase over the previous decade of about 25,000,000 tons of steel yearly.

The manufacture, uses and properties of iron and steel will be discussed under the following major headings:

I. Early History
  1. Antiquity of Iron
  2. Steel From Indirect Processes
  3. Steel From Direct Processes

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I. EARLY HISTORY

1. Antiquity of Iron.—Few implements of iron or steel survive for many years before they rust away; nevertheless there is evidence that the antiquity of iron smelting is great. It doubtless has been discovered and rediscovered many times; explorers reaching primitive peoples in many parts of the world find the native blacksmith using methods very similar to those known to other tribes at far distant times and places. Steelworking and hardening, an advanced stage in the art that doubtless required centuries to reach, was common 3,000 years ago in Greece, and is mentioned in Homer. In the new world, iron occasionally was used in its native state, but smelting was not employed before European contact. (*See* METALLURGY: *History.*)

It is more probable that iron was first found in the ashes of a big fire built near some red paint rock than that the first tools were made from meteorites. When paint rock and fire came to be associated with iron as cause and effect, the next step was to produce it intentionally in fires built against a bank exposed to prevailing winds or in pits or rude rock furnaces where the fires were fanned by bellows, one of the earliest mechanical devices. These are the primitive methods that survive today in the Catalan forge (*see* FURNACE, METALLURGICAL): a mixture of charcoal and iron ore, selected for its purity, is heated intensely for several hours, with fuel additions made from time to time and with a vigorous blast of air fanning the fire. The iron in the ore becomes an incandescent sponge of metal; the clay or other minerals together with the charcoal ash sinter into a slag, permeating the sponge and protecting the reduced iron from further action. After a given time, the furnace is broken into, the glowing ball of iron pulled out and, while white hot, hammered vigorously to expel as much of the slag as possible and to weld the particles of metal into a coherent mass.

2. Steel From Indirect Processes.—With various changes in the furnace details and in methods of producing the air blast, these methods produced all the iron available up to the 14th century. It was truly a wrought iron, the best product containing no more than 0.1% of total impurities alloyed with the metal, but shot through with microscopic slag particles, aggregating 3% or more of the total weight. Steel was made sometimes as an accidental product in the old forges; by design the wrought iron bars would be packed with charcoal in clay boxes or jars and heated for days, whereupon the iron absorbed enough carbon to become steel and thus acquired the superior hardness and strength necessary for keener tools.

As the demand for iron grew, the furnaces became bigger, and a stronger blast of air was required to drive the products of combustion from the bottom up through the mixed charge. As a result, the iron ore was reduced to spongy metal in the upper part of the furnace, and it then proceeded to absorb more carbon as the charge settled down, thereby being converted to pig iron, a much more readily fusible alloy. The bigger, taller furnaces introduced in the early 14th century therefore produced liquid pig iron, a complex alloy of iron, carbon and other elements. Subsequent developments have been along three main lines: (1) increasing the size of the furnace and developing mechanical auxiliaries to produce pig iron more economically and in greater amounts; (2) invention of various processes for changing this impure pig iron into the more useful wrought iron; (3) production of steel either by way of wrought iron or directly from pig iron. Henry (later Sir Henry)

Bessemer's process, announced in 1856, for making steel from pig iron in a pneumatic converter, began the steel epoch. (*See* also CONVERTER STEEL.)

Metallurgical developments consequently have been away from the simple and direct production of wrought iron to the complex, indirect manufacture of steel. The change from the small, intermittent operations controlled by a highly skilled artisan to large, mechanized continuous furnaces has been associated with enormous expansion in total output and a great saving in labour, with a notable conservation of raw materials. The last-mentioned has become a major factor in the free countries of the world. The greatly increased production of the metal in all its forms has caused a shortage of high-quality ores and fuels, which has resulted in important changes in ore processing and in supply routes as well as in extensive studies of means whereby electricity, oil or gas may be substituted for metallurgical coke.

3. Steel From Direct Processes.—Some metallurgists believe that the excessively high temperatures attained in the modern blast furnace cause the pig iron to alloy with undesirable compounds, notably of nitrogen, which cannot be eliminated later, and which, it is believed, causes the metal to be inferior to that produced by the old, direct processes operating at a low temperature. Hence many methods of making iron and steel directly from the ore are proposed periodically, and extended experimentation on a semi-commercial scale has produced some marketable metal by these processes. Most of them rely upon the fact that iron ore is reduced by gas in the upper, cooler part of the blast furnace. That is, the reaction

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

is substantially completed at 800° C., or low-red heat, too low to break up other minerals in the ore. Consequently hot iron ore is passed through a revolving kiln containing producer gas, and the iron sponge formed therein is either passed directly to an electric melting furnace or quenched rapidly to prevent reoxidation, separated from unreduced ore and gangue, and the metallic portion briquetted or melted. That these so-called direct steelmaking processes are destined to supplant the indirect system of smelting ore to an impure product and refining the latter is very unlikely. These processes may, however, be able to operate in isolated regions with a good local market where high-purity iron ore is available but good coking coal is not.

II. IRON ORE

Iron is smelted from several oxidized minerals occurring in abundance in the earth's crust. In order of commercial importance, these minerals are hematite (Fe_2O_3), magnetite (Fe_3O_4), limonite (hydrated iron oxide) and the carbonate siderite ($FeCO_3$). Great deposits of these minerals in reasonably pure state, close enough to the surface to be mined easily, occur in many regions. They are so common that an iron and steel industry will be developed whenever and wherever a machinery-using population accumulates. Iron deposits located in sparsely settled countries are potential ores of the future; for commercial uses an ore must be so situated and of such a nature that it can be mined, transported, smelted and marketed at a profit. Proximity to good fuel enhances the value of ore—in Great Britain, inland furnaces smelt local ores containing as low as 23% iron. The enormous ore deposits near Lake Superior in North America are 1,000 miles from coking coal and an iron-consuming population. But intensive production and cheap water transport on the Great Lakes enabled these deposits to dominate the North American market after the turn of the 20th century, shipments averaging 80,000,000 gross tons annually after 1940. The ever increasing needs of the industrial eastern states of the U.S. have been partially met by imports from Venezuela; ore from enormous deposits in Labrador-Ungava and Africa were reaching U.S. furnaces before 1960. The European continent depends largely upon the minette (limonitic) ores of Lorraine—ores that until the beginning of the 20th century were valueless for steelmaking because no way was known to eliminate a high percentage of harmful phosphorus. Sweden, the traditional producer of quality steels, has found it more profitable to export its high-grade ores, and Swedish metallurgists have successfully solved the problem of making a good product from rather poor raw materials.

A. DEPOSITS

1. North American Deposits.—The most productive iron ore region in the world is in very old (Pre-Cambrian) strata surrounding Lake Superior in both the United States and Canada. The Canadian deposits were brought into production in the late 1950s. Several long, narrow areas called ranges contain the workable ores, which are hematites. The names of these important ranges, their locations and the dates of opening are listed in Table I.

TABLE I.—*Important Ranges*

Name	Location	Opened	Name	Location	Opened
Old ranges			Old ranges (cont.)		
Marquette	Michigan	1854	Vermilion	Minnesota	1884
Menominee	Michigan	1872	New ranges		
Gogebic	Michigan and Wisconsin	1884	Mesabi	Minnesota	1892
			Cuyuna	Minoesota	1911

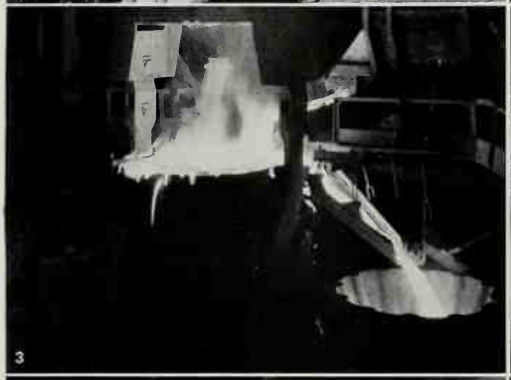
The deposits in the Mesabi range are flat, thick and close to the surface and are, therefore, mined in open cuts by steam shovels. Underground mining is the rule in the others, the veins being fairly steep and worked to 3,000 ft. depth. (For discussion of various mining methods *see* MINING, METAL.)

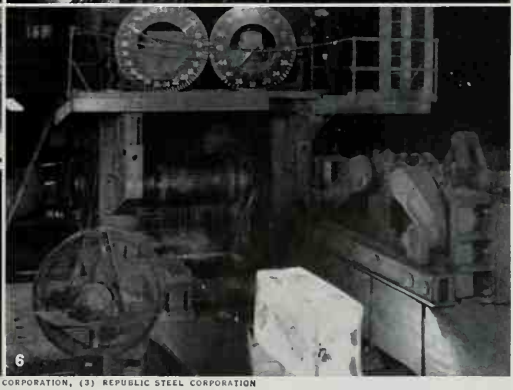
In view of the tremendous annual production of the iron ranges, it may be questioned how long it will be before the region is worked out. The average iron content of all lake ores dropped from 55½% in 1902 to 51¾% in 1910, and has been maintained since then at a guaranteed 51½% only by mining increasing amounts of high-grade ore and washing, screening or drying one-third of the remainder. Ore shipments were sharply increased at the beginning of World War II and continued at that high level, so that the virtual exhaustion of the open-pit mines could be foreseen in the latter half of the 20th century. Since the Mesabi range is within an iron-bearing formation about 100 mi. long and containing about 70,000,000,000 tons of low-grade material, serious attention was given after 1950 to the concentration of the magnetic iron oxide in this taconite (*q.v.*) rock. By the 1960s several large concentrators were operating and producing high-grade pellets. The method consists of crushing and fine-grinding the taconite, separating the iron oxide (Fe_3O_4) by its magnetism, mixing these magnetite fines with a little binder clay, anthracite dust and water and passing the mixture through a drum something like a long cement mixer. It emerges in spheres about the size of golf balls; these are coated with fine coal and fired at about 1,260° C. into hard, porous pellets that withstand shipping and storage and can readily be smelted in the blast furnace. The taconite contains about 25% iron; the pellets 63%. While the mining and concentration is costly (three tons of rock to one ton of marketable product), this expense may be recovered in lower shipping charges, lower coke and flux requirements and increased rate of production in the blast furnace.

Two-thirds of North American ore comes from the Lake ranges and one-sixth is imported. Most of the balance of about 20,000,000 tons has been taken from many ore occurrences in the Clinton formation in the Appalachian mountains. In the northern Appalachian region the ores are predominantly magnetites and much ore almost free of gangue is produced from them. In the southern part of Alabama, deposits of a low-grade red hematite with an easily fusible gangue are found near extensive coal measures. All these deposits are mined by underground methods; among them are mines that have produced continuously since the earliest iron smelting in North America. Open pit mining of the extensive Quebec-Newfoundland (Labrador) hematite deposits was developed in the 1960s.

2. Lorraine Deposits.—Ore beds second in importance only to those in the Lake Superior region occur in strata of Mesozoic age near the Franco-German border, extending northward into Luxembourg and Belgium. While of recent commercial development, they are the chief ores for the European Coal and Steel Community (France, Belgium, Federal Republic of Germany, Italy, the Netherlands and Luxembourg), which produces 25% of the world's pig iron. Mining is done in three principal basins, Longwy, Briey and

IRON AND STEEL INDUSTRY





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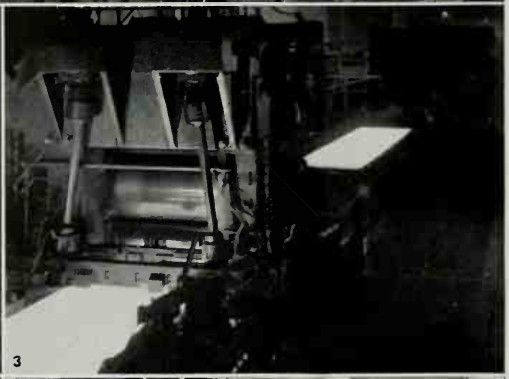
STEPS IN STEEL MAKING

1. View of the upper part of a blast furnace, showing a skip car (lower left) on the inclined track carrying raw materials to the top for charging. These materials—iron ore, coke and limestone—are reduced to molten iron, the first step in the manufacture of steel. The iron is then tapped into waiting ladle cars which carry it to open-hearth furnaces, electric furnaces or Bessemer converters, where it is made into steel
2. A Bessemer converter in full blow. By forcing air through the molten iron, the carbon, manganese, silicon, other elements and impurities are oxidized and eliminated to form steel in about 15 minutes
3. The open-hearth process. The raw materials are charged into a large, shallow furnace hearth. About five hours are required for melting. For about six hours more the heat is allowed to "work" while the refining action takes place, forcing many of the impurities into the slag which forms on top of the molten metal. The picture shows the tapping of a finished heat of steel from the open hearth into a ladle (left). The slag floating on top runs off into the slag pot at the right
4. Pouring (teeming) molten steel from a ladle into ingot moulds
5. The moulds are stripped from the formed ingots, which are then sent to the soaking pits pictured. These furnaces heat the ingots thoroughly and uniformly. The ingots are then ready for the first rolling in the blooming mill
6. First rolling operations of the steel in the blooming mill, where the ingots are reduced and elongated as they pass back and forth through a set of rolls. Up to this point, the steps in making steel are similar, although hundreds of chemical formulae are used to vary its composition, and some variations in procedure are made during various steps according to the destined use of the steel

IRON AND STEEL INDUSTRY



BY COURTESY OF (1-4) JONES & LAUGHLIN STEEL CORPORATION, (5) REPUBLIC STEEL CORPORATION

PROCESSES IN FINISHING STEEL

1. In the manufacture of welded pipe, blooms and billets are first rolled in the blooming mill, then rolled into skelp in the skelp mill. Buttweld pipe is made by drawing the heated skelp through a welding bell, as pictured
2. The Mannesmann process of making seamless pipe. The blooms are heated, then rolled into rounds at the round mill. The rounds are cut to desired length, centred for piercing and heated again to the proper temperature for piercing. Finally the pipe goes to the sizing mill, where it is brought to true diameter by a series of grooved rolls. In the picture, semifinished pipe is emerging from a seamless-tube mill
3. Ingots rolled in the blooming mill are cooled, conditioned and reheated to proper rolling temperature for operations known as descaling, roughing and finishing. In the picture the slab at the right has passed through the last roughing stand and is proceeding to the finishing train. The slab in the left foreground is entering the last roughing stand
4. Examining tin-plated steel. This type of steel is rolled from slabs on the continuous strip mill, wound into coils, placed in a continuous pickler, cold rolled and rewound before it is sent to the tin mill
5. Polishing machine which produces various degrees of brightness on sheets of stainless steel

Nancy in northeastern France. The ore beds occur in flat strata 60- to 120-ft. thick, from 300 to 750 ft. below the surface. The iron is contained in tiny nodules of hematite, cemented with a calcareous or a siliceous gangue. It is only necessary to combine these two to procure a self-fluxing, easy smelting mixture, very desirable commercially even though its iron content is quite low (35% to 42%). Phosphorus is strikingly uniform, being 1.7% to 1.9% of the iron contained, and the Lorraine pig iron must therefore be used in basic steelmaking (see *Bessemer Steel: Thomas-Gilchrist Discovery*, below).

3. Ores in Great Britain.—Since the rich blackband, clay ironstone and brown hematites of the Carboniferous strata have been almost exhausted, 80% of the iron ore mined in Great Britain is taken from leaner strata, averaging only 27½%, which are a continuation of the Lorraine beds. Workable deposits extend in a broad strip from the coast of Yorkshire southwest to that of Dorset and are estimated to contain 3,400,000,000 tons of workable ores. The beds are nearly horizontal, and consequently have broad outcrops in gently rolling ground, thus permitting them to be mined chiefly by quarrying operations. As a rule the individual deposits are small and do not warrant powerful excavating machinery such as installed in the great Mesabi pits. A maximum working face is 30 ft. Such "marlstones" (or simply "stone") contain the iron in tiny oöliths like the Lorraine ore, but near the surface the iron has been oxidized and hydrated to limonite, and at depth it is a carbonate. Gangue materials are either calcareous or siliceous. These deposits have been longest mined in the Cleveland district of North Riding, Yorkshire, and there a limited area has produced 5,500,000 tons a year since 1875. All mining of the carbonate ores is underground, sometimes as deep as 600 ft.; 9- to 12-ft. beds are reckoned excellent. Cleveland ores are suitable for basic steelmaking, wrought iron manufacture or general iron foundry work. Great Britain's ore demands have been slowly growing, annual production of pig iron rising from about 10,500,000 tons after World War II to about 15,000,000 tons by the 1960s—about one-third that of the European Coal and Steel Community.

4. Reserves of Iron Ore.—Conservative estimates by economic geologists indicate that there is enough ore in reserve to last 200 years at the current rate of consumption. Of this huge tonnage, two-thirds is located in the western hemisphere; Brazil and the United States possess most of this, but Canada and Cuba both have notable deposits; France has half the balance, and the rest is scattered about in more or less readily accessible locations. Nothing precise is known about Soviet reserves, but United Nations estimates have been in the range of 11,000,000,000 tons, and the U.S.S.R. has reported substantial reserves and rising production, with increases over a 20-year period from 27,800,000 tons in 1938 to 84,240,000 in 1957, and to more than 100,000,000 in the 1960s. Extensive deposits are reported in China, in the northeastern province of Hopeh and in Manchuria, and good deposits in the lower Yangtze valley. India's largest reserves are in the central provinces, with others in Orissa, Madras and Mysore. Substantial reserves also are known in the Philippine islands and in Indonesia. All such computations assume a certain state of metallurgical art in order to define "ore." But metallurgical art is constantly advancing as shown, *e.g.*, in the notable progress made in concentrating the Minnesota taconites and the use of inferior ores in Sweden. *See* also ORE DEPOSITS.

B. Preparation of Ore for Smelting

1. Transport.—In England and on the continent of Europe much of the iron ore is smelted in furnaces erected nearby—even at the mine mouth. Freight is a minor matter. That which is transported from overseas is handled for the most part in ordinary cargo vessels. In the United States, however, the long haul down the Lakes from the ranges to the furnaces has caused the development of specialized handling equipment. At the mines, hopper-bottom railroad cars of 50 to 60 tons capacity are loaded by steam shovels in the pit or from storage bins at the mine, and hauled to the nearest port. There long lines of ore bins are built out into the water; whole trainloads of ore are dumped in a few minutes by pneumatic devices. When these bins are full, an ore boat docks alongside, the hatches are opened, and a load of 10,000 tons of ore is spouted into the hold in less than a half hour. Ore boats that are used for service on the Great Lakes are of special construction and are essentially long, self-propelled barges with movable decks. When one of these boats arrives at its destination, the hatches are again opened, and enormous grab buckets reach into the hold, scooping out the ore and conveying it inshore and loading it either in railroad cars or on a stockpile. If the furnace plant is inland, trainloads of ore are hauled to the site and dumped in bins or placed in stockpiles. Hopper-bottom cars are used almost exclusively for this purpose, although for stockpiling a car dumper, which turns the car upside down, often is used and the ore is moved to the pile by a grab bucket and overhead bridge. The magnitude and power of this unloading machinery cannot be comprehended unless it has been seen in operation. Large stockpiles, which are almost unknown elsewhere, are the general rule in the United States, where water transportation is entirely suspended by ice during the winter months. Limestone and coke are also stocked in sufficient quantity to provide against irregular deliveries from a distance.

2. Dressing.—Up to the beginning of the 20th century iron ore was seldom treated in any way prior to its utilization. High-grade materials, however, became increasingly scarce, and there was a rapid extension of ore-dressing methods.

Screening is the simplest method. At least one-quarter of the lake ores are improved by this method. In England the miner frequently digs marlstone without removing the loamy overburden; the quarried material is then crushed and the fine particles screened out and discarded. In this way the average iron content of the ore is increased, and the suitability for smelting improved, for too many fines in the charge slow down blast-furnace operations.

Washing is also common in the United States. Many million tons of Mesabi ore are treated in washers. The washer is an inclined trough; from end to end is a stout shaft with plow blades so set on its circumference that, when the shaft revolves, the plows clear the trough bottom and move any solid material gradually along. The fine screenings enter at one end and travel against a copious current of water, which washes out the finer, clay-bearing particles, lean in iron.

Concentration is producing many million tons of excellent pellets for blast furnaces or ore for the open-hearth steel furnaces, as briefly described above in the description of North American ore deposits.

Calcining is common in England, particularly on the Cleveland carbonate ores. The Gjers kiln is ordinarily used, a short cylindrical steel shell set vertically and lined with firebrick. A mixture of ore, with about 5% slack coal, is charged through the top as the burned ore is withdrawn at the base. Such a kiln will drive moisture and carbon dioxide from about 1,000 tons of ore in a week; Cleveland ores lose 27% to 30% in weight, but the resulting ore has had its iron percentage increased to about 31%; still a very lean ore, viewed by North American standards. Lorraine ores contain much moisture, but cannot be calcined because this preliminary heating causes them to powder.

Sintering is a method of converting fine ores or flue dusts into a porous clinker that can easily be smelted. Low-grade North American and Swedish magnetite ores are frequently concentrated by fine grinding and drawing the iron-bearing minerals out of waste rock with strong magnets. This fine magnetite is then moistened and mixed with fine coal and a little flux or with blast-furnace flue dust, and spread over a traveling grate, the coal ignited and burned in a strong downdraft. The resulting clinker smelts so much more easily than the dense magnetic ores that the latter, even of high grade, are frequently sintered at plants in the United States. Sintering of flue dusts recovered from the furnaces and other by-product fines from the steel mills is also done on an ever increasing scale.

C. Blast Furnaces

Having followed thus far the mining, transport and preparation of ore, attention should next be given to the process of smelting

it into metal. This is done in a blast furnace, and the metallic product is a high-carbon alloy of iron called pig iron and containing more or less silicon and manganese. Since a separate article is devoted to the construction and operation of the blast furnace (*q.v.*), these matters will be summarized only briefly here; more attention however will be given to the entire assemblage of auxiliary equipment that together goes to form the blast-furnace department of a modern steelmaking plant. A blast furnace and its top works often rise 250 ft. above ground level. It is round in cross section, bound with steel plates and lined with a thick wall of special firebrick. Piercing the very top of the shell are two side openings leading into brick-lined pipes (downcomers) for venting the furnace gases. The top is closed by a double bell, which in effect is an air-lock for introducing charges of ore, coke and limestone, while preventing the escape of any gas. Charging is continued at such a rate that the furnace shaft is always full. About eight feet above the furnace base is a series of 10 or 12 water-cooled nozzles called tuyères, equally spaced around the circumference, through which hot air is blown into the interior. The coke in the mixed charge burns in this air, producing a region of intense heat sufficient to melt the metallic iron descending to that level from above, and superheat it so much that when it trickles to the hearth it collects at the bottom of the shaft in a pool that remains molten for hours. Five or six times a day this iron is drawn off or cast by opening a taphole at the very bottom.

1. Reduction of Iron Ore.—The chemical reactions that reduce the ore to iron can only be presented here in highly simplified form. At the tuyères the heat is so intense that coke burns to carbon monoxide, thus:

$$2C + O_2 \rightarrow 2CO$$

It is this gas that reduces the ore at a fairly low temperature, *i.e.*, near the top, by a series of reactions that may be simplified as

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

The secret of rapid furnace driving to produce big tonnages is to use such ore, or prepared sinter, that the gases may permeate it readily and completely. Pure iron is relatively infusible, having a melting point of 1,539° C.; when alloyed with 4.3% carbon its melting point is about 1,130° C. The freshly reduced iron picks up this necessary carbon to convert it into the more fusible pig iron, either by physical contact with the hot carbon, or, much more readily, by gas reaction

$$2CO \rightarrow [C]_{Fe} + CO_2$$

The principal chemical reactions between ore and gas are such that they are promoted by pressure, and this fact is utilized in some blast furnaces by running them with "pressurized top," as it is called. Even without this device, modern furnaces have been of such size that daily production of 1,250 tons during long campaigns are commonplace. With favourable combination of porous ore, high in iron, and properly sized coke, stone and flux in the charge, production rates reach 1,500 tons per day. Of course in the United States, as elsewhere, furnaces of half that production or less are still economically operating.

The large, tall furnaces cannot operate without first-class coke strong enough to carry the heavy charge column. Such coke is not everywhere available. A notable pilot plant at Ougrée, Belg., has been in operation since 1953 by an International Committee for Research on the Low Shaft Furnace. The furnace hearth is oval, 9 ft. by 3 ft., and the shaft carries 19 ft. of burden. Ore is low grade (26% to 34% iron depending on source) in granules from ¼ to 1¼ in. in diameter, and partially coked coal or non-coking coal is in slightly larger sizes. Air blast is enriched to 28% oxygen and heated to 700° C. Daily production is 40 tons of marketable iron, and campaigns have lasted as long as two months.

Other efforts to make iron commercially without coke ("H-Iron") followed the successful Swedish methods of making sponge iron, in which mixed carbon monoxide and hydrogen gas from an outside gas producer is blown into the lower part of an 80-ft. shaft furnace, withdrawn halfway up and returned to the gas producer for regeneration (except for a fraction passed on up for preheating the top part of the descending column). The lowest part of the shaft is strongly water cooled so the reduced iron is quickly chilled before discharging. Highest quality ore, free from gangue, is desirable; however, about 10% emerges unreduced. Capacity of these furnaces is about 75 tons per day. About 120,000 tons per year is made in Sweden, most of it remelted into high-grade steel.

2. Slag Formation.—Impurities in the ore and the coke ash in a blast furnace must be disposed of. If they contain a preponderance of a single oxide like silica (SiO_2), they cannot even be melted unless sufficient limestone is present to flux them; that is, convert them into an easily fusible glass or lavalike substance called slag (*q.v.*) or cinder. The formation temperature of slag depends upon the relative proportion of basic oxides (lime CaO, or magnesia MgO) and acid oxides (silica SiO_2, or alumina Al_2O_3) that are present in the furnace charge. Like the iron, slag melts in the hot region above the tuyères and trickles down, forming a pool floating on the iron. It is tapped or flushed through a cinder notch located between the tuyère line and the furnace bottom, usually just before the iron is tapped.

3. Ore Handling.—A small size furnace making 600 tons of pig iron a day will consume 1,160 tons of ore, 580 tons of coke, 290 tons of limestone and 2,370 tons of air blast. It produces in addition to the iron 330 tons of slag, 70 tons of dust and 3,400 tons of gas. It requires 17,000 tons of water to keep the furnace parts cool and to wash the dust from the gas. Therefore equipment must be provided to handle expeditiously no less than 26,000 tons of material each 24 hours. Such auxiliaries are so large and so numerous that the furnace itself is frequently inconspicuous, despite its huge bulk. In the United States, much space is ordinarily given to stockpiles. Ore that comes from such storage, or direct from the mine, is dumped into bins alongside the furnace. Other compartments hold coke and flux. On a track underneath operates a scale car, which stops under appropriate gates while the attendant draws off a specified amount. When the proper quantities have been assembled, the car proceeds to the skip pit and drops its load into a car which in turn is hoisted up the inclined bridge and dumped into a hopper at the very top of the furnace.

4. Disposal of Iron and Slag.—The pig iron and slag tapped from a big furnace are led by clay-lined troughs or runners to the edge of the foundation where they flow into ladle cars standing below and are hauled away while still liquid. If the furnace is serving a steelmaking plant, the iron may be taken direct to a steelmaking furnace. More usually it is poured into a mixer that is in effect a storage reservoir, sometimes of 1,500 tons' capacity. A mixer is usually shaped like a huge barrel, made of strong steel plate and lined with firebrick; it may be rolled on its foundation by suitable trunnions so the opening may at one time receive metal from a ladle car above, or later discharge it into another for transfer to the steel furnace. The bad effect on steelmaking processes of sudden variations in composition of the pig iron, so-called off casts, is minimized by dilution in a pool of reserve metal. Furthermore, some of the harmful sulfur may be eliminated from high-manganese pig iron in the mixer if the temperature is properly controlled. Iron that cannot be converted promptly must be cast into pigs, either in a pig casting machine, an endless chain to which is attached a series of molds, or by running iron direct from the taphole into pig molds formed in the sandy floor of the furnace house. Slag may be dumped, or, in some localities, marketed for railway ballast, filling material or concrete aggregate. Since the slag is essentially a calcium aluminium silicate, large tonnages are utilized as raw material in the manufacture of portland cement.

5. Utility of Blast-Furnace Gas.—As noted above, gases from the furnace top are good fuels, but they bear too much dust to be used without cleaning. Much of the coarser ore and coke particles swept out of the furnace with the gas remains in the dust catchers, which are essentially enlargements of the downcomer pipes; the velocity of the gas and its carrying power are reduced in passing through them. Further cleaning, either by scrubbing towers or by electrostatic precipitation, is commonly undertaken. Electrostatic precipitation has the advantage that it handles gas without cooling it and may recover valuable amounts of potash for fertilizer. In this process the slightly humidified gas is passed

through vertical pipes; in the centre of each is a wire charged at high voltage. In the electrical field so formed solid particles drift toward the grounded pipe walls, adhering there until dislodged by hammering.

D. Blast-Furnace Plant

1. Blowing Engines.—The energy contained in the furnace gases is utilized to generate hot blast and auxiliary power for pumping, hoisting and lighting. Cleaned gas is used to drive gas engines connected with compressor cylinders. Compressed air goes to the furnace by way of a stove, therein acquiring a temperature of about 700° C., and on through a brick-lined hot-blast main to a bustle pipe circling the furnace. From the bustle pipe, gooseneck connections deliver blast to the furnace through the tuyère openings. The required amount of air is fixed by the size of the furnace and the pressure, which varies from 12 to 20 lb. per square inch (p.s.i.) with operating conditions (and is correspondingly higher if the furnace is run with pressurized top, as mentioned above), and must be delivered without fail. About 50,000 cu.ft. of air per minute is necessary for a furnace making 600 tons of pig iron per day.

2. Dry Blast.—One auxiliary more commonly installed in Great Britain, although proposed by James Gayley of the United States, reduces the humidity of the blast. Gayley showed that water vapour entering the tuyères, amounting in summer to about 250 gal. per hour, is dissociated into its elements by the white-hot coke, this action absorbing heat not usefully regained within the furnace. Variations in moisture content are especially undesirable, for these produce variations in the temperature at the focus, and consequently change the chemical composition of the pig iron. To produce a low and uniform humidity in the air blast, the compressors may suck air through a refrigeration system. Furnaces in regions with hot, humid summers (as in Birmingham, Ala.) consume noticeably more coke and produce much more pig iron of variable and undesirable chemical composition during the summer, due to large and unpredictable changes in moisture content in the blast. There a variation of the Gayley "dry blast" is used whereby the atmosphere is first drawn through chambers where it is cooled to 4.44° C. by copious sprays of cold water. Air entering the blowing engines is therefore saturated with water at 4.44° C., a constant value, and an absolute amount often but a fraction of the moisture in the original air.

3. Stoves.—Four stoves are usually installed to heat the blast. These are steel cylinders up to 100 ft. high and 22 ft. in diameter. Each has a vertical combustion chamber, either at side or centre; the burned gases then return to the bottom through a multitude of narrow flues made of firebrick (*see* Cowper Stove). In the passage they give much of their heat to the brickwork and flow off through a chimney. In the operation of a four-stove installation, three of the stoves may at any hour be filled with burning gas, thus acquiring heat; the cold blast passes through the other stove; when this one cools off, valves are changed to put it on gas, *i.e.,* heating, and one of the heated stoves on wind, *i.e.,* giving up its heat to the air passing through it en route from engines to furnace. Usually valves are changed every hour. In a four-stove installation, therefore, each stove is heating for three hours and cooling for one.

4. Blast-Furnace Operation.—The blast-furnace superintendent's task is primarily to harmonize operations of various large, mechanical elements. But the furnace itself is his greatest care, even though the principal reactions within it are in mobile equilibrium. Slight variations from normal are self-adjusting; that is, if for some reason a surplus of heat is generated, the action within the furnace changes in the direction that will absorb the extra quantity of heat. Nevertheless the skilled operator is quick to observe clues that indicate deviations from the normal, and he immediately makes such adjustments in the operating conditions as experience tells him will avoid any serious irregularity.

Control of Sulfur.—Sulfur, largely from iron pyrite contained in coke ash, is the most troublesome impurity in pig iron, causing the iron to be very brittle at red heat (red short). High-sulfur castings often crack in the molds after cooling, and high-sulfur steels may break when being worked in rolls or forging. Since no sulfur is removed in the converter or in some open-hearth steelmaking processes, it is essential that the amount of this element in the pig iron be reduced as much as possible. This is done in the blast furnace by charging limestone so the slag will be distinctly basic and thus have a higher solubility for sulfur compounds. Such a slag requires more coke, and some works in the Federal Republic of Germany smelt at low heat and desulfurize the molten iron with sodium carbonate. The harmful effects of sulfur may be mitigated in castings if two or three times as much manganese is present; an innocuous manganese sulfide results. Commercial steels also contain about .75% manganese to neutralize the sulfur as well as to help deoxidize the molten steel (see *Ingots: Gases in Molten Metal,* below). Sulfur may be eliminated in electric-furnace steel by refining at a high temperature under a "carbide" slag very high in lime on which floats some coke. Pig iron for gray iron castings must have less than .10% sulfur; structural steel must contain less than .06%; many alloy steels are specified to contain less than .04% sulfur.

Effect of Silicon on Pig Iron.—A blast furnace working very hot tends to reduce silicon and manganese from any minerals containing them that are present in the charge. Manganese is now considered beneficial in all subsequent processes, but silicon must be sharply limited to pass some specifications. Silicon in pig iron causes much of the carbon present to separate and collect into tiny flakes of graphite, permeating the entire metallic structure; this graphite is responsible for the characteristic gray fracture of castings for machinery; its presence also makes for easy machinability. The carbon would otherwise exist in the alloy as a compound of iron (a carbide, Fe_3C, called cementite) and form a much harder, stronger alloy. Consequently in such things as car wheels or in white iron castings, which are later to be converted into malleable iron by annealing, the silicon must be strictly limited. (Iron malleable as cast requires very low sulfur.) Silicon in pig for steelmaking must also be under close control. Therefore for those irons where both sulfur and silicon are limited, the ore and fuel must be specially selected for a low content of sulfur.

Gray and White Iron.—Carbon is another element in pig iron that will vary somewhat. It may be from 3.0% to 4.25%, depending upon furnace conditions. Generally if either silicon or phosphorus runs unduly high, the carbon will be low. Manganiferous irons, on the other hand, are usually high in carbon. The colour of a freshly broken piece of pig iron is due to the way the carbon is held, rather than its total quantity; in white iron, nearly all the carbon is combined with iron in the carbide cementite; in gray iron, seven-eights of it is in the form of graphite; intermediate proportions are called mottled irons.

Phosphoric Ores and Iron.—Phosphorus, until about the start of the 20th century, was the most undesirable element entering the blast furnace. Whereas much sulfur could be slagged off, between 90% and 100% of the phosphorus entering with the ore and the fuel ash came out with the iron, and an excess made both iron castings and steel brittle. For some types of thin castings requiring fluid iron, *e.g.,* the old-fashioned iron stove plates, from about 1.0% to 1.5% of phosphorus could be permitted, but in steel it had to be kept as low as sulfur, namely, from .02% to .07%; in general, the lower the better the steel. Consequently the phosphoric iron ores of Lorraine were of small value, in fact, of no value for steelmaking, until the Thomas-Gilchrist basic process was announced (1878). Subsequent developments have converted the phosphorus in the ore to a pronounced economic asset; namely, a most valuable fertilizer. *See* also Cast Iron.

III. WROUGHT IRON

Wrought iron, as compared to the total tonnage of steel, is a vanishing commodity. But it should be given some attention for its unique combination of physical properties, which enabled it to survive for 75 years after the Bessemer and the open-hearth steelmaking processes were perfected. It once was the principal metal of engineering construction as well as the raw material from which steel tools were made.

1. Puddling Process.—If about 600 lb. of pig iron and considerable iron ore are placed on the hearth of a small reverberatory

furnace and melted, various reactions occur between the iron oxide from the ore and the impurities in the droplets of pig iron. The first reactions to occur may be simplified as follows:

$$2FeO + Si \rightarrow SiO_2 + 2Fe$$
$$FeO + Mn \rightarrow MnO + Fe$$

The iron thus reduced from the ore enters the pool of metal, and the silicon and manganese oxides join with the surplus ore to form a highly basic slag. This slag has the ability to absorb any phosphorus oxides that result from reactions between the phosphorus alloyed in the metal and the surplus iron oxide in the slag. The workmen stir the slag and iron together, an operation that is known as puddling; after the silicon and manganese have been substantially eliminated from the metal, the carbon content begins to go down. The reaction may be written as follows:

$$[C]_{Fe} + O \rightarrow CO$$

Carbon monoxide gas bubbling upward causes the bath to boil. Removal of all these alloying elements leaves practically pure iron, of a much higher melting point. Toward the end of the process, therefore, the bath is converted into a metallic sponge of white-hot, pasty iron, filled with liquid slag. This is cut into 200-lb. balls by the furnaceman, surplus slag squeezed from the dripping mass and the resulting balls rolled into flat muck bars. The metal is hot enough to weld together satisfactorily, and the process is accompanied by a great spray of slag sparks, squeezed out by the rolls. Muck bars are cut to short lengths, arranged and wired together in piles, heated to a welding heat and rerolled into marketable shapes.

2. Nature of Ferrite.—From a knowledge of the manufacturing process it may be understood that commercial wrought iron is essentially pure iron containing a greater or lesser number of slag particles. By weight, about 3% of the best wrought iron is slag.

A view of a polished section through a microscope shows the structure of wrought iron. The mirrorlike metal appears white in a photograph; the stony lustre of the slag particles appears gray. The slag itself is not a simple glass; it is a high-iron silicate containing more or less manganese and phosphorus and frequently develops well-crystallized minerals. Slight etching of the polished surface develops characteristic markings; the metallic portion seems to consist of a number of closely fitted or interlocking grains. If one of these grains were picked out, it would have an irregular surface; nevertheless it is undoubtedly true that its inner structure is that of a true crystal, that is, the atoms are arranged in regular rows, in geometric order. Such tiny crystals have a body-centred, cubic crystal structure and are called ferrite.

3. Properties of Wrought Iron:—Wrought iron has superior properties for forge welding, because at high temperatures the slag particles melt and spread into a film protecting the metal from atmospheric oxygen. The purity of the iron is responsible for its toughness, or resistance to shock. While no variety of iron or steel can resist rusting (corrosion in moist atmospheres) unless it is alloyed with more than 10% chromium, wrought iron and very low-carbon steel made in open-hearth furnaces and often called "ingot iron" have acquired a considerable reputation for superiority over ordinary carbon steel in sheet forms for siding or culverts. For some purposes a variety known as charcoal iron has been preferred. Wrought iron is only moderately strong in tension, developing from 45,000 to 55,000 p.s.i. ultimate strength. Furthermore it is a soft metal, its Brinell hardness measuring 75 to 80. Likewise the production of big masses of it is tedious, and puddling requires a large amount of exhausting labour from skilled workmen. These facts all combined to hamper competition with the harder and stronger steel, which after the development of the Bessemer process could be made rapidly and almost automatically in great quantity.

4. Cementation Process.—Wrought iron was the material from which steel was manufactured up to the introduction of the processes described immediately below. Bar iron would be packed in charcoal, layer upon layer, in covered stone boxes (fairly tight) and heated for days at about 926.67° C. Many secret mixtures were added to the charcoal but the modern chemist would explain their useful ingredient as some compound like barium carbonate that facilitated or catalyzed the production of carbon monoxide from the hot carbon and entrapped air. This gas reacted with the surface of the steel, and the reaction resulted in carbon being absorbed by the metal, until, after several days, about 0.9% would be present. Toward the end, a bar would be withdrawn and broken and its carbon content and uniformity judged by its fracture. Such a bar of blister steel (so called from its surface appearance) could be forged and hardened into an excellent tool. Frequently, bar steel would be forge welded together and hammered down, the process being repeated several times to increase the uniformity of carbon distribution. Likewise cemented bar could be melted in clay crucibles and poured into steel castings (or into ingots for rolling into steel shapes and bars). This variety was called crucible steel (*q.v.*). The product would be what a modern metallurgist calls "high-carbon steel," a variety still very useful although made by other processes.

IV. CONVERTER STEEL

Prior to 1870 the principal metallic materials of construction were cast iron and wrought iron. The former could be made quite hard, but then was brittle; the latter resisted shock excellently, but was comparatively soft. There was a great and growing demand for metal that was strong, wear resisting and tough, but there was no method of producing it cheaply enough to make, for example, railroad rails. Consequently, an eager market was awaiting the discovery of the Bessemer process for making cheap steel; and in turn the satisfied market created other demands. While accurate statistics are lacking, a reasonable guess would be that 250,000 tons a year of blister steel and crucible steel were being made in Europe in 1865. For the manufacture of fine tools and cutlery such processes survive still. But obviously this very indirect method of getting steel, bit by bit, was totally incapable of supplying the needs of the coming mechanical age. In the United States in the second half of the 20th century, fine steel of "crucible" quality is made exclusively in electric furnaces.

A. Bessemer's Invention

As has been pointed out, most of the alloyed impurities in pig iron can be eliminated by oxidizing them. In all the old refining processes, iron oxide in the form of ore, mill scale or iron silicate slag (basic cinder) is the means whereby the necessary oxygen is carried into the pig iron under purification. While experimenting on some methods for improving metal for cannon in 1856, it occurred to the English inventor Bessemer that this oxygen for refining could be taken directly from the air if a blast were blown on or through the melted pig iron. On trial it not only purified the iron, but, instead of blowing cold and freezing, the metal became hot enough to remain molten even when all the carbon was gone and hitherto infusible pure iron remained. The whole reaction required only a few minutes; at the end an ingot of mild steel could be cast, ready for the forge or rolling mill.

It took years of experimentation before the new process became a commercial success. The conservatism of engineers and construction men retarded the adoption of cheap steel and the installation of the mechanical auxiliaries, largely perfected by the American, Alexander L. Holley, which enabled a plant with two converters to send forth a continuous supply of steel ingots (*see* Converter Steel).

1. Converter House.—Molten pig iron comes from the blast furnaces in ladle cars, and an overhead crane lifts the ladles and pours the contents into the mixer (*see* fig. 1), establishing a reservoir of uniform and promptly available raw material. Uniformity and continuity are foundations of rapid production of Bessemer steel. At the proper time a ladle of iron, 10 to 30 tons depending upon the size of the converter, is poured from the mixer. A small locomotive pushes this full ladle car to the converter house and the contents are run into the hot converter, which is tilted over to receive the charge. The blast of cold air is turned on, the converter tilted up to vertical position and the blow is on.

2. Conversion Process.—The converter itself is a cylindrical steel pot perhaps 10 ft. in diameter by 20 ft. high, lined with a re-

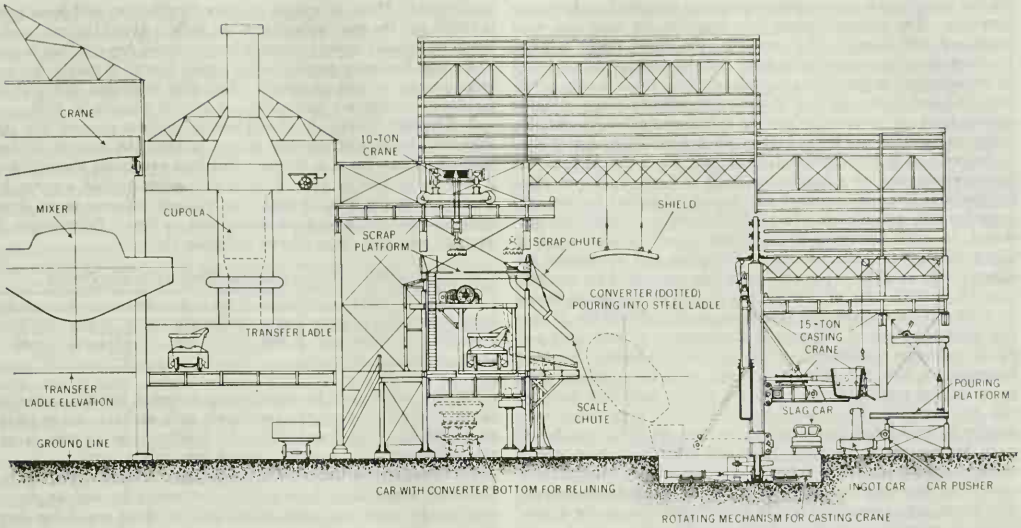


FIG. I.—GENERAL CROSS SECTION OF CONVERTER HOUSE

fractory mixture. The bottom bricks are perforated by many small openings, tuyères, through which air is blown into the metal. Oxygen in the air blast burns the pig iron it first strikes. This product of reaction may be represented by FeO, and it is swiftly distributed throughout the churning mass. At the temperature of operation, silicon and manganese atoms have a greater affinity for oxygen than has iron, so that the following reactions occur:

$$Si + 2FeO \rightarrow 2Fe + SiO_2$$
$$Mn + FeO \rightarrow Fe + MnO$$

These oxides are insoluble in metal and accumulate into droplets of slag—a mixture of iron oxide, manganese oxide and silica. When the metals silicon, manganese and iron combine with oxygen, or burn, much heat is released—enough to heat the incoming air and escaping nitrogen, to provide for radiation losses and to increase the temperature of the remaining metal and slag so it is always quite liquid. During this early stage of the blow the red-hot nitrogen coming from the mouth glows faintly. Gradually the carbon begins to burn, thus:

$$FeO + [C]_{Fe} \rightarrow Fe + CO$$

A roaring boil then takes place in the vessel; the carbon monoxide burns in a big, yellow, luminous flame at the converter mouth, and flying sparks of metal and slag add to the spectacle. In modern plants the course of these reactions is followed by a spectrograph or a photocell that records the presence of incandescent constituents by the colours radiated.

In only a few minutes the carbon is gone; the flame flickers and suddenly contracts. This is the signal for turning the vessel over on its side and stopping the blast. Inside the hot converter is now a seething mass of fluid iron, practically free of silicon, manganese and carbon, covered with a thin layer of slag. The metal, however, contains much gas in solution and if cast immediately would solidify in a spongy mass. Consequently some cupola-melted spiegel (pig iron containing 20% manganese) is run into the converter. A rapid reaction ensues, wherein the steel is freed of oxygen by combination with the excess of manganese and carbon in the spiegel. The converter then tilts further over, discharging its contents into a ladle. The blow has taken perhaps 12 minutes; no greater time is necessary to add the spiegel, pour out the steel, turn the converter upside down to discharge any loose slag chunks and back up to receive another ladle of liquid pig iron. A second converter alongside will be blowing while the first is dumping. The whole equipment of the converter department is coordinated for a complete cycle every 12 to 15 minutes, and is ruggedly constructed, so that delays from breakdowns seldom occur.

3. Converter Lining.—The violent reactions at high temperatures cause considerable scour on the lining of the vessel; especially the tuyère brick at the bottom, which must be replaced after 20 to 25 blows. When a new bottom is required, a car carrying a stout jack is placed under the upright converter, a series of bolts loosened and the jack lowered away, carrying with it the entire bottom part of the shell. This car is immediately replaced by another carrying a new bottom, already warm, ready for lifting and bolting into place. It is therefore unnecessary to leave a shell in the stand while it cools and the lining is repaired, dried and reheated—a matter of several days. In U.S. practice, the lining material is a highly siliceous rock, ground with a little fire clay, moistened and tamped in place with pneumatic rammers. Such a lining is known as an acid lining, and steel made therein is called acid Bessemer steel.

4. Pig Iron Used.—Since the reactions described above leave untouched any sulfur or phosphorus, it is necessary that the pig iron entering the converter be quite low in these two elements. Furthermore, silicon is limited by the rate of driving. It is the chief heat-producing element; if silicon in the pig is high, the converter shell and its contents get superheated during continuous blowings and must be cooled either by dropping a quantity of cold scrap into the shell, by blowing steam in with the blast (which dissociates and absorbs heat) or by delays for radiation. On the other hand, if the converter with a new bottom is a little cold, it is tilted partly over so some blast does not penetrate the iron, but burns the CO to CO_2, thus liberating more heat within the vessel. Maximum production may be had by blowing a pig iron with higher silicon and lower carbon, reducing the blowing time by charging mill scale or ore at the beginning of the blow and charging scrap to absorb the excess heat generated. But in general the pig iron used for acid Bessemer practice, and the product therefrom will be about as shown in Table II.

5. Growth of Uses.—Obviously such material as represented by

TABLE II.—*Average Analyses, Bessemer Converter Process*

Type	Carbon	Silicon	Sulfur	Phosphorus	Manganese
Pig iron	3.5 to 4	1 to 1.25	0.05	0.09	0.5 to 1.75
Full blown	0.03	0.01	0.05	0.10	0.03
With spiegel	0.1 to 0.4	0.10	0.06	0.10	0.90

the last analysis is immeasurably superior to wrought iron for many purposes. The carbon content is responsible for hardness, wear resistance and strength that wrought iron could never acquire. Furthermore, the amount of carbon, and the corresponding degree of improvement in properties, is under control, for it is only necessary to place some charcoal in the steel ladle to make a higher carbon steel, or to use a spiegel or a ferromanganese containing higher manganese and lower carbon when a milder or softer steel is desired. It is not surprising, then, that when the process was finally established on a production basis in Bessemer's own plant in Sheffield, Eng., the product was rapidly absorbed by the railways for rails and wheels. In 1868 there were 110,000 tons produced; in 1888 Bessemer steel reached a peak of production in Great Britain of 1,700,000 tons. Puddling had meanwhile declined; 70% of British pig iron went into wrought iron in 1883; only 5% in 1887. A similar story may be told of the United States. In 1867 460,000 tons of iron rails were made and sold for $83 per ton; that same year 2,550 tons of Bessemer steel rails were produced and some purchasers paid $170 a ton for them. By 1884, however, the last iron rails were made; steel had replaced them to an annual production of 1,500,000 tons a year and the price was $32 per ton. By 1940 rails had declined to a minor commodity in the United States and those were made of open-hearth steel, for reasons to be given later, but much Bessemer steel is made into skelp (flat bars) for welded pipe, and into wire and free-machining steel (low in carbon, but high in sulfur and phosphorus). The Bessemer process has declined in importance in the United States in comparison with the basic open-hearth process because the latter can handle ores with moderately high phosphorus content and can absorb almost any proportion of scrap (even 100% of the charge if scrap is cheaper than molten pig iron). However, the Bessemer process is used to produce the converter steel used in the open-hearth duplex process (see *Open-Hearth Process: Duplex Processes,* below).

B. Thomas-Gilchrist Discovery

1. Control of Phosphorus.—The so-called acid process described above demands low-phosphorus ores and pig, and in Europe such material is relatively scarce and costly. Early efforts to remove phosphorus in the converter failed. Arguing from an analogy in the puddling furnace, where a slag rich in iron oxide carried off phosphorus oxides, it was thought that if the converter blast was carried on after the carbon was gone, much iron oxide would go to the slag, and it would then be in a condition to absorb the phosphorus. When this was tried, however, the iron wasted away, ate into and ruined the lining, but unfortunately had no effect on the phosphorus. Not until 1876 did the Englishmen, Sidney G. Thomas and Percy C. Gilchrist, discover that if the converter were lined with a basic material like burned limestone, dolomite or magnesite, and if burned lime were charged with the pig iron, then a basic slag would form and be maintained in such condition that it would absorb and hold phosphorous oxides produced during the blow. This is the basic Bessemer process widely used on the continent for the production of so-called Thomas steel.

2. Basic Bessemer Process.—A basic plant is arranged much like its counterpart using the acid process. Converter shells are lined with different materials. Dolomite is freshly calcined in a cupola, ground with hot, dehydrated tar and the sticky mass tamped between the shell and a centre form. The perforated bottoms are lined two feet thick, yet must be replaced daily.

In its modern development, a heat of Thomas steel is made by charging 1½ tons of freshly burned lime and then 10 tons of pig iron into a 10-ton converter. The blast is turned on, the converter tipped up and the blow proceeds exactly like an acid heat already described, but it continues after the carbon flame drops. In this last stage the following reaction occurs:

$$5FeO + 2P \rightarrow 5Fe + P_2O_5$$

and the phosphorus joins with excess lime in the slag to form a calcium phosphate. The duration of the afterblow is controlled by chemical analysis; when it is finished the slag is skimmed off as quickly as possible, to prevent the phosphorus from returning to the metal; then the spiegel or other recarburizer and deoxidizer is added and the steel poured into the ladle. About the only additional equipment in the converter house needed beyond that found in an acid Bessemer plant is some handy means of caring for the large volume of slag produced. This slag is ground and sold as fertilizer; it contains up to 20% of soluble phosphoric acid.

3. Thomas Steel.—In this Thomas-Gilchrist process, the pig iron must have relatively low silicon to limit the amount of slag formed. Phosphorus is the principal heat-producing element and it may be as high as 3%. It is doubly essential that a mixer be used to store pig iron, in order that phosphorus may never show wide fluctuations in analysis, from heat to heat. Percentages in average analyses are as shown in Table III.

Table III.—*Average Analyses, Thomas-Gilchrist Process*

Type	Carbon	Silicon	Sulfur	Phosphorus	Manganese
Basic pig	3.5 to 4	0.5 to 1	0.05	2 to 2.5	1 to 1.5
Thomas steel.	0.10 to 0.60	0.20	0.05	0.03 to 0.10	0.30 to 0.50

Thomas steel provides satisfactory material for all classes of tonnage steels used on the continent, such as bars, boiler plate, pipe, structural steel and rails. In England, the process is extensively used for the production of low-carbon steels.

4. Nitrogen Control.—The advantages of basic Bessemer to European steelmakers have been accompanied by serious disadvantages in important applications such as sheet metal for deep drawing. For nearly 50 years this lack of ductility and workability in very low-carbon steel was ascribed to phosphorous; at the end of World War II serious attention was given to nitrogen that would average .015% in Bessemer steel and .005% in more ductile open-hearth steel. Co-operative work by Belgian steelmakers under Pierre Coheur's direction revealed that nitrogen remained low until the carbon dropped to about .50%. If the blow was then continued for two or three minutes with oxygen instead of air, steel of .004% nitrogen resulted, but temperatures would increase so much as to wear the vessel linings excessively. To control temperature, two-to-one oxygen-steam mixtures are used on this late portion of the blow, and low-carbon steels equaling open-hearth in nitrogen and phosphorous content, hardness and drawability are regularly produced. By the early 1960s, practically all Bessemer steel was being made by this process in Belgium and Luxembourg, and the practice was rapidly spreading in West Germany and France. Swedish metallurgists preferred a mixture of oxygen and carbon dioxide for the afterblow.

5. Basic Oxygen Process.—To avoid destruction of the tuyères by a pure oxygen blow, blowing 99.5% oxygen through a pipe (or lance)—the stream impinging on the top of a mixture of molten pig iron and scrap—was tried at the Austrian plants in Linz and Leoben (Donawitz) in 1952. This "L-D process" immediately demonstrated several advantages for the low-phosphorus pig iron from Styrian ores: as much as 35% scrap is used to control temperature; phosphorus, sulfur and carbon are eliminated simultaneously; oxygen efficiency is about 90%; steels very low in nitrogen are produced. On the other hand, gas cleaning equipment must be installed to prevent fumes from becoming a nuisance. The shell of course has no tuyères, is basic-lined and is rebuilt on weekend shutdowns. This process was being used for more than half the Austrian steel production. It is not adaptable to the high-phosphorus pig iron of Lorraine because of the great amounts of slag accumulating between oxygen nozzle and liquid metal, but it has been installed in a growing number of plants in the United States and Canada, where costs of 99.5% pure oxygen in plants capable of making 500 tons of oxygen per day are as low as $5 per ton of oxygen or 50 cents per ton of steel produced.

Another modification of the converter, the Tropenas side-blown converter, is used in many steel foundries. For discussion of this converter and of basic oxygen and oxygen-lance converters *see* Converter Steel: *Converter Design.*

V. OPEN-HEARTH PROCESS

As soon as the Bessemer process attained a production stage, it

was found that the mild steels intermediate in carbon content, strength and ductility between carbon-free wrought iron, on the one hand, and high-carbon crucible steel, on the other, were most useful materials for machinery and engineering structures. These mild steels were really new materials, never before procurable in quantity, and inventors attempted to make them in ways that would not infringe the Bessemer patents. An insuperable difficulty was the inability of any furnace, even when burning high-volatile coal under forced draft, to melt them. As in the puddling process, when the refining reached a certain stage, the metal became a pasty sponge. This obstacle was met by William (later Sir William) Siemens (*q.v.*) who resurrected a forgotten proposal to regenerate some of the waste heat (*see* FURNACE, METALLURGICAL). He passed the fumes from the furnace through brick checkerwork; after the passages had thus been highly heated, air for combustion of the coal was drawn through the chamber. This preheated air had the effect of increasing the flame temperature materially. Using a furnace with such a device, Émile and Pierre Martin made steel at Sireuil, France, in 1864, by melting a good grade of pig iron, adding some selected wrought iron scrap that alloyed with the pig iron and continuing these additions until the carbon content was reduced to the desired percentage, mainly by dilution (the Martin pig and scrap process). Siemens and his brother Friedrich found it necessary to erect an experimental furnace plant in Birmingham, Eng., to develop the application of their ideas in the steel industry. By 1868 the principal features of the open-hearth process were there developed; namely, gaseous fuel, regenerative checkerwork for preheating both air and gas; a thin furnace roof of silica brick; and the method of refining pig iron by adding ore or iron oxide (the Siemens pig and ore process). These furnaces, their hearths, side walls and roofs, were made of highly siliceous refractories; the only slags that would not corrode these furnaces contained an excess of silica—so-called acid slags. Not until Thomas had shown how to remove phosphorus by a basic, high-lime slag in the basic-lined converter did it occur to anyone to make an open-hearth furnace with hearth and side walls of sintered dolomite—lime and magnesia oxide—and to refine the steel under a high-lime slag. J. H. Darby built the first of these basic open-hearth furnaces at Brymbo, Wales, in 1884. The most readily available ores in both England and the United States smelt into pig iron well suited for such basic open-hearth refining; furthermore the product is distinctly superior in quality to Bessemer steel. Consequently the latter is used in the U.S. for the production of low-carbon steels for nonengineering purposes. Basic open-hearth steel, however, makes boiler and ship plate, structural steel, rails and all the higher carbon machine steels (and even alloy steels), such as shafting and forging billets. In the United States, production of acid Bessemer steel is stabilized at about 3,500,000 tons annually; electric-furnace steel (basic) is adding nearly 1,000,000 tons to its production annually, but the large expansion has been in basic open-hearth and basic oxygen steel.

1. Furnace Auxiliaries.—The essential furnace is often dwarfed by the auxiliaries found necessary for rapid and economical production. (*See* fig. 2.)

In the first place, adequate fuel must be provided; if cheap oil or natural gas is not available, another building containing gas producers (*see* GAS INDUSTRY) of the continuous type adjoins the furnace building. The producer house must have adequate coal-handling machinery (a plant with ten 125-ton furnaces would use 800 tons of coal a day) with means for hauling or sluicing the ashes away, and boilers for raising steam to blow into the producers. Gas producers are often found as stand-by equipment, even where other fuels are used, such as mixtures of blast-furnace gas, by-product coke-oven gas, natural gas, tar and oil.

Next a stock of adequate raw material is necessary. If open-hearth and blast furnaces are within the same plant, molten pig iron will be used. That requires a mixer for intermediate storage; otherwise, an ample stock of iron in pigs is required. Furthermore a big tonnage of steel scrap of various kinds is used—the proportions of pig iron and scrap charged into steelmaking furnaces depend solely upon the relative availability and cost of these two materials. Scrap is segregated as to nature and approximate analysis; big shears and drop balls (skull crackers) are used for cutting and breaking unwieldy pieces; traveling cranes and lifting magnets are installed for economical handling of this material. Bins and stockpiles are provided for the various special metals

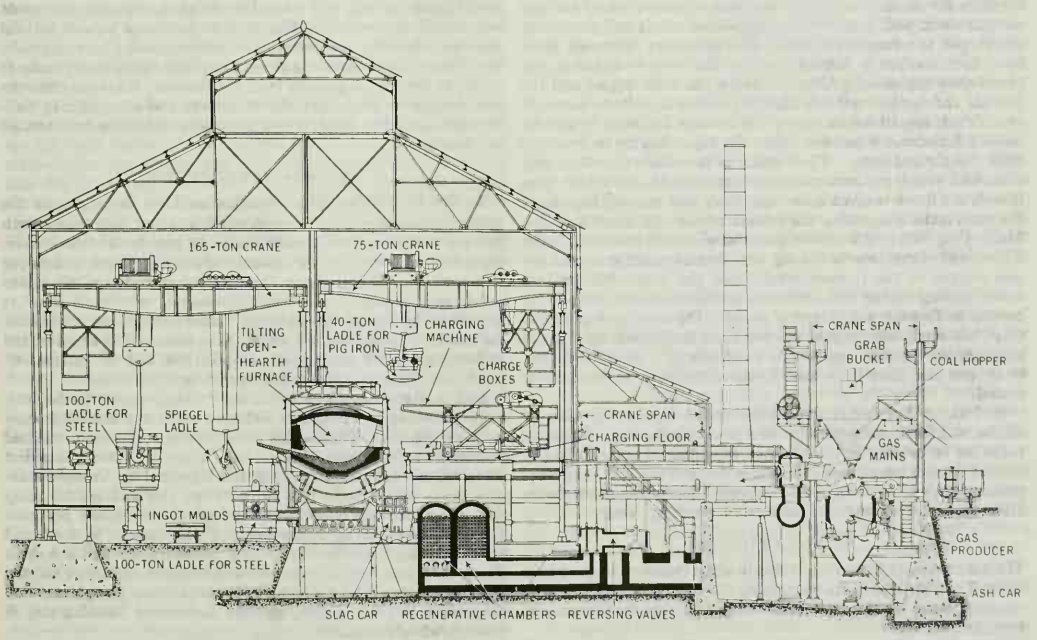


FIG. 2.—GENERAL DIAGRAM OF AN OPEN-HEARTH PLANT SHOWING GAS PRODUCERS AND CRANES FOR HANDLING METAL

used for alloying or deoxidizing the hot steel; for the limestone, fluorspar and other fluxes; for the silica, chrome, magnesite and other firebrick to repair the furnace; and for the dolomite or silica rock used for making the bottoms. In basic open-hearth plants an auxiliary building is necessary for grinding, calcining and storing the dolomite continually needed for repairing the furnace bottom and side walls (banks).

Means must be provided for introducing the fuel into the furnace and reversing the flow of flame at frequent intervals. This requires proper valves in the flues, with an appropriate series of interlocking operating devices. Trends in furnace design call for much shorter and more direct flues than shown in the cross-sectional view and the use of water-cooled gate valves offering no obstruction to gas flow when open. Waste-heat boilers are also quite frequently placed between regenerators and chimney, together with fans to pull the hot gases through them. A device is installed to charge solid material through the doors into the furnace itself. By this means, long delays between heats to refill the furnace are avoided, together with much exhausting labour. All solid materials are loaded into charging boxes, cast steel trays about 24 in. wide and deep and about 4 ft. long, that hold at least a ton of the bulkiest steel scrap. A complete charge for a furnace is assembled into 40 or 50 such boxes, placed on a train of small flatcars and moved to a track running close to the furnace doors. The charging machine operates on a wide gauge track alongside. Its ram engages an end socket on the box and is locked in. The ram then lifts the loaded box off the car, moves it forward through the open door into the furnace and tips it upside down, discharging its contents in the correct place. The empty box is returned to the car and the charging machine moves sideways, taking with it the entire train of loaded cars until the next full box is spotted directly in front of the proper door. This is then picked up, thrust into the furnace and dumped. In this manner a 100-ton furnace can be loaded in less than an hour. Equipment must also be installed to pour the finished steel into ingot molds.

2. Open-Hearth Steel From Cold Metal.—The basic open-hearth process makes most of the world's steel. Many steelmaking furnaces are distant from blast furnaces, so they operate entirely on cold stock, and, as noted, any proportion of pig and scrap may be charged, as economics require. This process as commonly practiced in a stationary furnace and its elementary chemistry are here briefly explained. After a furnace has been tapped and the bottom and banks repaired, charging is begun. Plate scrap, if available, is spread out to protect the bottom, followed by several tons of limestone, depending upon the impurities to be removed from the pig and scrap. The furnace is then filled as full as possible with scrap, pig iron and some iron ore; the doors are then closed, the flame is given an excess of air and melting begins; as the mass melts and settles, the balance of the cold metal is added. Melting pig iron trickles down over the white-hot steel, still solid. Silicon and manganese in the pig iron droplets oxidize by the excess oxygen in the furnace atmosphere and join with the iron oxide forming on the white-hot steel and some of the lime on the bottom or furnace wall, forming a slag. The meltdown period is often hastened, especially if massive scrap is charged, by a jet of pure oxygen directed against the solid charge. Since 1942, jets of oxygen also have been used in the latter part of the refining period.

In four to five hours the molten metal is virtually free of silicon, and much manganese has also gone into the slag. Chemical reactions occur only at the surfaces where metal and slag are in mutual contact, so vigorous stirring is necessary. This is effected principally by gases rising from the limestone, and some two hours after the metal is fluid it continues to break up, thus

$$CaCO_3 \rightarrow CaO + CO_2$$

The gas coming to the surface in big bubbles causes a characteristic boil. The lime also floats up, joining the slag as a base, not only releasing some of the iron oxide contained therein for refining reactions, such as

$$2P + 5FeO \rightarrow P_2O_5 + 5Fe$$

but also maintaining the basic slag necessary to dissolve and hold this phosphorus oxide. When the lime has all floated up, further boiling in the bath is due to the chemical reaction between iron oxide and carbon (which has been going on continually but its effect has been somewhat overshadowed by the lime boil):

$$FeO + [C]_{Fe} \rightarrow Fe + CO$$

The iron oxide is dissolved by the metal from the slag. Bubbles of carbon monoxide gas evolved continue to keep the metal and slag in motion. The active refining reagent in the open-hearth furnace, namely iron oxide, is the same as in the Bessemer and the earlier refining processes, but its origin is different. In the open-hearth process, iron oxide is formed by oxidation of the steel during melting, picked up from the rusty scrap and added as desired to the slag in the form of ore. In three hours the carbon boil should subside, the bath should be low in phosphorus and the slag essentially a high-lime silicate (to hold the phosphorus); the furnace is then driven hard to increase the metal's temperature sufficiently for casting. The slag and the metal have been slowly losing iron oxide and carbon respectively by mutual interaction, and the metal gives up considerable gas held in solution. After 1930 much attention was given to the relationship between the composition and viscosity of the slag existing in the refining stages and the quality of the finished steel. Slag composition is rapidly estimated on the furnace floor by pouring a small "pancake" of slag in a standardized manner and examining its surface, colour and fracture. Its viscosity is measured by the distance the slag flows down a pipestem mold. Likewise carbon in the steel may be closely estimated by rapid magnetic tests; the rate of carbon drop is an indicator of the state of oxidation in the heat. High-grade steels are deoxidized by the controlled slag in the furnace, after which further deoxidizing substances like ferromanganese (an alloy richer in manganese than spiegel, that is, containing more than 20%) or ferrosilicon may be added to the metal bath, followed by various alloying elements, as, for example, chromium, if an alloy steel is to be made. When the word is given, the furnace crew thrusts a long, heavy bar through an opening in the centre door, across the furnace into the bath; several battering-ram thrusts break through the plugged taphole, and white-hot metal rushes down the spout into a ladle set beneath. This ladle is just large enough to hold the steel; slag that follows after overflows into a pit or slag ladle alongside. Certain alloying elements are put in the empty ladle or added to the stream gushing from the furnace: these are elements that oxidize readily, especially aluminum, and are added to well-deoxidized steel to induce a desirable fine grain size in heat-treated machine parts.

A. Variations in Process

1. Use of Molten Pig.—Various methods deviate from the above routine and have been devised to adapt the open-hearth process to the economic conditions to be met by the steelmaker, especially as to the relative amounts of scrap steel and molten pig iron available. These range from processes for handling a preponderance of scrap and a minor amount of molten pig iron (as is usual in the United States) to the Talbot process described below for handling up to 80% hot metal (as is practiced in England and in localities where scrap is not so plentiful, and in "integrated" plants that have both blast and open-hearth furnaces).

In U.S. stationary furnaces of, say, 100 tons capacity, the limestone and scrap are charged as indicated above and heated strongly until well melted. During this time the slag forms from oxidized iron and calcined lime. Within two hours all but the heaviest scrap has melted and molten pig iron is poured in. A rapid reaction starts between the iron oxide in the slag and melted scrap and the carbon, phosphorus and silicon in the molten pig iron. Carbon oxides boiling up through the slag cause it to froth and swell, and much of this "flush slag" flows off through a hole in the back of the furnace well above the molten metal. This slag carries a little sulfur and much of the silicon, phosphorus and manganese in the pig iron, and the amount of finishing slag is correspondingly reduced.

2. Continuous Steelmaking.—Benjamin Talbot first built

furnaces for continuous production of steel at Pencoyd (near Philadelphia), Pa., in 1899. The Talbot process, however, became more popular in England. Furnaces are of large capacity—200 to 300 tons of metal—and are mounted on trunnions; they can be tilted forward and slag skimmed or metal poured through a spout, normally far above the liquid bath. Most of the finishing slag and about 10 tons of steel from the previous heat are retained in the furnace and on this is charged enough burned lime and ore so the first slag can be removed when the metal is .30% carbon above that desired. After heating the slag and furnace for two hours, scrap as available is charged, heated another two hours and about three-quarters of the required molten pig iron is poured in. Reaction is vigorous for about four hours, and then the remainder of the hot metal is added. The bath quickly comes to a good boil and the slag is carefully skimmed off one hour later. This slag carries most of the phosphorus; it may analyze 17% P_2O_5 and is a valuable by-product. The finishing slag is then made up of lime and scale (iron oxide) and the bath worked until carbon, sulfur and phosphorus in the metal are reduced to the required point (about three hours), whereupon ferromanganese is added and the steel is poured into waiting ladles.

3. Duplex Processes.—Other means of speeding the rather deliberate open-hearth reactions are used extensively, perhaps the most important being a combination of acid Bessemer and basic open-hearth. This enables the steelmakers to start with a high-sulfur ore, smelting it to a high-silicon, low-sulfur pig iron, blowing the silicon and carbon out in a converter and transferring the molten steel to a large, tilting furnace where the phosphorus, oxide and gases are eliminated. In U.S. practice, 250-ton tilting furnaces are used; 50 tons of molten steel are reserved in the hearth, a highly basic combination of ore and lime is charged and melted and about 150 tons of blown metal (converter steel) poured in. When the temperature and slag are correctly adjusted, a ladle of basic pig iron from a mixer is charged. A strong carbon boil ensues immediately, and the slag foams up and overflows, carrying much of the phosphorus and some sulfur. When the first reaction slows down, a second ladle of pig iron causes it to resume and drives out the rest of the phosphorus. The slag is then skimmed off, enough pig iron is added to bring the carbon to the desired percentage and the metal finished and superheated for pouring. From such a furnace, 200 tons of steel can be taken every three or four hours.

Duplex processes of the sort described but using two open-hearth furnaces originated in Germany for irons too low in phosphorus for the basic converter. In the first furnace, run at a rather low temperature, the phosphorus and silicon are eliminated into a lime slag rich enough for use as a fertilizer. The furnace is tapped, the slag separated and the metal introduced into another and hotter furnace, wherein awaits a proper slag for rapid carbon elimination. This is called the Bertrand-Thiel process; the Hoesch modification recharges the partly purified metal back into the furnace from which it has just been drained.

4. Acid Steel.—Furnaces made with siliceous bottoms and banks, the descendants of the original open-hearth furnaces, still exist in considerable number. They make steel under slags that are essentially mixtures of iron, manganese and silicon oxides, having well over 50% of the latter, so they are quite acid in nature. Such acid steel has an enviable reputation for quality, but since the furnace reactions remove neither sulfur nor phosphorus, the raw materials and fuel must be selected with much care.

Pig and scrap, as available, are charged cold into the furnace, which has a higher roof to withstand the higher refining temperature; during melting, nine-tenths of the manganese and silicon are oxidized, and join with the rust and burned iron to form a slag. Carbon is eliminated slowly by reaction with the iron oxide in the slag; a little ore is added about two hours after the charge is well melted to keep this reaction going until the residual carbon in the metal equals that required in the steel being made. Temperature is driven higher and higher. Toward the end of this refining period—which may require seven hours—some manganese and silicon re-enter the metal, reduced from the slag by reversible chemical reactions, and are very effective in removing oxygen and other dissolved gases. At the end, the metal is slowly losing carbon but gaining manganese and silicon. However, manganese is still too low for most steel specifications, so an appropriate amount of ferromanganese is added about 20 minutes before tapping. A complete cycle of operations may require up to 16 hours when making steels for ordnance. The superiority of acid open-hearth steel is due to the better grade of raw material used, the small amount of slag formed (perhaps 7% of the metal), the more deliberate working of the heat enabling the furnaceman to bring his metal to the right analysis without making large additions of alloys and the ability to eliminate gases and nonmetallic impurities from a superheated fluid metal while it is still in the furnace. All these procedures tend to produce steel with a minimum of nonmetallic inclusions, a condition found to improve toughness, shock resistance and long life under fluctuating loads (superior fatigue resistance).

VI. ELECTRIC STEEL

Electric furnaces (*see* FURNACE, ELECTRIC) are usually round in plan, with low side walls, flat-domed roofs and invert bottoms, built inside a stout bowl of steel plates, which in turn is attached to some tilting device. The side wall and bottom linings may be either acid—silica brick and fused siliceous material—or basic magnesite. (The acid furnace is confined generally to small installations in foundries and is merely a melting and superheating device, since the unique carbide slags to be described later cannot be formed inside a siliceous lining.) Roofs are of silica brick and are pierced for carbon or graphite electrodes, one for each phase of current, of proper size to carry the electricity without undue resistance. Roofs and electrode operating mechanisms frequently are attached to a pillar so they can be lifted and swung aside, thereby permitting top charging of the entire load from a bucket. Capacities range from $\frac{1}{4}$ ton for small foundries to 50 tons for superrefining liquid steel. Size is limited by the size of electrodes available; a carbon electrode 40 in. in diameter is the maximum; a seven-ton furnace would be about 12 ft. in outer diameter, with 13-in. side walls and the hearth $5\frac{1}{2}$ ft. inside height. In operation, the electrodes are automatically adjusted so the lower ends are constantly a correct distance above the slag. Electric currents of large amperage arc across this gap, flow through the slag to the metal and there neutralize equal currents of opposite phase led in through the other electrodes. Heat is generated principally by the resistance offered by the air gap and the slag layer to the flow of this current. The electrodes are consumed gradually, combining with oxygen of the air within the furnace, producing a carbon monoxide atmosphere, desirable for steel refining. While electrical energy may seem to be an expensive source of heat to melt cold iron, its cost generally has risen less than that of coal, oil or gas. Also, it can be transmitted long distances from its point of generation. Consequently, into the second half of the 20th century, output of electric steel increased more rapidly than its competitors.

1. Advantages of Electric Heat.—No virtue is given to electric steel by the electricity. It is merely a convenient source of heat, under close control. The advantages of electric furnaces for steelmaking are: (1) ability to generate a high temperature and thus cause certain desirable reactions to occur; (2) virtual absence of products of fuel combustion and their unwanted compounds of carbon, hydrogen, sulfur and oxygen; (3) the ability to remove a slag and make up new ones, thus controlling refining reactions; (4) the metal is hotter than the refractory, a prime advantage in cost over crucible melting; (5) there is less slagging of alloying elements, thus making for economy and control of chemical composition within narrow limits. Such advantages are illustrated in the process of superrefining molten metal from the open-hearth furnace; in such operations the basic electric furnace is a unit of a duplex or even a triplex process—the pig iron may be desiliconized in an acid converter, dephosphorized in a basic open-hearth and deoxidized and desulfurized in a basic electric furnace.

2. Superrefining Molten Steel.—Open-hearth steel is taken from the furnace when the carbon has dropped to the required figure, and a little ferrosilicon or aluminum is added to the ladle to

prevent further decarbonization during the transfer. In such condition the phosphorus and silicon are both very low (.010% or less), while the sulfur content depends upon the purity of the metal at the beginning, none being lost in the process so far; in fact the metal picks up a little from the furnace gases. If a nickel steel is to be made, the correct amount of shot nickel is added when the metal is poured into the electric furnace. After the current has played long enough to remelt any crust of metal that may have chilled, a highly basic white slag is made up and melted, consisting mostly of burned lime with only enough silica sand and fluorspar to give it the proper fluidity. In quantity this would amount to about 3% of the metal. An excess of ground carbon is then shoveled in, the furnace closed, left under current for from 1½ to 5 hours, depending upon the quality of steel required, and the doors opened only for sampling or adjusting the slag. Under these conditions of a reducing atmosphere, a high-lime slag and intense heat, calcium carbide is formed by reaction between the lime and crushed carbon:

$$CaO + 3C \rightarrow CaC_2 + CO$$

Slag samples quenched in water give off much acetylene (*q.v.*), easily distinguished by its characteristic odour. Such a carbide slag not only reduces oxygen in the steel but is capable of abstracting the sulfur. The reaction for the latter may be something like this:

$$3MnS + 2CaO + CaC_2 \rightarrow 3Mn + 3CaS + 2CO$$

By this means, ordinary open-hearth charges that usually melt to .05% sulfur are reduced to one-half that amount in a four-hour cycle, while selected charges melting to .015% sulfur can be driven to less than .010% in a heat taking eight hours. It will be observed from this reaction that some manganese is necessary. This will be residual in the open-hearth metal, for it has been found that if 2% manganese is in the original pig iron, the resulting steel, containing .30 to .50 manganese, will be of much better quality, sounder and cleaner, than from a low-manganese charge.

When the soapy slag stops its slight foaming, it is a sign that desulfurizing and deoxidizing are about completed, and the various alloys necessary to make the required analysis are added at intervals in order of their oxidizing power; namely, ferrosilicon first, then ferromanganese, ferrochromium and finally ferrovanadium. Carbon is picked up from the carbide slag and from these alloys. After all these alloys are melted and diffused, the current is shut off and the metal lies quiet for 30 minutes or more, to allow entrapped particles of slag to arise and the superheated metal to cool and liberate dissolved carbon monoxide gas. Slag is then most carefully skimmed, and the steel poured into a ladle that may contain a little carbon, ferrosilicon and ferrozirconium. After 30 minutes further cooling, the metal is teemed into warm, scrupulously clean molds with hot tops. A sectioned ingot will not show any cavities as large as a pinhead.

The above method of desulfurizing and refining steel in electric arc furnaces is not confined to heats starting with molten metal from another furnace, but is far more universally used for cold charges of scrap with or without pig iron.

3. Quality of Deoxidized Steel.—The quality of such deoxidized and desulfurized steels rests in a number of characteristics, some not readily evaluated, such as better response to heat treatment and less nonmetallic inclusions, as shown under the microscope and after deep pickling in strong acid. A better gauge is the transverse properties. If a well-made heat of basic open-hearth steel is forged into a big gun, tension test pieces cut out of this forging will show high ductility if the sample is cut in a direction parallel to the axis of the gun. On the other hand, if these test pieces are cut tangentially to the bore, the ultimate strength is satisfactory but the ductility is not much more than half that of the longitudinal piece. Unfortunately this transverse weakness is in the very direction that must bear the heaviest stress when the gun is fired. An accepted explanation of this phenomenon is that the work of forging ranges the nonmetallic impurities into layers parallel to the faces of compression and interrupts the metallic continuity. Obviously, the cleaner the steel the less would be the transverse weakness. For that reason, important forgings, such as hollow tubes to resist internal pressure, are commonly made of acid open-hearth steel. Even better, however, as shown by typical tests from big gun forgings, is superrefined basic electric steel (*see* Table IV).

TABLE IV.—*Typical Test Results for Selected Physical Properties of Superrefined Basic Electric Steel*

Physical properties	Longitudinal	Tangential
Ultimate strength, p.s.i.	110,000	110,000
Elastic limit	58,000	58,000
Elongation in 2 in., %	24	21
Contraction in area, %	56	42

The excellent tangential properties shown in Table IV are due in considerable measure to the care taken to produce steel low in hydrogen. From the beginning all metal, ferroalloys or slag-forming ingredients are heated to drive off moisture or char any oil or greases. Atmosphere in an electric melting furnace also contains a minimum of hydrogen compounds in comparison with a gas- or oil-fired open-hearth furnace. Any hydrogen from any of these sources that is dissolved by the molten metal is retained (also in solution) in the solidified ingot down to about 400° C., at which point its solubility suddenly drops to near zero. Ingots and forgings are therefore cooled through this range with extreme slowness—days being required for large masses—so the liberated hydrogen gas can diffuse outward and escape from the steel. Otherwise the gas would accumulate as tiny bubbles in favourable spots, such as discontinuities at grain boundaries, and build up internal pressures high enough to start internal bursts known as "snowflakes." Hydrogen gas was also found to be the cause of "shatter cracks" or "internal transverse fissures" in steel rails, so troublesome since the first disastrous wreck from these hidden defects in 1911. In the early 1930s Cameron Mackie of Nova Scotia discovered the following remedy, which is now universally practiced: the finished rails are cooled on the test bed to 500° C. and loaded into insulated railroad cars or cooling pits where it takes them 15 hours to cool to 100° C., thus allowing the insoluble hydrogen sufficient time to diffuse out of the solid steel.

4. Melting Cold Scrap.—By far the larger number of electric arc furnaces in North America are of small capacity for melting cold scrap. It is desirable to start with clean, relatively heavy scrap and melt without additions of iron ore. In a basic furnace, considerable lime would be charged into the empty furnace; melting is done under the heaviest power input practicable supplemented with liberal use of a jet of oxygen to burn the hot iron, producing iron oxide and liberating much heat at the same time. The slag formed on the steel is always black from the rust and the oxide formed during melting. This slag is removed as soon as the charge is melted, and some ground carbon electrode butts are shoveled into the furnace and flapped under the metal. As the carbon dissolves, it first tends to deoxidize the steel

$$[O]_{Fe} + C \rightarrow CO$$

and the carbon monoxide gas comes up in bubbles. Some surplus carbon helps bring the carbon to the required analysis. Then a white or carbide slag is made up, and the refining and alloying are done with current of lower voltage and as described above. An increasing percentage of steel is made in this way in regions where fabrication industries are concentrated. In-process scrap, such as trimmings, punchings and lathe turnings, can easily be remelted, cast into small ingots requiring no heavy blooming mills or forge hammers and sent directly to inexpensive merchant mills for rolling into strip or the smaller shapes required by nearby manufacturers.

5. Induction Furnaces.—The modern substitute for the crucible melting hole is the high-frequency induction furnace. The furnace case is a small cubical box that can be tilted about one upper edge. It contains a cylindrical spiral coil of water-cooled copper tubing that carries alternating current at about 2,500 cycles per second. The coil is electrically and thermally insulated, and a magnesite refractory is rammed inside it to form a crucible, into which is charged selected steel and ferroalloys for simple melting and mixing without refining. The intense alternating magnetic

field set up inside the coil induces eddy or Foucault currents in the metal charge to heat and melt it. Electrodynamic movement of the bath keeps the metal well stirred, which is of advantage in making high alloys of heavy metals, such as high-speed tool steel (*q.v.*), but tends to stir in particles of incidental oxide slag. As a simple melting furnace of rapid action, the induction furnace has no equal for laboratory research.

Electric steel has practically supplanted crucible steel in North America, but has not been so successful in Great Britain. Italy, being rich in water power but very poor in fuel, has several hundred electric furnaces, nearly all of them producing tonnage steels. Small furnaces of this sort are universally used for high alloys cast by the "lost wax" or investment processes (*see* FOUNDING) into such things as turbine blades for gas engines, but the induction furnace was not applied to tonnage production in the United States until the advent of vacuum melting.

Much controversy has turned on the relative quality produced by the crucible and electric furnaces, especially for fine steels and tool steels. It is probably true that there is little difference when selected raw material is charged, an expert furnaceman is employed and equally careful pouring, forging and annealing practice is adhered to; in other words, when equal care is given to the respective heats. But steel from either process can be disappointing when conditions get out of control. The crucible is used only for smaller casts of plain high-carbon steels; the electric is much more convenient for heavy ingots of plain carbon and alloy steels. (*See* also FURNACE, ELECTRIC.)

6. Vacuum Melting.—While magnetic alloys have been melted in moderately high vacuum since 1920, the extension of the practice to commercial steels awaited the perfection of efficient pumps for the very high vacuums required for many operations in the atomic energy industry. First production of vacuum-melted ingots, other than in the laboratory, utilized rather simple equipment—an induction furnace charged with high-grade scrap was placed in a vacuum tank large enough to contain an ingot mold. Appropriate remote controls were provided for observation, temperature measurement, additions of alloys at proper times and pouring the finished steel. Such metal turned out to be unusually free of inclusions and was first made into ball bearings that demonstrated a longer life in service. It also had superior ductility, stress-rupture and creep characteristics, and thus was worthwhile on expensive alloys like tool steels, high-temperature alloys and "super alloys" for gas turbine parts. To minimize the waste time required for pumping down a vacuum tank, semicontinuous units have been placed in operation wherein the charging mechanism and the ingot tank are in auxiliary vacuum chambers so they can be exhausted separately and then connected with the evacuated melting chamber through gate valves. Thus charging, additions and pouring do not interfere with the vacuum in the main chamber even during a week-long campaign. For some alloys a definite program of vacuum, hydrogen reduction and scavenging with argon is practiced during the melting cycle.

7. Consumable Electrode Melting.—The inescapable segregation of impurities toward the centre and top of ingots when solidifying slowly from large masses of liquid has turned attention to an adaptation of the consumable electrode method of ingot manufacture commercialized for reactive metals like titanium. R. K. Hopkins' electric ingot process utilizes a tubular steel electrode packed with appropriate alloys. The arc from its end is submerged in a 4-in. layer of protective slag and gradually builds up an ingot to 12 in. diameter—larger ingots require more than one electrode. Variations in chemistry are surprisingly small; directional properties of pancake forgings made from cross-sectioned ingots are uniform, showing no lack of ductility at the center.

VII. INGOTS

1. Gases in Liquid Metal.—Early attempts to make steel in England by the Bessemer process were failures because the metal boiled over when poured into ingot molds, and the remaining portion when solid was full of blowholes, like a Swiss cheese. Robert Mushet noted that the only apparent difference between sound ingots and the spongy ones was that the former were made of high-manganese pig iron and a little manganese remained in the steel; consequently he proposed adding some of the metal after the blow. Thus originated the practice already mentioned of adding spiegel or ferromanganese to heats of steel made by any of the Bessemer or open-hearth modifications. The purpose of the addition is to remove oxygen from the molten steel. In the crucible and acid open-hearth process much of this oxygen is eliminated by holding the melted metal quietly in the furnace until reactions between the siliceous linings and the metal allow the latter to absorb some silicon which, in turn, is very effective in removing dissolved or combined oxygen existing in the steel. This time-consuming reaction is avoided when producing cheaper steels in great tonnages by adding the deoxidizers to the steel in the ladle, or even as it is poured into the ingot. Melted spiegel is used for medium-carbon Bessemer steels. Since spiegel ordinarily contains 20% manganese and 5% carbon, sufficient manganese to quiet the steel will also introduce considerable carbon. Should this be too much for the desired grade of steel, ferromanganese is used instead. Since a relatively small amount of this is required, small pieces are placed in the ladle and melted by the inrushing steel; if the metal still seems too effervescent on casting, a few aluminium shot are thrown into each ingot. The principal effect of each of these additions is to convert harmful iron oxide in the steel to MnO, SiO_2 or Al_2O_3. These oxides are highly insoluble in metal and tend to accumulate into slag particles and float; but there is little opportunity for elimination when the reactions occur in the ladle or ingot mold. Entrapment of microscopic inclusions is an unmitigated evil for high-quality steel or alloys for severe services. An industrial exception would be the high-sulfur steels, intentionally loaded with manganese sulfide particles, which form the so-called free-machinable varieties; the sulfides embrittle the chips so they break freely away from the lathe tool or milling cutter. Lead is also added to steels for improving machinability—the tiny lead particles act as lubricants. A few hundredths of a per cent of aluminum added to a well-deoxidized or "killed" steel will cause it to retain a fine grain size after working and heat-treating, and this is desirable for most engineering applications except for machine parts that must steadily resist high stress and high temperature. Such "creep resistance" is usually enhanced somewhat by a coarse-grained microstructure.

2. Teeming Practice.—It is usual practice to transfer steel from a converter or open-hearth to the ladle while it is somewhat too hot to pour; also to use a ladle of correct size so most of the slag overflows. Ladles, therefore, contain from 5 to 200 tons of steel, depending on the furnace served. They are strong steel pots lined with firebrick and equipped with trunnions and shackles for crane transport (*see* fig. 3). Very hot metal is kept in the ladle sometimes as long as half an hour, to enable the trapped slag particles to float to the top. Then the ladle is carried to the ingot molds and the metal teemed through a hole in the bottom. When one mold is filled, the metal stream is stopped until the ladle is moved to an empty mold. Splashing against the inner sides of the molds must be avoided, for such splashing is the most general cause of surface defects on the finished articles. As shown in fig. 3, the molds are open-ended iron castings, usually with the larger end at the bottom for ease in stripping off the mold, and are placed on "stools" of cast iron or copper. They are usually coated inside with tarry smoke.

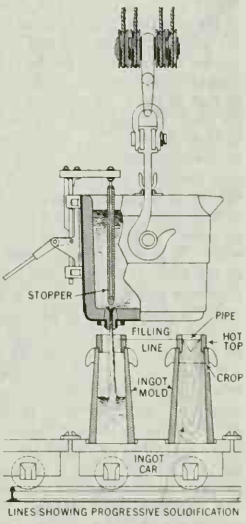


FIG. 3.—LADLE CONSTRUCTION AND METHOD OF POURING INGOTS

Steel castings are ordinarily teemed in the same way; electric or open-hearth furnaces in steel foundries are usually very small compared with furnaces serving rolling mills. Ninety-seven per cent of all the steel made is cast into ingots.

3. Cavities in Ingots.—Deoxidized or "killed" steel contracts in volume when it changes from liquid to solid; consequently the solidified ingot will have a cavity, or pipe, in that part that solidified last. Good practice so proportions the chilling effect of the mold, the temperature of the steel and the rate of pouring that the ingot solidifies from the bottom up.

A hot top in the form of a firebrick collar set on top of the mold, as shown in fig. 3, is a useful device for keeping the top portion of the metal fluid until the last and in condition to feed and fill the shrinkage cavity below. A certain segregation or concentration of alloying elements also occurs toward the pipe; consequently all the defective top must be cropped as indicated and remelted as scrap. Segregation and piping is also minimized by casting ingots big end up and by slow pouring of rather cool metal. The latter is well accomplished by having several ingot molds on one stool, teeming into a central runner and allowing metal to rise in the molds through connecting passages in the common base. Very large ingots for heaviest forgings such as electrical generator rotors and marine shafting may weigh 100 tons or more. In such sizes, the metal at the very centre solidifies at such a slow rate that the effect of shrinkage and solidification cannot be avoided. Practice then is to bore a large hole axially through the ingot or rough forging, thus removing all the defective metal, then searching the interior bore visually or by magnetic powders for traces of unremoved cracks and testing the body of the remaining metal by ultrasonic waves to discover any deep-seated discontinuities.

Enough gas is left in most low-carbon tonnage steels so a slight effervescence occurs in the mold, just enough to counteract the piping tendency. When properly made and cast, such ingots will have a flat top, a smooth solid surface, but a number of deep-seated, small blowholes. During subsequent rolling, these are squeezed shut and the metal welds together more or less effectively. In contrast with fully deoxidized, "killed" steel, metal of this sort is called "rimming" steel; the dense surface of the metallic ingot is an ideal start for thin sheet, small wire or nails.

4. Stripping and Soaking.—Size of ingots depends upon the use to which the metal is to be put. Ingots of alloy steel and high-grade tool steel sometimes weigh no more than 100 lb. Forging ingots are from two to five times the thickness of the biggest part of the resulting forging; those for rails, plates and structural shapes are adjusted to the size and capacity of rolling mill and the cross section of the desired product; for rolling mills, they are generally square in cross section, with rounded corners and about three times as high as thick. A common size is $2 \times 2 \times 6$ ft., weighing about six tons. Forging ingots are frequently fluted hexagons or octagons in cross section. The molds are heavy-walled iron castings, made of low-phosphorus, low-sulfur pig iron, such as is suitable for the acid Bessemer process, smoked or sprayed with lime wash. When the metal in the ingot has solidified, the train of molds is moved to a stripper, an overhead crane with a vertical plunger that can be forced down on top of the ingot, holding it down against the stool. A pair of stirrups then loop over the ears on either side of the mold and lift; if the inner surface of the mold is in good condition and smooth, there is no difficulty in removing the mold, and it is then placed on an empty car alongside. At this time, the surface of the ingot is at a full red heat, yet the interior may still be white hot. To equalize the temperature, the ingot is placed in a soaking pit, a square firebrick chamber large enough to contain two to six ingots standing on end; an arched cover rolls aside for entrance. Auxiliary heat is supplied as necessary by a gas-air flame, operating through regenerative checkerwork, ports and auxiliary control as described for open-hearth furnaces. Pit capacity for at least 100 ingots is required to maintain a steady supply of properly heated metal to a modern rolling mill.

5. Continuous Casting.—Ingot molds filled from the top are almost the exclusive means of providing solid metal for the rolling mills. However, the aluminum and copper industries demonstrated the advantages of continuous casting in producing slabs or rounds of any desired length with minimum segregation edge to centre and zero segregation end to end. In 1953 equipment of this sort was placed in operation at Beaver Falls, Pa., producing rounds of alloy steel capable of being pierced into seamless tubing without preliminary "breakdown" in a rolling mill or forge. A much larger casting machine was started in 1954 in Welland, Ont., casting slabs of stainless steel 5½ by 21 in. in cross section. The mold is a water-cooled copper collar, 20 in. high, open at both ends. At the start of a cast, the bottom is closed by a dummy ingot. As steel is slowly poured into the collar, the supporting metal is as slowly withdrawn downward by pinch rolls and drenched with water sprays. Slabs of appropriate length are cut from the bottom and sent to the reheating furnace prior to rolling into sheet.

VIII. ROLLING MILLS

1. Hot-Working.—A spongy lump of wrought iron, hot from the furnace, requires forging in order to squeeze out much of the trapped slag and to consolidate the metal. Even the best ingot of steel is improved by hot work, such as forging or pressing; its fracture is changed from a coarse crystalline cleavage to a fibrous appearance associated with greatly increased toughness; it also becomes more amenable to heat-treatment. Formerly all this was done on the blacksmith's anvil. Massive gun tubes and armour plates are forged slowly in hydraulic presses; heavy engine parts, axles and cranks are beaten out by steam hammers; tools, levers and machine parts are forged under drop hammers. In every instance the aim is to convert a steel casting (ingot) into a special shape with improved physical properties.

Modern machines and structures require large quantities of steel parts of uniform cross section, such as plates, bars, beams, rails, pipes, sheets, etc. These are made in rolling mills where the work is performed by passing the red-hot metal through one pair of heavy rollers after another, so grooved and spaced that each succeeding pass is smaller and more nearly the required final shape. While the products of a rolling mill vary widely in weight and shape, a common characteristic is that each piece is of uniform cross section from end to end and is of a length limited only by the size of the original ingot, or by the size of the runout floor.

The word "mill" may mean the entire steelmaking plant, just one department or one stand of rolls in the department. Complete departments have various names, such as rail mills, structural mills, plate mills or merchant bar mills, depending upon the product they most efficiently produce. Each such mill contains a number of roll stands of decreasing size and power, from the blooming or cogging mills that do the heaviest work, down through the intermediate stands to the last pass, finishing mill or finishing stand, which impresses the exact final cross section. Nearly all of this work is done at full red heat, at which the steel is quite plastic. Some products, such as shafting, sheet and wire, are finished cold, either for a much smoother surface or for enhanced strength from cold-working in passing through the planishing mills or the wire dies.

There still exist many rolling mills, some producing the highest type of tool steel, that start with a small piece of metal (a 150-lb. ingot or a chunky rolled bar called a billet) and produce rods, bars, hoops or flats a fraction of an inch thick. Metal is passed back and forth by tongs in the hands of skilled labourers. Such roll stands are usually arranged side by side and the hot bars are looped from stand to stand, entering from alternate sides, until the final shape is produced. Sometimes curved guides are installed to do the work of alternate workmen; as the size of the bars increases, hand labour cannot cope with the situation. Most rolled shapes start from white-hot ingots, perhaps six tons in weight, which are taken from soaking pits by a traveling crane and placed on the first of a series of "tables"—power-driven roller conveyors—that transport the metal wherever a distant electric-switch operator directs.

Blooming mills are usually arranged so the ingot is passed back and forth several times through the same roll stand. This requires a screw-down device and indicating dial on top of the housing for lowering and reversing the rolls progressively as the piece becomes smaller. The spindles connecting the rolls to the driving engine

or motor are of most rugged construction, for upward of 20,000 h.p. is transmitted at times. Obviously the whole mill—tables and rolls—reverses rotation for successive passes; hence the name "reversing, two-high mills." Other heavy mills have three rollers ("three-high") and are not reversing; the tables at either side of such a stand are tilting or elevating, so the billet or slab passes forward between bottom and intermediate roll and backward between intermediate and top roll. Four-high mills are mostly used for strip and continuous sheets and plates.

2. Heating Furnaces.—In a modern rail mill the ingot, having been reduced to a long bloom perhaps eight inches square in cross section, has its ends sheared off to sound, unpiped metal by massive guillotine shears operated by hydraulic power and is cut into such lengths, called billets, that each billet will make one or two rails of required length and cross section; these are then reheated before further rolling; other mills that reheat cold billets require special furnaces, usually gas- or oil-fired, frequently having waste heat boilers or recuperators. Furnaces have a long, rectangular hearth, slightly inclined, as wide as the billet is long, and a low roof. Water-cooled skids carry the weight of the steel and prevent scraping on the brick furnace bottom. At the cool end, billets are pushed in sideways by a plunger, one by one, moving ahead closer to the hot end. Every time a cold piece enters the furnace, a hot one is pushed out the other end on a roller table leading to a roll stand; other continuous furnaces have water-cooled rollers or other devices built into the bottoms for moving lighter pieces, such as wire coils, through them at a slow, steady rate.

Small electric-furnace plants casting small ingots frequently heat them by high-frequency currents using the same principles as described above for induction furnaces. In this instance, the cold pieces are pushed end to end through closely fitting brick channels around which the conductors for the alternating currents are wrapped spirally. Frequency of the current, spacing of the spiral and timing of travel is so adjusted that the ingot or billet emerges at correct heat for rolling.

3. Rail Manufacture.—A reheated bloom in a rail mill may then be given four more passes in another reversing mill, called the first roughing stand, passing then to the first finishing stand. This is three-high, *i.e.*, there are three rolls in a stand. The forward pass is through a groove cut in the lower and the middle roll; the receiving table is then elevated bodily and a backward pass is made between a groove cut in the middle and upper roll. Four such passes and a final one through a finishing stand complete the rail; a total of 15 passes and one reheating will convert an ingot into a rail weighing 100 lb. per yard. Structural shapes such as angles, channels and I-beams are rolled in a similar routine. Frequently rail mills, by simple change in rolls, are made to produce structural steel when there is no market for rails. Special and extra-heavy equipment is necessary to roll the massive H-beams with deep flanges used for building columns.

More intricate shapes in both carbon and alloy steels are made by extrusion, a process long utilized for softer metals in the nonferrous industry. Adoption of this process awaited the discovery of some lubricant that could keep the hot metal from scoring the exit die. Molten glass was proposed by French metallurgist J. Séjournet; in fact, the extrusion billet can be heated in a bath of molten glass. Enough adheres to the surface when the billet is transferred into the cylinder of the extrusion press so a thin film always sheathes the hot metal, no matter how high the pressure exerted by ram, cylinder, die or piercing tool. Irregular and hollow shapes can thus be made very economically; one appropriate die takes the place of a whole set of intricate rolls. (*See* also DIE CASTING [PRESSURE CASTING].)

4. Plate Manufacture.—These departments are less complicated than a rail mill, although the machinery may be more rugged. First the ingot—6 to 10 tons and up to 30 tons or more—is rolled to a flat slab in a blooming mill, sheared into pieces and the slabs reheated. Further work is done by cylindrical (ungrooved) rolls. A single reversing two-high roll stand may do all the work, or two three-high mills with elevating tables may be used. Because of the enormous bending stresses carried by the rolls when rolling wide plates, many two-high reversing stands have been built as four-high mills, having two rather small working rolls, each backed up with a larger one for stiffness. Plates of more uniform thickness, edge to centre, may be made in this way. The action of a rolling mill does not widen the piece very much—most of the change in shape results in increasing its length. Consequently a heavy slab is cut to a length that equals the width of the required plate, and it enters the plate rolls sideways. Cross-rolling in this way results in a better plate; metal worked in only one direction acquires transverse weakness. This means that the ductility of bars cut with their axes parallel with the direction of extension during rolling will be higher than when cut from the plate with axis in any other direction. Other mechanical devices employed in a plate mill include plate straighteners, cooling beds, crosscut and edge shears, turnover devices, caster beds and magnetic grips. Side shearing on narrow plates may be avoided by using a universal mill, which is a roll stand to which is added a pair of stout vertical rolls. The latter are adjustable, up to perhaps 48 in. apart, and are set a proper distance to keep the hot plastic plate the exact width during its formation.

IX. MILLS FOR SEMIFINISHED MATERIALS

1. Continuous Mills.—Four classes of semifinished materials are manufactured in such tonnage that special mills are set up to produce them, namely: sheet bars, skelp, strip and continuous sheet (wide strip) and wire rods. These products are the raw material for special manufacturing plants often located at a distance from the steel furnaces. Sheet bars are worked into tin plate, galvanized and uncoated sheet; skelp is made into pipe; strip is narrow sheet for hoops and bands; continuous sheet up to 96-in. wide is shipped in coils to manufacturers of automobile bodies, refrigerator cases and smaller stampings; and rods are drawn into wire, from which all kinds of fencing, screening, cable, nails and springs are made. Sheet bars and skelp are made in bar mills, frequently located immediately beyond a blooming mill, which take a six-inch square bloom hot from the shear and roll it into the thin narrow plate without reheating. Such a plan requires the most rapid handling to complete the rolling before too much heat is radiated. This is done by placing a succession of two-high roll stands in tandem, within a few feet of each other, and guiding the bar automatically from one roll to the next. Since each pass elongates the piece, the speed of each roll is higher than the preceding, and the relation between speed and reduction must be nicely adjusted so the hot bar will neither buckle nor be stretched at any stage. A succession of eight or ten such rolls, with perhaps three pairs of vertical rolls to control the width—interspersed in the train—can produce standard width 8-in. sheet bars or skelp from 6 to 20 in. wide (suitable for forming into pipe up to 6 in. in diameter) and from $\frac{1}{4}$ to $\frac{3}{8}$ in. thick, at the rate of 4,000 to 20,000 tons per week depending upon the sectional area of the bars manufactured. Since a mill of this sort can easily produce material far too long to ship, flying shears are set beyond the finishing roll to cut the rapidly moving bars squarely to length. Sheet bars are sometimes quenched by traveling down a long table under a series of water spray nozzles.

2. Sheet Mills.—Sheets are $\frac{1}{8}$ in. thick or less, whereas plates have sufficient mass to retain heat until rolled to proper gauge, and a surface covered with mill scale is quite good enough for most purposes. Sheets, because of their thinness and the excellent surface demanded by such finishing operations as galvanizing or lacquering, must be rolled in an entirely different manner. Hand methods of rolling sheets originated in Wales in the 18th century.

In hand-rolling, sheet bars are cut with length slightly greater than the width of the required sheet, heated to a dull red (850° C.) and rolled sideways through a two-high mill with massive cylindrical rolls, 32 in. in diameter. One workman catches the bars as they come through and passes them back to another over the top roll; a third screws down the top roll gradually to continue the reduction. The crew passes two bars back and forth very dextrously; when these bars have been flattened to about $\frac{3}{32}$ in., one is placed on top of the other, the top roll raised and the pair rolled down until it is about twice as thick as the desired sheet. In the best practice, one pass is then given in the mill to be used for finishing, in order to "shape" the pack to this mill.

By this time, reheating is necessary; the pair is opened, that is, the two sheets are separated and placed in a furnace until the temperature is up to about 800° C. Low temperatures and a smoky flame are necessary to prevent surface oxidation in the furnace. A pair of these sheets is then further rolled to the required thickness in a finishing mill, more accurate in construction and requiring more skill to operate. For thin gauges, sheets are folded double and rolled in packs of four or even eight. Frequent opening and reheating is necessary in the latter stages of the process. They are then straightened and sheared to size.

Many surface finishes are required by customers who manufacture a multitude of objects of sheet metal. The sheets may be annealed either by being passed slowly through a long furnace with hot central zone (blue annealing) or by being piled in a tight box containing a prepared atmosphere to protect the steel from tarnish and heated for hours at a considerably lower temperature (box annealing); or the cold sheets may be given several passes through accurate rolls for a smooth surface and a somewhat stiffer temper. Interspersed with these operations, the oxide or mill scale may be removed by pickling in weak sulfuric acid. Finally, the cleaned cold-rolled sheets may be dipped in white metal for a protective coat, wiped, cooled, polished and boxed. Coating with zinc is called galvanizing; tin or tin sheet is thin steel dipped in pure tin; terne sheet is dipped in a lead-tin alloy.

3. Strip and Continuous Sheets.—The 1930s saw a replacement of hand mills by continuous sheet mills, especially in the United States. Since 1900 it was common to roll strip up to 3 in. wide and 16 gauge or less in thickness in very long coils in a series of roll stands placed close together; mills have been built for wider and wider strip sheet, and sheet 8 ft. wide has been produced commercially in the United States since 1939.

In a narrow strip, hoop or cotton-tie mill, a continuous heating furnace feeds flat bars about the width of the finished piece endways into the first of a series of six tongue-and-groove rolls, perhaps ten inches in diameter. One edger may be installed after the third roll, and the remainder then be flat rolls. Then the bar passes through a series of three very accurate finishing rolls, sometimes being bent sharply, scraped and air blasted to remove the scale before entering the last roll. These finishing rolls are cylindrical, and the guides are shifted sideways at frequent intervals to prevent the chilled strip from wearing the roll surface irregularly; speeds are watched closely; the first roughing roll is very slow, the last very fast; in fact, the trailing end of the billet may still be in the furnace when the front end is being reeled, 200 ft. away, at the speed of 1,000 ft. per minute. One great advantage of such close-set continuous mills is that the time of passage from furnace to finishing roll is the same for all parts of the billet; consequently the temperature at the last pass is uniform, and the thickness after cooling is also quite uniform. Finished strip is automatically turned on edge, looped back and forth on a broad, slow-moving conveyor belt passing through a muffle; emerging, it is cool enough for reeling, cutting to length and bundling. Such a strip mill can produce from 10 to 20 tons of strip per hour, depending upon its width and gauge. The strip has a surface covered with mill scale, or, if this is scraped off, a blued colour formed during slow cooling. For higher finishes and stiffer tempers, the strip may be pickled and cold-rolled rather slowly to accurate gauge and smooth surface.

In modern continuous sheet mills, slabs weighing up to a ton and a half, the product of a blooming mill, are reheated to the proper temperature and delivered to the first roll stand, where jets of high pressure, superheated steam strike the hot slab just as it enters the rolls, thus breaking loose most of the scale. This roll stand is set somewhat further from its successors than the space between later stands. Some of this table is utilized for a turning mechanism, so that the slab can be turned sideways, since its original length should represent the width of the strip. Heavy machinery holds the slab down while its edges are squeezed to the correct distance apart. The slab is also held here a little time to radiate down to the necessary temperature; the latter is fixed by the speed of the remaining stands and the desired delivery temperature. Once started on its way, the slab passes through three or four heavy, four-high roll stands comprising what is known as the roughing train, separated far enough so the slab is entirely free in its passage along the roller table from stand to stand. This roughing train will reduce the thickness of the 4½- to 5-in. slab to somewhere around 1 in., and correspondingly increase its length. It is usual for these stands also to have vertical edging rolls set at their entering side to keep the width of the hot metal correct. The work rolls in all these four-high mills are relatively small in diameter and have very heavy, massive backing-up rolls. Next in train comes a series of six four-high stands set fairly close together, each one rotating at a faster speed than its predecessor, the last one delivering sheet of required thickness from, say, ¼ in. down to $\frac{1}{16}$ in., at a speed of 30 m.p.h. The metal emerges from the last stand before the trailing end is clear of the first, so safe passage without breaking requires electronic control of the speed of the mills, as well as accurate and ready adjustment of the clearance between rolls, that is, the relative amount of reduction, stand to stand. Temperature of delivery of the sheet is important for many applications. Instantaneous and automatic optical pyrometers, indicating and recording temperatures not only of the slab at the beginning, but of the finished sheet at the end, are essential items of equipment. Sometimes the hot-finished sheet is rapidly cooled by water sprays; at other times the sheet is delivered as hot as possible to the coiling devices and the tightly wound coil is cooled quite slowly.

This sheet-mill product may be cut or slit into such sizes as make it available for other operations, such as thin plate or thick sheet for tankage or barrels, or it may be slit into narrow strips suitable for making into pipe. However, if most of it is to be further rolled into thinner sheet, the mill scale is pickled off and then the material is rolled through four-high cold-rolling mills, usually set three in tandem. Reduced finally to the proper thickness and hardness, the coil is uncoiled through a leveler and automatic shear that cuts and piles the sheets, after which they are sent to the annealing department for proper annealing. This is now done in controlled atmosphere so that there is no scaling and little discoloration. After a final pass through a four-high stand ("skin-rolling and leveling"), the sheets are resquared, inspected, oiled and shipped.

The necessary amount of cold reduction after annealing and pickling is frequently done in one cluster mill with work rolls rather small in diameter, each backed up by a larger roll which, in turn, is backed up by two other rolls. This gives a very stout assemblage with minimum elastic spring in the rolls and consequently produces sheet with minimum variation in thickness, edge to centre. An adjunct is two power-driven reels, one on each side of the stand. A coil of sheet is placed on one and the end threaded between work rolls and attached to the reel on the far side. The work rolls are screwed down by powerful motors, and the mill started up; the reel on the exit side puts heavy tension on the emerging sheet, the reel on the entering side holds back stoutly. Just before the end of the coil is reached, the mill reverses, the work rolls are screwed closer and the two reels reverse their functions. The combination of small rolls squezing the sheet, which at the same time is pulled forward between them, permits much heavier reductions per pass and more passes before the process must be interrupted for a softening anneal. A careful combination of rolling and annealing will control the grain size of the resulting sheet. Furthermore, grains can be caused to be oriented predominately in one direction—an important consideration in silicon steel used for electrical machinery. (*See* also ANNEALING; GALVANIZED IRON AND STEEL; TIN PLATE AND TERNEPLATE.)

4. Pipe.—Skelp, the flat bars from which small-sized pipe is made, is rolled in a continuous mill specially designed to produce bars true in thickness, width and properly beveled on the edges. Sometimes the finishing stand is adjustable, and a skilled workman varies the roll spacing slightly in accordance with his estimate of the temperature of the metal issuing, thus compensating for the different amounts of contraction during cooling. Skelp is cut 20 ft. long, one end pointed, and then charged into a flat hearth, properly designed to produce a uniform white heat throughout; when reaching the welding temperature the metal appears to be covered with

a shiny grease, which is molten iron oxide. The white-hot bar is drawn through a welding bell (fig. 4[A]) forming the flat bar into a tube and pressing the butted ends together into a true weld all in one operation. Further operations reduce the pipe, but only slightly, to the correct size, straighten it, remove the scale, shape and thread the ends, proof test it and finally cover it with a protective coating. Skelp for lap welding and butt welding is of plain low-carbon steel (.10% carbon); the harder varieties and alloys are not amenable to such simple forge welding practices.

Butt welding is done on pipe from $\frac{1}{8}$ to 3 in. nominal inside diameter. Common pipe from two to eight inches is more usually made of flat plate by lap welding (see fig. 4[B]). Plates are piled into a furnace, heated to a dull red and run one by one through scarfing rolls, which form the necessary bevel on the edges for an overlapping seam. The hot steel is then drawn through a forming bell that curls it up into a tube (fig. 4[A]). After reheating to the welding temperature, this tube is caught between a pair of rolls and rolled over a manganese steel mandrel (fig. 4[B]), and the joint welded by the high temperature and pressure at the point of contact. When the length has been rolled, the bar that has been holding the mandrel in position is withdrawn from the far end of the pipe, and the latter rolled away for the finishing operations already enumerated. It requires only a few seconds to weld a standard length pipe by either of these processes. Welded pipe over 30 in. in diameter is made by hammer welding or by automatic arc welding. In the former, the wide plate is curled on plate-bending rolls and the overlapping joint heated and forged shut in sections (*see* fig. 4[C]). After welding, the length is rerolled for shape and annealed, the ends sized and shaped and the pieces tested and dipped in anticorrosive liquid.

For arc welding, the edges of the plate are planed to a beveled V opening (fig. 4[D]), the pipe bent to shape in rolls, clamped between long copper bars and the bevel filled with metal from a slowly traveling wire, from which an electric arc is struck to the steel plate below. Another common method of making welded pipe uses resistance heating. A plate of necessary width and thickness is bent into a U by a series of rolls and then the U is closed into an O by further forming rolls in the train. This formed tube is then passed between two sets of rolls shaped so as to squeeze the joint tightly together; midway between are electrodes—copper disks, one on each side of the joint—which pass enough current to heat the adjoining edges continuously to welding temperature. Electric welded pipe can be made in higher carbon (harder) and alloy (stronger) steels than those used for butt and lap welding. (*See* also WELDING.)

5. Seamless Tubing.—In the United States, seamless tubing is preferred for all purposes where the internal pressure is high and service severe, and an increasing amount of such pipe is being made in diameters up to 18 in. First, a round billet at full red heat is pierced by inclined rolls and mandrel. As sketched in fig. 4(E), two 36-in. rolls of special shape are set side by side, with axes crossing and about 10° askew. The shape is such that the rolls grip the end of the ingot and move it forward slowly, forcing it over a mandrel set between them. The operation is such that the mandrel seeks and maintains a truly axial position. After piercing, the inner and outer surfaces are smoothed and the tube brought to exact size by several rollings over a mandrel, as in lap welding. Further operations from straightening to shipping are performed with considerable care. Not only is such pipe more reliable for the lack of any welded seam, but the piercing operation is so strenuous that nothing but metal of good quality can endure it. Therefore, the tubing can safely withstand a considerably higher pressure than the best of welded pipe. Seamless piping is used for all high-pressure fluids in power plants and in chemical, petroleum and process industries, the analysis of the steel being adjusted to the pressure, temperature and corrosive environment to be endured.

Plain carbon seamless tubes, after cold-drawing to thin walls, are much used for structural members on bicycles and for shaping into metal furniture and machine parts. Cold-drawing is done as sketched in fig. 4(F). A tube somewhat too large and thick in wall has the end swaged down slightly. All oxide is then pickled off, the tube washed, dried and dipped in tallow or other lubricant. The pointed end is thrust through a round die and gripped by draw-bench tongs. Next, a mandrel is thrust through the tube from the far end until it has a position directly within the die, and then the tube drawn forcibly through the annular opening thus formed. In this way, the outer and inner diameter may both be controlled. Each draw hardens and strengthens the metal and makes it more

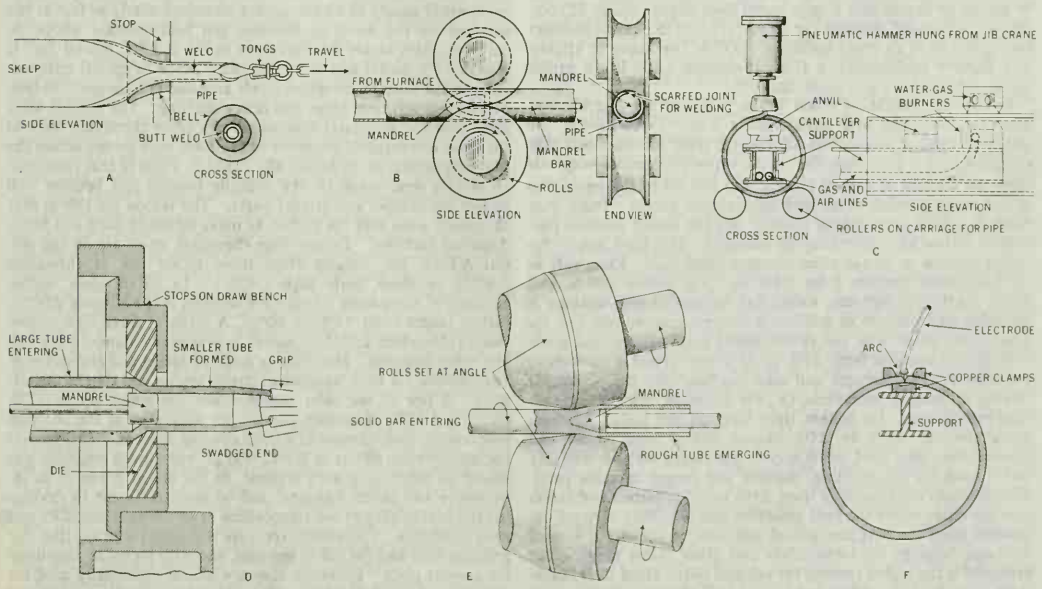


FIG. 4.—VARIOUS METHODS OF MANUFACTURING PIPE: (A) BUTT WELDING A 2-IN. PIPE; (B) LAP WELDING; (C) HAMMER WELDING OF 30-IN. PIPE; (D) DRAWING SEAMLESS PIPE; (E) MANNESMANN METHOD; (F) ARC WELDING OF 30-IN. PIPE

brittle; after a few such passes, if the required size is not yet reached, the pipe is given a low-temperature anneal to relieve the cold-working strains and the process continued.

6. Rods and Wire.—As indicated above, wire rods are frequently rolled from two-inch billets, 30 ft. long, on continuous mills, and the 16th or finishing pass delivers a .2 in. round to reels at a speed of 45 m.p.h. Such a mill will produce 15 tons per hour. Other arrangements utilize a continuous mill for breaking down a four-inch billet, and about a dozen loops fed by hand in a cross-country mill to finish. Rod reels are dumped automatically, and the rod cold-drawn through dies, with frequent annealings and other intermediate operations, into wire of various diameters, finishes and tempers. Most of this wire is stranded into cable or wire rope, woven into screens, netting, fencing or made into nails. *See* also WIRE.

X. PROPERTIES AND USES OF CARBON AND ALLOY STEELS

Any classification that accounts for the destination of steel made by any combination of the processes described above must evidently be impossible because of its complexity. As to process, it may be said that any of them can be made to produce steel that easily passes commercial specifications, even for so severe a duty as railroad rails. Somewhat over 40% of U.S. production is in the form of sheet, strip and tin plate and about 16% in bars, 12%–13% in pipe and 9%–10% in wire and wire products. Structural shapes account for 6%–7%, track material about 2½% (down from 5% before World War II) and miscellaneous products make up the balance, about 3%. A feature of the industry in the United States has been a large increase in sheet production and a rapid decline of track material.

The automobile industry consumes 17% of U.S. production and, in addition, absorbs quantities from warehouses and from forge shops and other converters and processors. About 12% of the total production goes into construction (in structural shapes and concrete reinforcement), 9% into containers and 6% into machinery. Export accounts for 4% and all other uses 32%. In England and the continent the proportion of exports is very much larger than in the U.S., and the consumption for automobiles is less.

An idea of the amount of steel required for modern products may be gained by saying that a large ocean liner might require 35,000,000 lb., a railroad sleeping car about 115,000 lb., a 50-passenger bus 13,000 lb., a six-room residence 5,000 lb. (exclusive of kitchen and laundry equipment), a U.S. automobile 3,500 lb., a garden spade 5 lb. and a 1-gal. paint can 1 lb.

1. Carbon Steels.—Carbon is the principal alloying element used for hardening and strengthening iron. Consequently the utility of various iron-carbon alloys—the plain carbon steels that comprise such a large majority of the entire production—depends upon the amount of carbon present and has led to the separation of the entire possible range into approximate grades. Ingot iron, made in a basic open-hearth furnace, has the lowest possible content of carbon and other alloying elements. It is used largely for sheets because of its corrosion resistant properties. Extra-soft or dead-soft steel contains from .08% to .18% carbon and is used where ductility, toughness, weldability or ease in cold-working is desirable and strength or stiffness a minor consideration, *i.e.*, for pipe, rivets, sheet, wire and casehardened parts. Structural grade or mild steel contains from .15% to .25% carbon and is used where a combination of strength and easy machinability is desired, for forging or flanging operations, *i.e.*, for buildings, bridges and railroad rolling stock, for boilers, drop forgings and bolts. Medium grade contains .25% to .35% carbon and is even harder and stronger than mild steel, yet it may be hot-forged without difficulty and is used for shipbuilding, shafting and forged machine parts. Medium-hard steel contains from .35% to .65% carbon and enters into the range where the final condition and reliability is much dependent upon the past mechanical and heat treatment; it is used for large forgings for locomotives and other prime movers, car axles and in the higher carbons for railroad rails. Hard steel ranges from .65% to .85% carbon and is used only after it is heat-treated to a correct combination of strength and ductility; it is used for wrought steel wheels, locomotive tires, woodcutting tools and sledges. Spring grades range from .85% to 1.05% and are used in a heat-treated condition, wherein a great range of hardness, resiliency and brittleness is possible, *i.e.*, automobile springs, cold chisels, rock drills and shear blades are made of these steels. High-carbon tool steels range from 1.05% to 1.20% and are used only after heat-treatment for railroad springs, metal-cutting and forming tools. A characteristic of these carbon steels is that each .01% of carbon increases the ultimate strength in the annealed condition by approximately 1,000 p.s.i., but at the expense of ductility or toughness. Hardness also is increased.

2. Alloy Steels.—Combinations of even higher strengths with considerable ductility and impact resistance may be had only in alloy steels, of which a number have been developed with special properties. (*See* also ALLOYS.)

Use of alloy steels, which prior to 1910 was confined mostly to big guns, armour and projectiles, has spread rapidly into all metal-working industries, among which the automotive leads. Production statistics are either lacking or uncertain because there is no agreement as to what constitutes an alloy steel. The trend is toward lower and lower contents of alloy made by basic open-hearth furnaces and by basic oxygen, or oxygen-lance, converters, operating under very special control for deoxidation and grain size. (*See* STEELS, ALLOY.) They are special steels, not merely a carbon steel to which alloying elements like nickel, chromium or manganese have been added. Production of such material is about 9% of the total steel made in the United States.

Nickel and Chromium.—Although there are infinite possibilities in alloying, by far the most important steels are those containing nickel and chromium; they are used for crankshafts, axles, gears and other automotive and machine parts. Relatively few analyses would be used in a single plant, the tendency being to minimize the number of alloy steels in process so as to avoid mixtures of the stock. A revised list of standard alloy steels issued in the late 1950s by the American Iron and Steel institute (A.I.S.I.) and the Society of Automotive Engineers contained 107 analyses. With the advent of alloy steels into ordnance and armour, nickel was the favourite element. It goes into solid solution in the ferrite and progressively adds to strength, but does not decrease toughness even without precise heat-treatment (*see* NICKEL STEEL). However, world supply of nickel has not increased nearly as fast as the demand for the metal in stainless and heat-resistant alloys, so only one plain nickel steel survives in the A.I.S.I. official list; it contains 5% nickel and 0.17% carbon. Made to special analyses, annealed or normalized nickel steels are used in long-span bridges, pressure vessels, gun tubes and heavy shafting. The earliest alloy steel used for structural purposes was a plain chromium steel in the main compression members of the Eads arch bridge across the Mississippi river at St. Louis, Mo. (1874). Prior to that time, cast chromium steel made by the crucible process had become well known for crusher and grinder parts. The reason for this is that chromium joins with the carbon to make intensely hard and finely dispersed carbides. Twenty-four chromium steels are on the official A.I.S.I. list, ranging from those rather low in chromium (.30%) to those fairly high (.80%). In all of them sizable amounts of manganese (.80%) are counted in the alloying effects; carbon ranges from .15% to .60%. A series of three high-carbon steels (chromium 1.25% or more) is practically standard for ball and roller bearings. Much use is made of nickel and chromium in combination for their hardening, strengthening and toughening effects. A few of the older combinations containing up to 3.5% nickel and 1.5% chromium persist, but nearly all of the analyses now contain molybdenum as a third alloying element. This reflects the conservation efforts of World War II, when much emphasis was placed on minimizing alloy content, on the use of boron as an inexpensive and potent hardener and on heat-treatment to develop the full potentiality of the composition as to strength, ductility and wear resistance. Chromium steels are still used for projectiles, for grinding rolls and for roller bearings, and with nickel or vanadium for armour plate. However, they are almost universally used for heat-treated machine parts, axles and gears. Rustless irons and steels contain 12% to 18% chromium and up to 8% nickel. (*See*

also STAINLESS STEEL.) Heat-resistant steels contain up to 25% of each alloying element.

Manganese is present in all steel, but when it adds up to between 1.0% and 2.0%, with carbon .30% to .50%, the steel acquires special properties. These analyses are favoured in the United States for high-strength castings, heat-treated forgings, rifle barrels and for casehardening. The U.S. standard list contains four medium-carbon steels with 1.75% manganese, used to an increasing extent in the automotive and farm equipment field, since they carry the least expensive alloy addition. So-called silicon structural steel used in long-span bridges and for boiler plate is one of the lower manganese steels of this classification. The tough Hadfield manganese steel, used in castings for shock and wear resistance, contains 11% or 12% manganese and 1.0% to 1.2% carbon.

Vanadium is an element that has a powerful deoxidizing and scavenging effect; thus a vanadium treatment on steel that shows very little of the element in the analysis makes for soundness, fine grain structure and reliability in forgings. From .5% to 2.0% is added along with other alloying elements to make high-speed steels and tools for hot work.

Molybdenum is added to chromium, nickel and chromium-nickel steels in from .2% to .3% to widen the range of heat-treatment for given values and to improve the forging and machining properties and their resistance to creep when working at high temperature. Carbon-molybdenum steels of controlled grain size and hardenability are favoured by many U.S. metallurgists, 11 such steels comprising the so-called 4,000 series. Molybdenum is readily available as an alloying element; in fact nearly three-quarters of the U.S. standard steels contains .25%. It deepens the hardened surface in quenched steels, resists coarsening of grain during high heating for forging and hardening and raises the creep resistance at moderately elevated temperatures.

Boron.—Prior to World War II, U.S. ferroalloy producers were marketing various trade-named "intensifiers" containing various amounts of deoxidizers such as titanium and silicon and grain refiners such as vanadium and aluminum, but, in addition, minor percentages of boron. The effect of the latter was to increase hardenability, which it did so effectively that, in the wartime emergency of 1940–45, the so-called "National Emergency Steels" (designed to minimize amounts of chromium, nickel and molybdenum) were further fortified with .0005% boron that enabled the combined alloy content to be again reduced by half; 17 of these low-alloy boron steels are still listed in the A.I.S.I. standards.

Hardenability Bands.—It has long been known that the properties induced in heat-treated steels are not additive, which is to say that a certain hardness induced either by $x\%$ of chromium or $y\%$ of molybdenum can be achieved by less than $x + y\%$ of the two in combination. It has also been demonstrated that many of the useful properties of steels in service are related to the hardness of the piece after it has been fully quenched and tempered. Likewise that the depth below the surface that can be fully quenched to the hard metallographic structure called martensite (described below) depends primarily on the alloying combination, whereas the surface hardness depends primarily on the carbon content. For nearly all engineering purposes, therefore, the metallurgist is interested in supplying metal that will harden to the centre in the size being quenched and in the quenching medium adopted. This will give a piece of uniform strength, hardness and endurance measurable by surface tests. It is generally immaterial what combination of alloys will do this. For this reason the Jominy end-quench test is widely used for assigning correct steels and heat-treatments to parts for severe services. In this test a one-inch round specimen four inches long, heated to normal hardening temperature, is placed in a fixture so a jet of cold water sprays on one end only. After the piece is cold, hardness tests are made at $\frac{1}{16}$-in. intervals from end to end, and the metallurgist can then identify the proper steel by its response to hardening rather than by its chemical composition. The A.I.S.I.'s standards contain 80 steels whose hardenability bands (plots showing maximum and minimum allowable hardness in the Jominy end-quench test) are specified.

High-Speed Steel.—Carbon tool steels for cutting metals are heat-treated by quenching from a high temperature, which gives them hardness, and then by reheating or tempering to a moderate degree to restore toughness. In use they must be operated at such low speeds that the friction between chip and tool nose will not reheat the cutting edge above the drawing temperature, else the hardness and usefulness of the tool is destroyed. Better speeds could be made by using self-hardening tool steels, those which are hard after a slow cooling from a high temperature, such as the patented tungsten-manganese alloy invented by Mushet in England sometime between 1860 and 1870, or the chromium-tungsten substitutes adapted by some U.S. steelmakers. During a 26-year research into the art of cutting metals, Frederick W. Taylor and Maunsel White discovered, 1898 to 1900, that if these steels were quenched from an austenitizing temperature so high that it would utterly ruin a carbon steel, the hardness would be retained even when the cutting speed was so high that the nose of the tool and the chip leaving it were red hot. Modern high-speed steels possessing this property of red hardness fall into four general classes as shown in Table V.

TABLE V.—*High-Speed Steels*

Alloying Element	High tungsten (%)	Low tungsten (%)	Molybdenum (%)	Cobalt (%)
Carbon	0.65	0.75	0.85	0.75
Tungsten	18.0	14.0	1.5	18.0
Chromium	4.0	4.0	4.25	4.0
Vanadium	1.0	2.0	1.0	2.0
Molybdenum	...	...	8.0	...
Cobalt	...	...	...	8.0

These are crucible or electric steels carefully forged to break up the crystals of complex carbides forming during the solidification of the ingot and distribute them evenly throughout the bar. A well-annealed bar is not very hard (Brinell 240) and can be machined into a complex tool like a milling cutter and then heat-treated; preheated to 850° C., heated rapidly to 1,300° C., cooled in oil or an air blast, giving a Brinell hardness of at least 600. Reheating 30 minutes at 600° C. is then necessary to give the quality of red hardness; the Brinell hardness is even higher and the toughness materially better. As an indication of the revolution that these steels have effected in machine-shop practice, a plain carbon tool steel will cut 16 ft. per minute on a medium-steel forging, a self-hardening steel 26 ft. per minute, the same after being given the high quench 60 ft. per minute and a modern high-speed steel 100 ft. per minute or more, all cuts being of same depth and feed and on the same material. Cobalt high speeds are for cutting extra-hard or gritty substances.

Tungsten Steels.—Other alloys whose properties are due principally to tungsten, in addition to the air- or self-hardening tool steels and the high-speed steels, are tool steels to which from 1% to 5% tungsten is added to improve the quality of the woodworking or other tools that would be made of the plain carbon steels. They are also good for making finishing cuts on metal after most of it has been removed by deep cuts with high-speed steel. Magnets are also made of steels with 6% tungsten and .7% carbon, quenched but not tempered.

Other Tool Steels.—A wide variety of tool steels is marketed for special purposes, reflecting in part the lack of standardization in this highly competitive industry. Among the most important are the oil-hardening, nondeforming steels containing about 1% each carbon, tungsten, chromium and manganese. Complex tools made of such steels can be hardened with minimum change of dimension to high hardness, retaining this high hardness (Rockwell C-63) after a toughening temper and maintaining a keen edge for cutting purposes. Tools for cold-working, such as forming dies, punches and thread rolling dies, contain either 1% carbon, 5% chromium and 1% molybdenum and are air-hardening, or 2.25% carbon, 11.5% chromium and .5% vanadium and are oil-hardening. The latter is exceedingly tough and wear resistant. Die steels for hot work comprise another major group; they are sometimes called semi-high-speed steels and contain about .3% carbon, 12% tungsten, 3% chromium and .4% vanadium. Their characteristic is abrasion resistance even when their surface is heated by being in contact with steel at forging heat.

XI. SOME FERROALLOYS

Ferroalloys are highly important and include those metallic substances used for finishing carbon steel and manufacturing alloy steel. Most of them are electric-furnace alloys of iron and carbon plus the third distinguishing metal, manganese, silicon, chromium or some other, although for some purposes the carbon content must be as low as possible. For such specifications, the alloys are made using either metallic aluminium or silicon for the reducing agent. A growing amount of pure metal—manganese or chromium made by electrodeposition—is also used for extra low-carbon steels or the so-called superalloys for high-temperature service.

It was early discovered that manganese must be added to make sound steel by Bessemer's process. As already noted, the usual ferroalloy for this purpose is spiegeleisen, a blast furnace product made from iron ore sufficiently high in manganese to smelt into a pig iron containing 10% to 30% of that element, with carbon about 5%. Spiegel cannot be used for low-carbon steels because the required amount of manganese carries with it too much carbon. For such purposes, ferromanganese is used, containing nominally 80% manganese and 6¾% carbon. This is also a product of the blast furnace when smelting an ore containing 40% to 50% manganese, low in iron. Since manganese and iron are so alike chemically, the actions in the furnace are very similar to those previously described. The output in ferromanganese from 50% ore is only about one-third as much as though common pig iron were produced; the blast is about 120° C. hotter and the coke consumption twice as much; about one-fifth of the manganese is lost in the slag. While ferromanganese can be made in an electric furnace of the pit type, it cannot compete with the blast-furnace product except under special economic conditions, as in Norway, or where carbon below .25% is required, as for high-manganese alloy steels.

Ferrosilicon is the next most important alloy. A 12% silicon pig iron may be made in the blast furnace, but alloys higher in silicon are now used to deoxidize nearly all steel for castings, most tonnage steel from basic open-hearth furnaces and to make several silicon alloy steels. Ferrosilicons are exclusively an electric furnace product and are made in several grades—50%, 75%, 80% and 95%. Carbon is about .5%, phosphorus and sulfur less than .10%—the former particularly must be kept to the minimum to prevent the alloy from absorbing moisture from the air and generating poisonous phosgene gas (PH_3). A shallow electric furnace is employed, rectangular in cross section, with bottom built of carbon blocks. Through the roof are suspended three carbon electrodes, one for each phase of current; a granular mixture of pure quartzite, clean iron turnings and coke is shoveled into the open top, filling the entire furnace. Passage of current from electrodes to furnace bottom gives the necessary heat for the coke to reduce silicon metal from the rock. Carbon monoxide produced by the reaction rises and burns at the top of the charge column, and a molten alloy of iron and silicon collects within the coke mass accumulated on the hearth, from which it is periodically drained.

Ferrochromium.—This is one of the earliest ferroalloys produced in an electric furnace. Commercial alloys contain about 67% chromium. The so-called high-carbon alloys range from 4% to 8% carbon by units, whereas the low-carbon alloys necessary to make stainless irons range from .20% to 2.0% carbon by steps. Chromium metal of high purity is also commercial. Ferrochromiums are ordinarily made in closed furnaces of the Heroult type, with bottoms laid in carbon blocks. A charge of chromium ore, iron or iron ore, anthracite coal for reducing and flux for slagging impurities is mixed and shoveled in, the doors closed and electric current turned on. Carbon reduces the metallic oxides in the intense localized heat; at the finish, the molten charge is poured into slabs, broken, analyzed and graded for shipment. To reduce high carbon, these varieties are remelted with concentrated chromium oxide; under a lime-fluorspar slag, or, as noted above, prepared from high carbon ferrochromium by electrolysis.

Nickel is added to molten steel as shot metal, or a nickel-steel scrap may be used to make alloy steel—nickel having little tendency to enter the furnace slag.

Ferrovanadium is one of the most difficult alloys to make, because of the activity of the element. The pure metal is not used in steelmaking but is available for many special applications. B. D. Saklatwalla developed various means of commercial alloy production, using a mixture of vanadium oxide, iron oxide and powdered aluminium, either in crucibles by means of the thermit reaction or in shaft furnaces with the assistance of the electric arc. In the United States, the ore is melted in a reverberatory furnace, and the vanadium concentrated in the slag. This slag is ground, mixed with carbon, iron scale and fluxes (broken glass, lime and fluorspar) and fed in a fine stream into a covered furnace, directly through the arc between graphite electrodes, thus effecting the reduction almost instantly in the intense heat. Reduced alloy and slag collect in the hearth and are tapped three or four times a day. A common analysis contains 35% vanadium.

Ferrotungsten.—Tungsten ore is widely distributed, and the concentrate comes to the refiner in such complex mixtures of minerals that frequently the first step is the production of the oxide WO_3 by chemical means (*see* TUNGSTEN STEEL). This oxide is easily reduced to metallic powder without melting by mixing with fine carbon, sealing in a crucible and heating to 1,300° C. for several hours. Ferrotungsten, which has become more popular for making high-speed steel, may contain from 60% to 85% tungsten and is made in single-phase electric-shaft furnaces. The bottom is one terminal; the electrode set above is surrounded by a shaft of loose brickwork, and a mixture of oxide ore, iron and carbon is filled in. As the reduced alloy builds up on the hearth, it chills into a thicker and thicker button, because it has an unusually high melting point; when this solid metallic mass has grown to a point where its electrical resistance interferes with operations, the temporary furnace is torn down and the sow (metallic mass) crushed, analyzed and classified.

XII. METALLOGRAPHY AND HEAT-TREATMENT

1. General Structure of Steel.—Much may be discovered about the general structure of the metal by a close scrutiny with the naked eye or with a magnifying glass. Such studies (macroscopy) include examination of the finished surfaces, of freshly broken fractures and of roughly polished sections etched in various ways. Information gained from a freshly broken fracture has not yet been systematized and correlated with microscopic appearance except as to grain size of the steel after heat-treatment. To be of value it requires a keen eye, much practice and everyday familiarity with the fracture of satisfactory metal to note small differences. In the hands of a skilled inspector it is the first step in securing uniformity in raw materials. In fact this was the only means available to the iron- and steelworker up to the 20th century.

General structure may best be exhibited on a roughly polished surface by etching in freshly prepared ammonium persulfate solution, 10% $(NH_4)_2S_2O_8$. It shows immediately differences in grain size caused by differences in heat-treatment or other cause.

Deep etching is much favoured in the U.S. for acceptance tests on high-grade steel. It shows any nonuniformity in chemical composition or general bad quality. The smooth sample is held in hot hydrochloric acid (diluted 50%) for about 30 minutes. Impure spots, blowholes or cracks are eaten more deeply than elsewhere, and the result is an irregularly pitted surface.

During solidification of a steel ingot, excess of sulfur compounds will collect toward the centre and top part, where they are trapped and remain during further rolling and manufacture. The distribution of sulfur compounds in a smooth section may be shown by pressing it firmly for about a minute against a sheet of photographic paper moistened with 2% sulfuric acid, then washing and fixing. The dark areas indicate the location of higher sulfur in the steel. Phosphorus also accumulates around the borders of the large metallic crystals that form in the ingot, and during rolling or forging are pressed out into stringers or sheets in ruling directions.

Ordinary plate or forging steel will always be found thus marked. In forging, these *flow lines* are arranged more or less parallel to the finished surface, and the dies are so constructed that the flow lines take an easy curve around corners. Any crinkling is associated with a weak, brittle region. To show phosphorus segregations, a polished surface is washed in alcohol and immersed in 10% copper-ammonium chloride. A thin, copper plate will coat

out on those portions low in phosphorus, leaving high-phosphorus regions bright.

The fact that the hardness, toughness and general properties of a piece of steel could be profoundly modified by a simple heating and cooling has been known since time immemorial; in fact, what is now known as steel was perhaps not recognized as having great merit until the fortunate discovery of heat-treatment was made. This is a quite mysterious happening, this heat-treatment, and it is not surprising that, down through the long centuries when the art was guarded as a closed secret, many superstitions arose regarding the efficacy of certain heating fires and quenching fluids. Within the past century the chemist and physicist have done much to clear up the mystery by analyzing the various operations; we now know the essential differences between the various steels, irons, fuels, atmospheres and quenching fluids. Only since the beginning of the 20th century, however, have intensive studies with the microscope, pyrometer, hardness- and tension-testing machines brought forth a knowledge of the changes that go forward in steel or iron during a heating and cooling cycle, and working hypotheses of the causes of hardening (*see* METALLOGRAPHY). Logically, an ingot in a soaking pit prior to rolling, or a billet in a heating furnace prior to forging, may be said to be undergoing heat-treatment, but from a workshop viewpoint the term is restricted to a heating and cooling to restore original ductility and workability in a partly finished piece, or a heating and cooling—sometimes repeated—to induce special properties in the finished article. (*See* also ANNEALING.)

2. Furnaces.—Furnace size depends upon the pieces to be treated and the temperature required. A well-designed furnace is one that easily attains the necessary temperature and maintains that temperature uniformly in all parts, with an atmosphere that does not deteriorate the furnace and yet has the desired effect, or no effect, upon the metal being treated. Fuels may be coke or coal, gas, oil or electricity. Choice of source of heat is merely a matter of which is the most convenient and economical. Gas and electricity are favoured because of their ease of manipulation to give uniform temperature—choice depends upon the relative cost per thermal unit and the atmosphere required. For instance, it is handiest to use electric resistors for heating elements in a furnace for annealing transformer sheets in a hydrogen atmosphere. Gas or oil fuel would probably be chosen for treatments on products such as roller bearings running into tons per day. Sometimes recuperators or regenerators are installed to save heat. Mechanical devices for handling the metal, such as charging machines, furnace bottoms built on wheels or moved on rollers, revolving heating muffles and conveyors, are installed wherever the weight of material receiving uniform treatment is great. Temperature control including the rate of increase in heat, duration at heat and speed of cooling is most important. Continuous furnaces are devised to maintain this cycle automatically. Batch furnaces are controlled by hand or by automatic control of the fuel burners through pyrometers, which indicate or make a permanent record of the temperature at all times. An important method of localized heating is by high-frequency currents; pieces such as crankshafts are rapidly heated one at a time at only those bearing surfaces that are to be hardened. (*See* also FURNACE, ELECTRIC; FURNACE, METALLURGICAL; HEAT-TREATMENT.)

3. Atmosphere.—The atmosphere within the furnace is important. In an open-flame furnace, scaling (the production of oxide on the metal's surface) may be minimized by feeding rather less air than the gas or oil requires for complete combustion. This deficiency of oxygen means that little or none will be available to react with the hot metal. In long heating of thin sheet, or long annealing of tool steel, where the surface must be preserved, the work is protected from the furnace atmosphere by closed boxes or tubes. For bright annealing, atmospheres of flue gas, partially burned fuel gas or even gas engine exhaust may be used; due to the comparatively low annealing temperature (650° C.) any mixture of an excess of carbon monoxide over carbon dioxide will protect the steel. It must be fairly dry to prevent tarnishing by steam on the cooling cycle. Protection during heating to higher temperatures (900° C.) for quenching is far more difficult because the reactions are much more rapid and the steel must neither oxidize nor gain or lose carbon. Such atmospheres are made in commercial generating equipment. One general type is known as endothermic because it requires auxiliary heat for its production. Methane, CH_4, and a deficiency of air are passed through a heated catalyst and cooled to a mixture of 40% nitrogen, 40% hydrogen and 20% carbon monoxide, a most useful gas whose "carbon potential," or tendency to add or subtract carbon from the surface of a given steel, can be easily regulated by adjusting the dew point or moisture content. The other and more widely used type of gas (exothermic) burns methane in a slight deficiency of air and contains varying amounts of CO_2, CO and H_2 depending on proportions of air and gas fed to the burner. Its reaction to hot steel depends on the relative amounts of carbon oxides and hydrogen and also on moisture content, the latter being easily reduced by refrigeration. By the addition of methane, the gas becomes useful for casehardening; further small additions of ammonia will make it suitable for carbonitriding or the production on a soft steel part of a thin, intensely hard surface high in both carbon and nitrogen. By catalyzing the CO to CO_2 and absorbing the latter, this exothermic gas can be converted to a mixture of nitrogen and hydrogen similar to dissociated ammonia and suitable for the heat-treatment of stainless steels. Casehardening is also done in the old manner—packing the parts in boxes with carbonaceous products that form the necessary gaseous atmosphere. In any event a "fine-grained" steel is used, one that resists grain growth for long times at the high temperature (925° C.) employed. These steels, as already pointed out, are well deoxidized and then alloyed with a fractional per cent of aluminum. (*See* also SURFACE HARDENING.)

4. Quenching.—This may be done in various liquids, depending upon the speed required. All kinds of solutions of outlandish materials have been used, but there is no virtue in a quenching fluid except the ability to abstract heat quickly. In practice, the most drastic quench is given by a properly disposed nest of nozzles that spray cold water at high pressure on the hot steel. Next comes a bath of iced brine, then cold water, then high flash point oil, then boiling water, then molten lead, then air blast, then quiet air—even slower cooling may be done in 8 hours by burial in lime; a dying furnace may require from 24 hours up to seven days. Quenching baths require methods for circulating the medium, maintaining its correct temperature either by heating or refrigerating coils and dashing it against the metal so no air or steam bubbles remain attached to the hot metal, else soft spots will occur on an otherwise hardened surface. Conveyors, or other mechanical methods of getting the hot metal rapidly into the quench and removing it when cold, are installed to save labour. In order to understand what goes on during these heating and cooling cycles, an introduction to the science of metallography and the so-called iron-carbon-equilibrium diagram is necessary.

5. Metallography.—Metallography is the study of the inner structure of metals and how this varies with the chemical composition of the alloy and its past heat-treatment or the work that has been done on it. It also includes the study of the relationship between the inner structure of metal and the physical properties, such as strength, toughness and hardness. In this study, the use of a microscope is a long step in advance of the ancient practice of breaking the metal and looking at the fracture. It enables the student to magnify the apparent size of the grains a thousandfold. A sample of the piece under study is given a high polish, etched slightly in a suitable acid and placed on a microscope stage with a special illuminating device for opaque objects (*see* MICROSCOPE). Much higher magnifications are available if the lens system is adapted to the use of ultraviolet light, and even greater enlargements revealing finer detail are obtainable through the electron microscope. The resulting structure may by appropriate means be photographed for permanent record and for study in connection with information on its past history, its physical strength, hardness or electrical characteristics. Important physical properties affected by heat-treatments include strength, toughness, hardness, electrical and magnetic characteristics and corrosion resistance. Of these, the first three are most relied upon. Machines and methods for

making tension tests and determining the ultimate strength, elastic limit and ductility are described under MATERIALS, STRENGTH OF. Hardness is measured by the size of impression left by a steel ball or a diamond cone or pyramid weighted down by a given load. Toughness or impact strength is measured by the amount of energy absorbed from a swinging hammer by the instantaneous fracture of a standardized test piece.

6. Evidence That Metal Is Crystalline.—Viewed through a microscope, an etched metal surface presents a mosaic patchwork of interlocking grains.

Much evidence is at hand to support the idea that these granules, despite their irregular boundaries, are crystalline, *i.e.*, the ultimate atoms are in an orderly geometric arrangement of rows and ranks. The fact was finally proven by X-rays in a manner easiest explained by this analogy: if a street lamp is viewed through a window screen, the brilliant centre appears to have a series of bright rays extending outward, caused by reflections of light from every wire so placed as to throw light back into the eyes. The geometric pattern of rays is caused by the geometric arrangement of the wires; arguing by analogy, if the atoms of metal are arranged in definite geometric patterns, then an X-ray beam penetrating the crystal would be reflected in definite ways and emerge in a geometric pattern; a mathematician can predict the atomic spacing and arrangement from the diffraction pattern so produced. Thus it is found that wrought iron at room temperature is in the body-centred cubic arrangement. That means that if the space occupied is subdivided by imaginary planes into a space-lattice of tiny cubes regularly placed on top and to both sides of one another, the iron atoms are located at the corner of each of these imaginary cubes, and each cube will have one atom in its centre. Some theoretical studies have postulated that the crystals may not be perfectly symmetrical but may have scattered imperfections and discontinuities. These have actually been photographed in certain salt crystals. Many changes in metallic properties, such as hardening by cold-work, plastic flow under stress and brittle fractures are theoretically explicable by this hypothesis. *See* ALLOYS: *Structure of Alloys;* CRYSTALS, DISLOCATION OF; HEAT-TREATMENT: *Recovery and Recrystallization.* (E. E. T.; R. E. GE.)

XIII. STEEL METALLURGY

A. Slowly Cooled Steels

Although commercial steels invariably contain several chemical elements, they are described as being essentially alloys of iron and carbon containing up to about 2% by weight of carbon. When more than 2% of carbon is present in a ferrous material, it is usually termed cast iron (*q.v.*).

The properties of a steel are primarily dependent on its structure; this is determined by the chemical composition of the steel, particularly its carbon content, and by the thermal and mechanical treatment it has received. Before attempting to assess the effects of chemical composition, it is essential to consider the structural changes that occur in pure iron when it is heated and cooled.

1. Allotropic Changes in Pure Iron.—Much information can be obtained about the structural changes in a metal by measuring the rate of temperature change of a sample of the metal when it is heated or cooled slowly. When no structural change occurs, the rate of temperature change will be fairly constant, but when the structure changes it results in an energy change that will temporarily decrease the rate of temperature change in the sample. Thus, when a sample of a pure metal melts, the latent heat of fusion is absorbed from the surroundings and, while this happens, the temperature of the sample remains constant at its melting point. This method, called thermal analysis, enables the temperatures of structural changes to be determined. The nature of structural changes is best examined by X-ray diffraction methods.

In pure iron, four changes are detectable by thermal analysis, at 768° C., 910° C., 1,390° C. and 1,539° C. At room temperature, the iron crystals have a body-centred cubic structure; that is, each crystal is composed of a regular pattern of atoms such that an atom can be considered to be in the centre of a cube and surrounded by eight equidistant neighbours, each of which is at a corner of the cube. This body-centred cubic form of iron is called α-iron, or ferrite (although more generally ferrite designates a solid solution in which α-iron is the solvent) and is magnetic at temperatures below 768° C. On being heated through 768° C., the α-iron loses its magnetism, in what is termed the A_2 change. The body-centred cubic structure exists up to 910° C. when the atoms regroup themselves into a face-centred cubic structure; in this latter structure the atoms are arranged in such a way that one is at each of the eight corners of a cube and one at the centre of each of the six faces of the cube. The structural change at 910° C. is called the A_3 change and the face-centred cubic structure is called γ-iron. Solid solutions in which γ-iron is the solvent are known as austenite, in honour of the British metallurgist Sir William C. Roberts-Austen. The face-centred cubic form is stable up to 1,390° C., at which the atoms regroup into a body-centred cubic structure. This is the A_4 change and the body-centred cubic structure formed is called δ-iron or δ-ferrite.

The final structural change is at 1,539° C. when δ-iron melts. On slow cooling, the reverse changes occur and in order to differentiate between changes on heating and those on cooling, the suffix *c* is used to represent a change during heating (*chauffage*), while the suffix *r* represents a change during cooling (*refroidissement*); thus, the Ac_3 change in iron is α-iron to γ-iron, while the Ar_3 is γ-iron to α-iron.

2. Effect of Carbon Content on Structure.—Only a very small amount of carbon can enter into solid solution with α-iron to form ferrite—0.025% by weight at 723° C., and less at lower temperatures. When a steel has cooled slowly to temperatures below 723° C., the carbon in excess of .025% forms a compound called cementite, Fe_3C. This compound is very hard and brittle, whereas ferrite is soft and tough. A steel containing 1.0% of carbon would, after slow cooling, consist of about six parts of the soft ferrite and one part of the very hard cementite, whereas a steel containing less carbon, say .3%, would contain more ferrite and less cementite. Thus, in slowly cooled steels, the hardness and strength increase with carbon content while the ductility and toughness decrease (*see* fig. 5). For this reason, steels of maximum ductility and toughness are of low-carbon content.

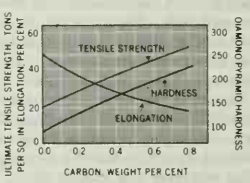


FIG. 5.—MECHANICAL PROPERTIES OF ANNEALED STEELS

Whereas in pure iron the A_3 change (α-iron $\rightleftharpoons$ γ-iron) occurs at 910° C., the addition of increasing amounts of carbon up to .8% decreases the temperature of this change progressively to 723° C. Gamma-iron will hold much more carbon in solid solution, forming austenite, than does ferrite—.8% at 723° C., and the amount increases with rise in temperature to 2.0% at 1,130° C. When the carbon content exceeds that which can enter into solid solution with austenite, the excess forms cementite.

The effects of temperature and carbon content on the structure of slowly cooled steels in the solid state are normally expressed as a diagram, called the "steel-portion of the iron-cementite phase diagram" (fig. 6). This diagram is not a true equilibrium diagram because cementite is not a truly stable phase—on annealing at high temperatures it slowly decomposes to graphite and austenite or to graphite and ferrite, depending on the annealing temperature; however, the diagram is used as the basis for steel heat-treatment because the decomposition of cementite does not normally occur at a sufficient rate to affect steel structures.

In order to illustrate the application of this phase diagram, it is convenient to consider three steels of different carbon contents. At temperature below 723° C., all slowly cooled steels consist of ferrite and cementite, the relative amounts depending on the carbon content.

Considering, first, a steel containing .8% by weight of carbon, the diagram shows that at temperatures above 723° C. the structure consists entirely of austenite. So, when the steel is heated to just above 723° C. (point E, fig. 6) the ferrite changes to austenite and, since this austenite can dissolve .8% of carbon, the cementite disappears. This change is known as the Ac_1 change.

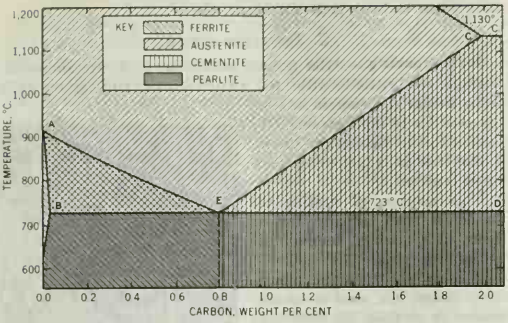


FIG. 6.—STEEL PORTION OF IRON-CEMENTITE DIAGRAM

The austenite crystals thus formed are initially very small, but if heating is continued to some higher temperature, some crystals grow at the expense of others and so the austenite crystal size increases. When this steel is slowly cooled to below 723° C., the austenite decomposes into a mechanical mixture of ferrite and cementite—the Ar_1 change. This type of solid state change where a phase stable at high temperature decomposes on cooling to two or more different phases is called a eutectoid change, and, in the case of carbon steels, can be expressed as:

$$\gamma(0.8\%\ \text{C}) \underset{\text{Ac}_1}{\overset{\text{Ar}_1}{\rightleftharpoons}} \alpha(0.025\%\ \text{C}) + \text{Fe}_3\text{C}\ (6.67\%\ \text{C})$$

The eutectoid mixture of ferrite and cementite consists of alternating platelets of the two phases (lamellar structure, with pearly lustre) and is known as pearlite (fig. 7). The rate and extent of the decomposition and the coarseness of the pearlite structure produced are very much dependent on the rate at which the steel is cooled; this is discussed later.

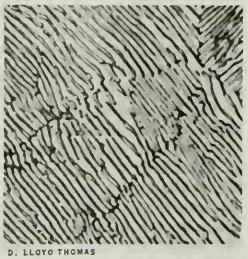


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FIG. 7.—PEARLITE. ×1,000

When a steel of lower carbon content, say .3% by weight, is heated to just above 723° C. (line BE, fig. 6), austenite containing .8% carbon is formed from the cementite and some of the ferrite, while some of the ferrite is not affected; the structure is thus ferrite and austenite. As the temperature is increased, the austenite progressively absorbs the remaining ferrite and this absorption is complete at about 830° C.; *i.e.*, the temperature at which line AE (fig. 6) is equivalent to .3% carbon. The temperature range over which the structure changes from ferrite and cementite to austenite is known as the critical temperature range of the steel. Above the critical range, the steel consists entirely of austenite crystals whose size increases as the temperature is raised. The result of slowly cooling this steel through the critical range is, first, to allow ferrite crystals to form from the austenite. Since the ferrite will hold in solid solution only a very small amount of carbon, the austenite crystals become progressively enriched in carbon until, at about 723° C., they contain .8%. These austenite crystals then decompose to pearlite, so that the slowly cooled structure will consist of ferrite and pearlite (fig. 8). The ferrite crystals grow from the crystal boundaries of the austenite and so the final distribution of ferrite and pearlite will depend on the size of the austenite crystals, which in turn depends primarily on the temperature above the critical range to which the steel has been heated. Thus, if one sample of the steel is heated to 1,100° C. and another to 850° C., on slowly cooling the former will have a much coarser distribution of ferrite and pearlite than the latter, and the former is said to have been overheated. Whereas the hardness and tensile properties of an overheated steel are not appreciably different from those of a steel with a fine structure, the toughness measured on a notched test piece will be inferior to that of the fine-grained steel, and the overheated steel is liable to fracture in a brittle manner at temperatures at or just below those of the normal atmosphere (*see* MATERIALS, STRENGTH OF: *The Problem of Failure*). The overheated condition can be remedied by reheating the steel to just above the critical temperature range and cooling slowly.

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FIG. 8.—FERRITE (LIGHT) AND PEARLITE (DARK AND LAMELLAR). ×600

Heating of a steel containing more than .8% by weight carbon, say 1.2%, results in the ferrite and some cementite changing to austenite of .8% carbon content at just above 723° C.; as the temperature is raised further, the remaining cementite is progressively absorbed by the austenite, whose carbon content is thereby increased, until at temperatures above about 860° C., *i.e.*, the temperature at which line CE (fig. 6) is equivalent to 1.2% carbon, the steel consists entirely of austenite crystals that grow larger with rising temperature. On slowly cooling the steel, cementite begins to separate around the austenite crystals at about 860° C. and the austenite thereby becomes progressively depleted in carbon until at about 723° C. it contains .8%. This austenite then decomposes to pearlite, so that the structure is finally cementite and pearlite. This type of structure is very brittle because the hard cementite, having formed around the austenite crystals, is present as a continuous network. To overcome this, steels containing more than .8% carbon are forged while cooling to about 760° C., so that, as the cementite separates from the austenite, it is broken up and by this means dispersed.

After the steel has been forged this way, it is essential that any subsequent heat-treatment should not involve heating to a temperature above about 760° C.; otherwise the cementite that had been dispersed would dissolve in the austenite and, when the steel is cooled, would separate as an embrittling network.

See also HEAT-TREATMENT.

B. QUENCHED STEELS

1. Carbon Steels.—An eutectoid steel (.8% by weight carbon) when slowly cooled from above 723° C. transforms at a temperature of about 700° C. to a relatively coarse pearlite structure, *i.e.*, the platelets of ferrite and cementite are relatively thick and this structure is quite soft. If the cooling rate is increased, the first effect is that the temperature at which austenite transforms is progressively lowered with increase in cooling rate, to about 550° C.; this results in a refinement of the pearlite structure and an increase in hardness and strength. Thus the heat-treatment process of full annealing, which consists of cooling steel slowly in a furnace from a temperature just above the critical range, produces coarse pearlite, whereas normalizing, in which steel is allowed to cool freely in air, produces finer pearlite and therefore a somewhat harder, stronger but less ductile steel. When the cooling rate is very rapid, *e.g.*, when a small sample is quenched in cold water, the formation of pearlite is partially or completely suppressed and a very hard structure called martensite begins to form from any untransformed austenite at about 200° C.; when the steel has cooled to room temperature, almost all the austenite not transformed to pearlite will have changed to martensite (fig. 9).

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FIG. 9.—MARTENSITE. ×600

The minimum cooling rate that is necessary to produce a martensitic structure, *i.e.*, to suppress completely the formation of pearlite, is termed the critical cooling velocity of the steel and the formation of this martensitic structure is the aim of the heat-treatment process of quench-hardening.

In order to produce a martensitic structure in steels containing less than .8% carbon, and thus to harden them, it is necessary to quench from a temperature above the critical temperature range (usually about 50° C. above) so that both ferrite and pearlite separations are suppressed. Steels containing less than about .2% carbon cannot be readily hardened by quenching because the complete suppression of ferrite is more difficult as the carbon content of the steel decreases.

Furthermore, the hardness of the martensite decreases rapidly with decrease in carbon content, so that the degree of quench-hardening that can be attained in these low carbon steels is low.

When steels containing more than .8% carbon are to be hardened, they are quenched from 760° C., so that the dispersed cementite produced by forging is retained in a matrix of martensite; a mixture of cementite and martensite gives the maximum possible hardness to the steel.

2. The Hardness of Martensite.—Martensite is the product of face-centred cubic austenite with carbon in solution transforming to a body-centred cubic structure without precipitating cementite; *i.e.*, martensite is ferrite supersaturated with carbon. This supersaturation distorts the atomic arrangement from cubic to tetragonal, the distortion and tetragonality increasing with increasing carbon content.

Distortion is also caused by the expansion in volume that occurs when martensite forms and by the peculiar and characteristic mechanism of the transformation. The hardness of martensite is the result of the distortion of the crystal structure and increases rapidly with increase in carbon content (fig. 10).

3. Low-Alloy Steels.—In plain carbon steels, the critical cooling velocity is high, and this imposes severe limitations on the applications of quench-hardening to these steels. Rapid cooling rates introduce differential contraction in a steel component and thus give rise to large-scale distortion and, in severe cases, to cracking.

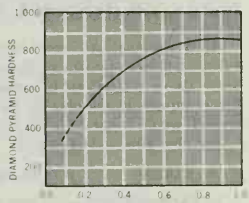

FIG. 10.—HARDNESS OF MARTENSITE

Furthermore, because the rate of cooling in the centre of a large section is appreciably less than in a small section, the thickness of plain carbon steel that can be effectively hardened throughout, even by such a drastic quench as cold water, is restricted to about $\frac{3}{4}$ in.

The addition of alloying elements, such as nickel, chromium, manganese and molybdenum, either singly or in combination, markedly reduces the critical cooling velocity and hence increases the so-called hardenability of steel. The hardness of martensite in plain carbon and in alloy steels is primarily dependent on the carbon content and not on the content of the other alloying elements, but these elements make the production of martensite easier.

By the use of alloying elements, it is thus possible to reduce the rate of cooling and thereby the dangers of large-scale distortion and cracking and, furthermore, much larger sections of steel can be hardened throughout. Thus, whereas in a carbon steel, the maximum section that can be effectively hardened is about $\frac{3}{4}$ in. and that by water quenching, in a typical nickel-chromium-molybdenum steel, sections of up to 6 in. can be hardened by oil quenching. Increased alloy additions can reduce the critical cooling velocity to such an extent that cooling in still air produces hardening; *i.e.*, whereas carbon steels are water-hardened, alloy steels may be oil-hardened or air-hardened. However, the cost of alloy steels is greater than that of carbon steels, the cost increasing with alloy content, and so generally alloy steels are used only when carbon steels are unsuitable.

C. Tempered Steels

1. Tempering.—After quench-hardening, steels are almost invariably too brittle to withstand service stresses and carbon steels in particular also contain internal stresses due to rapid cooling. To reduce the brittleness and the internal stresses, a tempering treatment is given.

D. LLOYD THOMAS
FIG. 11.—TEMPERED MARTENSITE. ×1,000

This consists of heating the hardened steel, usually for an hour, at a selected temperature within the range 200°–680° C., *i.e.*, below the critical temperature range; the steel is usually cooled in air from the tempering temperature.

Tempering results in the decomposition of martensite to ferrite and cementite, the extent of the decomposition increasing with tempering temperature up to about 400° C. Thus, whereas in martensite the carbon atoms are in enforced solid solution, in tempered martensite the carbon forms separate particles of the hard cementite compound, these particles being embedded in a soft and tough matrix of ferrite. The cementite particles are extremely small, their size increasing with increase of tempering temperature, but even those formed on tempering at 600° C. are only just resolved with an optical microscope at a magnification of 1,000 (fig. 11). Although tempering results in a loss of hardness and strength, the combinations of strength and toughness attainable by hardening and tempering are the best that can be produced in a steel. The structural reason for this is that whereas in annealed or normalized steels the cementite is present in pearlite as platelets that are to some extent embrittling, in hardened and tempered steels the cementite particles are much more finely dispersed and thus impart strength without brittleness.

The selection of tempering temperature controls the combination of hardness and strength on the one hand with toughness on the other: the higher the tempering temperature up to a maximum of about 680° C. the lower are the hardness and strength but the higher the toughness (fig. 12). Thus, in tool steels, the purpose of tempering is to relieve internal stresses without decreasing appreciably the hardness, and so tempering is usually done within the range 200°–250° C.; steel springs are tempered at 350°–500° C., whereas steels of medium-carbon content that have to withstand high stresses in service would generally be tempered at 550°–650° C. in order to develop the best toughness together with strength.

Alloy additions, such as nickel and chromium, as well as increasing the hardenability of steels, also confer better mechanical properties in the hardened and tempered condition, primarily because the additions strengthen the ferrite matrix. Thus, if a carbon steel and a nickel-chromium steel were treated to give the same strength, the nickel-chromium steel would have greater toughness than the carbon steel.

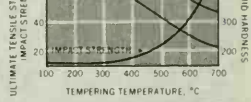

FIG. 12.—EFFECTS OF TEMPERING TEMPERATURE ON MECHANICAL PROPERTIES

In highly alloyed steels, the softening caused by tempering may be appreciably less than in carbon or low-alloy steels. This quality is utilized in high-speed tool steels which are hardened by quenching from very high temperatures, *e.g.*, 1,300° C., and tempered at 550°–600° C.; the tempering results in very little softening and in some cases the hardness increases—this is termed secondary hardening. The resistance to softening of these steels is of value when high temperatures are developed in service, such as in machine tools operating at high cutting speeds.

2. Temper Brittleness.—Whereas it is generally true that the higher the tempering temperature up to about 680° C. the tougher the steel, this is not invariably so. Certain steels, particularly those containing high proportions of chromium, manganese or phosphorus, become brittle if tempered within the range 400°–550° C. or if tempered at higher temperatures than these and slowly cooled; this is termed temper brittleness.

It may be avoided in steels that are susceptible by tempering at temperatures about 550° C. and quenching from the tempering temperature; additions of molybdenum markedly reduce the susceptibility of a steel to temper brittleness.

D. Surface Hardening

Service conditions frequently call for a steel with a hard, wear-resistant surface and yet for the component as a whole to be tough and resistant to shock and dynamic loading. Since both high hardness and toughness cannot be obtained from steel in a given condition, methods have been developed of imparting a hard surface or "case" without impairing the toughness of the main mass or "core." There are four principal methods.

1. Carburizing.—The component is made from a low-carbon steel, with or without alloying additions; the lower the carbon content the greater the toughness attainable. The component is then heated at about 900° C. in a carburizing atmosphere so that carbon diffuses into the steel; the depth of carbon penetration is dependent on the nature of the carburizing atmosphere, the temperature and the time of heating. After this treatment, the "case" usually contains about .8% by weight carbon, whereas the carbon content of the "core" is virtually unaltered. After carburizing, the "case" is hardened either by quenching the steel from the carburizing temperature or, better still, by heating the steel to about 760° C. and quenching. The structure of the "case" then becomes martensite of about 0.8% by weight carbon, *i.e.*, very hard, whereas the "core" is essentially ferrite and therefore tough.

2. Flame and Induction Hardening.—The component is made from a medium-carbon steel, with or without alloying additions, and is hardened and tempered in order to develop the optimum strength and toughness properties. The surface of the component is then rapidly heated to above the critical temperature range by means of either an oxyacetylene flame or high-frequency induction and, after a period varying from a second to a few minutes, the component is water-quenched. It is essential that only a thin skin or "case" is heated to above the Ac_1 temperature so that the properties of the "core" remain unaffected. On quenching the "case" becomes martensitic and hard.

3. Nitriding.—The two methods described above produce surfaces that are hard provided the temperatures developed during service do not exceed about 200° C.; at higher temperatures the martensitic "case" tempers and thereby becomes softer and less resistant to wear. Nitriding produces a thin but very hard "case" whose hardness is retained up to about 500° C. The components are made from steels of medium-carbon content and containing small amounts of aluminum, chromium and molybdenum. They are hardened and tempered at 550°–650° C. to develop the "core" properties and then heated for about 80 hours at about 500° C. in an atmosphere of ammonia. The ammonia partially dissociates into nitrogen and hydrogen; the nitrogen diffuses into the steel and, by forming compounds particularly with aluminum and chromium, gives rise to a very high hardness at and near the surface. The depth of the hard "case" increases with the duration of the nitriding treatment.

4. Hadfield's Manganese Steel.—The above three methods produce surface hardening only to a limited depth and so prolonged abrasion will wear away the "case." Castings made from steel containing about 14% by weight manganese and 1.4% by weight carbon, when quenched in oil from about 1,000° C., are extremely tough. Under the action of abrasive wear, the surface becomes extremely hard and this process of abrasion hardening is continuous so that in effect the "case" is never worn through (*see* Manganese Steel).

Other methods of surface hardening include "hard facing," *i.e.*, welding or brazing onto the steel component a very hard material like stellite, an alloy containing carbon, chromium, cobalt and tungsten, or tungsten carbide.

See also Surface Hardening. (D. L. T.)

XIV. SURVEY OF PRODUCTION

In tracing the development of the world's iron and steel output it is customary to commence with Great Britain, for although the output of pig iron in Great Britain in the second half of the 20th century was less than 10% of the world's total, and about the same in steel, nevertheless Great Britain was the birthplace of the modern iron and steel industry, and many of the developments connected with the industry originated there. Until 1871 the output of pig iron in Great Britain exceeded that of all other countries put together; in 1890 Great Britain was for the first time surpassed by the United States: in 1904 for the first time by Germany and in 1921—because of a coal stoppage—for the first time by France. In 1931 the output of the U.S.S.R. exceeded Great Britain for the first time.

According to Mushet, the output of pig iron in Great Britain in 1720 was 17,350 tons, but T. S. Ashton, in his *Iron and Steel in the Industrial Revolution*, gives reasons for thinking this too low, preferring the estimate of William Rea, an ironmaster of Monmouth, who put the output of pig iron at this period at about 25,000 tons per annum; he also points out that Scrivener's *History* (p. 57) wrongly gives 1740 as the date of Mushet's estimate, an error that has been followed by many later writers. The 25,000 tons produced in 1720 had risen to 68,300 tons by 1788; but, whereas the majority of the furnaces in 1720 had been charcoal, 55 in 1788 were coke furnaces. It is not possible to assess the effects of improvements in blast furnaces upon the demand for iron, nor of the demand for iron (created by engineering inventions) upon blast-furnace improvements; suffice it to say that by 1840 production of pig iron had risen to 1,396,000 tons; by 1860 to 3,890,000 tons; and by 1880 to 7,750,000 tons. Having nearly trebled in the 20 years between 1840 and 1860 and doubled between 1860 and 1880, the increase between 1880 and 1900 was no more than 16%. In the next several decades production of pig iron in Great Britain lagged, but by the second half of the 20th century it had increased to more than 10,000,000 tons.

It was not until the development of the pneumatic (Bessemer) converter in 1856 that the production of steel at relatively low prices was made possible. This was followed by the discovery of the open-hearth process by Siemens Brothers in 1864–67. Between 1877 and 1883 another obstacle to low-cost production of high-grade steel was removed through the perfection by Thomas and Gilchrest of a technique for removing phosphorus from steel during the processing period. The influence of these improvements on steel production is indicated by the rapid expansion of output in Great Britain. From 220,000 tons in 1870, it had grown to 4,900,000 tons by 1900 and by 1920 it had almost doubled again. Shortly after World War II, steel production was around 15,000,000 tons a year, or three times larger than at the beginning of the 20th century, and by 1960 it had reached almost 25,000,000 tons.

It is impossible to trace, even in this broad outline, the progress of development in the other iron and steel producing countries. In all cases, except where the industry is of comparatively late growth, iron was first smelted with charcoal, and coke but slowly won its way; *e.g.*, mineral fuel was first used in France in 1782, but by 1819 only two furnaces out of a total of 350 were using coke (*Memoirs of the Geological Survey of Great Britain*, vol. i, pt. 1, 1856, quoted by Ashton): but in all countries the great bulk of the steel output is made by the open-hearth process, which, after its discovery, rapidly supplanted the pneumatic converter process because of its economy and regularity of operation.

In 1880 open-hearth production in Great Britain accounted for about 20% of the total output, but by the second half of the 20th century it was almost 100%.

1. Pig Iron.—It will be seen from Table VI that in the 100 years ended in 1910, the average increase in world production of pig iron in any decade was 60%, while because of the dislocation caused by World War I, a loss of 3% was experienced in the ten years ended in 1920. However, in the decade ended in 1930,

the upward trend was resumed with increases of 26% and 29% each in the next two decades. A contributory cause of the slow growth after 1910 was that following World War I a greater proportion of steel scrap was used in steelmaking. Pig iron production, however, exceeded 100,000,000 tons in 1940 and reached an all-time peak during World War II (115,900,000 tons in 1943), after which it declined, as it had after World War I, and again increased, exceeding 200,000,000 tons by 1955 and 250,000,000 tons by 1960.

2. Steel.—Although output of pig iron in Great Britain reached a record of more than 10,260,000 tons in 1913 and never recovered completely from its subsequent decline, output of steel surpassed the production of pig iron frequently and by wide margins. By 1950 output of steel was nearly twice as large as in 1913. This high postwar level made Great Britain the first country among major world producers to exceed its highest annual output of the

TABLE VI.—*World Output of Pig Iron at the End of Each Decade, 1820 to 1920 and Certain Years From 1920 to 1960*

Year	Output (tons)	Year	Output (tons)
1820	1,000,000	1925	75,690,000
1830	1,800,000	1929	97,410,000
1840	2,700,000	1930	79,240,000
1850	4,700,000	1935	73,130,000
1860	7,220,000	1940	102,400,000
1870	11,840,000	1943	115,900,000*
1880	18,160,000	1945	79,300,000
1890	26,750,000	1950	134,000,000
1900	39,810,000	1955	212,200,000
1910	64,760,000	1960	260,000,000†
1920	62,850,000		

*U.S. Bureau of Mines, *Minerals Yearbook*. †Estimate.

war period. Production in the United States, after a severe slump in the decade prior to World War II, climbed swiftly to new heights during the war, exceeding 100,000,000 tons in the 1950s. Near the end of the war and immediately following, with output greatly reduced in most of Europe, the United States was called on to produce more than half the world's annual output of steel.

At the end of the war, world production of both pig iron and steel slumped from the record levels that had been attained. By the 1950s, however, production had recovered, exceeding prewar levels.

3. Iron and Steel Exports.—Annual exports of iron and steel from Great Britain and Belgium-Luxembourg shortly after World War II showed little change from the exports immediately preceding the war. Exports from the United States were several times larger than prior to the war. After World War II, during which the great bulk of iron and steel produced was immediately consumed, it was clear that the potential demand for iron and steel was considerable, but in the early postwar years most countries were too impoverished to make that demand effective, while most belligerent countries who before the war supplied capital for development were no longer able to do so on the same scale.

After World War I, France acquired Alsace and Lorraine from Germany. French production of iron and steel was greatly increased, leading to stronger competition in Europe. The German iron and steel industry, in second place among world producers between the two wars, underwent violent changes in the two wars. Recovery in the German Federal Republic (West Germany) was rapid and that country regained third place before 1960.

The increase in production in the U.S.S.R. of both pig iron and steel after 1925 had probably never been equaled. In 1925 output of pig iron was 1,300,000 tons, while in 1939 it was 15,000,000 tons, an increase of more than 1,100%. Steel production in 1925 amounted to 1,840,000 tons, but by 1939 it had expanded to nearly 23,000,000 tons, a gain of more than 1,200%. Thus, in 14 years the U.S.S.R. rose from sixth in importance among world producers to a position of nearly a tie for second place behind the United States. After World War II, production was increased progressively, exceeding Germany's prewar totals and placing the U.S.S.R. firmly in second place.

4. U.S. Production.—The output of pig iron in the United States, the world's largest producer since 1897, was 30,966,000 tons in 1913 and of steel ingots 31,301,000 tons. The enormous contracts for munitions, machine tools, etc., placed by the Allies during World War I, as well as the demands for equipping its own army, necessitated the extension of existing iron and steel plants and the erection of new ones. After the war, the great increase in capacity was absorbed by the growing internal demand and by 1937 output of pig iron was 37,130,000 tons and of steel 50,570,000 tons. These tonnages, somewhat less than in 1929, but the highest in the 1930s, were far surpassed during World War II and the postwar years. Continued expansion after that war placed steel capacity in the United States four times larger than at the beginning of the century.

With the development of alloy steels, which greatly widened the field of steel consumption, together with such refinements in production as the continuous sheet and strip mill which acted to lower greatly the cost of steel, the saturation point of steel consumption seemed as far away at mid-20th century as it was when the pneumatic converter was invented. However, plastics, and new processes for producing and fabricating such nonferrous metals as aluminum, magnesium, copper and zinc alloy die castings, constituted a challenge to the steel industry's position. Yet, on the other hand, steel had supplanted wood on a large scale for such applications as small home building, interior constructions, etc., which might counterbalance the effects of the greater use of plastics, etc. It might be reasonably assumed that the low cost of steel would for a long time support its position as the basic material of the modern world. This position apparently was more assured with huge new iron mining developments following World War II.

See also references under "Iron and Steel Industry" in the Index.

(W. A. PH.; W. S. To.)

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(E. E. T.; R. E. GE.)

IRONBARK, the name applied to certain species of *Eucalyptus* (*q.v.*) in Australia, from the hardness of the bark.

IRONCLAD, a naval term that came into use in the middle of the 19th century to denote a warship whose hull was protected by iron plates. Most of the earliest ironclads carried iron plates about 4½-in. thick, mounted on either a wooden hull or an iron hull. French and British ironclad floating batteries proved their value in the Crimean War (1854–56) and led the French to build the "Gloire," the first seagoing ironclad in 1859 and the British to build the "Warrior" in 1861. The first duel between ironclads occurred during the American Civil War (*see* "MONITOR" AND "MERRIMACK," BATTLE OF) and attracted world-wide attention. Before the end of the century iron plates gave way to steel and the term "ironclad" gave way to "battleship" (*q.v.*).

IRON CURTAIN, a term that came into popular use after World War II to denote the Soviet Union's efforts to seal off itself and its eastern European satellites from normal contacts with western Europe and other noncommunist areas. The term was used by Winston Churchill, Britain's wartime prime minister, in an address at Westminster college, Fulton, Mo., on March 5, 1946, when he declared that the U.S.S.R. had rung down an "iron curtain" across eastern Europe. The term so aptly described the conditions that existed after World War II, when the wartime

Allies split apart in an atmosphere of mutual distrust, that it soon gained widespread currency. When the People's Republic of China adopted a similar policy of exclusiveness in 1949 the term "bamboo curtain" was used to distinguish the Chinese policy from its Soviet counterpart. *See* EUROPE: *History: Communism and Europe.*

IRON GATE (EISERN TOR): *see* DANUBE.

IRON MASK. The identity of "the Man in the Iron Mask"—in fact a man in a velvet mask—remains one of the most famous enigmas of French history. During the latter decades of Louis XIV's reign this political prisoner was kept in captivity first at Pinerolo (Pignerol) in Piedmont, Italy, later in the fortress in the Îles Ste. Marguerite and finally in the Bastille, in Paris, where he arrived on Sept. 18, 1698, and where he died on Nov. 19, 1703. He was buried in the church of St. Paul (the parish church for the Bastille) and entered in its register under the name "Marchioly." Mystery and legend surrounded this man even in his lifetime: his jailer, the sieur de Saint-Mars (Bénigne d'Auvergne), a faithful servant of the marquis de Louvois, himself spoke of the "fairy tales" which were circulating on the subject. Many solutions to this mystery, some fantastic, have been attempted.

During the 18th century various suggestions as to the man's identity were made: in 1711, an English nobleman; in 1745, Louis de Bourbon, comte de Vermandois, a son of Louis XIV and Louise de La Vallière; between 1738 and 1771, an elder half brother of Louis XIV (Voltaire gradually launched this unlikely solution, which was later taken up by Alexandre Dumas in *Dix ans plus tard, ou le vicomte de Bragelonne,* translated into English as *The Man in the Iron Mask,* and it was Voltaire who first wrote of "a mask with springs of steel," instead of a simple velvet one); in 1768, François de Vendôme, duc de Beaufort (*q.v.*); in 1768 likewise, James, duke of Monmouth (*q.v.*); in 1770, Ercole Matthioli (*see* below); in 1789, Louis XIV's finance minister, Nicolas Fouquet (*q.v.*); and in 1790, the Armenian patriarch Avedick, kidnapped from Constantinople by the French ambassador Charles de Ferriol. The 19th- and 20th-century solutions include Louis, chevalier de Rohan (1869); an adventurer and spy from Lorraine called Oldendorf proposed by A. Jung (1872); Molière, imprisoned by the Jesuits in revenge for *Tartuffe* (1883); Eustache Dauger (*see* below; first proposed by J. Lair in 1890); Gen. V. L. de Bullonde, arrested by Louis XIV for his retreat from the siege of Cuneo (1893); a Jacobin monk (1893); the *abbé* Pregnani, involved in the religious affairs of Charles II of England (1908); Eustache d'Oger de Cavoye, a dissolute young man of the period 1659–65 (1932); and Marc de Jarrige de la Morelhie, the son-in-law of the physician who supposedly proved Louis XIII's impotence at his autopsy (1934). Consultation of the authentic documents in the archives of the Bastille, of the French foreign office and of the ministry of war shows that only two of these hypotheses are tenable: Matthioli and Eustache Dauger.

Matthioli, a minister of Ferdinand Charles, duke of Mantua, had been entrusted with the secret negotiation of the treaty of 1678 whereby the impoverished duke was to deliver the stronghold of Casale over to France in return for 100,000 *écus;* but as soon as the agreement was signed, he nullified its effect by betraying the secret to several foreign courts. Furious at having been tricked, Louis XIV had him quietly abducted by Gen. N. Catinat and imprisoned at Pinerolo (1679). It is generally agreed, however, that Matthioli died in the Îles Ste. Marguerite in April 1694, and that the prisoner in the mask was Eustache Dauger.

The correspondence of Louvois indicates that Dauger was only a valet who was arrested on his orders for an unknown reason near Dunkerque in July 1669. At Pinerolo this Dauger served as Fouquet's valet, and after Fouquet's death (1680) he was kept in close confinement with another man who had also served Fouquet. From Pinerolo, Saint-Mars took him in 1681 to Exiles (whereas Matthioli then stayed behind), before moving to the Îles in 1687. It is possible that both Louvois and Colbert, enemies of Fouquet, wanted these prisoners kept in custody, lest they should divulge secrets that Fouquet could have told them.

Perhaps this consideration, rather more than his original crime, explains the absolute secrecy to which Dauger was condemned and the precaution of the mask. Numerous conjectures have been made about his first crime, which no documents mention. His arrest at Dunkerque in the summer of 1669 raises the possibility that he may have been concerned in the secret negotiations which led to the treaty of Dover (*q.v.*) between England and France. On the other hand, some think that Dauger had been involved in a scandal incriminating some great family. If it be granted that Matthioli died in 1694, the enigma can be regarded as solved insofar as the identity of the prisoner is concerned; the reason for his arrest and imprisonment for 34 years remains a mystery.

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IRONMONGERY: *see* HARDWARE.

IRON MOUNTAIN, a city of Michigan, U.S., the seat of Dickinson county, adjoining the city of Kingsford, is just north of the Menominee river, which separates the upper peninsula of Michigan from Wisconsin. Iron Mountain, the commercial centre of the county, was settled as a mining community in 1879 and incorporated in 1889. It was so named because of its proximity to a bluff heavily stratified with iron ore. Mining continued to be important in the economy until the 1930s, when ore deposits were virtually exhausted. Kingsford was incorporated as a village in 1925 as an outgrowth of Ford Motor company operations; it was incorporated as a city in 1947.

The Iron Mountain-Kingsford area is studded with small plants that manufacture metal parts; electric controls; chemicals; furniture, paper and other wood products; and wearing apparel. A large ski slide, on which the world's foremost skiers have jumped distances over 300 ft., is but one of many tourist attractions. Iron Mountain is also the home of a large veterans' administration hospital. For comparative population figures for both cities *see* table in MICHIGAN: *Population.* (R. F. O'D.)

IRONSTONE, referring in the past to certain iron carbonate deposits, notably the clay ironstone concretions, this term later came to mean an iron-bearing formation. Iron, the fourth most abundant element in the earth's crust, occurs in nearly all rocks, the iron content varying from nil to several per cent. In some sedimentary strata it exceeds 15%; such rocks are called an iron-bearing formation, an iron formation or ironstone.

Ironstones are sedimentary deposits of varied composition. They may be iron sulfides (pyrite), iron carbonate (siderite), iron silicates (chamoisite, greenalite, etc.) and iron oxides (hematite, etc.). These materials are generally mixed with silica (commonly chert), clay, etc., and form strata of ironstone.

Among the best-known ironstones are those of Pre-Cambrian Age in the Lake Superior region. These average 25% iron but in places are enriched and constitute iron ores. Since their discovery they have yielded about 2,000,000,000 tons of ore (50% or more iron). Silurian ferric oxide ironstones occur in the Appalachian region and are mined in the Birmingham district of Alabama.

Ironstones were precipitated in marine waters, in lakes and in swamps ("bog ore"). Their mineralogy is dependent on the oxidizing potential of the environment.

See F. J. Pettijohn, *Sedimentary Rocks,* pp. 449–467 (1957). (F. J. P.)

IRONWOOD, a name applied to many hard and heavy woods or to the trees that produce them. Certain ironwoods, e.g., *Krugiodendron, Olneya,* sink in water. Many are very difficult to work and so require the use of machine tools rather than hand labour. Among the ironwoods of the United States, the most widely distributed are *Ostrya virginiana,* also called hop hornbeam, and *Carpinus caroliniana,* also called hornbeam and blue beech (*see* HORNBEAM). These trees, members of the birch family, range over eastern United States and adjacent Canada. Their wood is used for fuel, levers, fence posts and tool handles. Ironwoods of more southerly distribution in North America include desert ironwood (*Olneya tesota*) of southwestern United States and adjacent Mexico. Its wood makes excellent fuel and is used for novelties. Black ironwood (*Krugiodendron ferreum*), one of the world's densest woods (specific gravity 1.34–1.42), is native to southeastern United States, southern Mexico, British

Honduras and the West Indies. Ironwoods of somewhat similar distribution are those derived from *Cyrilla racemiflora*, also called leatherwood; from species of *Jacquinia*, also called joewood; and from *Exothea paniculata*, known in Florida as butterbough or inkwood. Catalina ironwood in the California coastal islands is *Lyonothamnus floribundus*. *Reynosia septentrionalis*, found in Florida and the Bahamas, is known as red ironwood. The durable wood of *Hypelate trifoliata*, white ironwood, is used in Florida for fence posts.

Woods known as ironwood in Jamaica include *Sloanea jamaicensis* and *Turpinia paniculata*, neither of commercial importance. The useful timber of *Dialium guianense* is called ironwood in British Honduras. Asiatic ironwoods include *Xylia dolabriformis* and *Mesua ferrea*, valuable timber trees. Among Australian trees that may be known as ironwood are scrub ironwood (*Myrtus acmenoides*); lemon ironwood (*Backhousia citriodora*); giant ironwood (*Syncarpia subargentea*); species of *Geijera*, also called axe-breaker; and *Notelaea ligustrina*, also called silkwood. Uganda ironwood (*Cynometra alexandri*), of Uganda and the Congo, and black ironwood (*Olea laurifolia*), of South Africa, are used for heavy construction. One of the most durable timbers of west tropical Africa is ekki, red or west African ironwood (*Lophira procera* var. *alata*). (J. W. Tt.)

IRONWORK, in this article refers to all objects made in iron with the exception of armour and weapons (for which *see* Armour, Body; Helmet; Sword; etc.), but special emphasis has been given to the use of iron in the exterior or interior decoration of buildings. This article begins with a brief over-all view of the history of ironwork, followed by surveys of the history of ironwork in various countries: India and southeast Asia, China, Japan, the major countries of Europe, and the United States. The article concludes with a section on the techniques of wrought iron and cast iron. *See* also Metalwork, Decorative.

HISTORY

The earliest recorded iron artifacts are some beads, dating from about 3500 B.C. or earlier, found at Gerzah in Egypt. They are made from meteoric iron, as are a number of other objects of only slightly later date that have been found both in Egypt and Mesopotamia. The earliest known examples of the use of smelted iron are the fragments of a dagger blade in a bronze hilt, dating from the 28th century B.C., found at Tell Asmar in Mesopotamia and some pieces of iron from Tell Chagar Bazar, in the same area, of approximately the same date. There is, however, no evidence of any extensive use of iron in either Egypt or Mesopotamia before the end of the second millennium B.C. In Asia Minor, on the other hand, iron was probably used regularly from at least as early as 2000 B.C. and it seems likely that the first true iron industry was established there in the second half of the second millennium B.C.

From the ancient east the knowledge of ironworking was transmitted to Greece and the Aegean, probably at the beginning of the first millennium B.C., whence it spread gradually to the rest of Europe. By the 6th century B.C. it had been widely disseminated over central and western Europe.

Iron was at first apparently regarded as a precious, semimagical material, presumably because of its rarity and its connection with meteorites. But once it had become common, as a result of the spread of knowledge of the technique of smelting ore, it seems to have been used, at least in Europe, almost exclusively for objects of utility. A few Belgic firedogs and at least one amphora stand skilfully forged in iron with decorative terminals in the form of animal heads are known, but the practice of forging iron into decorative shapes does not seem to have become general until the middle ages.

A few cast-iron objects dating from classical times have been found in Europe. The extreme rarity of these, however, suggests that they were only produced experimentally. The earliest known evidence for the general use of cast iron comes from China (*see* below) and it does not seem to have been produced regularly in Europe before the 15th century. From the second half of that century onward it was used widely for the manufacture of ordnance, utensils, firebacks and stove plates, the last two usually decorated with designs in relief. The development in Britain during the 18th century of the puddling process and the cupola furnace made possible the production of larger quantities of better-quality cast iron and during the second half of the century it was used increasingly in architectural work, notably for decorative railings, grates, etc. By the early 19th century cast iron had become the most widely used of all metals, remaining so until the second quarter of the 20th century. (C. Bl.)

Asia

India and Southeast Asia.—The manufacture of iron and steel by primitive small-scale methods has survived in southern India and Ceylon to the present day. The iron is smelted directly from the ore, and true carbon steel of high quality is made by melting the iron with a small proportion of green wood in a clay crucible heated to a high temperature. The slag heaps of ancient furnaces are common and the processes have probably been in use for more than 2,000 years, but it is unknown whether they are of indigenous invention or acquired. In southern India iron immediately succeeded stone as a material for tools and weapons, and prehistoric iron weapons began to come into use about 500 B.C. Alexander received a gift of Indian steel from the Punjab chiefs; steel dating from the 2nd century B.C. has been found at Besnagar and in Ceylon, and tempered steel is referred to in the *Ummagga Jataka*. Buddhist begging bowls are generally made of iron. The wrought-iron pillar of Delhi, set up about A.D. 400 by Kumaragupta I in honour of his father, is over 23 ft. in height and weighs more than 6 tons; it demonstrates the abilities of Indian metalworkers in handling large masses of material, for not until the latter part of the 19th century could anything of the same kind have been made in Europe. There are other large iron pillars at Dhar and at Mt. Abu. (*See* also Indian Art; Indonesian Archaeology and Art.) (A. K. C.)

China.—Iron began to take its place in the brilliant Bronze Age culture of China during the Ch'in dynasty (221–207 B.C.) and the early Han dynasty (202 B.C.–A.D. 221). By the end of the 2nd century A.D. bronze weapons had been almost completely supplanted, while iron had been generally substituted for bronze in common use in utensils and vessels of various kinds, tools, chariot fittings and even small pieces of sculpture. These were commonly cast in sand molds, were patterned after bronze prototypes and were typical in style and decoration of the Han period.

From the 9th century iron increasingly took the place of bronze in China as a material for sculpture, especially in the north and under the Sung dynasty. The few extant examples from the 11th century and later show work done on a larger scale and in coarser technique than the bronzes, though the modeling is usually more naturalistic.

Several iron pagodas, ranging in size from miniature models to towers 30 or more metres in height, and dating from the 10th to the 14th century, give further evidence of the dexterity of the Chinese iron caster. These imitate in detail both the structural and decorative effects of the more common tile-roofed brick pagodas. Iron for temple furniture has long been in use, and a large number of the braziers, censers, caldrons and bells found today in the temples are of iron.

In China in the 17th century the iron picture was developed, the craftsmen seeking to reproduce in permanent form through the medium of wrought iron the effects of the popular ink sketches of the master painters. When completed, these pictorial compositions were mounted in windows, in lanterns or in frames as pictures. When in the latter form a paper or silk background often bore the signature and seal of the maker, heightening the resemblance to a painting. The craft flourished in Anhwei province and is still practised, though with less patience and fineness than formerly.

Japan.—The Iron Age in Japan is supposed to have begun in the 2nd century B.C., though the chief early remains are weapons from the dolmens of the 2nd to the 8th centuries A.D. The Japanese iron founder attained a considerable skill at an early date and acquired a social position which was never attained by the bronze caster, or by the ironworkers in China where the Bronze Age tra-

dition was much stronger. It is apparent that iron was used in China chiefly as a substitute or imitative medium, worked often with great skill but with little artistic invention. In Japan, however, the ironworker developed a distinctive and original means of expression and high artistic attainment in furniture for the sword. With the rise of feudalism and the establishment of the samurai class after the wars of the 12th century, the equipment of the warriors became an object for the efforts of the artist.

At first these efforts were devoted to the embellishment of defensive armour, but from the 15th century the sword became the centre of attention. The blade is not properly part of the subject of this article, but in the mountings, especially the guards (tsuba), is found exquisite artistry expressed chiefly in iron. A remarkably soft and pure variety of the metal especially free from sulfur was employed. It was worked by casting, hammering and chiseling; and innumerable surface effects were obtained by tooling, inlaying, incrustation, combination with other metals and patination by various, usually secret, processes. Simple conventional patterns, crests and pictorial designs were the bases for the decoration. As these were often furnished by painters or designers the criterion of connoisseurship in Japan is the unsurpassed technical quality of the handling of the iron itself. With the promulgation of the edict of 1876, prohibiting the wearing of swords, this art came to an end, but the skill of the Japanese ironworker may still be noted in numerous small decorative objects. (B. Mar.)

Europe

Belgium and Holland.—The ironwork of these two small countries prior to the 15th century was in no way inferior to that produced elsewhere. Yet so few pieces remain that the significance of craftsmen of the Low Countries has often been underestimated. During the 15th century design and craftsmen from the Low Countries began to make their influence evident across the channel in England. The outstanding craftsmen were of the Massys family of Louvain. Representative examples of this period are in the great church at Breda; the treasury door of the cathedral and some presses in the church of St. James, both at Liége; and hinges of the church of Notre Dame, Hal. The beautiful spires of Bruges, Ghent and Antwerp should also be mentioned.

During the first half of the 16th century, before the Spanish occupation, there were diversified forms of ironwork, such as protective grilles for doors, windows and chapels, often in fleur-de-lis patterns; window gratings of vertical bars, frequently octagonal in section; and interlacing bars, producing rectangular or lozenge-shaped patterns. Only a few examples still exist; *e.g.*, some lunettes in the *hôtel de ville* of Brussels; a tabernacle grille from the chapel of the counts of Flanders and a window grille from St. Bavon, both from Ghent and now in the Victoria and Albert museum, London; and hinges at the *hôtels de ville* of Bruges and Ypres. Few Renaissance screens have survived.

During the second half of the 16th century the cruelty of the duke of Alba and his 20,000 troops, together with the threat of the Inquisition, drove hundreds of artisans to England. After the Spanish domination there was little indigenous design in Holland and Belgium, and such ironwork as was produced fell under the spell of French importations. (G. K. G.)

2. England.—The initial use of wrought iron was purely protective because violent attacks were frequent, and doors had to be strengthened with massive ironwork inside and out. Window openings, especially those of the treasuries of mansions and cathedrals, were for similar reasons filled with strong interlacing bars of solid iron; a good example remains at Canterbury cathedral. When in course of time the need for protective barriers ended, there came greater freedom of work and a definite ornamentation. Throughout England, medieval church doors are found with massive iron hinges, the bands worked in rich ornamental designs of scrollwork, varying from the plain hinge band with crescent, to the most elaborate filling of the door. Examples exist at Skipwith and Stillingfleet in Yorkshire, many in the eastern counties, others in Gloucester, Somerset and the west Midlands. The next important application of ironwork came with the erection of the great cathedrals and churches, whose shrines and treasures demanded protection. Winchester cathedral possesses the remains of one screen with a symmetrical arrangement of scrollwork. The grille above the tomb of Queen Eleanor at Westminster abbey recalls Thomas de Leghtone, a master craftsman in iron who had succeeded another great smith, Henry of Lewes. Tombs were enclosed within railings of vertical bars with ornamental finials at intervals, such as that of the Black Prince at Canterbury. A new development appeared in the early years of the 15th century when the smith, working in cold iron, attempted to reproduce Gothic stone tracery in metal. This work was more like that of a woodworker than of a smith, often consisting of small pieces of iron chiseled and riveted, and fixed on a background of sheet iron. Many small objects such as door knockers, handles and escutcheons are to be found executed in the same manner. A typical monumental example is in Henry V's chantry at Westminster abbey, but the most magnificent is the great grille at St. George's chapel, Windsor, made to protect the tomb of Edward IV. It was executed by an Englishman, John Tresilian.

Smithing declined in England during the 16th century. The development of the art during the Renaissance period was very uneven in the various countries of Europe. In England the smith fell behind and seemed to have lost interest, producing no very great or important work. He continued to make iron railings, balconies and small objects for architectural application, such as hinges, latches, locks and weathercocks. But toward the end of the 17th century, there was a growing interest in beautifying houses and laying out gardens and squares with a commensurate demand for balconies, staircases and garden gates. The man to whom the credit is usually given for the revival of ironwork in England was Jean Tijou, a Frenchman who, together with many of his Protestant fellow craftsmen, had been forced to leave his country owing to the revocation of the Edict of Nantes in 1685. After some years in the Netherlands he went to England in 1689 where he enjoyed the patronage and favour of William III. His most important works for his royal patron are to be seen in the immense mass of screens and gates with which he embellished Hampton Court palace. He also executed work at Burleigh house, Stamford. Probably by the queen's wish he was associated with Sir Christopher Wren, then engaged on the rebuilding of St. Paul's cathedral. Wren apparently did not particularly like ironwork and probably exercised some restraint on Tijou, with the result that his work at St. Paul's is more dignified and freer from appendages than that at Hampton Court.

A great amount of fine ironwork of the 18th century may be studied in London in the form of gates, railings, lamp holders, door brackets, balconies, staircases; in almost every suburb may be seen gates and brackets. The precincts of the colleges of Oxford and Cambridge, as well as almost every old town in England, furnish a variety of handsome work. Throughout the 18th century the smith was a busy man; the general tendency of his work, unaffected by the rococo movement on the continent, was toward a less ornate but more characteristically English style, Perpendicular, severe, lofty and commanding, as contrasted with Tijou's French love of richness and mass of details.

At the end of the 18th century the work of the architect brothers Adam shows a departure from true smithing; its slender delicate bars are enriched with rosettes, anthemion and other ornament in brass or lead. The effect is pleasing and harmonizes with the architecture with which it is incorporated.

During the first half of the 19th century the art of the smith was largely eclipsed by that of the iron caster. But under the stimulus of the Victorian gothic revival and later of the *art nouveau* movement there was a renewal of interest in the decorative use of wrought iron and much excellent work was produced.

France.—Medieval door-hinge ornaments were not basically different from those in England, and beautiful work is found on church doors, especially in central and northern France. It reaches a height of greater elaboration and magnificence than in England, the culminating example being the west doors of Notre Dame, Paris, the ironwork of which is so wonderful that it was attributed to superhuman authorship. Grilles at Troyes and Rouen reveal a high standard of excellence. Working the iron cold, and employ-

ing methods associated with carpentry, was immensely popular; it was applied to small objects such as door handles, knockers, ambry doors, and above all to locks. These exhibit an amazing amount of detail and a remarkable delicacy of finish.

The Gothic tradition survived in France until well into the 16th century, and was marked by the production of work of the highest skill, largely in the form of locks, knockers and caskets of chiseled iron. The introduction of the Renaissance style did not radically alter the direction of the smith's art—a strange fact when it is remembered how Germany and Spain were fabricating works of enormous size and magnificence in wrought iron. France, like England at that time, was content to make door furniture, in the form of locks, keys, bolts, escutcheons and the like, but did little ironwork of any great size. A school of locksmiths came into being under Francis I and Henry II, working from designs by Androuet du Cerceau in the 16th century, and Mathurin Jousse and Antoine Jacquard in the 17th. The bows and wards of keys were of unusually intricate design, and the locks of corresponding richness. Representative pieces may be seen at the Victoria and Albert museum, London. Among them is the famous Strozzi key, said to have been made for the apartments of Henry III, the bow of which takes the favoured form of two grotesque figures back to back. But as far as architectural ironwork was concerned, France remained almost at a standstill until the accession of Louis XIII in 1610. Under that monarch, a worker at the forge himself, came a great revival. It seemed to be uninfluenced from without, at first weak, as if feeling its way, but by the end of the 17th century it had attained a marvelous pitch of perfection. It proved to be the beginning of a new movement, the force of which made itself felt in the adjoining countries and inspired ironworkers with new energy. From the accession of Louis XIV the French ironworkers must be acknowledged as the cleverest in Europe, combining as they did good and fitting design with masterly execution. Their designs were often very daring, exploiting all the latent and previously unexplored possibilities of iron. They recognized its great adaptability and took every advantage of it, at the same time being conscious of its limitations. Their forms of expression were endless.

Screens and gates were needed for parks, gardens and avenues, staircases for mansions and palaces, screens for churches and cathedrals. Among celebrated designers were Jean Lepautre, Daniel Marot and Jean Bérain. Earlier work had been of a simple character, balconies for instance, being in the form of a succession of balusters, but as the smith became more versatile and imaginative, they took the form of panels of flowing curved scrolls, rendered with a freedom never attained before, while constructive strength was observed and symmetry maintained. Enrichments were usually attached in hammered sheet iron. These may be considered the distinguishing features of Louis XIV work such as that at St. Cloud, Chantilly, Fontainebleau and elsewhere. But under Louis XIV all previous efforts were surpassed in the work for his palace at Versailles.

The art of ironwork received a further impetus by the introduction of the rococo style. The movement initiated in 1723 was due principally to the imagination of two artists, Just Aurèle Meissonier, architect, and Gilles Oppenordt. There was a balanced asymmetry in the design, and fantastic curves with a luxury of applied ornamentation. To the French smith it furnished the opportunity for a yet greater display of his skill. He was clever enough to secure a feeling of stability in his work by counterbalancing swirling masses of ornament with straight constructional lines; he knew how to introduce an iron screen of rococo style into a Gothic church or cathedral without giving offense to the eye or arousing any uncomfortable feeling of incongruity. With astonishing manipulative power he worked as if the material under his hand were soft and pliable, rather than solid and unyielding iron.

BY COURTESY OF THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM

FIG. 1.—IRONWORK RAILING FROM A BALCONY AT VERSAILLES: LATE 18TH CENTURY

Later in the 18th century ironwork took on a more classical appearance, owing to the general revival of interest in ancient art, and many Greek and Roman details were introduced into the ornamentation. The amount of work executed was prodigious, and its beauty and craftsmanship may be seen in most cities of France; *e.g.*, in Nancy.

Nearly all the adjacent countries were seized with the desire to imitate this French rococo style, England excepted.

Germany.—In the Romanesque period in Germany bronze was preferred to iron; the earliest examples of ironwork are later than those of France and England. The first iron grilles were imitations of French work, having C-scrolls filling spaces between vertical bars. Typical examples of door hinges prior to the 14th century were those at Kaisheim, St. Magnus church, Brunswick, and St. Elizabeth's church, Marburg (the latter having a curious cross in the middle). Throughout the Gothic period in Germany, the imitation of natural foliage was the basis of design.

There were no new marked developments in ironwork during the 14th century. Smiths confined their efforts mostly to hinges. Up to this period the vine had been the only motif for elaborate hinges, but flat, lozenge-shaped leaves were introduced, such as at Schloss Lahneck on the Rhine.

During the 15th century grilles became more popular. One of the best examples is the grille in the chapel of Bishop Ernst, Magdeburg cathedral (*c.* 1498), with elaborate Gothic tracery, nine columns and a cornice. In hinges the cinquefoil displaced the quatrefoil, as at Orb, Oppenheim and Magdeburg. The Erfurt cathedral was enriched with notable hinges having the vine pattern interpolated with rosettes and escutcheons of arms. Hinges for houses usually were the plain strap type, but when ornamented they consisted of superimposed layers of sheet iron. As in other parts of Europe at this time, pierced sheet iron was fashioned into tracery of a semiarchitectural nature, much like Gothic windows. Pierced ornament and twisted rods were often combined to form grilles, with their extremities beaten into complicated foliage forms.

During the Renaissance, ironwork in Germany was in use everywhere and for every purpose: for screens in churches, window grilles, stove guards, gates, fountain railings, well heads, grave crosses, door knockers, handles, locks, iron signs and small objects for domestic use. Smiths were their own designers, and more often than not planned intricate devices merely to show their skill in executing them. They set no limits to their problems, and so far as manipulative excellence went, they were the foremost nation of Europe. But clever as their workmanship undoubtedly was, their designs frequently showed a lack of stability and a tendency to run riot. Thus many of their most imposing works consist largely of filling panels with elaborate, interlacing scrollwork, and the sense of constructional and protective strength is missing.

An abundance of smiths' work is to be found in the southern parts of Germany. Iron bars, circular in section, were most frequently used, and the most common features are: interlacing bars, terminations of flowers with petals and twisted centres, foliage or human heads. All of these characteristics occur with almost monotonous repetition, witnessing to skill, but also lack of imagination and sense of design. The style may be studied in many German and Austrian cities; *i.e.*, Augsburg, Nürnberg, Frankfurt, Salzburg and Munich; the work at Innsbruck is also well known.

The German smith gave much attention to door knockers and handles, enclosing them in pierced and embossed escutcheons, as well as locks with very involved mechanism. German influence made itself strongly felt in Switzerland, Austria and Czechoslovakia.

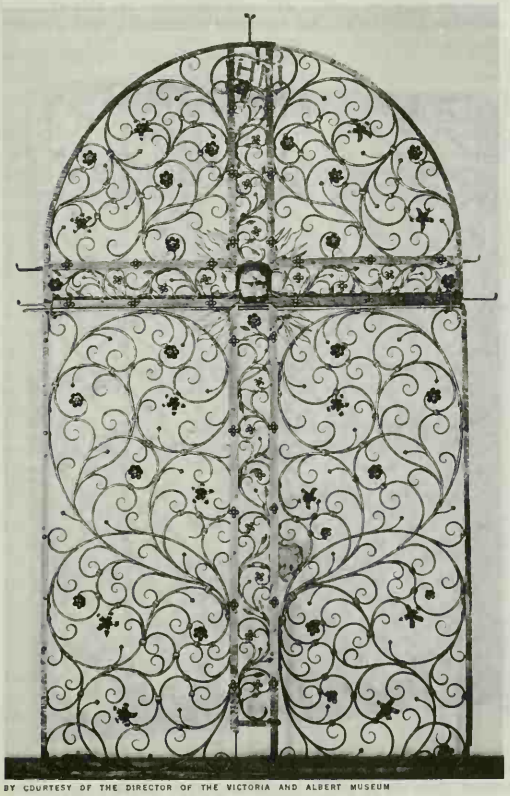
The baroque and rococo periods are distinguished by a perfec-

tion of detail which exceeded that of German medieval or Renaissance ironwork. Smiths used wrought iron as though it were a plastic material, meant to be employed in extravagant forms wherever possible. Some examples are at Zwiefalten, Weingarten and Klosterneuburg. In the late 18th and early 19th centuries cast ironwork of outstanding quality was produced in Germany, notably at the Prussian royal foundry established in 1804.

Italy.—The few extant examples of ironwork in Italy prior to the 14th century indicate a wide appreciation of how the material could best be worked with only the tools of the smith. Some noteworthy examples are: chancel grille at left of nave, Orvieto cathedral (1337); grille around the Scaligeri tombs of Verona (*c.* 1340); grille at baptistery of Prato cathedral (1348); chancel screen in the sacristy chapel of Sta. Croce, Florence (1371); and the grille to the Capella degli Spagnoli, Sta. Maria Novella, Florence.

Until the 16th century Italian smiths respected the natural characteristics of wrought iron by relying almost entirely upon those forms which could be wrought with hammer and anvil. The grille was generally made by dividing it into regular panels with vertical and horizontal bars (sometimes triangular in section and enriched with dentils). Often the quatrefoil filled some or all of these panels; they were made in Tuscany from a pierced plate, and in Venice from separate scrolls collared together. A noted example is in the Palazzo della Signoria, Siena, crowned by a *repoussé* frieze, and surmounted by a cresting of flowers, spikes and some animal heads.

It might have been thought that in the fountainhead of the Renaissance, ironwork would have proceeded at the same pace and with the same brilliant success as architecture, sculpture, bronze casting and the other arts. Strangely enough, little use of it is found in connection with the fine buildings of the revival. Bronze was favoured, and what in other countries is found in iron, has its counterpart in Italy in bronze. As time went on the smiths grew less inclined for the more difficult processes of hammering and welding, and contented themselves ultimately with thin, ribbon iron, the various parts of which were fastened together by collars. Work of the later periods may be distinguished, apart from the design, by this feature, whereas the English and French smiths vigorously faced the hardest methods of work, and the German and Spanish smiths invented difficulties for the sheer pleasure of overcoming them.



BY COURTESY OF THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM

FIG. 2.—VENETIAN GRILLE, 16TH CENTURY. IN THE VICTORIA AND ALBERT MUSEUM

Notable centres of artistic ironwork were Florence, Siena, Vicenza, Venice, Lucca and Rome, where important pieces may be found in the form of gates, balconies, screens, fanlights, well covers and a mass of objects for domestic use, such as bowl stands, brackets and candlesticks.

In screenwork the favourite motif was the quatrefoil, which is found with many variations ever since the 14th century. Early examples are strong and virile, later ones tend to weakness. The C-shaped scroll is used in many combinations. The churches and palaces of Venice contain many examples. Peculiar to Italy are the lanterns and banner holders such as may still be seen at Florence, Siena and elsewhere, and the rare gondola prows of Venice. Of the ironworkers of the early Renaissance the most famous was Niccolo Grosso of Florence, nicknamed "Il Caparra" because he gave no credit but insisted on money on account. He worked at the end of the 15th century. From his hand is the well-known lantern on the Strozzi palace in Florence, repeated with variations elsewhere in the same city. Siena can show other lanterns and banner holders attached to the facades of its palaces. Cressets are still to be seen at Lucca and a few other towns.

The decadence of 17th- and 18th-century ironwork paralleled that of architecture. Designs were borrowed directly from France and Germany. The metal was too often worked cold, using thin members, and the resulting construction was flimsy. Scrolls were often encased in thin, grasslike leaves. Conventional or naturalistic flowers were tacked on as seeming afterthoughts. Instead of using rods and bars, ribbonlike bands were used, with cast ornaments pinned on. Intersecting tracery was copied from Germany. The best examples of this period are confined to Venice and northern Italy, such as the screen in the south aisle chapel of S. Ambrogio, Milan; the chapel enclosure in S. Pietro, Mantua; and the screen in the Palazzo Capodilista, Padua.

Spain.—Prior to the 15th century Spanish ironwork was basically similar to that in France and England. The Spanish smith accepted the limitations imposed by anvil and ancillary tools, but he skilfully exploited to the limit all manner of variations; *e.g.*, twisting square rods, coiling flat bars into C-shaped scrolls of all sizes and devising imaginative crestings to surmount the top of church chapel screens or domestic window grilles. Many Moorish craftsmen of extraordinary ability were enticed to remain in Spain as the Moors were slowly pushed southward; the resultant blending of Gothic with Moorish resulted in the Mudéjar style.

Ironwork of the Renaissance period from about 1450 to 1525 reached a height of grandeur and magnificence attained in no other country. Of all the Spanish craftsmen the smiths were the busiest, especially during the 16th century. The particular manifestation of work in iron, which for more than a century towered above all the others, may be seen in the screens of monumental size (*rejas*) to be found in all the great cathedrals of Spain.

These immense structures, rising to 25 or 30 ft., show several horizontal bands or tiers of balusters, sometimes divided vertically by columns of hammered work and horizontally by friezes of hammered arabesque ornament. Usually such screens are surmounted by a cresting which is sometimes of simple ornament, but more often is a very elaborate design into which are introduced a large number of human figures. Shields of arms are freely incorporated, and the use of bright colour, silvering and gilding adds to their impressive beauty. The great balusters were always forged from the solid, and their presence in hundreds demonstrates the

extraordinary skill and power of the Spanish smith. The *reja* shut off the high altar of the church or cathedral from the nave, and a further opportunity came to the smith when the choir was moved from the transept, to west of the crossing. This necessitated a second screen to enclose the east end of the choir, and naturally this screen could be in no way inferior to that in front of the high altar. Thus in many cathedrals two of these monumental *rejas* are found facing one another. It was the smith's opportunity, and he availed himself to the full. Monumental *rejas* may be seen in all the large cathedrals of Spain—Barcelona, Saragossa, Toledo, Seville, Burgos, Granada, Córdoba and many others.

Ironwork on a smaller scale is found in gates, balconies and window screens; wrought-iron pulpits also exist. The panels of hammered and pierced iron, heightened with colours and gilding, were used in connection with domestic architecture; many doors were ornamented with elaborate nailheads or embossed studs.

(W. W. W.; G. K. G.)

United States

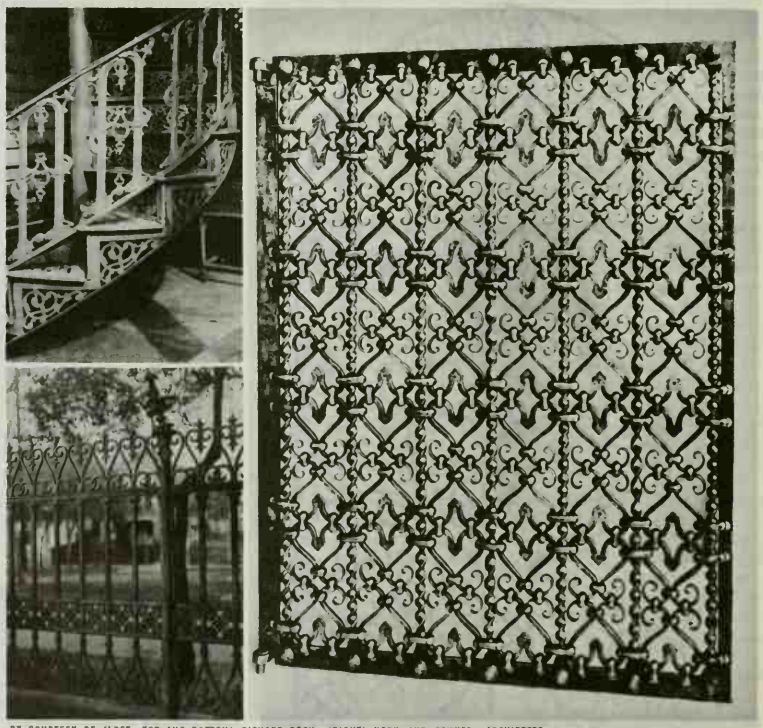
Early History.—The characteristics of the earliest ironwork in the various colonies naturally reflected those of the parent countries. The English were more sparing in its use in the New England colonies, than were the Germans in Pennsylvania or the French in Louisiana. In the 17th and 18th centuries ironwork was used mostly for such practical purposes as weather vanes, foot scrapers, strap hinges, latches, locks and particularly for the necessities and conveniences for fireplaces (firedogs, cranes, skewers, toasters, kettle warmers and spits). It was not until the late 18th century, when the threat of Indian raids and food shortages had waned, and the established communities enjoyed a sense of tranquility and prosperity, that smiths fashioned wrought iron into railings, fences, grilles, gates and balconies. Square or flat iron bars were generally used to produce designs that were usually light, airy and graceful, and rather in contrast to the contemporary European preference for sturdier forms.

The revolt against English political rule was reflected in the decline of English ironwork traditions, and in the steadily increased acceptance of the work by French and German craftsmen throughout all the 13 colonies.

Gradually ironwork designs tended to develop characteristics of an American or composite nature, as a logical consequence of the diverse origins of colonists and smiths. An innovation, which appeared toward the end of the 18th century, was the combination of structural wrought-iron rods or bars, with lead or cast-iron ornamental features. While the use of wrought iron declined during the 19th century, during its last quarter the use of cast-iron columns and panels for non-residential buildings increased. These designs, timid or bold, decorative or structural, engendered the prototypes of commercial buildings for the ensuing decades.

Unfortunately the life of structures in U.S. cities has been short. There are few examples of 18th- or early 19th-century ironwork extant in New York, not many more in Boston, some in Philadelphia, but more in and near Washington, D.C., such as the excellent balconies and railings at the Octagon (headquarters of the American Institute of Architects). Charleston, S.C., has a rich legacy in gates, notably those at numbers 12, 23 and 36 Legare street, 63 Meeting street, and the unusually beautiful pair at St. Michael's church. The latter is credited to Justi, who came to Charleston from Germany in 1820. Two other gifted German artisans who settled in Charleston were Werner in 1828, and Julius Ortman in 1847.

New Orleans has more ironwork than other U.S. cities, thanks to a group of citizens dedicated to the preservation of the old French Quarter. Its earliest ironwork was forged by Spanish and French smiths. Unfortunately fires, rust and remodeling have so taken toll of the Spanish ironwork, that almost the only remaining example of importance is the gateway of the Cabildo (town hall). It has moldings beaten from solid bars, like many of the old *rejas* in Spanish cathedrals. After the Louisiana purchase in 1803, the influx of ironworkers from northern states brought about a broadening of influences that are apparent in designs and techniques. Ironwork of New Orleans can be roughly divided into three periods: (1) forged wrought iron by French and Spanish artisans with strongly marked European characteristics; (2) a transitional period with wrought-iron structural members embellished with cast-iron ornaments in the Directoire and Empire styles of France, plus some U.S. innovations; and (3) entire grilles, screens and treillage made entirely of cast iron. No other city in the U.S. has two- and even three-story iron porches and balconies which can compare with those of New Orleans. Some of these lacy structures were built above the sidewalks, such as those on St. Peter street. Balconies sometimes not only extended across an entire façade, but continued undaunted around a corner,



BY COURTESY OF (LEFT, TOP AND BOTTOM) RICHARD KOCH, (RIGHT) YORK AND SAWYER, ARCHITECTS

FIG. 3.—LEFT, TWO EXAMPLES OF WROUGHT IRONWORK IN NEW ORLEANS, EARLY 19TH CENTURY; TOP, STAIRS; BOTTOM, FENCE. RIGHT, WROUGHT IRON GRILLE FOR THE CENTRAL SAVINGS BANK, NEW YORK, EXECUTED BY SAMUEL YELLIN IN THE 20TH CENTURY

as on the original building of the Little theatre.

Mid-19th Century Onward. —Distinctive national characteristics in the design of ironwork gradually tended to disappear in Europe, due to increased travel and communications between countries. The influence of French Renaissance architecture (modified or revived) continued to exert a viable effect where the acceptance of the *art nouveau* (last quarter of the 19th century) was flaccid or denied. However, in England 18th-century designs continued with slight modifications. In the U.S. probably the most important force, prior to World War I, was exercised by architects trained in Paris, with the result that ironwork designs were similar to French work of this period.

The increased mechanization of all forms of manufacture understandably affected the character and use of ironwork. As the cost of cast iron came down, its use increased. Because wrought iron is produced by hand by beating red-hot iron on an anvil, not much change was possible through increased mechanization, whereas the casting of molten iron lent itself to improved equipment and techniques. The lowered cost of duplicating ornamental cast-iron components and the introduction of structural steel parts expanded the usage of ironwork to the modest building, whereas it had been generally confined to public or monumental structures. Foundries in the U.S. established a flourishing business in pierced cast-iron panels, modeled after Louisiana porch treillage.

Compared with prior periods, the last half of the 19th century will scarcely be commemorated as introducing enduring or beautiful ironwork forms. It was not until the first quarter of the 20th century that a master craftsman-designer gave impetus to a new conception of design forms and textures. Edgar Brandt of Paris broadened the scope of decorative usage by the rich inventiveness of his compositions, and by an entirely original approach which resulted in a wrought-iron texture that is akin to beaten silver. Examples of his work at the Exposition des Arts Decoratifs Moderne at Paris in 1925, had an immediate effect upon ironwork designed and executed in the U.S. during the great building boom which lasted until about 1930. During this period both wrought and cast iron enjoyed an unprecedented period of popularity, not only in the form of bank screens, entrance doors and grilles in public buildings, but as decorative grilles and gates in private homes. In many cases the craftsmanship equaled that of representative examples of the Gothic or Renaissance periods in Europe.

One of the most gifted and dedicated iron craftsmen in the U.S., Samuel Yellin of Philadelphia, raised the standards of wrought-iron craftsmanship to its apex during the 1920s. He not only trained an atelier of craftsmen for the first time in the U.S., but by his efforts, wrought iron was recognized as being capable of enriching even the most monumental building. Yellin's influence was ended by the depression of the early 1930s. As building activity declined after 1930, so did the use of ironwork, but it did not increase with the revival of building after World War II.

TECHNIQUE

Wrought Iron

Wrought iron is the type of ironwork that is forged on an anvil. There are no fabrication similarities to cast iron, which is poured in a molten state into prepared sand molds. There are three kinds of iron, whose physical characteristics vary chiefly according to their carbon content: wrought iron has .04%; machine, open-hearth or Bessemer steel has .2% to .6%; cast iron has 2% to 6%.

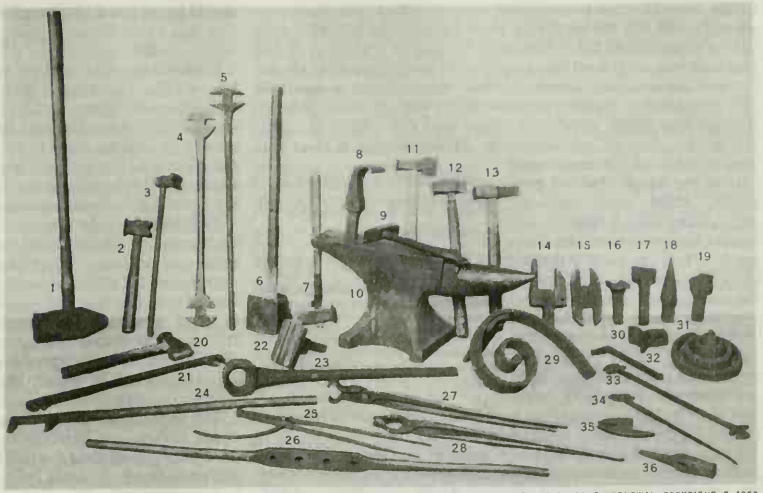


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FIG. 4.—WROUGHT-IRON SMITH'S TOOLS

(1) Sledge; (2, 3) Top swages; (4, 5) Twisting bars; (6) Flatter; (7) Set hammer; (8) Scroll starter; (9) Cross-peen hammer; (10) English anvil; (11) Top fuller; (12, 13) Hot chisels; (14, 15) Bottom scroll forks; (16) Bottom swage; (17) Bottom fuller; (18) Mandrel; (19) Bottom swage; (20) Top fuller; (21) Scroll fork; (22) Bottom swage; (23) Heading tool; (24) Special twisting bar; (25) Dividers; (26) Twisting bar; (27) Link tongs; (28) Hollow bit or bolt tongs; (29) Scroll form; (30) Bottom swage; (31) Scroll form; (32) Special tool; (33, 34) Twisting bars or scroll forks; (35) Bending tool used in vise; (36) Punch

Properties.—Wrought iron is fibrous in structure and light gray in colour. It can be hammered, twisted or stretched when hot or cold. The more it is hammered, the more brittle and hard it becomes, but it can be brought back to its original state by annealing (heating and then cooling slowly). It will not shatter when dropped.

The grade of wrought iron least susceptible to rust, yet the most malleable and tough, is called Norway or Swedish iron. Among the chief sources of the ore are the bottoms of shallow Swedish lakes, where from 4 to 6 in. are deposited over a period of 15 to 30 years. The usual forms of wrought iron available to the craftsman are rods or bars, and thin plates. It is from these that his final product must be fashioned on an anvil.

Fabrication.—From earliest times, the smith has had a forge to heat the iron, an adjacent water tank in which to cool it, an anvil on which to form it, plus a wide assortment of hammers and tools. One of the few changes has been the mechanization of the blower at the forge, in place of the hand- or foot-operated bellows. The smith knows from the colour of the heated iron when it is at the optimum temperature for a specific operation; dark red indicates suitability for surface finishing; bright or light red show that the iron is malleable but the surface will scale and it is therefore not suitable for finishing; light yellow denotes a good forging temperature; and white designates the correct temperature for welding.

The most important tool is the anvil. The English type, generally used for forging wrought iron, has a flat top surface, which is used as a solid base for hammering the heated iron into shape, for welding, for splitting or for incising decorative chisel marks in the hot iron. One end of the anvil is shaped like a pointed cone, and is used for forming curved surfaces. The other blunt end, or heel, has one or two square or rectangular holes on top, into which fit various tools which are used for holding one end of a bar, making twists or holding scroll forms.

Design.—The two most important factors in wrought-iron

design are: (1) the form of the material (bars, rods and thin sheets); and (2) the relatively short time period in which iron can be forged while hot. Although the Spanish craftsmen of the late 15th century proved they could work almost impossible shapes in their unsurpassed cathedral grilles, this type of ironwork is not considered a realistic exploitation of the material. Ideally wrought-iron design should use forged bars and rods in imaginative forms, practical, yet decorative. Ornamentation is most successful when it is an integral part of the design (twisted bars, scrolls, chisel mark incisions, etc.), rather than a realistic imitation of nature, riveted on afterward. From the anvil is derived the expression, "to strike while the iron is hot," and this implies spontaneity and rapid hammer blows. The wrought-iron craftsman should not be expected to repeat with meticulous exactitude one intricate component after another. In fact, wrought iron by a master craftsman is esteemed for the variations which naturally occur.

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FIG. 5.—CHISEL MARK ORNAMENTATION

The individual components of a wrought-iron design are often plain or twisted rods, with or without chisel mark incisions. They are frequently composed as a series of straight, parallel members, or in combination with scrolls, or a repeat design of some geometric shape such as the quatrefoil. Where two curved members are tangent, they are characteristically secured together by bands or collars, rather than by welding. Where two straight bars intersect, it is accredited craftsmanship to make the vertical bar pierce or thread the horizontal member. Grilles consisting of two series of parallel small-diameter rods, one series at right angles to the other, were sometimes interlaced or woven in decadent periods.

The term *repoussé* refers to three-dimensional, ornamental wrought ironwork. Depending upon the depth of the relief, various fabrication techniques may be employed. Sheets $\frac{1}{16}$ in. or less in thickness generally are used. The general configuration of the modeling is obtained by beating the back of the sheet; the final details are embossed on the front face. The finer the scale and detail, the more work which must be done when the iron is cold. A *repoussé* design may be pierced, but this term usually connotes a solid sheet forged into a mask, a shield or an entire embossed panel. The traditional means of setting off a cutout *repoussé* design was to superimpose it on a vermilion-coloured background panel. Modern approximations of *repoussé* work consist of mechanically stamped designs touched up with random hammer blows.

Care.—The texture of wrought iron is one of its principal assets, so painting it in order to prevent rust is not nearly as desirable as preserving the highlights of the original finish with wax. Professional craftsmen recommend removing all traces of rust by rubbing with emery cloth, augmented by a few drops of turpentine if the rust is heavy. Then the entire surface should be rubbed with any good liquid floor wax, or beeswax dissolved or softened in turpentine. After about 15 minutes when the wax has set, the surface should be rubbed with a soft cloth. This treatment should be repeated about once every three months.

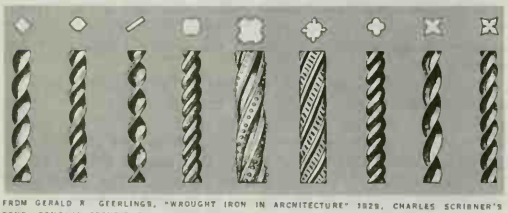

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FIG. 6.—EXAMPLES OF THE DECORATIVE POSSIBILITIES INHERENT IN TWISTED BARS

Cast Iron

Properties.—The carbon content of cast iron varies from 2% to 6%. Cast iron is melted in a furnace or cupola, stoked with alternate layers of coking iron, then poured into prepared sand molds. After the cast iron cools in the mold, the sand is cleaned off, and the work is virtually complete. Its shape is fixed, and while a casting can be slightly trued up by the judicious use of a hammer, it is in no sense as workable as wrought iron. Because it is brittle, it is almost certain to shatter if dropped.

Fabrication.—An iron casting is not the creation of a single craftsman, but the combined result of the skilled efforts of several groups of artisans. There must be an architect's or designer's drawings at full size, showing in detail all the features of the design. From these drawings full-size models or patterns must be made in wood, plaster or wax, depending upon the nature and the intricacy of the casting to be made. These patterns must be made slightly over-sized, according to a shrinkage scale; when the molten iron cools it will be slightly smaller than the patterns used in the molds.

The next step is to use the patterns to make sand molds, into which molten cast iron will be poured. For each casting there must be one sand mold for the back face of the casting (the cope), and another for the front or finished face (the drag). These two molds must be made so that when fitted and clamped together, there will be a space between. When this space is filled with molten metal and cooled, the result will be a casting with the desired size, shape, thickness and surface ornamentation of the pattern. If the casting is to be an ornamented panel, with a raised centre portion, a wood pattern might be used, with the ornamentation either carved in wood or applied. The drag mold (for the front face of the casting) is prepared by first placing on the foundry floor a plain-surfaced follow board. The pattern is placed on this, face up, supported by a bed board, in cases where the pattern has a raised centre portion. A parting powder is dusted on the face of the pattern (so that at a later stage the sand will not cling to the pattern when it is removed). Then the pattern is sprinkled or riddled with facing sand, which is firmly rammed as it is added. Finally heap sand is added until the rectangular, boxlike drag is filled to the top edge. A bottom board is then clamped on the top to hold the pattern and sand in place. Then the entire drag is turned upside down. The bed board, which had been on the floor and now is on the top, is removed. The pattern is then very carefully withdrawn from the sand, and its imprint inspected to be certain that it is a precise duplicate (reversed of course) of the pattern. Slight imperfections in the sand surface are filled if necessary, and loose sand is removed.

The next step is to repeat the same process for the cope, the sand mold for the back face of the casting. When completed, there thus will be two rectangular boxes, each rammed with sand, bearing the imprint of the pattern, and a space between them equal to the thickness of the metal. The drag remains on the foundry floor, but the cope is superimposed, being lifted in place with a crane if it is large. The sand of the (upper) cope mold has funnel-shaped openings provided (sprues), into which the molten metal will be poured. Horizontal grooves are then made in the sand of the cope called gates, which will provide tunnels for the metal to flow from the vertical sprues. In addition, there are risers (grooves in the sand located as far as possible from the sprues) to allow gases and displaced air to escape. The molten cast iron is ladled until the metal begins to fill the risers. When pouring a very large casting, a reservoir or pouring basin is provided above the cope, to contain sufficient molten metal to supply the entire mold simultaneously.

Technical metallurgical knowledge is required both in preparing the cast iron in the furnace or cupola, and in determining when the iron is right for pouring. Mechanical skill is necessary in ladling the molten metal from the cupola into the mobile mixing ladle, and from the latter to the prepared sprues of the cope. Foundries usually operate on a schedule so that the pouring of all molds is done toward the end of the working day. About two

or three minutes after a mold is poured, the iron is said to be set. At this stage there are two foundry practices. In one, the clamps which hold the cope and drag together, are loosened, the cope is removed, and the molder in charge estimates where the casting should be entirely uncovered or "stripped" of sand, or, whether to uncover only those parts of the casting which have the thickest metal, and to retard those areas where it is thinnest by shoveling on more sand in order to equalize the shrinkage rate between thick and thin parts. Skilled manipulation at this point determines the difference between a casting that is true and satisfactory, and one that is warped, and will consequently require tedious labour to straighten out. On the other hand, some foundries allow the casting to cool as slowly as possible, without removing any sand, and perform any straightening later. A casting which has cooled slowly is more readily straightened than one which has done so quickly.

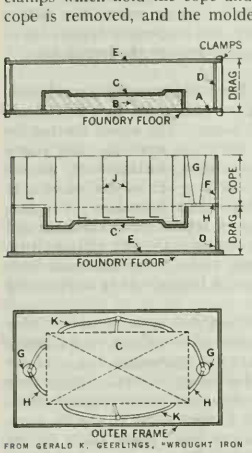

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FIG. 7.—CAST-IRON FABRICATION: (TOP) DRAG BEING PREPARED; (CENTRE) DRAG IN POSITION WITH COPE SUPERIMPOSED; (BOTTOM) COPE FROM ABOVE, SHOWING GATES AND RISERS
(A) Follow board; (B) bed board; (C) pattern; (D) drag outer frame; (E) bottom board; (F) cope outer frame; (G) sprues; (H) gates; (J) gaggers to reinforce sand; (K) risers

After the castings have cooled overnight, they are sandblasted to remove any sand that may adhere. Unwanted protuberances, such as those where gates and risers were located, are ground or cut off. Following this, the process is not unlike the operations in a woodworking shop; edges and surfaces that must conform to narrow tolerances are rimmed and planed. Ornamental features in cast iron cannot be chased and polished as in cast bronze. If the ornamental cast-iron details are not replicas of the original pattern, the only recourse is to make a new casting. *See* also CAST IRON.

Design.—From the foregoing description of fabrication, it is obvious that certain forms are more suitable to cast iron than to wrought iron. For example, if repetitive balusters or columns, or panels with low-relief ornamentation are desired, cast iron is the most suitable material. In the U.S. excellent examples are to be found in the cast-iron railings and porches of Charleston, S.C., and New Orleans. Some of the patterns used in the 19th century are still being used today. The same is also true of ornamental firebacks (for the rear of fireplaces). Some good examples of 20th-century cast ironwork are the imposing entrance and window spandrels of the Fidelity Mutual Life Insurance building, Philadelphia (Zantzinger, Borie & Medary, architects); the window frames and panels of the Integrity Trust Company building, Philadelphia (Paul Cret, architect); the entrance and show window of the Packard Motor building, Philadelphia (Albert Kahn, Inc., architect, and Philip S. Tyre, resident architect); the mullions and window spandrels of the Home Savings bank, Albany, N.Y. (Dennison & Hirons, architects); and the entrance to the Federal Trust building, Newark, N.J. (Dennison & Hirons, architects, George E. Jones, associate architect).

Care.—The material has a fairly uniform, cold, gray colour when the casting is cooled and cleaned. The usual finish procedure is to give the casting an initial coat of red lead, red oxide of iron paint, or a gray priming coat, followed by whatever final coat is desired. If there is delicate modeling which will be lost under successive coats of paint, it is recommended practice to burn off the old paint, and start off again with a priming coat, followed with a finish coat. (G. K. G.)

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IRONY, a form of speech in which the real meaning is concealed or contradicted by the words used. Often confused with sarcasm, which arises from contempt and is uttered in a snarling tone, irony arises from awareness of contrast, a sense of weakness or of inevitability, and is uttered with a "dry mock," controlled pathos or great pity for oneself or others. Socratic irony consists of feigned ignorance as a method of dialectic. *See* FIGURES OF SPEECH: *Figures of Degree of Emphasis.* (G. W. A.)

IROQUOIS, a confederacy or league of North American Indians which originally included the Mohawk, Oneida, Onondaga, Cayuga and Seneca nations. During the 17th and 18th centuries the Iroquois, or Five (later, Six) Nations of New York, were the native people of greatest political importance north of Mexico. Iroquois is a French name derived from uncertain Algonkin or Huron sources, and also has been adopted for the linguistic family of which the Five Nations were the most durable representatives (*see* INDIAN, NORTH AMERICAN).

The Iroquoian Family.—The Iroquoian linguistic family occupied a continuous territory around the lower Great Lakes, sur-

rounded by Algonkian-speaking peoples, with southeastern outliers at tidewater and in the Appalachian highlands. In the Susquehanna and St. Lawrence valleys and bordering Lakes Ontario, Huron and Erie lived Iroquoians including the Huron, Tobacco (Tionontati) and Neutral (Neuter) to the north; the Erie, Wenro (Wenrohronon) and Iroquois proper to the south; and the Andaste or Conestoga (Susquehanna) in Pennsylvania. The Laurentian Iroquois who received Jacques Cartier in the period 1534–41 spoke a distinct language representing an ancient cleavage within the Iroquoian speech community, which is not accounted for by disappearance into Mohawk-Onondaga or Huron-Wyandot. The linguistic place of the tidewater languages, Nottaway and Meherrin, from Virginia south of the James river, is unknown; but the Tuscarora of the Neuse river, N.C., has affinities with Mohawk and Huron. Cherokee, from the Great Smoky mountains, is the most divergent branch and the southern outpost of Iroquoian speech.

The Iroquois-speaking tribes were semisedentary, practised maize agriculture, palisaded their villages in time of need, and more than 100 long houses of multiple-fireside families sheltered maternal lineages that painted their crests on the gable ends. Living south of the range of the paper birch, they stripped elm bark for sheathing houses, for containers ranging from dishes to barrels and for canoe building. Birchbark canoes were available to the Huron of Georgian bay by trade from Algonkin neighbours. A village band of several hundred persons was the social and economic unit. Gangs of men built houses, erected palisades, fished, hunted, traveled, traded, gamed, defended the village against attacks and went on the warpath. Outside the towns, parties of women, each directed by a matron, worked fields of maize, beans and squash, averaging 3 to 6 ac. per family. After harvest, family hunting parties ranged far into the forests, camping until the festive midwinter homecoming, when they returned with dried venison and consumed grain stored in pits and bark barrels. For several weeks between maple sugaring and planting, settlements were evacuated to attend the March migration of now extinct passenger pigeons, and prodigious quantities of birds were taken. Spring runs of fish drew families to nearby streams and lake inlets to erect weirs and traps for spearing. Old women gathered spring greens to tide them over the hungry period before the first berries ripened.

The Long House family was the image for Iroquois society; households, or blood lineages, were projected into clans, clans into moieties, moieties into tribes or nations, and nations into leagues or confederacies. Common to all the league tribes were the exogamous Bear, Wolf and Turtle clans. The Seneca had an eight-clan system of two moieties (Bear, Wolf, Beaver, Turtle; and Deer, Snipe, Heron, Hawk) which had Cayuga and Onondaga counterparts. The moieties or sides had overtones of kinship, but functioned mainly in games, at ceremonies and at funerals.

Kinship and locality were the bases for political life. Each community had its council of adult males who guided the village chief, or chiefs. Peace chiefs concerned with civil affairs were appointed by women to represent their clans, and the office descended to the sister's son. Speakers of the council (the mouth of the chiefs) were often chiefs of merit called pine tree chiefs whose rank, as well as that of war chief, was an achieved status and not hereditary. In forest protocol speakers named the hierarchy of civil chiefs, warriors, women and the public, which were the circles of society ranged around the council fire. The Iroquois were addicted to meetings, spending considerable time in council. Groupings for council were determined by locality, sex, age and the specific question at hand, and each had its own protocol and devices for gaining consensus.

Elaborate Iroquois cosmology was based on the myth of a woman who fell from the sky, and featured deluge and earth-diver motifs. No other tribes showed such a preoccupation with supernatural aggression and cruelty, sorcery, torture and cannibalism. This literature was relieved by occasional beautiful star myths and journeys to the other world. Formal religion consisted of six agricultural festivals featuring long prayers of thanks to a hierarchy of spirit forces between mother earth and a superimposed sky world. Much ritual sought to propitiate earth-bound malefic spirits that were most active in dreams between the frosts. The "Handsome Lake" religion (named after a visionary Seneca) perpetuated many of these aspects and combined them with Christian ethics. Rituals imparted sanction to political activity, giving rise to the Indian treaty literature of the 18th century, and supporting hopes of sovereignty among nativists who hoped to restore the league after it became ineffective.

Warfare was so ingrained in Iroquois personality, and self-respect so dependent on achieving personal glory, that individualism outweighed the philosophy of peace. The elders continually complained that they could not control the warriors, their young men. Warfare kept down the population, sustained by women farmers who freed warriors from hunting. Economic warring in the fur trade has been overemphasized by historians. Captives were tortured, enslaved or adopted to replace dead kinsmen, and made up much of the Iroquois population in the late 17th century. Adopted captives embraced Iroquois values, some becoming leaders, and some white captives preferring Indian society to resuming their earlier lives.

A major problem in Iroquois history has been to explain their linguistic-cultural position. Cherokee culture shows resemblances to the northern Iroquois which are at first impressive, but on closer study fit a culture adapted to a Muskogean (Creek) Appalachian habitat. The northern Iroquoian tribes more nearly resemble Muskogean societies than the Algonkin hunters north of the St. Lawrence. Mohawk and Oneida cultures have many traits of the neighbouring Mahican and Delaware. The once popular theory which held that Iroquoians migrated up the Ohio valley as intruders in an Algonkian culture area lacks empirical support. Approximately 1,300 years by radiocarbon dating separate the most recent Hopewell mound builders from the earliest (*c.* A.D. 1400) Iroquois in the northeast. Moreover, maize agriculture preceded the Iroquoians into the lower Great Lakes area among Point Peninsula and Owasco peoples between the Hopewell and Iroquois dates. Iroquois pottery types from Point Peninsula, as well as discoveries in Ontario, support the theory that Iroquois developed out of resident cultures. In eastern New York state the latest Owasco site was found to be separated by a scant 100 years from the earliest Mohawk, suggesting they were competing cultures.

Linguistically, the widest cleavage in the Iroquoian family is between the lone southern branch, Cherokee, and all the rest, representing a time depth estimated at not less than 3,500 years. Tuscarora represents a split from the northern languages of about 2,000 years, and the languages of the Five Nations diverged at least 1,200 years ago, when classic Iroquois culture is first recognizable from archaeology.

The Iroquois League.—The Five Nations of the Iroquois league characterized themselves as "the people of the extended house." The Mohawk, Oneida, Onondaga, Cayuga and Seneca (*qq.v.*) lived in this order from Schoharie creek westward across central New York state to the Genesee river; from door to door the "Longhouse" extended nearly 180 mi. between what are now Amsterdam and Rochester. Tradition credits formation of the league to Dekanawidah, born a Huron. He is said to have persuaded Hiawatha, an Onondaga living among Mohawks, to abandon cannibalism and advance "peace, civil authority, righteousness and the great law" as sanctions for confederation. The Dekanawidah epic, a masterpiece of aboriginal literature, recited from memory on state occasions, became available in several versions to ethnologists in the early decades of the 20th century. Iroquois sources (18th century) place the league's beginning between 1570 and 1600, consistent with archaeological and linguistic evidence and the disappearance of the Laurentians between Cartier's and Samuel de Champlain's voyages. What Benjamin Franklin termed "a league of ragged villages" had arisen voluntarily, preserving the integrity of each tribe. They united in common council, installing the 50 existing clan and village chiefs as founders in a common ceremony of condolence. The Mohawk and Oneida had 9 representatives each, the Onondaga 14, Cayuga 10 and Seneca 8. Size of delegation did not affect decisions since each tribe had one vote; unanimity was the rule. The Mohawk and Seneca delegations would confer separately and together before handing the issue

across the fire to their "offspring" or "younger brothers," the Oneida and Cayuga. These, in turn, would repeat the process before sending the question on to the Onondaga fire keepers, whose speaker as host opened the council, presided and voiced the mind of the Five Nations.

League chiefs were peace chiefs, their joint jurisdiction embracing civil affairs at the intertribal level. Each chief was answerable to his own tribal or clan council and ultimately to the matron who presided at his nomination by the women of the lineage in which the title passed. Their nomination required ratification by clan, tribal and league councils. For propositions to the league council there was a regular chain of clearances from family to clan, to moiety, to town, to nation or tribal councils, and down again. The relationship of league chiefs to war chiefs is not clear in historical sources. Best known to history were the pine tree chiefs, awarded their rank for wisdom and oratory, and including men of real ability (like Red Jacket) who made policy by voicing the opinions of the league, of warriors and of women. A fourth class of chiefs by virtue of age and wisdom constituted the town council and heard deputies from the warriors, the women and the league. J. F. Lafitau, a Jesuit, described (1724) this council as ". . . a greasy assemblage, sitting *sur leur derrière,* crouched like apes, their knees as high as their ears, or lying, some on their bellies, some on their backs, each with a pipe in his mouth, discussing affairs of state with as much coolness and gravity as the Spanish Junta or the Grand Council of Venice."

The Iroquois league differed from native confederacies in the northeastern woodlands only in being better organized, more consciously defined, and more effective. The Huron also used the ritual of condolence to install chiefs to take the place of deceased founders, but the Iroquois used the rite constantly to stress the importance of the "great peace." They persuaded colonial governments to use the ritual in negotiations and fostered a tradition of political sagacity based on ceremonial sanction rather than the occasional superior individual. Even though war parties got out of hand and dissipated the fruits of diplomacy, public policy was made at Onondaga and success strengthened it. The league lacked administrative control, and the nations did not always act together, but spectacular successes on the warpath compensated for this and were possible because of security at home.

For the century and a quarter before the American Revolution the Iroquois stood athwart the path from Albany, N.Y., to the Great Lakes, keeping the water-level route from permanent settlement by the French and containing the Dutch and English. Their success has been variously ascribed to their strategic position astride the first gap in the Appalachian chain and atop the sources of five river systems, accidents of history, their genius as politicians, the terror of their small war parties, their possession of firearms, and their role in the fur trade.

During the formative period of the league, the Laurentian Iroquois abandoned the sites of Hochelaga (Montreal) and Stadacona (Quebec) to Algonkins, the Huron concentrated toward Georgian bay, and the Five Nations had withdrawn to central New York. The Laurentians remain a mystery. They had their own language, yet their pottery is Onondagalike. Tradition says the Mohawk moved from the Laurentian region, but most historians favour the Huron claim.

For a generation the tribes of the new league, beset from all sides, enjoyed no advantage save removal from contact, and barely held their own with the Mahican and related tribes who traded freely with the Dutch. By 1628, no longer cowed by firearms, the Mohawks had emerged from "castles" secluded in wooded highlands to defeat the Mahican and lay the Hudson valley and New England tribes under tribute of goods and wampum. For another decade the beaver trade exceeded 10,000 skins per year, when the Mohawks themselves obtained firearms from competing independent traders mainly at Ft. Orange. Acquiring new weapons coincided with the local depletion of beaver but enabled league members to carry the beaver wars against far-flung enemies. In a decade they turned west and dispersed the Huron (1648–50), Tobacco (1649), Neutral (1650–51) and the Erie (1654–56). Two Seneca towns were composed largely of captives from these nations, besides individuals distributed through the league to produce more Iroquois in the next generation. To the upper lakes and into the Ohio woods fled scattered remnants of the defeated peoples. Hurons to become Wyandots, and Eries to become Mingos; later merging in Cayuga and Seneca outliers. Large palisaded towns had proved vulnerable to large-scale assault, whereas family hunting bands living scattered in the forest in the Algonkin manner could resist indefinitely. The Andaste, though often better armed and attacking league towns in 1662, finally succumbed in 1675, having first been assaulted by the militia of Maryland and Virginia. Andaste who were not adopted by the Seneca fled to Virginia and were exterminated during Bacon's rebellion. Next, various eastern Siouan allies of the Andaste against the league felt the Iroquois ax, and by the mid-18th century all piedmont tribes were incorporated or destroyed. To the west the Miami and Illinois were badly mauled "for cutting down the Tree of Peace and hunting beaver on Iroquois lands." Only the distant Ojibwa set a boundary to Iroquois conquests in the west.

If the central fact of 17th-century intertribal rivalry was the fur trade, so in the 18th century these activities depended on the French and British struggle to control the continent. Despite the power of Iroquois war parties which ranged to the Catawba of South Carolina and the Cherokee, and even into the canebrakes of Georgia against the Creek, they did not settle or effectively control the vast area they claimed. Rather, Iroquois delusions of empire were converted to Britain's advantage by Sir William Johnson (*q.v.*), who controlled the destiny of the Iroquois for over 20 years until his death in 1774.

By 1712 the Delaware were under tribute to the league. The Tuscarora, having left Carolina the previous year, returned north in stages, and became the sixth nation of the Iroquois confederacy. Following official recognition in Albany (1722) the Iroquois were known to the English as the Six Nations.

The Iroquois were consistent and bitter enemies of the French, who had espoused their traditional foes. Yet, though they were in friendly trade with the Dutch, and afterward the English, their first treaty (1624) was with the French. Whether or not they loved the Dutch and their English successors, the Iroquois depended on Albany for European goods which were cheaper than in Montreal, and Albany was never attacked. Though twice invaded by the French, the Iroquois never succumbed, retaliating devastatingly in Canada. But for the Iroquois, the English colonials, who could not field an army in time, would have been flanked behind by the French, and the history of the continent might read differently. The Iroquois quest for neutrality was far from a complicated game of balancing the two European powers, for the league lacked decision and the power for consistent action. Nonetheless, theirs was a remarkable achievement for an aboriginal people that could field only 2,200 men from a total population of scarcely 12,000.

During the American Revolution, a schism developed among the Iroquois. The Oneida and Tuscarora espoused the revolutionary cause, and the rest (led by chief Joseph Brant's Mohawk loyalists) fought the war out of Niagara, decimating their ancestral valley. John Sullivan's expedition of 1779 destroyed the fields, granaries and morale of the Six Nations. The Mohawk and Cayuga mainly withdrew to the Grand river in Canada, but the Onondaga and Seneca remained in their ancient seats. The Oneida departed for Wisconsin a generation later. Having acknowledged defeat in the second Ft. Stanwix treaty (1784), the Six Nations and the U.S. made a treaty at Canandaigua, N.Y., in 1794, in which each pledged not to disturb the other in lands they had relinquished or reserved.

In the 1960s about 8,000 persons inhabit six Iroquois reservations in New York, and eight reserves in Canada contain about 16,000 persons of Iroquois descent. Although considerable intermarriage with whites has occurred, Indian features are still evident. Iroquois life is remarkable in retaining parts of the old culture while engaged in modern occupations.

See also references under "Iroquois" in the Index.

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(W. N. F.)

IRRATIONAL NUMBERS are real numbers that cannot be expressed as integers or quotients of integers. For example, there is no number among integers and fractions that solves the problem of finding the square root of 2, or a number whose square is 2. A counterpart problem in measurement would be to find the diagonal of a square whose side is one unit long. It thus became necessary in the history of mathematics to extend the concept of number to include irrational numbers. Without such an extension, many problems involving such operations as subtraction, division and the extraction of square root cannot be solved. The square root of every positive integer that is not a perfect square, for example, is an irrational number.

The imposition of secrecy on the ancient Pythagoreans (who saw religious meaning in numbers) may have been related to a desire to conceal the insufficiency of rational numbers in solving such problems. A way out of the difficulty (4th century B.C.), attributed to Eudoxus and adopted by Euclid, amounts not so much to the introduction of irrational numbers as to a scheme by which such numbers can be avoided. A period of over 2,000 years followed in which mathematicians seem to have been unconcerned about such niceties. The problem again arose in the more critical and rigorous mathematics of the 19th century.

One of the simplest approaches to the problem is to find approximate solutions; for example, to consider a nonrepeating infinite decimal derived from a fraction whose square is very nearly 2, and to continue calculation until a certain number of digits gives a satisfactory approximation. A similar situation arises in finding the number π (the ratio of the circumference of a circle to its diameter). Many mathematicians consider this infinite decimal fraction as being, or representing, the irrational number. In applied problems, for example, π has been usefully approximated by using the fraction $22/7$. Of course, it is not possible to calculate the whole infinite decimal, but a rule may be given that specifies the computation of any desired number of successive digits.

The problem may also be approached by noting that any fraction is either too small or too large for the irrational number in question. This separates all fractions into two classes such that every fraction in one class is less than every fraction in the other. Such separations are called Dedekind cuts, and it is possible to treat these cuts as numbers by defining arithmetical operations on them. This procedure is equivalent to the introduction of irrational numbers by approximations. Other methods have been offered for dealing with irrational numbers, but none of them avoids all the difficulties presented.

These difficulties, however, do not prevent mathematicians, scientists and engineers from making use of irrational numbers. Efforts to avoid their use would tremendously complicate the expression of many useful ideas. For further discussion of irrational numbers, *see* NUMBER.

IRRAWADDY, the principal river in the Union of Burma, traversing the centre of the country and running throughout its entire course within Burmese territory. It is formed by the confluence of the Mali Hka and N'mai Hka (*hka* being the Kachin word for "river") in 25° 45′ N. The N'mai is the eastern branch. The definite position of its source is still uncertain, and it seems to be made up of a number of considerable streams, all rising within a short distance of each other in about 28° 30′ N. It is shown on old maps as the Lu river of Tibet; but it is now quite certain that the Tibetan Lu river is the Salween, and that the N'mai has its source or sources near the southern boundary of Tibet, to the northeast or east of the source of the Mali. At the confluence the N'mai is larger than the Mali. The general width of its channel just above the confluence is 350 or 400 yd. In the rainy season this channel is filled up, but in the cold weather the average breadth of the river is from 150 to 200 yd. The N'mai is practically unnavigable. The Mali is the western branch. Like the main river, it is called Nam Kiu by the Shans. It rises in the hills to the north of the Putao (Hkamtī) country, in about 27° 50′ N. Between Putao and the confluence it runs in a narrow channel through continuous hills. About 1 mi. above the confluence it is 150 yd. wide in January and 17 ft. deep, with a current of $3\frac{1}{4}$ mi. an hour.

Steam launches can ascend from Myitkyina to the confluence only at the height of the rainy season. Country boats ascend to Laikaw or Sawan, 26° 2′ N., all the year round, but can get no farther at any season. From the confluence the river flows in a southerly direction as far as the confluence of the Kaukkwe stream, a little above Katha, where it again turns in a southerly direction, as far as the great bend near Mandalay, where it is joined by the Myitnge. Thence it follows a westerly course and is joined by the Mu river—an important source of water for irrigation in the Shwebo district—on the north bank. Beyond Myinmu it again assumes a southerly direction and is joined by its chief tributary, the Chindwin, described below. Between the confluence and Mandalay the river varies in width from 50 to 4,000 yd. It is narrowest in the three well-known "defiles." The third or upper defile lies between Myitkyina and Bhamo and is entered 3 mi. below Sinbo by a channel only about 50 yd. wide and below this, throughout the defile, it averages about 100 yd. in width.

At the "Gates of the Irrawaddy" at Poshaw two prism-shaped rocks narrow the river to 50 yd., and the water banks up in the middle with a whirlpool on each side of the raised pathway. All navigation ceases there in the floods. The defile ends at Hpatin, and below this the river widens out to a wet-season channel of 2 mi., and a breadth in the dry season of about 1 mi. At Sinkan, below Bhamo, the second defile begins. It is not so narrow, nor is the current so strong, as in the third defile. The narrowest place is more than 100 yd. wide. The hills are higher, but the defile is much shorter. At Shwegu the river leaves the hills and becomes a broad stream, flowing through a wide plain. The first defile is tame compared with the others. The river merely flows between low hills or high wooded banks. The banks are covered at this point with dense vegetation and slope down to the water's edge. Here and there are places which are almost perpendicular, but are covered with forest growth. The course of the Irrawaddy after receiving the waters of the Myitnge opposite Sagaing, as far as 17° N. lat., is exceedingly tortuous. Below the junction of the Chindwin and Irrawaddy, the tributary streams throughout the dry belt are but small, though some, especially those in the Minbu district, are important sources of water for irrigation, and others, like the Yaw Chaung, are used for floating teak logs to the main river. At Akauktaung, where a spur of the Arakan hills ends in a cliff 300 ft. high, the river enters the delta, the hills giving place to low alluvial plains, now protected on the west by embankments. From 17° N. lat. the Irrawaddy divides and subdivides, converting the lower portion of its valley into a network of intercommunicating tidal creeks. It reaches the Andaman sea in about 16° N. lat. by nine principal mouths. Practically no water, however, now reaches the sea through the western and eastern mouths (the Bassein and Rangoon rivers respectively), though these are the ones used by seagoing ships to reach the ports of Bassein and Rangoon.

The largest tributary of the Irrawaddy is the Chindwin (*q.v.*), its entire course being in Burmese territory. The geomorphological history of the Irrawaddy basin is an interesting one. It would seem that there were originally two parallel streams, the Upper Irrawaddy-Sittang and the Chindwin-Lower Irrawaddy. Slight earth movements perhaps connected with an eruption of Popa Mt. (4,981 ft.) deflected the Upper Irrawaddy westward and beheaded the Sittang, now a small misfit stream. Especially where it passes through the dry belt the Irrawaddy is bordered by extensive gravel-capped terraces which have yielded human artifacts of distinctive cultures, by the early 1960s still imperfectly studied. One particularly well-marked terrace on which most of the town of Yenangyaung is built is approximately 100 ft. above river level and gives rise to some imposing river cliffs.

The area of the catchment basin of the Irrawaddy is 158,500 sq.mi.; the total length of the main river from its known source

to the sea is about 1,300 mi. Throughout its course, except through the defiles, it is full of islands and sandbanks; its waters are extremely muddy, the mud being deposited partly in the delta, in part being carried far out to sea. The river begins to rise in March; about June it rises rapidly, and attains its maximum height about September. The total flood discharge is between 400,000,000 and 500,000,000 metric tons of 37 cu.ft.

From Mandalay up to Bhamo the river is navigable for large steamers all the year round for a distance from the sea of nearly 1,000 mi.; but small launches and steamers with weak engines are often unable to get up the second defile in the months of July, August and September, because of the strong current. The steamers of the Inland Water Transport commission which has replaced the old Irrawaddy Flotilla company (whose 600 ships were scuttled at the time of the Japanese invasion in 1941–42) go up and down several times a week, but the mails are carried to Bhamo by a ferryboat from the railway terminus at Katha.

The Irrawaddy river itself supplies no main irrigation works, although agriculture is concentrated on the alluvial lands of its delta; the great value of the river is as a highway and economic life line. It is the main means for goods to reach such important centres as the oil fields of Yenangyaung and Singu, which are not served by railway. The Irrawaddy is crossed by only one bridge, that below Mandalay, but there is a steam ferry at Henzada to connect the railway system on either bank. The vast delta (about 150 mi. wide and at its apex about 180 mi. from the sea) is one of the world's greatest rice producing areas.

The name Irrawaddy is also given to a division of Burma, coinciding roughly with the western three-quarters of the delta. It includes the districts of Bassein, Henzada, Maubin, Myaungmya and Pyapon.

See L. D. Stamp, "The Irrawaddy River," *Geog. Jour.*, vol. 95, pp. 329–356 (1940). (L. D. S.)

IRREDENTISTS, an Italian patriotic and political party which was prominent in the last quarter of the 19th century. The name was formed from the words *Italia irredenta*—unredeemed Italy—and the party had for its object the emancipation of all Italian lands still subject to foreign (*i.e.*, Austrian, French and British) rule. The lands which they claimed as Italian were south Tirol (Trentino), Gorizia, Istria, Trieste, Ticino, Nice, Corsica and Malta. The agitation was, however, mainly superficial and sank into insignificance when the French occupation of Tunis in 1881 offended the Italians deeply, and their government entered into those relations with Austria and Germany which led to the triple alliance. The name "Irredentists" is also used of any other nationalist group aiming at the emancipation of any of their countrymen subject to foreign control.

IRRIGATION is the artificial application of water to land. Modern irrigation and the associated practices of drainage, fertilization, mechanization and mass production for special markets under professional management are producing a revolutionary efficiency in agriculture that, along with an attractive and profitable way of life, best guarantees food and fibre for the fast-growing population of the world.

Normally vegetation grows on soil watered by rain. Where rain is so seasonal that it does not meet the requirements of a particular crop or is deficient or practically nonexistent, the drying of the soil to an ever increasing degree retards, until it eventually prevents, vegetable growth. Irrigation can give better results than nature itself produces by fitful rainfall, because water can be given regularly just when it is needed.

This article briefly sketches the historical background of irrigation and the development of ancient and modern mechanical aids, and deals with methods of securing irrigation water, storage of water, legal title to water, principal systems of irrigation, little-used systems, drainage in relation to irrigation, irrigation practices, supplemental irrigation and a brief survey of irrigation throughout the world in the second half of the 20th century. For another method of farming with a limited natural supply of water *see* Dry Farming. *See* also separate articles on individual states and countries, as Egypt; Idaho; etc., and on rivers, as Colorado River; Nile; etc. *See* also Ground Water; Hydrology; Soil.

HISTORICAL BACKGROUND

The use of irrigation as an aid to the growth of vegetation is an ancient art. (*See* Agriculture, Primitive.) The probabilities seem to point to Egypt as its place of origin. The paintings and sculptures of ancient Egypt show that the peasantry bailed up water at least 4,000 years ago, and there is evidence of earlier irrigation there and in other parts of the ancient world which strengthens the belief that irrigation preceded, and made possible, the development of ancient civilization. Reliance was not placed entirely on direct labour; mechanical aids were invoked, and such machines as the *shaduf*, the *sakia* and Archimedes' screw were invented.

Ancient Mechanical Aids.—The simplest device for lifting water consists of a long tapering and nearly horizontal pole supported on a horizontal crossbeam about eight or ten feet above the ground. A skin or bucket is hung on a rope from the longer and thinner end and a counterbalance placed on the shorter and thicker end. The worker pulls down on the rope to fill the bucket, after which the counterbalanced end drops and raises the bucket of water to his hand, where it is emptied. Each of these devices can irrigate about two acres, and two or more of them can be placed one above another for the higher lifts. In Egypt this is called a *shaduf* or *shadoof*, while in India the name is *denkli* or *paecottah*.

The Egyptian *sakia* (called a *harat* or Persian wheel in India) is operated by oxen. It is so arranged that a vertical wheel turns continuously. Two parallel endless ropes pass over the wheel and are attached to buckets spaced a short distance apart. While half the buckets are descending and filling, the other half are rising full of water. At the top they tilt automatically into a prepared channel leading to the field. Each machine can irrigate from 5 to 12 ac., depending on the height of the lift.

The most ingenious of these old devices is the Archimedes' screw, which was invented about 200 B.C. in Syracuse. A corkscrew-shaped tube is placed in or around a wooden cylinder about one or two feet in diameter. One end of this 10- to 15-ft. cylinder is under water, and the other end rises about 3 ft. to the bank where water is discharged as the cylinder is rotated by hand. Knowledge of these mechanical aids probably spread to other ancient empires. All are still in constant use.

Modern Mechanical Aids.—Not until the era of steam, the internal-combustion engine and electricity, which brought with it the power to drive pumping plants of all kinds, was human and animal life relieved of almost all the duty of directly lifting water onto the soil. Irrigation makes use of such pumping plants in all sizes, ranging from one- or two-horsepower engines up to huge installations whose power is measured in thousands of horsepower and which are capable of dealing with great volumes of water.

Electric motors are now generally used for the larger pumping plants, diesel engines for those of moderate size and gasoline or liquid petroleum gas engines for smaller plants. Portable plants are available for areas up to several hundred acres. Usually the power and pump are directly connected in a single unit. Centrifugal pumps are preferred for lifting from open water, while turbine pumps are used in wells of a few feet to hundreds of feet in depth. The axial-flow or propeller pump that was developed in New Orleans, La., for drainage of that city, is best for lifting large volumes of water through low heads or differences in elevation. Each power plant and pump is designed by hydraulic engineers especially for the work which it is to accomplish.

An important mechanical development after World War II was the use of 20- to 40-ft. lengths of lightweight portable aluminum pipe with special couplings which permit the pipe to be quickly assembled, dismantled and moved to a new location on the surface of the ground. This is especially useful in portable irrigation systems, where the pipe is laid quickly over the ground, then dismantled and moved to another tract of land by one or two men, thus minimizing the investment necessary.

METHODS OF SECURING IRRIGATION WATER

Much irrigation water is pumped from ponds, reservoirs, lakes, streams, canals, pits and wells, occasionally as high as several hundred feet for valuable crops. The more abundant and cheaper

water supplies are found in the larger streams and usually are obtained therefrom by diversion dams without pumping. Often these structures raise the level of the water in the river and sometimes provide storage. From them, canals and many other types of structures convey and distribute the water over the land.

Canals.—Man was not satisfied with his efforts to supply water to the fields and early saw that he could assist nature by taking water from a river at a point higher upstream than the point immediately opposite his own particular field, and thus take advantage of the difference of level between these two points, or the fall of the river. Take the case of the fall of a river being only 12 in. in one mile—as is not unusual. As some slope must be given to the water in a canal to make it flow, and if this is, say, six inches in one mile, the canal water will stand higher by six inches at the end of each mile of length than the river opposite to it. Obviously, to establish fall sufficient to be effective under such conditions, a canal must draw its supply from the river many miles upstream of the areas it is intended to serve.

Diversion Dams.—That the use of diversion dams (also called weirs or barrages) as an aid to heightening water level is old there is no doubt, yet only in modern times has the idea been used to any great extent. These structures are built across a river so that a higher level can be produced on the upstream side of the dam simply by closing sufficiently the sluices, or gates, placed in them. This enables the water flowing at the higher level to irrigate the land much nearer the headworks of the canals taking off from either bank. Thus these structures, like the canal already mentioned, are devices for doing, almost forever without any further labour than adjusting the sluices, what hitherto had to be done, laboriously and expensively, by the aid of manual or mechanical work.

When these structures are necessary in those parts of a river's course where there is no other foundation than sand or silt, water is seldom raised more than ten feet. Whatever heading up of the waters is necessary, it should avoid reducing the silt-carrying power of the river.

STORAGE OF WATER

Reservoirs.—At an early stage man must have realized the advantage of storing water against periods of shortage, as rivers and wells run low at times even if they do not run dry. At what date reservoirs first came into use as an additional aid to a regular supply is unknown; the remains of ancient reservoirs throughout the world, however, testify to the antiquity of the idea.

The earliest form was probably the earthen embanked reservoir, or tank, as it is called in India. The tank suffers from the disadvantage of retaining all the silt contained in the water stored in it. In time this leads to practical obliteration and a new tank has to be constructed elsewhere. Reservoirs with masonry dams were also built. These, too, became filled with silt, and not until modern times, and until the Periyar dam was built in India (1895) with sufficient sluiceway near its base to pass all the flood-waters and arrest only the later clean supply, was the problem met and a reservoir constructed which, in a silty river area, could be depended upon to keep itself clear of detritus. A magnificent example is the dam at Aswan, on the Nile in Egypt (1902–34), where the whole of the heavy flood passes through the structure without dropping any of its silt content and only clear water is stored. Thus a nearly perpetual life is guaranteed to the reservoir.

When dams are built in rivers where relatively little silt is carried, it is anticipated that the reservoir will fill with silt only after a long time; then another storage dam will be built farther upstream. The original storage will be lost, but the difference in water level above and below the old dam will remain available for hydroelectric power.

In modern practice, storage reservoirs are often created by multipurpose dams that will make the water available for municipal supply, hydroelectric power, industry, irrigation and navigation while also giving protection against floods. Silt and polution control, fish and wildlife protection and recreation often are important by-products. A series of these dams on a stream and its tributaries often provides comprehensive, integrated, basin-wide development. In a few cases, water is stored in one drainage basin, or watershed, and conveyed for use into another. Seven of the world's eight greatest surface reservoirs are in the U.S. (*See* also DAM; RESERVOIRS.)

Natural Underground Storage.—Throughout the ages man has availed himself of a small part of the enormous supplies (exceeding those of all reservoirs and lakes, including the Great Lakes) of underground water, often called ground water (*q.v.*). Most of this water has accumulated over long geological ages, but some is replaced by current rainfall as used. Heavy pumping reduces the permanent supply and lowers the water table, or level of the water, in the ground, and both of these effects make pumping increasingly expensive, a condition already serious by the second half of the 20th century in the southwestern United States and elsewhere.

Perhaps the largest and cheapest supplies of ground water for irrigation are found in humid deltas and coastal plains where the water is not too salty. There the heavy rainfall maintains a relatively inexhaustible underground supply, and large river flows also are available. *See* also HYDROLOGY.

LEGAL TITLE TO WATER

Population increases were accompanied by an alarming growth in the variety of industrial and other water uses in the second half of the 20th century. It appeared that availability of adequate water would largely determine where civilizations would develop.

The right to use specific supplies of water for irrigation and other purposes has caused militant and legal action throughout history. While these contests for water rights (*q.v.*) continued between nations, states, cities, industry, agriculture and individuals, in the 20th century resort to force was rare. The respective claims were customarily settled through the considerable body of applicable law and by negotiation.

Priority of appropriation and use may be advantageous. However, the trend of settlements is toward giving less weight to priority and to the English common-law principle of riparian rights,

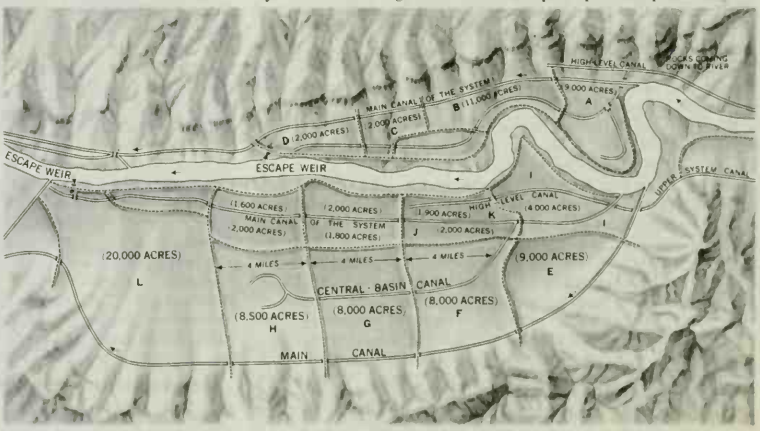

FIG. I.—BASIN SYSTEM OF IRRIGATION. A,B,C,D, FLAT LANDS IRRIGATED BY THE MAIN CANAL; E,I,J,K, LARGE BASINS IRRIGATED BY THE HIGH-LEVEL CANAL; F,G,H,L, BASINS IRRIGATED BY THE CENTRAL-BASIN CANAL

which entitled owners of land adjoining a defined natural watercourse to a reasonably undiminished and unpolluted flow but made little provision for irrigation; and toward giving predominant weight to the principle of beneficial use for the many.

Water is scarce in the western U.S. and serious difficulties have arisen regarding water rights. The arid states, however, enacted comprehensive statutes which enabled most disputes to be adjudicated satisfactorily. In the more humid eastern U.S. the growing use and scarcity of water increasingly drew attention to the urgent need for legislation defining rights to use both surface and underground waters. In the more acute situations, inventories of available water and of the community uses for it were made as a first step toward the complicated public relations, educational efforts and legislation that were needed. In any event, the prospective irrigator should consult competent local authorities and assure himself of a reasonably permanent right to the use of water before undertaking expensive irrigation.

PRINCIPAL SYSTEMS OF IRRIGATION

Basin System.—There are two main forms of irrigation. In the more primitive and inexpensive system the area to be served is surrounded by embankments, and is thus called a basin; into this a canal leads the waters from the river until a depth of three or four feet is attained. Many of these basins are of great size, the largest covering as much as 60,000 ac. The water is run off after a time and the exposed area is sown with crops which need no further watering to bring them to maturity. The system obviously originated in the fact that a river can be easily made to give a supply once a year during its flood period, whereas enormous expense would be required to make it do so at other times. It happens, also, that the production of food crops follows the flood season in many rivers; the system devised, therefore, was one which took advantage of a river's flood season.

Fig. 1, representing a basin system in upper Egypt, will serve to explain this system of irrigation, the firm lines representing canals, the broken lines embankments along the river and between basins. It will be seen, beginning on the east or right bank of the river (top of fig. 1), that a high-level canal flowing, like the river, to the north, from an upper system divides into two. The right branch waters all the desert slopes within its reach. The left branch passes, by a structure, under the main canal of the system, taken from the river close at hand (and therefore at a lower level; see *Canals*, above). This left branch irrigates the high strip of land bordering on the river. In years of very favourable flood, this high-level canal may not be wanted at all; irrigation could be done from the main canal with the great advantage that the main canal water would carry with it much more silt than would be carried from the tail end of the high-level canal which drew its supply from the river perhaps 25 mi. farther upstream. The main canal flows freely over the areas C and D and, if the flood is good, over B and a part of A. It is carried around the next desert point, and to the north becomes the high-level canal. The masonry works required for this system are a structure to pass the high-level canal under the main canal near its head, bridges fitted with sluices where each canal passes through an embankment, and an escape weir at the tail of the system to return the water to the river. The left (west) bank is similarly watered.

Perennial System.—The other modern and expensive system, where a perennial supply of water is made use of, is also fed by canals, but in this case the canal system is enormously developed compared with that of the basin system. In the latter, one canal only may be required to feed many basins by running through the higher-level basins and terminating at the middle of the last one of the series. In the perennial system, branch canals lead off from the main canal, lesser branches lead off from the main branches, and so on in ever decreasing size until as a last branch the smallest runlet is reached. The cost of this canalization is great, but the returns are correspondingly valuable, and usually about two crops can be grown each year instead of the single crop possible with basin irrigation.

Fig. 2 shows a perennial canal system. Only the main canals and principal branches are shown. The main canal may extend over any distance up to 200 mi. or even more. This plan also shows how efficient drainage is provided between the canals. A more detailed canalization from the branches is shown in fig. 3.

OTHER SYSTEMS

Minor Systems.—Dating from Roman times, water meadows in England have been flooded in the wettest and coldest times of the year so that the warmer water might be used as a protection against frost. Warping is an old English practice of flooding land so that the suspended silt may be deposited to form a new topsoil on which crops will be grown under rainfall only.

Subirrigation.—In a few localities water is applied laterally and upward from ditches, drains or pipes located below the surface of the ground. It may result naturally or be installed artificially.

Sewage Farming.—Many towns situated in inland districts, instead of passing their sewage into the nearest stream, deal with it by means of modern settling tank systems, from which the effluent is run off into small canals which irrigate suitable cultivable areas. The yield of crop produced is great, as such waters contain a very high percentage of nitrogenous matter. The drainage of Cairo, Egy., for instance, is said to be 30 times as valuable as the equivalent of Nile water, even in floodtime, when the latter bears its fertilizing silt. Sewage irrigation is not commonly practised in the U.S.

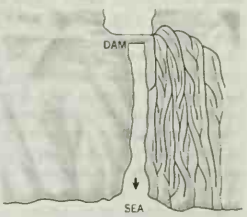

FIG. 2.—DIAGRAM OF IRRIGATION PROPERLY COMBINED WITH DRAINAGE

DRAINAGE

A necessary concomitant to irrigation is drainage of the soil. In few areas does nature provide it adequately without artificial aid. Poor drainage, resulting in excessive salts in the soils, popularly called alkali, has reduced yields in the arid western areas of the U.S. by about 20% and has occasionally caused abandonment of the land, as was often true in ancient countries of the middle and far east. Heavy rainfall in parts of the eastern U.S. and elsewhere causes other difficulties.

For many years the supply of irrigation water was the only problem effectively considered by engineers; the disastrous results which followed in many, if not all, cases from a neglect of the provision of adequate drainage, however, awakened everyone to the necessity of supplying it if optimum moisture control was to be attained, and if fields were to continue fertile in order to raise maximum crops and to utilize longer growing seasons.

Land may be smoothed with proper slopes and ditched so as to remove excess water before it enters the soil and thus prevent erosion, leaching of nutrients and standing pools of water on the surface, and to permit early spring planting. If carefully planned, this smoothing also can prepare the land for surface irrigation, thus serving two purposes by one earth-moving operation. After excess water enters the soil, its removal is an expensive and specialized undertaking that is not directly connected with irrigation, although it sometimes may be necessary for irrigated land. (*See* also LAND RECLAMATION.)

Much of the more promising surface irrigation occurs in humid or semihumid regions where it can be combined with drainage, usually in broad river valleys, alluvial deltas and coastal plains. Huge areas in these regions await this type of development, which, for example, has begun in the 20,000,000 ac. along the lower Mississippi river, where the poorly distributed annual rainfall averages 50 in. Here combined ditching and leveling with heavy

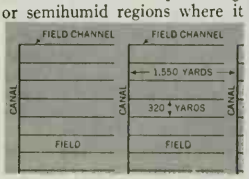

FIG. 3.—PLAN OF FIELD CHANNEL IRRIGATION

grading equipment is little more expensive than for irrigation alone, water supplies are cheap and relatively inexhaustible, expensive flood control and main drainage systems are already installed, the country is settled and large acreages are held under single ownerships that simplify organization, professional management and low-cost mass production under mechanization.

IRRIGATION PRACTICES

Distribution.—Where irrigation is carried on throughout much of the year, as in the perennial system, proper water distribution becomes a most important operation. It is often considered sufficient if during any one season two-thirds of the area commanded is actually supplied with water. This encourages that rotation of crops which seems to be a necessity of good farming, and also the lying fallow for a time of some part of the soil, which also appears to be a necessity in all countries during a portion of each year. Some crops, of course, require water much more often than others; much depends on the temperature at the time of irrigation; and seasons vary from year to year and from place to place. During the winter months in northern India magnificent wheat crops can be produced which have to be watered only two or three times. But to keep sugar cane, indigo or cotton alive in summer before the monsoon begins in India, or the Nile rises in Egypt, the fields should be watered at least once every 15 days, while rice requires an almost constant supply of water. Several irrigations per season are required over much of the United States.

Quantity.—Even if the crops grown under irrigation were in each case identical, in different countries and at different seasons the conditions are so variable as to preclude a statement of volumes of water which would be applicable everywhere. The depth of water applied varies with its purpose, with the climate, season, soil, subsoil, drainage, crop and other factors. Usually, from 2 to 6 in. in depth of water may be given at every one of the several times of watering under the perennial system, whereas the one watering of the basin system may take 30 to 50 in.

Seasonal net requirements of delivered water in the U.S. average from 1 ft. in depth where the effective rainfall is more than 12 in. during the crop-growing season, to as high as 3 ft. where the annual precipitation is less than 10 in., the season long and temperature high.

Measurement.—Various devices have been perfected for accurately measuring the amount of water flowing past a particular point. The rate of flow is usually measured in cubic feet per second (second foot) and the volume in acre feet, that is, 1 ac.ft. being the volume equal to 43,560 cu.ft. required to cover 1 ac. with water 1 ft. deep. A flow of 1 cu.ft. per second will furnish nearly 2 ac.ft. in 24 hours.

By measuring the water, analogously to measuring household water by a meter, it is possible to divide the water equitably among users, charge for the amount delivered and thus conserve scarce and valuable water. Measurement of the volume delivered also enables the irrigator to compute the depth of water that he is applying, a vital fact in attaining maximum production. Only by applying the right amount at the right time can optimum results be secured; otherwise irrigation may be ineffective or even harmful.

Applying the Water.—A proper control of irrigating water can save hard and expensive physical labour, assure uniform and satisfactory results and improve the yield as much as 100% over inefficient methods. Uncontrolled streams of water cause erosion, inefficiency, waste and uneven distribution, and they may even create expensive damage claims. Makeshift devices and procedures may be worse than useless and expert advice is essential. Water is applied to land by flowing it over the surface or by sprinkling from pipes, either method being satisfactory if properly planned and used. The newer sprinkling method predominates in the eastern U.S. and the older surface method in the west.

Experience indicates that a plan for irrigating any field should be chosen so that it will be suitable for different crops, both because of the desirability of rotation and because other crops may become more profitable.

Surface Irrigation.—Where topography and soil are favourable, where skilled irrigators are obtainable, where pumping is unnecessary, where surface drainage would be helpful and where labour and farm equipment are more available than cash, or where many of these conditions exist, surface irrigation may be preferable. Small canals, ditches, flumes or pipes convey the water to the field.

In order that water may flow uniformly and easily over the land, the surface must be reshaped to a suitable slope, only rarely made level. This leveling removes such humps and hollows as would interfere with the flow of water and improves the slope. The type and amount of leveling required is dependent upon the topography, depth and quality of soil, crops to be raised, method of irrigation to be employed and flow of water available. A ground surface free of irregularities permits even distribution of water to the land and crop, a resultant saving in water and labour, and a uniform crop yield. Yields are increased, sometimes as much as 50% to 100%, as a result of leveling. Initial light leveling will nearly always pay in facilitating the distribution of the water in the fields, and usually initial heavy leveling will be advisable, especially for reducing costs on large acreages and where surface drainage is desirable. Efficient equipment is generally available for both light and heavy leveling.

Irrigation water is usually made to flow over the ground through furrows, small ditches or runlets sloping downward between rows of plants; corrugations, which are smaller and closer furrows through closely cultivated plants; flooding, where a shallow sheet of water is confined by small dikes or levees within sloping border strips, contour strips or level basins as it advances over the land; and, less satisfactorily, through wild flooding manually out of ditches without benefit of land preparation and water control as just described. Other surface methods are used occasionally.

Sprinkler Irrigation.—For those not skilled in irrigation and where drainage is unnecessary, overhead sprinkling from pressure pipes, usually with revolving sprinklers and under engineering direction, offers the surest method of applying water. It may be used on most topography without leveling and without experienced irrigators, and, where pumping would be necessary in any event, it may well be the best method. Sprinkling is widely and increasingly used under engineering direction.

When and How Much to Irrigate.—There are both practical and theoretical approaches to this question, and, in addition, judgment must be developed through local experiment and experience. To get the full value and the best yields from irrigation, the moisture content in the soil must usually be kept well above the wilting point and slightly under the storage capacity of the soil in the root zone. When a crop wilts, irreparable damage usually has occurred. On the other hand, too much water can leach the plant nutrients from the soil, keep air out of the soil and cause erosion.

In the latter 1950s studies, described below, were made to determine the optimum soil-moisture content for specific crops at various stages of growth; they indicate that much better crop yields may become possible under carefully controlled optimum moisture conditions.

Fertilization.—Of the many factors controlling plant growth, two limit growth more often than all of the others combined, namely (1) a lack of adequate moisture control and (2) a lack of ample amounts of the so-called plant foods or plant nutrients. Through irrigation and drainage, farmers can deal satisfactorily with the moisture problem. By the addition of fertilizer (*see* FERTILIZERS AND MANURES), often applied in the irrigation water, they can supply plant foods without which crop production would be limited. This combined use of irrigation, drainage and fertilizer opens up a new frontier for agriculture. Together they present one of the great advances of modern times for growing more and better crops without expanding acreage.

SUPPLEMENTAL IRRIGATION

The older irrigation in the United States was generally developed before the middle of the 20th century by groups of farmers on large projects that by the late 1950s totaled about 28,000,000

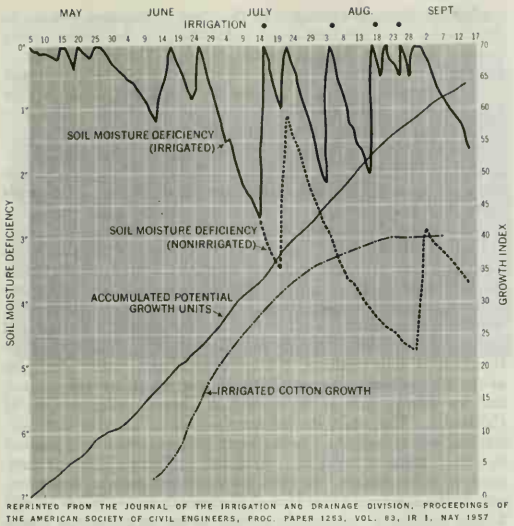

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FIG. 4.—SOIL MOISTURE DEFICIENCY IN THE SOIL OF THE ROOT ZONE, ACCUMULATED POTENTIAL GROWTH UNITS AND THE ACTUAL GROWTH OF IRRIGATED COTTON. DATES AT WHICH IRRIGATION WAS APPLIED ARE INDICATED BY THE BLACK DOTS AT THE TOP OF THE CHART

ac. west of the 100° meridian, which runs north and south through the centres of the Dakotas, Nebraska and Texas and through the western ends of Kansas and Oklahoma. There the annual rainfall of from 5 to 20 in. is very light during the growing season and heavy irrigation is essential.

On the other hand, supplemental irrigation has been practised mainly since mid-century by individual farmers on much smaller projects totaling by the 1960s about 3,000,000 ac. east of the 100° meridian. There the normal annual rainfall of between 20 and 50 in. is fairly adequate during the growing season and only light irrigation is required, although that small amount produces large returns. Seldom was water added artificially before 1950 except to a limited extent on lawns, golf courses, gardens, rice fields and horticultural crops. However, from 1950 to 1960 in the U.S. about as many acres were brought under eastern supplemental irrigation as were added to the larger and older western total irrigation; moreover, more irrigable land is available in the east than in the west.

As efficient and expensive agriculture developed and as disastrous droughts afflicted much of the humid and semihumid eastern U.S. in the 1950s, this region turned to supplemental irrigation mainly as insurance against droughts. It soon became apparent that added water also increased crop yields in most years, not only during obvious droughts in very bad years, and that even abundant annual rainfall seldom provided enough moisture at all of the times that it was needed. Next it was realized that maximum yields resulted only when the highest type of crop culture was combined with adequate water in the root zone of the soil reservoir at the right time in the growth schedule. Doubling of yields or a return of 100% on the annual cost of supplemental irrigation was not uncommon and it appeared that even larger returns might be anticipated as practices improved. Since supplemental irrigation is expensive in both first cost and operating cost, and since it is quite different from ordinary farming, it must be undertaken and conducted under expert advice. Only when it is accompanied by every modern aid to better agriculture will the best yields be obtained.

Optimum Plant Growth.—Studies in the nearly forgotten science of phenology, the relation of climate to the growth of plants, were undertaken by C. W. Thornthwaite and others, having as their first objective the scientific scheduling of supplemental irrigation and of the crops grown thereunder. Unless supplemental irrigation is applied at the right time and in the right amounts to maintain optimum soil-moisture conditions, it is not only wasted but it may actually be harmful, and crop scheduling is essential to efficient production. Scientific supplemental irrigation requires that both of these practices be utilized. With optimum moisture, scheduling and nutrients provided, actual crop growth can be measured daily and necessary remedial action taken immediately, before permanent injury has occurred, to keep that growth up to its climatic and economic potential, with resulting yields that have seldom been attained in the past.

Fig. 4 shows an actual case relating growth to its potential under an optimum level of soil moisture, a relationship possible only where irrigation is available whenever needed, as, for example, under individual pumping. Where canal water is delivered by rotation many days apart and not in sufficient quantity to fill a badly depleted soil reservoir, as is often the case in the arid west, it may not be possible to maintain the optimum level.

The solid upper curve shows the soil moisture deficiency in the root zone when irrigation is used, and the dotted upper curve shows the deficiency as it would be without irrigation, all plotted downward on the left-hand scale. In this locality the heavy rainfall of 50 in. annually frequently filled the soil reservoir to 0 on the scale. Irrigation was used only four times as shown by the solid dots at the top.

The solid line running upward to the right shows potential growth in this locality, and the dashed lower curve plots the actual measured daily growth of the cotton plants, all plotted upward on the right-hand scale. When actual growth as plotted on this dashed curve began to drop away from potential growth toward the end of July, remedial action should have been taken by irrigating, fertilizing, weeding, pest control or whatever appeared to be necessary. The curves are plotted daily to show when remedial action is necessary, usually several weeks before it becomes apparent on the plants.

The upward potential growth curve and the downward parts of the soil moisture deficiency curve are computed and plotted from evapo-transpiration, which is the moisture being used by the plants and being evaporated into the atmosphere (*see* DROUGHT).

IRRIGATION THROUGHOUT THE WORLD

World Survey.—As the second half of the 20th century was well under way, the total irrigated acreage of the world had nearly tripled since 1900. The largest acreages were credited to China, India, the United States, the U.S.S.R. and Pakistan. The total for all countries was about 320,000,000 ac., as compared with a total of about 110,000,000 ac. in 1900.

A general idea of the nature and expansion of modern irrigation and associated water control throughout the world was indicated

BY COURTESY OF AUSTRALIAN NEWS AND INFORMATION BUREAU

FIG. 5.—FARMS ALONG A MAIN CHANNEL OF THE MURRUMBIDGEE IRRIGATION AREA, NEW SOUTH WALES, AUSTR.

by a few of the plans and accomplishments in the late 1950s. The government of Communist China announced readiness to start construction on the first and largest of the 46 dams projected to control the floods of the Yellow river, produce electric power far in excess of the previous total and greatly increase the irrigated acreage. Formosa (Taiwan) and South Korea were modernizing and increasing their irrigated land area by several per cent annually. There, and throughout much of the far east, large rice acreages limited to one crop annually would be able to grow two crops annually when additions to their water supply were secured. India completed Hirakud dam on the Mahanadi river in the state of Orissa (1957), creating a storage capacity of more than 6,500,000 ac.ft. and permitting the eventual irrigation of about 670,000 ac. The project, entirely an Indian engineering effort, was begun in 1948. India's five-year plans included programs to increase the total irrigated area from 51,500,000 ac. in 1951 to more than 70,000,000 ac. in the 1960s. In Pakistan, construction was well along on the Warsak dam, planned to generate 240,000 kw. of electricity and effect the irrigation of 120,000 ac. India and Pakistan signed the Indus Waters treaty in 1960, and construction of dams, including the key Jhelum river dam, canals and other works was begun with aid from the World bank (International Bank for Reconstruction and Development). In the Rechna Doab project in West Pakistan, tube (drilled) wells were installed to create favourable drainage by lowering the water table, while providing water for irrigation.

U.P.I. COMPIX

FIG. 6.—FARMERS OF THE DAMODAR VALLEY, INDIA, AT WORK IN FIELDS FLOODED BY THE REGION'S CANALS

Spain's effort to restore productivity to the Guadiana river valley and provide electricity for Madrid had brought about the irrigation of about 33,000 ac. of an expected ultimate 300,000 ac. Work was also started to use the Ebro river for the early irrigation of about 250,000 ac. and eventual service to 2,500,000 ac. In Portugal the Mira river scheme was planned to irrigate 30,000 ac. in citrus, vegetables and cereals; since 1937 nearly 300,000 ac. had been brought under irrigation in government schemes and more than 600,000 ac. in private projects. Australia opened the Eildon reservoir to create an irrigation storage capacity of 2,750,000 ac.ft. of water near the source of the Goulburn river in the province of Victoria. Work continued in the 1960s on the Snowy Mountains project begun in 1950. Venezuela completed the nine-mile long earth dam on the Guárico river, expected to bring about the irrigation of 272,000 ac. of pasture and forage land. In Mexico the acreage irrigated by government projects increased by more than 100% between 1950 and 1960, from 3,000,000 ac. to 6,700,000 ac.; crops from this land were estimated to represent 33% of the total value of agricultural production.

In Italy the Flumendosa project was planned to effect the irrigation of 123,500 ac. in the Campidano di Cagliari, a plain in southwestern Sardinia, by three dams on the Flumendosa river and its tributaries, with connecting tunnels and irrigation distributaries. The most important feature of a four-year program in Japan was the proposed irrigation of 42,000 ac. already under paddy and 40,000 upland acres in the Aichi region on the island of Honshu. This was reported as the nation's first attempt to irrigate ridge lands. Among the several objectives of the Bhumiphol project in Thailand was the provision of additional water for the irrigation of more than 2,000,000 ac. in the area served by a large new system in the Chao Phraya river basin.

Considerable progress has been made in Africa, for example, on the Aswan high dam project. The Nile Waters agreement (1959) between Egypt and Sudan made necessary the construction of Roseires dam, in Sudan, for water storage. Related projects included the Managil extension to the Gezira irrigation system to increase by 75% the land under cultivation by the Sudan Gezira board. (*See* also NILE; AFRICA: *Natural Resources: Water.*) In Southern Rhodesia, Kyle dam was opened in 1961 as part of the Sabi-Lundi basin project to irrigate more than 300,000 ac. of low veld formerly devoted to ranching. The project was planned to greatly expand cotton, citrus and sugar acreage.

Both total and supplemental irrigation are being rapidly extended and improved by governments throughout the world in a scientific manner that will ensure greatly increased crop yields by modern procedures.

See also articles on various countries.

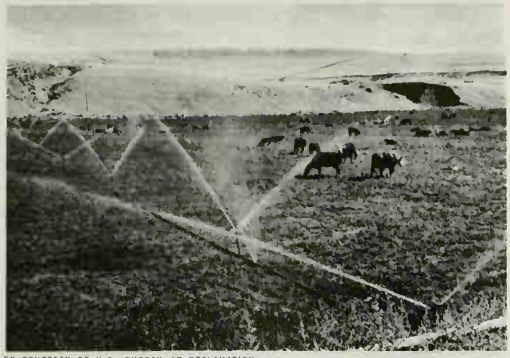
United States.—Perhaps the most efficient development of irrigation may be found and studied in the United States. In a single year of the late 1950s, the United States bureau of reclamation announced a construction program that, upon completion, would provide water for 150,000 ac. not previously irrigated and additional supplies for 94,000 ac. Contracts were let for the construction of main features of Glen canyon dam, major structure of the comprehensive upper Colorado river basin storage project, and for Trinity dam in the expanding Central valley project of California. That state started construction of Oroville dam, initial and key unit of the Feather river project, which was planned to serve extensive areas in central and southern California hundreds of miles distant. Beyond the foregoing western expansion, and in the same year, the United States soil conservation service helped to place a comparable acreage under supplemental irrigation in eastern U.S.

Relatively small areas in the southwestern portion of the country were irrigated in prehistoric times. The customs and methods used were improved by the Spanish conquerors and their descendants. Modern irrigation in the U.S. west began with the arrival of the Mormons in Utah in 1847 and increased to about 31,000,000 ac. early in the second half of the 20th century. Taking into consideration the available land and the availability of water supplies of reasonable cost, it was estimated that about 20,000,000 ac. more of western land could be developed by irrigation and perhaps another inadequately supplied 10,000,000 ac. could be furnished with additional water. In the humid eastern U.S. it was felt that an equally large acreage might be brought under supplemental irrigation, as described above.

Irrigation development in the United States followed a natural course concurrent and interwoven with the settlement and development of the west. The first works were simple ditches built by the settlers for diverting water from streams to easily reached farm lands in the valleys near by. These settlers were not financially able to build costly works, and common practice involved the use of wood and temporary structures.

In course of time, however, many land and water corporations were formed, with the aid of invested capital, for the purpose of exploiting the agricultural resources of the west. There followed legislative action by the states to enlarge the powers of farmers' organizations, enabling them to bond their land and raise funds for building, purchasing and reconstructing irrigation systems. In 1902 congress passed the Reclamation act, by which the federal government became an active participant in irrigation work. These agencies employed experienced engineers and designed and constructed more extensive and permanent irrigation works. The work of building new systems and remodeling and reconstructing existing enterprises continued, and the makeshifts of earlier periods were generally replaced by substantial structures of concrete and steel.

A degree of efficiency and permanence was attained in irrigation systems comparing favourably with those of any other country. The original Reclamation act was revised and greatly enlarged in scope, and under it the U.S. reclamation service and its successor, the bureau of reclamation (est. 1923), built many of the world's largest irrigation structures. It investigated and planned a comprehensive development of all the available water resources of the western states for their optimum utilization for irrigation and related purposes in large integrated basin-wide projects involving many large storage reservoirs, transmountain diversions, etc. In



BY COURTESY OF U.S. BUREAU OF RECLAMATION

FIG. 7.—SPRINKLER IRRIGATION IN THE COLUMBIA BASIN PROJECT, WASHINGTON

co-operation with the U.S. army corps of engineers, it continued to investigate and report on the comprehensive use of water resources for the arid west and to aid in construction and operation. The U.S. soil conservation service promoted irrigation in the humid east.

The United States was believed to rank first in the number, dimensions and permanency of its dams for storage of irrigation water; in the efficiency of mechanical equipment used to pump and control water for irrigation; in the efficiency of works to convey water to and distribute it on farms; and in scientific agricultural applications.

Chemical and agricultural science, mechanization, agricultural education and mass production for special markets under professional management combined to bring about a very efficient agriculture which was correspondingly expensive; while governmental aids tended to support prices at only modest levels, if at all. Under these conditions farmers seldom can afford to spend the larger production costs without having adequate, even if expensive, irrigation water to assure a good crop.

The necessity of these expensive aids for profitable modern agriculture established a trend toward increased acreage under a single management in order to secure low-cost agricultural mass production analogous to large-unit industrial mass production. Costly irrigation and drainage accentuated this trend and made it increasingly difficult for the traditional small family farm unit of the U.S. to furnish a satisfactory living for the family. There were, indeed, exceptions under special conditions, when a single-family farm unit might be very efficient. Various types of farm organization were being studied with a view to increasing the acreage irrigated under a single management. Historically, irrigation has always forced individuals to organize into larger groups with larger investments and better management. It continued to play this important role.

See also references under "Irrigation" in the Index.

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(H. RY.)

IRTYSH, a river of the U.S.S.R., flows through western Siberia and Kazakhstan and traverses the East Kazakhstan, Semipalatinsk and Pavlodar *oblasts* of the Kazakh Soviet Socialist Republic and the Omsk and Tyumen *oblasts* of the Russian Soviet Federated Socialist Republic. It is the principal tributary of the Ob river and rises in the glaciers on the southwestern slopes of the Mongolian Altai (in Sinkiang, China). Until it flows into Lake Zaisan it is called the Cherny Irtysh (Black Irtysh). Its total length is 2,760 mi., almost wholly navigable. From Lake Zaisan the river flows for a distance of 70 mi. (as far as the Kurchum river) through a monotonous steppe, its banks being low and covered with reeds. After being joined by the Narym river, the Irtysh traverses the western edge of the Altai, flowing through a narrow valley, the narrowest part of which lies between the mouth of the Bukhtarma and the town of Ust-Kamenogorsk. The channel of the river there is stony and in places the banks are precipitous. Lower down the Irtysh is joined by the Ulba and Uba rivers. From Semipalatinsk to Omsk (625 mi.) the Irtysh receives no considerable tributaries. Its banks in this sector are generally low and sandy, and the channel is often broken by islands. The valley there is about 6 to 7 mi. wide. A little above Omsk the Irtysh emerges from steppe into forest country and later into the taiga zone. From Omsk to Tobolsk the river receives several tributaries. The banks are sandy and the right bank is usually higher than the left. The width of the valley is about 3 mi. After receiving the Tobol tributary the water capacity of the Irtysh increases greatly. It joins the Ob near Khanty-Mansisk. The width of the valley from Tobolsk to the river mouth is about 7 mi. and at the actual confluence is nearly 20 mi. In the lower reaches the largest tributaries are the Ishim, Tobol, Vagai and Konda on the left, and the Om, Tara and Demyanka on the right. In its upper course the Irtysh receives its water from the mountain snows and glaciers, and in the lower course from snow and subsoil water; rainfall accounts for only a small part. The volume of water varies considerably from year to year. At Omsk the average annual discharge of water amounts to 933 cu.m. (32,946 cu.ft.) per second, while at Tobolsk it is 2,240 cu.m. per second. The Irtysh abounds in fish, those of industrial importance being sturgeon, sterlet, burbot, ide and bream.

There are many important mineral deposits in the Irtysh basin, particularly in the Altai. In the Pavlodar region is the Ekibastuz coal field. In the middle course there are many salt lakes. There too is much cultivation of wheat, and milk and meat are produced in large quantities. The Ust-Kamenogorsk hydroelectric station was completed in 1953 and that at Bukhtarma was constructed under the seven-year plan (1959–65). Steamers, carrying mainly timber, grain and coal, ply regularly from Malokrasnoyarka to the mouth of the Ob river (*c.* 2,000 mi.). The main river ports are Khanty-Mansisk, Tobolsk, Tara, Omsk, Pavlodar, Semipalatinsk and Ust-Kamenogorsk. (G. E. WR.)

IRVINE, a royal and small burgh and seaport of Ayrshire, Scot., standing on the Irvine river, which with the Annick runs into the Garnock estuary; it is 8 mi. W. of Kilmarnock. Pop. (1961) 16,911. Alexander II granted it a charter which was confirmed by Robert Bruce in 1322. About the end of the 17th century it was reckoned the third shipping port in Scotland, but its importance declined, partly because of the partial silting of the harbour and partly because of the establishment of harbours at Ardrossan and Troon. Now mostly coastal shipping uses the harbour. The academy is a pre-Reformation foundation. While the town is essentially industrial, it lies in the centre of golfing country, there being two first-class golf courses on the northern boundary—Bogside and Irvine municipal—and the well-known Gailes and Barassie golf courses on the southern boundary. Industries include ship repairing, the manufacture of cold-formed metal sections, iron and brass founding, saw milling, and pipe manufacture; there are also factories making hosiery, chemicals, bottles and horn products. The principal exports are bricks, tar, cement, fireclay goods, pipes, gravel and sand; imports include timber, limestone and cement.

IRVING, the name of a family of English actors.

SIR HENRY IRVING (1838–1905), the most famous English actor after David Garrick, was the son of Samuel and Mary Brodribb and was born at Keinton Mandeville, Somerset, on Feb. 6, 1838, being christened John Henry. As a youth he was employed as a clerk in the City of London, but in 1856 he decided to be an

actor, taking the name of Henry Irving. His first appearance was at the Royal Lyceum theatre, Sunderland, as Gaston, duke of Orleans, in Bulwer-Lytton's *Richelieu*. For ten years he played in provincial stock companies, acting more than 500 parts. In 1866 he was engaged by Dion Boucicault to play in Manchester the leading part, Rawdon Scudamore, in *The Two Lives of Mary Leigh*, which later, retitled *Hunted Down*, was transferred to the St. James's theatre, London. This led to Irving's engagement by Alfred Wigan at the newly opened Queen's theatre, and in 1870 he made his first conspicuous success as Digby Grant in James Albery's *Two Roses* at the Vaudeville. His performance in this part and, on the night of his benefit, his dynamic recitation of Thomas Hood's *The Dream of Eugene Aram* inspired Hezekiah Bateman, the American impresario, to engage him as leading man at the Lyceum theatre. Bateman's enterprise was a failure until he allowed Irving to produce and to play the leading part of Mathias in *The Bells*, a version of Erckmann-Chatrian's *Le Juif Polonais* by Leopold Lewis. Irving's success as Mathias was immediate and sustained; the play ran for 150 nights and remained a feature of his repertory until his death in 1905. Irving, after playing the title role in W. G. Wills's *Charles I* and *Eugene Aram*, and in *Richelieu*, made in 1874 a bid for supremacy as an actor by appearing as Hamlet. The humanity and distinction of his performance won him public acknowledgment as the leader of his profession, and the play had an unprecedented run of 200 nights. When Bateman died in 1875, Irving, under the management of Mrs. Bateman, continued to play in partnership with her daughter Isabel until 1877, appearing successively in Shakespearean tragedy and contemporary plays.

In 1878 Irving became lessee and manager of the Lyceum. With Ellen Terry (*q.v.*) as Ophelia and Portia, he revived *Hamlet* and produced *The Merchant of Venice* (1879). His Shylock was as controversial as his Hamlet, the dignity with which he invested the Jew pleasing some as much as it offended others. The play became a mainstay of his repertory; he declared toward the end of his career "in all humility . . . mine is the only great Shylock." After the production of Tennyson's *The Cup*, he invited Edwin Booth (*q.v.*) to play with him at the Lyceum, the English and American actors alternating in the parts of Othello and Iago. Irving's brilliantly conceived Iago was highly praised; his Othello, which lacked physical force, comparatively failed. In 1882–83 Irving and Ellen Terry had their greatest Shakespearean success in *Much Ado About Nothing*. Later in the year, Irving paid the first of several visits to the United States with the whole Lyceum company and with the scenic and lighting effects for which his theatre was famous. He continued in management of the Lyceum until 1899, producing *Twelfth Night* (1884), *Olivia* (a dramatization by Wills of Goldsmith's *Vicar of Wakefield;* 1885), *Faust* (1886), *Macbeth* (1888), *The Dead Heart* (1889) and *Ravenswood* (1890). In 1892 Irving's performance of Wolsey in *Henry VIII* was acclaimed, and in 1893 he produced Tennyson's *Becket*, in which, as the archbishop, he made a deep impression upon his audiences. Further productions, such as *King Arthur* and *Don Quixote* (1895), *Cymbeline* and *Richard III*, one of his most striking interpretations (1896), and *Peter the Great* (1898), did not meet increasing costs. In 1899 ill-health and misfortunes, which included the destruction by fire of almost all his stocks of scenery, induced him to surrender his control of the Lyceum to a limited liability company. In 1902 the company went into liquidation and Irving's reign at the Lyceum ended. His farewell season at Drury Lane in 1905, however, showed that his powers as an actor and his popularity with the public were undimmed. On Oct. 13 of that year he died, shortly after playing Becket at the Theatre Royal in Bradford. He was buried in Westminster abbey.

Both on and off the stage Irving maintained a high ideal of his profession. In 1895 he received the honour of knighthood, the first ever accorded an actor. His acting, apart from his genius as a stage director, divided criticism, opinions differing as to whether his mannerisms of voice and deportment hindered or helped the expression of his ideas. He excelled in the portrayal of fear, horror, scorn or malignity. A commanding personality such as his was bound to colour whatever part he assumed, but the richness and originality of this colouring were as admirable as the intellect and imagination with which his interpretations were conceived.

In 1869 Irving married Florence O'Callaghan, but after the birth of their two sons, Henry Brodribb and Laurence Sidney Brodribb, Irving and his wife were legally separated.

Henry Brodribb Irving (1870–1919), elder son of Sir Henry Irving, was born in London on Aug. 5, 1870. He was educated at Marlborough and at New college, Oxford, where he joined the Oxford University Dramatic society. He was called to the bar in 1894 but soon abandoned a legal career for the stage. His first appearance in London was made in Sept. 1891 with John Hare at the Garrick theatre in T. W. Robertson's *School*. In 1894 he joined Ben Greet's company, where he met Dorothea Baird, whom he married in 1896. His first notable success was in Barrie's *The Admirable Crichton* (1902–03). In 1905 he appeared as Hamlet at the Adelphi theatre, where his scholarly and vital performance established him as a creative actor of distinction. Forming his own company, he produced a successful version of Robert Louis Stevenson's *Dr. Jekyll and Mr. Hyde* and Stephen Phillips' *The Sin of David*. He was lessee and manager of the Savoy theatre from 1913 until his death in London on Oct. 17, 1919. Irving was a keen student of criminology and published *The Life of Judge Jeffreys* (1898), *French Criminals of the Nineteenth Century* (1901), *A Book of Remarkable Criminals* (1918) and *Last Studies in Criminology* (1921).

Laurence Sidney Brodribb Irving (1871–1914), younger brother of Henry Brodribb Irving, was born in London on Dec. 21, 1871. He was educated at Marlborough and, to enter the diplomatic service, studied for three years in St. Petersburg, but financial stringency prevented him from fulfilling this intention. Returning to England in 1893, he began his career as an actor in Frank Benson's Shakespearean company. In 1894 he made his first important appearance in London in Barrie's *Walker, London*. He married the actress Mabel Hackney and with her presented foreign plays of distinction to English audiences, notably *The Three Daughters of M. Dupont*, his own dramatization of Dostoevski's *Crime and Punishment* and M. Lengyel's *Typhoon*. In the last play (1912) he revealed himself as an actor of genius, which his brief appearances as Iago and as the Earl Skule in *The Pretenders* by Ibsen later in that year confirmed. In 1914 he took his company to Canada and was returning thence when he and his wife lost their lives in the sinking of the "Empress of Ireland" on May 28, 1914.

Laurence Irving wrote several plays, including *Peter the Great, Bonnie Dundee* and *Richard Lovelace*. His scholarship, allied to his unusual sensitivity, enabled him as an actor to portray with remarkable integrity the manners and characteristics of foreign peoples.

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IRVING, EDWARD (1792–1834), minister of the Church of Scotland, famous preacher closely associated with the formation of the Catholic Apostolic Church (*q.v.*), was born at Annan, Dumfries, on Aug. 4, 1792, and studied at Edinburgh university. After several years as a teacher he was called in 1822 to the Caledonian chapel in London where his congregation grew so large that in 1827 a new church was built in Regent square.

The eschatological emphasis in Irving's preaching gradually lessened his popularity, and in 1828 his orthodoxy was challenged. Two great themes had come to dominate his thoughts—his understanding of the incarnation of Jesus Christ and his growing expectation of the second coming. In 1828 Irving published a volume of sermons called *The Doctrine of the Incarnation Opened* which aroused a storm of controversy. In 1830 he brought out a further volume, *The Orthodox and Catholic Doctrine of Our Lord's Human Nature*. It also aroused violent opposition and Irving was

charged in ecclesiastical courts with holding "the sinfulness of Christ's humanity." Irving himself maintained that the charge was unjust, being based on a misinterpretation of his words. He was excommunicated by the London presbytery and in 1833 condemned and deposed from the ministry of the Church of Scotland by the presbytery of Annan. From this time he traveled throughout the country, preaching where he could, until he returned to London, where he was accorded a minor position in the evolving Catholic Apostolic Church. He died in Glasgow on Dec. 7, 1834, and is buried in the crypt of Glasgow cathedral.

Among Irving's closest friends were Thomas Carlyle, Charles Lamb and Samuel Taylor Coleridge. From 1826 he was a member of the Albury conferences, led by Henry Drummond, for the study of unfulfilled prophecy. About 800 from his Regent square congregation, influenced by Irving's belief in the catholicity of his teaching and the continuance of the apostolic order of the church, formed the Catholic Apostolic Church, the first edition of whose office and liturgy was issued from Albury shortly after his death.

Irving's sermons and lectures and his collected writings, edited by G. Carlyle, were published in 1864 and 1865 respectively.

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IRVING, WASHINGTON (1783–1859), U.S. writer, is variously called "first American man of letters," "dean" or "father of American literature," and "inventor of the short story." Much of the praise bestowed on him was deserved; some of it was owing primarily to his having been "first." Intellectually, Irving was a lesser man than many of his predecessors. He lacked the religious intensity of Mather, the philosophical acumen of Edwards, the versatility of Franklin, the statesmanship of Jefferson or the dedication of Paine. Yet he outlives them all in the history of American letters. His greatest literary success was won with *The Sketch Book* in 1819—precisely at the moment when British-American animosity had reached a new high—as if in answer to Sidney Smith's contemptuous query, "In all the four quarters of the globe, who reads an American book?" It was a book which all the world, especially many Englishmen, read with delight. While it gave little evidence that Irving was a man of great ideas, emotional depth or imaginative power, it established him as a talented writer, possessed of a temperament and a style, which he combined and varied deftly from sentiment and romance to wit and urbanity in ways to leave no doubt that here at last was an American whose elegant good taste was instinctive. Far from a bumptious provincial, he was a cosmopolite, speaking a language universally recognized in cultivated circles.

Irving was born in New York city on April 3, 1783, and in the attainment of the graces of living was conditioned by his rearing. The favourite and last of 11 children of an austere Presbyterian father and a more genially minded Anglican mother, young Irving grew up in an atmosphere of indulgence. A disposition toward frailty and sensitivity got for him the best that family competence and brotherly favouritism could supply. He escaped the regularity of a college education which his father required of his older sons, but because it was still customary for a gentleman to have a profession, even though he might not practice it, he read intermittently at the law, notably in the office of Josiah Ogden Hoffman, with whose pretty daughter Matilda he early fell in love. His "inveterate enemies, the fathers of the law," did not prevent his participation, as a gay-young-man-about-town, in the social whirl of the city or his association with young men bent, like himself, on enjoying life in terms of feminine society, theatrical entertainment and literary amusement. Associations of this kind led to his writing a series of whimsically satirical essays over the signature of "Jonathan Oldstyle, Gent.," published in Peter Irving's paper, the *Morning Chronicle*, during 1802–03. This youthful playing with the pen was interrupted by several trips up the Hudson, another into Canada in the interest of his health, and, during 1804–06, an extended tour of Europe, during which his health improved markedly, his manners were given a brush and several notebooks were filled with experiences picked up in a constant round of sight-seeing, flirtatious pleasantries and frivolous entertainment.

On his return, he passed the bar examination late in 1806 "by the grace of God and Josiah Hoffman," his tutor and chief examiner; and soon thereafter he set up as a lawyer by moving into his brother John's office at No. 3 Wall street. But his pursuit of this profession was desultory. During 1807–08 his chief occupation was to collaborate with his brother William and James K. Paulding in the writing of a series of 20 periodical essays entitled *Salmagundi*. To secure variety, they followed the Addisonian scheme of having the several subjects treated by several quaint gentlemen, each reminiscent of members of the Spectator club. They posed as "critics, amateurs, dilettanti, and cognoscenti" and proceeded, in true *Spectator* fashion, "to instruct the young, reform the old, correct the town, and castigate the age." They went on merrily, moralizing seldom, content to take "the world as it goes," yet gently satirizing the ways of the fashionable world, ridiculing the pretensions of political upstarts and social climbers, inserting squibs on the theatre, waging war against boorishness and mediocrity, "folly and stupidity," while teaching "parents how to govern their children, girls how to get husbands, and old maids how to do without them." Occasionally they mixed in a little pointed satire of Jefferson, his "rabble republican" followers and the "logocratic" democracy they sought to institute. *Salmagundi* made an impression, and became a mild terror in certain quarters of the town. While concerned primarily with passing phases of contemporary society, the essays retain significance as an index to the social milieu in which the Federalistically indoctrinated young men moved so easily.

His next book, *Diedrich Knickerbocker's History of New York* (1809), was planned merely as a parody of Samuel Mitchell's pretentious guidebook to New York city, but was eventually expanded into a comic history of the Dutch regime in New York, prefaced by a mock-pedantic account of the world from creation onward. Like *Salmagundi*, it embodies a great deal of contemporary social and political satire, born of youthful exuberance and effrontery.

The composition of this "first great book of comic literature written by an American" was interrupted in April 1809 by the sudden death of Matilda Hoffman. Grief incapacitated him for a while; but in the end the hard work necessary to complete *Knickerbocker*, the success of the book and his transfer in 1811 to the newer and wider scene of Washington as a lobbyist in the interests of the Irving brothers' hardware-importing firm helped transmute his grief into the realm of memory. His life, however, seemed to him more or less aimless for some years more, during which he turned to a variety of pursuits. He prepared an American edition of Thomas Campbell's poems, edited the *Analectic Magazine* and acquired a staff colonelcy during the War of 1812. In 1815, when his brothers' business (in which he had been a nonparticipating but profit-sharing member) declined, he sailed for Europe to look after the firm's interests in Liverpool, only to find that his efforts were not enough to stave off bankruptcy. What turned out more profitable in the end were the literary associations that he formed in London, and more especially a visit to Sir Walter Scott, who encouraged and stimulated him to renewed effort. The result was *The Sketch Book of Geoffrey Crayon, Gent.* (1819–20).

A true sketch book, miscellaneous and uneven, a composite of sentiment and romance, satire and whimsicality, fact and fiction, old and new world—its thirty-odd pieces include the first three so-called modern short stories ("The Legend of Sleepy Hollow," "Rip Van Winkle" and "The Spectre Bridegroom") and an essay, "English Writers on America," in which Irving spoke sane, abiding and forthright words on the nonsensical controversy which kept the British and the Americans in a bad humour with each other. The tremendous success of the book assured Irving, now reliant on his own resources, that he could live by his pen, and two years later he produced *Bracebridge Hall*, a sequel as it were to *The Sketch Book*. When critics pointed out literary borrowings and refurbishings of old tales in these two books, Irving set upon a studied search for novelty. Aware that his mind was not truly creative but rather receptive—that it needed some outside stimulation, such as travel, new associations, or old tales and anecdotes

might provide—he resolved: "I shall occasionally shift my residence and write whatever is suggested by objects before me." Hence he traveled in Germany, Austria, France, Spain, the British Isles and later in his own country; his pictures are the transcriptions of an antiquary rather than the conceptions of a creator.

Seeking better health and expecting to exploit the wealth of German folklore, Irving went to Germany, where during the winter of 1822–23 (spent mainly in Dresden) he gathered the materials for a "German sketch book," *Tales of a Traveller* (1824). This proved to be little more than a hodgepodge of travel reminiscences and badly assimilated ragtags of legendary lore, which the critics attacked savagely. Next he turned to Paris, where he collaborated in various dramatic and operatic productions, notably with John Howard Payne; and early in 1826 he accepted the invitation of Alexander H. Everett, then chargé d'affaires in Madrid, to attach himself to the American legation in Spain and there to translate M. F. de Navarrete's recent book on Columbus. Instead, he chose to produce his own *Columbus* (1828), followed by *The Companions of Columbus* (1831). Although both have long been superseded by later researches, they still supply readers with the essentials of Columbus' romantic life and exploits. Meanwhile Irving had become absorbed in the legends of Granada and of the Moorish past, and residence in the old Alhambra provided a fit setting for the composition of his *Conquest of Granada* (1829) and *The Alhambra* (1832), the latter the Spanish counterpart of *The Sketch Book*.

After 17 years' absence, Irving returned to New York in 1832, where he was warmly received. Impressed by the opening of the western frontier, he made an adventuresome journey west and produced in rapid succession *A Tour of the Prairies* (1835), *Astoria* (1836) and *The Adventures of Captain Bonneville* (1837). Except for four years (1842–1846) of distinguished service as minister to Spain, Irving spent the remainder of his life at his home "Sunnyside" on the Hudson, surrounded and revered by friends and relatives, and devoted to literary pursuits, chiefly biographical: *Oliver Goldsmith* (1849), *Mahomet and His Successors* (1850) and a five-volume life of his namesake, *George Washington* (1855–1859). He died on Nov. 28, 1859.

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(H. A. P.)

IRVING, a city of central Dallas county, Tex., U.S., a residential community west of Dallas (*q.v.*) and within its metropolitan area. The townsites Kit and Gorbett preceded Irving, but when the Rock Island railroad shifted its proposed route the present location of Irving was determined in 1902 by Otis Brown and J. O. Schulze. Irving's population increased rapidly after 1950; for comparative population figures *see* table in TEXAS: *Population*. (E. C. BE.)

IRVINGTON, a city in Essex and Union counties, N.J., U.S., bordering Newark and 10 mi. W. of New York city in the Newark standard metropolitan statistical area. Pop. (1960) 59,379. (For comparative population figures *see* table in NEW JERSEY: *Population*.) It is highly industrialized; products manufactured there include foods, machinery, jewelry, toy electric trains, paints, electronics, plastics, tools and castings. The city has several parks and playgrounds, a large library, a hospital and many national club organizations.

The area was settled in the 1690s and was a part of Newark. By 1812 it became an independent township, called Camptown; this name was changed in 1852 to Irvington in honour of the writer Washington Irving. The city was incorporated in 1898. In its early history it was noted for its shipbuilding, its horse racing and its position, after 1802, as a relay station for the New York-Philadelphia stagecoach run. (W. L. CA.)

ISAAC, the second of the fathers of Israel (*q.v.*), was the only son of Abraham (*q.v.*) by Sarah, and the father of Esau and Jacob (*q.v.*). The biblical etymology of Isaac, "he laughs," is connected with the circumstances of his birth (Gen. xvii, 15 ff.). The episodes reported of Isaac are strangely similar to episodes in the Abraham story. He is associated with sites in the south of Palestine, Beer-lahai-roi (xxiv, 62) and Beersheba (xxvi, 23). Vague and scanty as his story may be, Isaac is nonetheless the child in whom God's promise to Abraham is kept, and he in turn becomes the vehicle of the promise (Gen. xxvi, 24; Rom. ix, 7; Gal. iv, 28). In the Old Testament, in Judaism and in the New Testament God is called the God of Abraham, Isaac and Jacob, because with them God's relationship of promise and purpose was fixed for all those who descend from them (Ex. iii, 6; Matt. xxii, 32). The story of Abraham's sacrifice of Isaac was used in the early church as an example of faith (Heb. xi, 17) and obedience (James ii, 21), and as a type of the sacrifice of Christ (Barnabas 7); and in later Jewish tradition the sacrifice of Isaac is cited in appeals for the mercy of God, much as the cross of Christ was used in the church. (J. L. MA.)

ISAAC I (ISAAC COMNENUS) (*c.* 1005–1061), Byzantine emperor from 1057 to 1059, was the son of an officer of Basil II named Manuel Comnenus, who on his deathbed commended his two sons Isaac and John to the emperor's care. Basil had them educated at the monastery of Studius in Constantinople and advanced them to high official positions. During the reigns of Basil's successors, Isaac by his prudent conduct won the confidence of the army; in 1057 he was one of the Asian military magnates who overthrew Michael VI, and after the latter's deposition was invested with the crown, thus founding the new dynasty of the Comneni.

Isaac made some attempt to propitiate the defeated civil aristocracy by conferring office on Michael Psellus and Constantine Lichudes. But his radical opposition to the policy of this party is seen in his stringent financial economies. He even confiscated ecclesiastical property. He came into conflict with the arrogant patriarch Michael Cerularius, whose challenge to the traditional interdependence of church and state was met by a demand for his resignation. Cerularius refused; he was then sent into exile by Isaac in Nov. 1058 and was called upon to stand his trial for treason and alleged heresy, but he died before this took place. This episode added to Isaac's unpopularity with the people and the church; he also had to face the opposition of the displaced civil party. His only military expedition was against the Hungarians and Pechenegs (Patzinaks), who began to ravage the northern frontiers in 1059. Shortly after this successful campaign he was seized with an illness and, believing it to be mortal, was persuaded to appoint as his successor Constantine X Ducas, to the exclusion of his own brother John. Although he recovered, Isaac did not resume the purple but retired to the monastery of Studius and spent the remaining two years of his life as a monk there, alternating menial offices with literary studies.

As one of the military aristocracy, Isaac aimed at restoring a sound financial economy at home and building up the neglected military defenses of the empire. His somewhat high-handed methods were unpopular with the civil aristocracy and the clergy and not understood by the people.

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(J. M. HY.)

ISAAC II (ISAAC ANGELUS) (*c.* 1155–1204), Byzantine emperor from 1185 to 1195 and again from 1203 to 1204, was unexpectedly acclaimed by the mob in Constantinople who murdered Andronicus I (*q.v.*) Comnenus. His reign was inaugurated by the decisive victory of his general Alexius Branas over the Normans, who after invading the empire and sacking Thessalonica (1185) were now driven off Greek soil, except for the islands of Cephalonia and Zacynthus (Zante). He concluded a treaty with Bela III of Hungary and married his daughter Margaret. But he failed in an attempt to recover Cyprus from the rebel Isaac Comnenus. Nor could he quell the rising of the Bulgarians and Walachians under Peter and Asen that broke out toward the end of 1185, though he himself led the campaigns against them, and in 1187 he recognized the second Bulgarian empire. In 1189 Isaac was faced with the third crusade, and Frederick I Barbarossa, who took the land route

through the Balkans and Byzantine territory, proved an implacable enemy. Frederick conspired with the Serbs and Bulgars and also with the sultan of Iconium against the Byzantine emperor, who had tried to protect himself by a treaty with Saladin. Isaac, however, was forced to assist Frederick, who otherwise threatened to capture Constantinople, and in 1190 he concluded the treaty of Adrianople with him, promising transport and provisions. Once Frederick had left for Asia Minor, Isaac turned his attention to the Balkans, where he defeated Stephen Nemanya of Serbia in 1190 and concluded a marriage alliance with him. But he was unsuccessful in campaigns against Bulgaria. With Hungarian help, he was about to embark on a further expedition against the Bulgarians when he was blinded by his brother Alexius, who was then recognized emperor (April 1195). After eight years' imprisonment Isaac, though little more than a figurehead, was once more raised to the throne in July 1203 (*see* CRUSADES) and reigned together with his son Alexius IV (*q.v.*). But in Jan. 1204 he was again deposed, this time by his general Alexius V (*q.v.*) Ducas Murtzuphlus, and died shortly afterward. Although he was incapable of stemming administrative abuses, Isaac before he was blinded was not a feeble nonentity, as often implied; he did make some attempt to hold his own against Frederick I Barbarossa and to retrieve imperial fortunes in the Balkans.

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(J. M. HY.)

ISAAC OF ANTIOCH (called THE GREAT) is the name used to distinguish Isaac of Amida, a 5th-century Syriac writer, from two Edessene Isaacs, one a late 5th-century monophysite priest who settled at Antioch and the other a monophysite at the time of Bishop Paul (512) but who became orthodox under Bishop Asclepius (522). Jacob of Edessa distinguishes the three Isaacs; Gennadius knows of two. According to Zacharias Rhetor, Isaac visited Rome, and Dionysius Telmaharensis mentions his poems on the secular games of 404 and the capture of Rome (410) by Alaric. The Jacobite patriarch bar Shushan (d. 1073) calls him the disciple of Ephraem's pupil Zenobius. If Isaac is the author of the poem on the destruction of Antioch by earthquake in 459, the date of his death must be later than this, but some, *e.g.*, Duval, ascribe the poem to the earlier Edessene Isaac. Bar Shushan collected Isaac's writings but included many which have to be allotted to his namesakes and some even to Isaac of Nineveh, while some ascribed to Ephraem may be Isaac's, so great is the copyists' confusion, which modern scholars have not yet fully resolved.

See editions by G. Bickell (1873) and P. Bedjan (1903). *See* also A. Baumstark, *Geschichte der syrischen Literatur*, pp. 63–66 (1922).
(W. D. MCH.)

ISAACS, JORGE (1837–1895), Colombian poet and novelist, whose best work, *María*, is the most famous Latin-American novel. Isaacs was born at Cali, in the province of Cauca, Colombia, in April 1837, the son of a prosperous English Jew. He received an excellent education, first at Bogotá and later in England. During the War of the Cauca (1860–63) he was reduced to poverty by the destruction of his patrimony in the Cauca valley. Settling in Bogotá in 1864, he published a slight volume of *Poesías*, which attracted considerable attention, and in 1867 the novel *María*, which won immediate recognition and remains his chief title to fame. Seizing the opportunity thus opened to him for a political career, he entered public life, and in 1871–72 was appointed consul general in Chile. On his return he served in the provincial legislatures of Cauca, Cundinamarca and Antioquia, and filled numerous political, educational and editorial positions. He died in Ihagué on April 17, 1895.

Although Isaacs continued to write until his death and was a generous contributor to periodical literature, none of his later efforts fulfilled the promise of his first two volumes. An idyllic picture, very likely autobiographical, of life among the Cordilleras of his native Cauca valley, *María* was called by one eminent critic "the poem of America" and was translated into several foreign languages. Among his notable poems are "Río Moro," "En la Noche Callada" ("In the Silent Night") and "La Tumba del Soldado" ("The Soldier's Tomb"); *Saulo* is part of an uncompleted drama; *La Revolución radical en Antioquía* is his most important prose work outside fiction.

ISAAK, HEINRICH (*c.* 1450–1517), the leading Flemish composer of his generation, was probably born in Brabant. He may have been in Italy *c.* 1474–82, initially as a pupil of the famous Florentine organist Antonio Squarcialupi. He was certainly at the imperial court in Innsbruck in 1484. He then moved to Florence, where he taught in the household of Lorenzo de' Medici and set to music some of Lorenzo's own carnival songs. He apparently left Florence during the Medicean exile, returning to imperial service in 1494–95; he was officially appointed court composer in 1497, though he spent most of his life elsewhere. Between 1497 and 1514 he traveled extensively, finally settling in Florence, where he died in 1517.

Isaak's main publications were a collection of Masses (Venice, 1506) and the posthumous *Choralis Constantinus* (Nürnberg, 1550–55). The latter is the first complete polyphonic setting of the Proper of the Mass for all Sundays (and certain other feasts); it also contains five settings of the Ordinary. At least part of the work was commissioned for the diocese of Constance in 1508 and employs plainsongs unique to the Constance liturgy. Isaak left his great monument unfinished: the task of completing it fell to his pupil, the Swiss composer Ludwig Senfl.

In his sacred music, Isaak treats *cantus firmus* with infinite resourcefulness, placing the chant in any voice or sharing it between two parts, either in long notes or embroidered with shorter values; he also uses it as the thematic basis of contrapuntal imitations—a technique that came to dominate 16th-century music. Like Jakob Obrecht, he delighted in sequences and, like Josquin Després, in hovering, self-extending rhythms. In many respects, cosmopolitan and eclectic, Isaak remains Flemish in his rather hollow harmonies and his love of mensural intricacies. His Italian *frottole* have charming treble melodies, simply accompanied. His German *Lieder* normally present the tune in the tenor but avoid the sectional cadences of his contemporaries. Exceptionally, his famous "Innsbruck, ich muss dich lassen" recalls the style of the *frottola*. This song was later reworked as a chorale, "O Welt, ich muss dich lassen," familiar today through the arrangements by J. S. Bach and Johannes Brahms.

Isaak's secular music, edited by J. Wolf, appeared in *Denkmäler der Tonkunst in Oesterreich*, vol. 14, no. 1 (1907). His *Choralis Constantinus*, edited by E. Bezecny *et al.*, was published in the same collection in four volumes between 1898 and 1909; a final volume, edited by L. Cuyler, appeared in the U.S. in 1950. *Missa Carminum* was edited by R. Heyden (1930).

See H. Osthoff, *Die Niederländer und das deutsche Lied* (1938).
(B. L. TR.)

ISABELA, Philippine province in northeastern Luzon (*q.v.*). Area 4,069 sq.mi.; pop. (1960) 442,062. The eastern section comprises the rugged, sparsely populated Sierra Madre, which extends to the Philippine sea. Central and western Isabela lie in the fertile Cagayan valley, an important pioneer area since the early 1930s. Rice is the main crop, with surpluses shipped to Manila; corn is the leading local food crop. The production of Virginia tobacco is significant. The provincial capital and agricultural centre is Ilagan. (R. E. HE.)

ISABELLA (ELIZABETTA FARNESE; Spanish ISABEL DE FARNESIO) (1692–1766), queen consort of Philip V of Spain, was born in Parma on Oct. 25, 1692, the daughter of Odoardo Farnese (d. 1693), the eldest son of Ranuccio II of Parma and Piacenza. She was chosen as Philip V's second wife by the princesse des Ursins (*q.v.*), at the suggestion of the then Parmesan representative at Madrid, Giulio Alberoni (*q.v.*), and the marriage took place by proxy at Parma on Sept. 16, 1714. When, shortly after her arrival in Spain, Isabella was met by the princesse des Ursins at Jadraque, near Guadalajara, on Dec. 23, 1714, the queen, acting on the advice of Alberoni, forthwith dismissed the princess from her post of *camarera mayor* and sent her into exile. United with Philip the following day, Isabella immediately established over him a complete ascendancy, which she continued to exercise until his death 32 years later.

The direction which Isabella gave to Spanish policy was governed by the fact that Philip V had two sons surviving from his first marriage. Isabella's children—she bore Philip four sons and three daughters—therefore appeared to have little prospect of succeeding to the Spanish throne, and their mother sought instead to secure for them the Farnese lands in Italy. This quest dominated European diplomacy for more than 30 years; in it Isabella achieved remarkable success, her eldest son Charles (afterward Charles III of Spain) becoming successively ruler of Parma and Piacenza (1732) and of Naples (1734), while his brother Philip was recognized as duke of Parma in 1748. During the reign of her stepson, Ferdinand VI (1746–59), Isabella was removed from court, and although she was allowed to return for a short time after the accession of Charles III in 1759, she never exercised any real influence after the death of Philip V. She died at Aranjuez on July 11, 1766.

Isabella may justly be criticized for diverting Spain's meagre resources to narrow personal and dynastic ends, but the energy with which she pursued her aims, together with her capacity for choosing able and devoted ministers, gave a fresh vigour to the direction of Spain's internal affairs and were largely responsible for the improvement in the country's economy which occurred during the reign of Philip V. *See* also SPAIN: *History*.

See E. Armstrong, *Elisabeth Farnese* (1892); J. O. Lindsay (ed.), *The New Cambridge Modern History*, vol. vii (1957). (B. J. R.)

ISABELLA I THE CATHOLIC (Sp. ISABEL LA CATÓLICA) (1451–1504), queen of Castile from 1474 to 1504, was born at Madrigal on April 22, 1451, the daughter of John II of Castile by his second wife, Isabella of Portugal. Her marriage (1469) to the future Ferdinand II (*q.v.*) of Aragon led to the unification of Spain, and during her reign she restored the authority of the crown after its extreme weakness under her immediate predecessors. Ferdinand and Isabella succeeded as joint sovereigns to the throne of Castile on the death (Dec. 1474) of Isabella's half brother Henry IV, who had been forced to acknowledge her as his heir in preference to his own daughter Joan (*see* HENRY, kings of Castile). Afonso V of Portugal took up the claims of Joan but Isabella's Castilian army defeated the Portuguese at Toro (1476). In 1479 Ferdinand succeeded to the throne of Aragon and two years later associated Isabella with himself in the government of that kingdom. From 1481 the "Catholic Kings," as Ferdinand and Isabella were then known, ruled both kingdoms jointly, but it was a union of crowns and not of countries. The two kingdoms maintained their separate laws, institutions and governments (*see* SPAIN: *History*).

The Catholic Kings' first task was to fight the lawlessness in Castile. To this end they reorganized the medieval *hermandad* (*q.v.*). Isabella acquired a reputation for great severity but also for justice. The traditional policy of later Spanish monarchs in providing equal justice for all classes was undoubtedly due to her, but both in her own time and later this policy was only partly successful. Ferdinand and Isabella relied on the support of the towns in the Cortes to break the power of the nobles, who were forced to give up the crown domains which they had acquired. In her will, Isabella retracted her own grants of crown lands, an action which was regarded as sharp practice but justified by political necessity. Isabella induced the orders of Santiago, Calatrava and Alcántara to accept Ferdinand as their grand master, thus giving the crown the control over their vast property and patronage. The Cortes, once it served its purpose as an ally against the nobility, was summoned only very infrequently. The towns were brought under royal control by the appointment of corregidores (royal officials) to their administration. The royal councils were reorganized, the grandees being virtually excluded and their place taken by professional administrators and lawyers.

To win control over the Spanish church, Ferdinand and Isabella obtained from the pope the right to appoint all high ecclesiastical dignitaries. In 1478 they further obtained a papal bull establishing the Spanish Inquisition as a royal council under royal control. After a prolonged propaganda campaign, the Inquisition persuaded the Catholic Kings to expel the Jews (1492). With her narrow view of religion and influenced, no doubt, by the ecclesiastics in her entourage, Isabella was firmly convinced that she was fulfilling a pious duty in saving her subjects from contact with the heterodox. Most of her contemporaries agreed with her though it is doubtful whether the cynical Ferdinand was motivated by anything but political considerations. The expulsion of the Jews was not only extremely cruel but also economically disastrous for Spain. At the moment when Spain needed all its economic resources to sustain its new European position and overseas empire, Isabella deprived the country of its economically most active citizens and laid it open to exploitation by German and Italian financiers. Isabella was the moving spirit in the conquest of Granada and she fully supported Cardinal Jiménez de Cisneros in his policy of forced conversion of the Moors. The Moors rebelled (1502) and were defeated. Those who refused to be converted were expelled, just as the Jews had been.

Isabella died at Medina del Campo on Nov. 26, 1504. The Catholic Kings had given the monarchy in Castile a completely new basis of power and laid the foundations of Spain's political greatness in the 16th century. It was typical of Isabella's political vision that she agreed to finance the expedition of Christopher Columbus (*q.v.*). Isabella's religious policy, however, while typical of its age and even more of the succeeding age, has found full approval only from those historians who thought that no price was too high to pay for religious unity.

Isabella had five children: Isabel (1470–98), who married Manuel I of Portugal; John (1478–97), prince of Asturias; Joan (*q.v.*), "the Mad"; Maria (1482–1517), who also married Manuel I; and Catherine (*q.v.*) of Aragon.

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ISABELLA II (1830–1904), queen of Spain from 1833 to 1868, was born in Madrid on Oct. 10, 1830, the elder daughter of Ferdinand VII by his fourth wife María Cristina. Isabella's right to succeed to the throne was disputed by supporters of her uncle, Don Carlos, and her accession (Sept. 1833) precipitated a lengthy civil war (1833–39). During the queen's minority (1833–43) her mother and Gen. Baldomero Espartero acted as successive regents. In 1843 a military revolt drove Espartero from power and Isabella was declared of age. The period of Isabella's personal rule was, like the regency, a time of political instability: between 1833 and 1868 there were about 60 different governments in Spain and four separate constitutions were formulated amid a constant succession of risings and *pronunciamientos* (*see* SPAIN: *History*). For this state of affairs, Isabella's capricious nature and her attempts to rule despotically in the face of growing demands for a more progressive regime were largely to blame.

The queen married on Oct. 10, 1846 her cousin Francisco de Asís de Borbón (1822–1902), duque de Cádiz. He was widely believed to be impotent, and the simultaneous marriage of Isabella's younger sister to Louis Philippe's son, the duc de Montpensier, provoked a grave crisis in Anglo-French relations. The king consort was not of Isabella's own choice nor to her liking and she in fact lived mainly in separation from him. Scandalous reports of her conduct were circulated and this damage to the reputation of the monarchy, together with other discontents, led to Isabella's deposition on Sept. 26, 1868.

Shortly afterward Isabella went into exile, taking up residence in Paris. There, in 1870, she abdicated her rights in favour of her eldest surviving son, the future Alfonso XII (*q.v.*). She died in Paris on April 9, 1904. Apart from Alfonso, Isabella had eight other children, but of these only three survived infancy.

See also SPAIN: *History*. (R. S. Ll.)

ISABELLA OF BAVARIA (in French called ISABEAU DE BAVIÈRE) (1371–1435), queen consort of Charles VI of France, was the daughter of Stephen III, duke of Bavaria, and was married on July 17, 1385. Her husband's sudden insanity (Aug. 1392) caused her profound distress; she long pursued every imaginable remedy for him, both medical and supernatural. She bore the king six children between 1393 and 1403; but as his derangement grew

worse his rebuffs gradually drove her into flagrant misconduct, which was publicly censured by a court preacher as early as 1405. Her brother-in-law, Louis, duc d'Orléans (*q.v.*) became her constant companion, but this may be explained by the necessities of government, and it cannot be proved that he was her lover.

Isabella was frequently regent for her husband. After the murder of Orléans (1407) she relied for support on John (*q.v.*) the Fearless, duke of Burgundy, who rescued her from a brief imprisonment (1417) and with her set up a shadow government at Chartres and then at Troyes. Her gravest political act was the signing of the treaty of Troyes (1420), which disinherited her son Charles (afterward Charles VII) in favour of Henry V of England. She survived her husband 13 years, repudiated by her son, abandoned by the duke of Burgundy, despised by the English and loathed by the French. She died in Sept. 1435 at the Hôtel St. Pol in Paris. Capricious rather than able, Isabella had misjudged the French situation and rashly played a political game utterly beyond her skill.

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ISABELLA OF FRANCE (*c.* 1296–1358), queen consort of Edward II of England, played a principal part in the deposition of the king in 1327 (*see* EDWARD II). The daughter of Philip IV of France, Isabella was betrothed to Edward by the treaty of Montreuil (1299). The marriage took place on Jan. 25, 1308, at Boulogne, when Isabella was about 12 years old. Despite the suggestions of certain chroniclers, there is no evidence of any early quarrel between Isabella and Edward. By her marriage Isabella had two sons, Edward (afterward Edward III) and John of Eltham, earl of Cornwall, and two daughters, Eleanor of Woodstock and Joanna, later the wife of David II of Scotland. Isabella had extensive possessions in both France and England. After her marriage she was given the counties of Ponthieu and Montreuil for her personal expenses. After the death of Margaret, the queen mother, in 1318, other lands and revenues were made available to her. Altogether Isabella held manors and castles in north Wales and 17 English counties.

Isabella's early interventions in politics were conciliatory. After the murder of the king's friend, Piers Gaveston, in 1312 she attempted to promote peace; she was entrusted with a mission to France (1314) and was active in arranging the settlement of Leake in 1318. In the 1320s, however, Edward's new favourites, the Despensers, aroused Isabella's antagonism. On the pretext of a French invasion her estates were seized in 1324. Isabella sailed for France in 1325 in an attempt to settle the question of Gascony and was joined there by her son, Edward, prince of Wales. From France she made public her refusal to return to England until the Despensers had been removed from court. Joined by Roger Mortimer of Wigmore (*see* MORTIMER), whose mistress she became, and other baronial exiles, Isabella crossed to Essex in Sept. 1326 and routed the forces of Edward and the Despensers.

After the accession of Edward III in 1327, Isabella and Mortimer (created earl of March in 1328) enjoyed a brief period of influence. Her dower was restored and other grants were made to her. In 1330 Edward III's assertion of independence and the arrest and execution of Mortimer marked the end of her power. She was sent into retirement but her movements were not restricted. Her wealth was considerable, but in her old age Isabella took the habit of the Poor Clares and after her death in 1358 was buried in the Franciscan church at Newgate. (J. TA.)

ISABELLA OF HAINAUT (1170–1190), queen-consort of France from 1180 to 1190, was the daughter of Baldwin V, count of Hainaut, and Margaret, sister of Philip of Alsace, and was born in 1170 at Lille. She was married in 1180 to Philip II Augustus and brought to him as her dowry the province of Artois. This marriage brought about the revolt of the house of Champagne; hence Isabella's coronation could not take place at Reims, and she was crowned at St. Denis instead on May 29, 1180.

In 1184 Philip, waging war against Flanders, was angered at seeing Baldwin support his enemies and called a council at Senlis for the purpose of repudiating his wife. But Isabella succeeded in dissuading him from this purpose. She died in 1190. Her son became Louis VIII of France.

ISABEY, JEAN BAPTISTE (1767–1855), French painter of miniatures, was born at Nancy on April 11, 1767. He went to Paris in 1785 and later became a pupil of J. L. David. Employed at Versailles on portraits of the dukes of Angoulême and Berry, he was given a commission by Marie Antoinette, the first of many which he received up to his death (in Paris, April 18, 1855) from the successive rulers of France. Patronized by Josephine and Napoleon, he arranged the ceremonies of their coronation and prepared drawings for the publication intended as its official commemoration, a work for which he was paid by Louis XVIII, whose portrait he executed in 1814. Although Isabey did homage to Napoleon on his return from Elba, he continued to enjoy the favour of the Restoration, and took part in arrangements for the coronation of Charles X.

The monarchy of July conferred on him an important post in connection with the royal collections, and Napoleon III granted him a pension and the cross of commander of the Legion of Honour. "Review of Troops by the First Consul" was one of his most important compositions, and "Isabey's Boat," a drawing of himself and family, had an immense success at the Salon of 1820. His portrait of "Napoleon at Malmaison" is held to be the best likeness of the ruler ever executed. His son and pupil Louis Gabriel Eugène Isabey (1804–86) was a genre and marine painter and water colourist.

See Marion W. Osmond, *Jean Baptiste Isabey, the Fortunate Painter* (1947).

ISAEUS (*c.* 420 B.C.–*c.* 350 B.C.), a professional speech writer at Athens specializing in testamentary law, whose lucidity and logical method were a landmark in the development of forensic oratory. Accounts of his life are scanty and contradictory. His father is said to have been called Diagoras, which is not an Athenian name. According to one ancient source Isaeus was a Chalcidian, according to another an Athenian. To account for this discrepancy it has been suggested that his family belonged to a settlement of Athenian citizens at Chalcis. At any rate he spent his professional life in Athens, either as a citizen or as a resident alien. He appears to have taken no part in public life, but this is in itself no evidence that he was an alien: he may merely have had no desire to speak in public.

His profession was to write speeches for clients. He appears to have confined himself entirely to forensic speeches and almost entirely to those concerned with private suits. He had a minute knowledge of the laws of inheritance and expert skill in exploiting this knowledge to win a case. Too much weight should not be attached to ancient reports that he was a pupil of Isocrates and Lysias. Of Isocrates' influence his work shows little trace. The influence of Lysias is indeed unmistakable, but probably, as Dionysius of Halicarnassus says in his work on the Attic orators, Isaeus merely imitated him. Ancient stories of his personal relations with Demosthenes can largely be discounted, but there is no doubt that Demosthenes' writing owed much to him.

The author of the pseudo-Plutarchean life of Isaeus says that 64 speeches were ascribed to him of which he believed 50 to be genuine. Eleven are extant and a considerable part of a 12th has been preserved in Dionysius' essay on Isaeus. In most cases dating can only be tentative, but all belong to the first half of the 4th century B.C. Every one of the 11 speeches deals, directly or indirectly, with a will. Six relate to disputed claims to an inheritance and three to prosecutions for false witness in testamentary suits. The fifth speech concerns an action brought to compel a man to discharge his obligations as surety in connection with a will, and the 11th the indictment of a guardian for ill-treatment of his ward. The incomplete 12th speech is not connected with a will case; it refers to an appeal to a law court by a certain Euphiletus against the decision of his demesmen to strike him off the register. Many fragments and titles of other speeches have also survived.

The professional speech writer was faced with a difficult problem. It was essential to present a case in a convincing and persuasive form, but if the writer's skill were too transparent, the jurors would be on their guard and the client's case might suffer.

It is clear that Antiphon's self-conscious artistry had been found unsuitable for practical oratory. Lysias had allayed suspicions by writing in a simple style and by skillfully adapting the language and manner of a speech to the character of each particular client. Such characterization is not to be found in the work of Isaeus, but he resembles Lysias in the simplicity and clarity of his language and in avoiding pretentious embellishments. He makes sparing use of such linguistic adornments as antithesis, parison and anaphora. On the other hand he indulges freely in the so-called "figures of thought"; *e.g.*, rhetorical questions and the imaginary objections of an opponent.

Scholars have pointed out some divergences from strict Attic idiom in his writing; it is possible that these may be due to manuscript corruption. In general his style is lucid and businesslike, and the very fact that it lacked literary charm probably added to its effectiveness. In the arrangement of this matter Isaeus shows himself remarkably independent of the rules for subdivision prescribed by rhetoricians. He follows no single plan but varies the structure according to the needs of each particular speech. He shows particular skill in interweaving narrative and proof, thereby avoiding a long, unbroken relation of facts, which in testamentary cases might be complicated and difficult to follow.

Perhaps Isaeus' most significant contribution to forensic oratory lay in his method of argument; he appears to have been the first orator to build up his case point by point with logic and reason. At the same time he took pains to make his arguments intelligible, by frequent repetition and recapitulation at the end of a speech.

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ISAIAH, ASCENSION OF, a composite Jewish-Christian work dating in its present form from around the 3rd century A.D., which gathers together certain extrabiblical legends associated with the name of Isaiah.

The first five chapters tell the story of the Martyrdom of Isaiah, in which Isaiah resolutely accepts a painful death rather than recant his faith. The purpose of the story, which dates from the 1st or more probably 2nd century B.C., is obviously to encourage Jews to stand firm under persecution, and it was probably this which commended it to Christian editors in their time of persecution later.

Embedded in this story is a section (iii, 13–iv, 18) that is generally recognized as a separate Christian document, known as the "Testimony of Hezekiah," in which, on his deathbed, the king foresees the coming of Christ. In ch. vi–xi it is told how Isaiah was taken on a journey through the seven heavens and was given foreknowledge of the life of Christ. Now known as the "Vision of Isaiah," it was this *ascensio* of the prophet that gave its name to the whole work.

Both the Testimony and the Vision are Christian in origin and probably date from early in the 2nd century. They are intended to support the claim that Old Testament prophets foresaw and foretold the messianic role of Jesus. All three sections probably circulated separately at first and were brought together at a time when the possibility of persecution was still sufficiently real to give relevance to the Martyrdom (*i.e.*, not later than the beginning of the 4th century). The value of the two Christian sections is the light they throw on the growth of doctrine and institutions in the early church (Trinity, incarnation, resurrection, heaven; criticism of increasing worldliness of the clergy; the spread of heresies), though this is mitigated by the lack of firm dating.

The work survives as a whole only in Ethiopic, but Greek, Latin and Slavonic fragments are extant. The literary relationship of these versions is not easy to determine, but no serious challenge has been offered to R. H. Charles's account of the book in his classic edition, *The Ascension of Isaiah* (1900).

See O. Eissfeldt, *Einleitung in das Alte Testament* (1956).
(ST. B. F.)

ISAIAH (ESAIAS, ISAIAS), **BOOK OF,** in the Old Testament, is the first of the three Major Prophets (with Jeremiah and Ezekiel), or longer prophetic books, as contrasted with the Minor Prophets which together make up a scroll of about the same length, "The Book of the Twelve." Isaiah's 66 chapters comprise material from before (i, 1), during (xliv, 28) and after (lvi, 2–8) the Babylonian exile of the Jews (597–537 B.C.). The book has as its nucleus in ch. i–xxxix collections of prophetic oracles by, and narratives concerning, the prophet Isaiah son of Amoz, one of the four 8th-century prophets (with Amos—not identical with Isaiah's father—Hosea and Micah). A second major element in the book is a collection of prophetic poems in ch. xl–lv from an unknown writer who addresses himself to the situation of the Jews toward the end of the Babylonian exile about two centuries after the inception of Isaiah's prophetic ministry. Isaiah is the book most quoted in the New Testament because of its references to the messianic age and to the witness, rejection, suffering, death and exaltation of the chosen Servant of the Lord. It was also a favourite of the Qumran sect (*see* DEAD SEA SCROLLS).

Contents.—The book may be outlined as follows (passages of special interest are noted in parentheses):

i–xxxv	
i–v:	oracles, chiefly of judgment upon Judah and Jerusalem for pride, depravity, social injustice and perversion of religion ("your sins are like scarlet," i, 18; "swords into plowshares," ii, 4)
vi–viii, 18:	narratives and oracles; Isaiah's vision, the three signs to Ahaz, the prophet's temporary retirement ("Holy, holy, holy is the Lord of hosts," vi, 3; "If you will not believe, surely you shall not be established," vii, 9; "a young woman [virgin] shall conceive . . . a son . . . Immanuel," vii, 14)
viii, 19–x, 4:	oracles of doom and promise of the messianic king ("to us a child is born . . . Prince of Peace," ix, 6)
x, 5–xii, 6:	the Assyrian threat and the messianic ruler to come ("Assyria, the rod of my anger," x, 5; "a shoot from the stump of Jesse," xi, 1)
xiii–xxiii:	doom oracles on foreign peoples ("Babylon, the glory of kingdoms . . . will be like Sodom," xiii, 19; "How you are fallen from heaven," xiv, 12; "I will break the Assyrian," xiv, 25; "Isaiah . . . naked and barefoot . . . as a sign," xx, 3)
xxiv–xxvii:	a booklet of eschatological prophecy, psalms and prayers ("He will swallow up death for ever," xxv, 8)
xxviii–xxxii:	oracles chiefly on divine sovereignty over historic events ("a covenant with death," xxviii, 15; "in Zion . . . a precious cornerstone. . . . He who believes will not be in haste," xxviii, 16; "in quietness and in trust shall be your strength," xxx, 15; "The Egyptians are men, and not God," xxxi, 3; "a king will reign in righteousness," xxxii, 1)
xxxiii–xxxv:	a prophetic liturgy; the fearful doom of Edom; the joyful return to Zion ("the desert shall rejoice," xxxv, 1; "sorrow and sighing shall flee away," xxxv, 10)
xxxvi–xxxix:	modified excerpt from II Kings xviii, 13–xx, 19, concerning Isaiah's part in the crisis of Sennacherib's invasion in 701 (or 688?) B.C., and related matters ("Whom have you mocked and reviled? . . . the Holy One of Israel," xxxvii, 23; "I will defend this city," xxxvii, 35)
xl–lv:	prophetic poems of lyrical joy on the imminent deliverance of his people from Babylonian exile by Yahweh, Israel's Redeemer and the only true God. Incorporated within these chapters are four distinctive poems picturing the mission, suffering, justification and triumph of Yahweh's chosen Servant (xlii, 1–4 or –7; xlix, 1–6; l, 4–9; lii, 13–liii, 12; xlviii, 16c may be a fragment of another Servant poem)
xl–xlviii:	proclamation to the exiles of deliverance, at hand through the agency of Cyrus, in fulfillment of Yahweh's eternal purpose and as a demonstration to the world that he alone is God; the futility of idolatry and the downfall of the Babylonian gods; the mission of the chosen Servant ("Comfort, comfort my people," xl, 1; "In the wilderness prepare the way of the Lord," xl, 3; "He will feed his flock like a shepherd," xl, 11; "Behold my servant, whom I uphold," xlii, 1; "Before me no god was formed, nor shall there be any after me," xliii, 10; "Thus says the Lord to his anointed, to Cyrus, . . . I will go before you," xlv, 1–2; "Bel bows down, Nebo

stoops," xlvi, 1; "Go forth from Babylon," xlviii, 20)

xlix–lv: the consolation and abundant restoration of Zion under the everlasting covenant of Yahweh, her Maker and Redeemer; the chosen Servant's rejection and his wider mission; his persecution and death for others' sins and his promised reward ("I will give you as a light to the nations," xlix, 6; "he who vindicates me is near," l, 8; "Awake, awake, put on your strength, O Zion," lii, 1; "he was wounded for our transgressions," liii, 5; "my word . . . shall accomplish that which I purpose," lv, 11)

lvi–lxvi: admonitions to the restored community; new calls to rejoicing in view of the glorious future promised; a universal judgment and a new creation ("the Lord's hand is not shortened, that it cannot save," lix, 1; "Arise, shine; for your light has come," lx, 1; "the Lord has anointed me to bring good tidings," lxi, 1; "I create new heavens and a new earth; . . . I create Jerusalem a rejoicing," lxv, 17–18; "by fire the Lord will execute judgment," lxvi, 16)

Themes.—The central thought in the prophecies of Isaiah himself in ch. i–xxxix is that of the holy majesty of God, a terrible divine righteousness which confronts and confounds the pretensions of men and overrules the course of events in fulfillment of God's purpose for his people. The "Holy One of Israel" will not tolerate injustice and depravity among his people or their rulers, nor accept worship which is less than a wholehearted response to his ethical holiness. The pride and materialism of Judah's leaders —and, above all, their frantic search for political security through schemes which belie their claims to be Yahweh's people—can bring only disaster. Judah's only hope is to learn the meaning of religion, as ethical loyalty and complete trust in the unseen but conclusive mastery of events by God. A chastised and repentant people will know that Yahweh is both her judge and her defender.

In ch. xl–lxvi the central theme is Yahweh's imminent inauguration of a new age for his people by coming to deliver her from the captivity, suffering and spiritual defeat in which the old age had ended. The act of redemption through Yahweh's chosen instrument, the Persian conqueror Cyrus, will be at the same time a new act of creation in the realm of spirit. It will fulfill his unchanging and undefeated purpose made known in the covenants with Noah, Abraham and David; it will be a new Exodus to the land of promise. Nature itself will be re-created when Israel is reborn. This new mighty act of God is to be an act at once of creation, revelation and redemption, displaying the omnipotence of him who is the first and the last, the universal and only God. In contrast, the gods of the heathen will be shown to be no gods at all, because they are impotent to reveal and accomplish a creative purpose. Israel is summoned to take up the task of witness for which she has been chosen; she is called from fear to faith, and from spiritual defeat to the joyous liberation of spirit which will be a light to the nations.

The Songs of the Suffering Servant strike a muted note amid this paean of rejoicing. Their subject is the meaning of suffering as the means whereby Yahweh will bring salvation to mankind. The Servant who is chosen to mediate God's message to the nations is ignored, despised, persecuted and finally put to death. But, as a result, the kings and people learn that the suffering of the innocent and obedient at the hands of the rebellious effects an atonement which is within the purpose of God. The attempt to identify the Suffering Servant as an individual or collective figure is futile; he is not simply a martyred prophet, a suffering just man like Job, a king who dies for his people in symbolic ritual, or the empirical or the ideal Israel. The Servant is the composite portrait of an *idea* that defies precise identification and transcends any temporal setting. He personifies the redemptive and creative power of innocent suffering willingly accepted as the cost of bearing witness to the will of God. It is not surprising that this portrait provided the writers of the New Testament with the principal clue to the meaning of the crucifixion of Jesus Christ, though attention to the details of the portrait shows that the correspondence is on a deeper level than mere prediction.

Literary History.—The process through which the Book of Isaiah reached its present form represents a complex problem to which there is no agreed solution except in broad outline. The obvious differences between adjacent passages and different parts of the book—in literary forms and style, religious ideas, historical background and condition of those addressed—together with the sharp breaks in continuity, show that it was put together by many hands over a long period of time. Its oldest materials are the oracles of Isaiah's early period, shortly after his call to prophesy in 742 B.C. It was complete and believed to be throughout a prophecy of Isaiah by the time of Sirach (*cf.* Ecclus. xlviii, 17–25), *c.* 190 B.C., and probably considerably earlier than that. Ezra i, 1 (*c.* 400 B.C.), however, seems to attribute Isa. xlv, 1–7 to Jeremiah, in whose book there is no mention of Cyrus; this suggests that ch. xl–lxvi had not yet been attached to ch. i–xxxix. That a relevant section of II Kings (xxiv, 18–xxv, 21, 27–30) is appended to the Book of Jeremiah strongly suggests further that Isa. xxxvi–xxxix is a similar appendix to an earlier form of the Book of Isaiah, before the addition of ch. xl–lxvi and the insertion of the related ch. xxxiv–xxxv. The complete scroll of Isaiah found at Qumran in 1947 exhibits a unique space between ch. i–xxxiii and xxxiv–lxvi, which may indicate that in one form of the manuscript tradition the two parts of the book were recognized as distinct.

Although the unity of the book is still defended by some on dogmatic grounds, it cannot be maintained in the face of the internal evidence. The decisive point is that, whereas the superscription in i, 1 designates what follows as "the vision of Isaiah" in the reigns of four kings of Judah of the Assyrian period in the latter part of the 8th century B.C. while the Temple was unharmed, the second part of the book is addressed to Jews who are captives of the Babylonian power which succeeded the Assyrian, or who look back to the exile of 597–537 B.C. The overthrow of Babylon by Cyrus, the Persian king, is imminent (xlv, 1–7) and "the captive daughter of Zion" (lii, 2) is to be set free. The Temple has been destroyed by fire (lxiv, 11). It is in this situation that the poet utters his message of comfort and hope: Jerusalem's warfare is ended (xl, 2); for Israel's sake God her Redeemer will "send to Babylon and break down all the bars" (xliii, 14); he says of Cyrus "He is my shepherd," of Jerusalem "She shall be built," of the Temple "Your foundation shall be laid" (xliv, 28).

Ch. xl–lxvi (II Isaiah).—That ch. xl ff. (designated, for convenience, II Isaiah; ch. i–xxxix are referred to as I Isaiah) originated not earlier than the Babylonian exile was hinted by Ibn Ezra in the 12th century and was argued on grounds of internal evidence by J. C. Döderlein (1775) and J. G. Eichhorn (1783). It has long been a commonplace of scholarship, but the further question as to the unity of authorship of the whole of ch. xl–lxvi remains in dispute. The thesis of B. Duhm (1892) that ch. lvi–lxvi are a work of the 5th century B.C. to be distinguished from Deutero-Isaiah, and that within ch. xl–lv four "Songs of Yahweh's Servant" are to be distinguished from the contexts into which they have been inserted, has markedly influenced all subsequent discussion. The majority of scholars from K. Budde (1906) to O. Eissfeldt (1956) and J. Muilenburg (1956) recognize in ch. lvi–lxvi the work not of a single author but of a school of tradition dependent on Deutero-Isaiah. E. König (1926), C. C. Torrey (1928) and L. Glahn (1934) revived the view that ch. xl–lxvi (to which Torrey adds ch. xxxiv–xxxv) are substantially one work, which Torrey however dates about 400 B.C. Several scholars distinguish ch. xl–xlviii and xlix–lv as written by the same author before and after Cyrus' edict of liberation in 538 B.C., and W. Caspari (1934) sees the whole of ch. xl–lv as the work not of an individual but of a group of returning exiles.

Most scholars have followed Duhm in distinguishing within ch. xl–lv the "Songs of Yahweh's Servant," although not always delimiting them as he did (xlii, 1–4; xlix, 1–6; l, 4–9; lii, 13–liii, 12), or agreeing whether they are from a writer earlier than, later than or identical with the author who composed their immediate literary context. In the context the "Servant" is identified as the collective Israel (xli, 8; xliii, 10), suffering deserved punishment but promised restoration in fulfillment of Yahweh's purpose and in order that she should be the witness to the world of his sole deity. In the songs the Servant, though in some sense identified with Israel in xlix, 3, has a mission both to Israel and to the world (xlix, 6). But the portrait is that of an individual, whether it be a

historic, representative, symbolic or mythological figure. He is chosen and endowed by Yahweh with his spirit in order to proclaim Yahweh's truth to the ends of the earth; he is persecuted, suffers and dies for the sins of others in obedience to Yahweh's will; finally Yahweh promises his vindication and triumph (liii, 4–12).

The contrast is most marked in the explanations of the Servant's suffering—in the one case as retributive, in the other as vicarious. Nevertheless the songs have so much in common with their context in thought and phraseology that some scholars, stressing the Hebrew propensity to personify collective groups and abstract ideas (*e.g.*, Amos v, 2; Ezek. xvi, 3; Ps. lxxxv, 10; Heb. lxxv, 11), explain the differences as due to fluidity or development in the thought of Deutero-Isaiah; some reaffim the earlier view that the songs are structurally related to their immediate contexts.

Ch. i–xxxix (I Isaiah).—The literary history of ch. i–xxxix also presents a complicated problem, even though the critic has more concrete data to work with and hence is less dependent on subjective judgment than he is in the analysis of ch. xl–lxvi. The divisions between different sections are more clear-cut. Some sections bear editorial headings which define the time and circumstances of what follows (i, 1; ii, 1; vi, 1; xiii, 1; xiv, 28; xx, 1). In two instances a regular strophic structure with identical refrains shows that passages now separated belong together (ii, 6–22 with v, 14–16; v, 25–30 with ix, 8–x, 4). Autobiographical memoirs (vi, 1–13; viii, 1–18) and historical narratives (vii, 1–17; xxxvi, 1–xxxix, 8) incorporate some oracles and set the prophet Isaiah firmly in the historical scene.

The affinities of ch. xxxiv–xxxv are clearly with II Isaiah rather than with I Isaiah; their present position separating ch. i–xxxiii from its appended historical section ch. xxxvi–xxxix must date from the time when I Isaiah and II Isaiah were combined in a single scroll. The remainder of I Isaiah falls into four divisions which can be distinguished by their subject matter: (1) ch. i–xii, mainly oracles of denunciation and threat from Isaiah's early period; (2) ch. xiii–xxiii, mainly oracles of doom on foreign peoples; (3) ch. xxiv–xxvii, a distinct body of eschatological prophecy, psalms and prayers; and (4) ch. xxviii–xxxiii, mainly oracles from Isaiah's later period, proclaiming trust in Yahweh's purpose as Judah's sole security. Each of these except the third contains material from, or directly related to, the Isaiah who has given the book its name, together with supplementary additions and insertions from a later time.

Views vary as to the process through which these sections, each containing post-Isaianic matter, came into existence and were arranged as they are now found. Duhm (1892) holds that the first two of the present divisions represent small "Books of Isaiah" with independent histories, to which late in the Greek period other miscellaneous matter, ch. xxiv–xxxv, was added. R. H. Pfeiffer (1941) believes that ch. ii–xii were put together from recorded words of Isaiah and supplementary matter soon after the prophet's death, and to this ch. i was later prefaced; ch. xiii–xxvii was a collection of doom oracles on foreign peoples which happened to include some from Isaiah, and xxviii–xxxiii represented a further collection which grew independently around an Isaianic nucleus. O. Procksch (1930) believes that the original oracles in ch. i–vi, ix, 7–x, 4, and xxviii–xxxi were assembled by Isaiah himself, and that a second and a third collection, containing materials relating respectively to the Syro-Ephraimite crisis and to foreign peoples, were made by his disciples. S. Mowinckel (1933) sees in the present book a rearrangement of an earlier one of which the core was vi, 1–viii, 23a, recorded by Isaiah, to which after his death two collections containing genuine oracles were added by his followers, together with further groups of non-Isaianic matter. R. B. Y. Scott (1956) holds that Isaiah himself recorded two groups of his oracles, one from his early period (*cf.* viii, 16–18) and one from his closing years (*cf.* xxx, 8), and that these were the nuclei of two collections which developed independently until they were combined during or after the exile, and then expanded by addition of ch. xxiv–xxvii and a series of eschatological promises.

Prophetic Ministry of Isaiah.—Isaiah (Heb. "may Yahweh save *or* regard [him]") was called to prophesy in the year of King Uzziah's death, *c.* 742 B.C., and was still active at the time of Sennacherib's invasion of Judah in 701 B.C. (or *c.* 688 B.C.; there seem to have been two such invasions). The legend of his martyrdom under King Manasseh (*c.* 692–638 B.C.), which appears in rabbinic tradition and in the apocryphal Ascension of Isaiah (*see* Isaiah, Ascension of) and probably is referred to in Heb. xi, 37, has no known historical basis beyond the general statement of II Kings xxi, 10–16. Internal evidence in I Isaiah indicates that the prophet was a Jerusalemite of the upper classes, married, and with at least two sons. It is possible that before his call to prophesy he was a member of the king's council or a cult prophet, since he had ready access to the king and to the head priest (vii, 3; viii, 2), and his place during a temple ceremony was among those officiating (vi, 4; *cf.* Joel ii, 17). He shows familiarity with the way of life of the ruling group and concerns himself increasingly with matters of public policy (v, 8–23; xxx, 1–2). He champions the poor because of his conviction of the holiness of justice (iii, 14–15; v, 16), rather than by identifying himself with their sorrows as Micah and Amos did.

Isaiah's prophetic voice was raised first in the reign of Jotham (*c.* 742–735 B.C.) in proclamations of impending doom; some of these are coloured by memories of a recent disastrous earthquake (v, 25; *cf.* Zech. xiv, 5), others by forebodings of invasion by Assyrian armies (v, 26–29; vi, 11–12). In 743 the new strong man on the Assyrian throne, Tiglath-pileser III, had begun a series of campaigns into Syria and north Palestine; Menahem, king of Israel, was put under tribute in 738 (II Kings xv, 19). The prophet condemned the social and religious corruption of Judah and Jerusalem, especially the depravity and rapacity of the upper classes, as sins for which Yahweh's hand was outstretched to strike (v, 8–25). From first to last he opposed military adventures in alliance with foreign nations, declaring on one such occasion in Jotham's reign that "only a remnant . . . will return" (x, 22–23) and giving this as a name to his son (Shear-jashub; vii, 3). Thirty years later he was denouncing the rulers who looked for safety in alliance with Egypt (xxx, 1–7; xxxi, 1–3).

Judah's only security lay in confidence in her God (vii, 9; xxviii, 16; xxx, 15). When Damascus and northern Israel invaded Judah to force her into an anti-Assyrian alliance Isaiah offered to the doubting king a "sign," the confident prediction that a child soon to be born would be named Immanuel ("God is with us") in thanksgiving for deliverance. When the panic-stricken Ahaz instead sought safety by imploring Assyrian aid, at the cost of an enormous tribute and the erection in the Temple of an altar to an Assyrian god (II Kings xvi, 7–16), Isaiah retired and recorded his predictions while awaiting their fulfillment (viii, 16–18). Not until after Ahaz' death (*c.* 715) many years later, it seems, did Isaiah resume his public role (xiv, 28). The famous dynastic oracles in ix, 2–7 (Heb. ix, 1–6) and xi, 1–9, which later were applied to the Messiah, may have been composed for the accession ceremonies of Hezekiah, Ahaz' successor.

The oracles of this later period, culminating in those proclaiming that Yahweh would defend Jerusalem against Sennacherib (x, 5–16; xxxvii, 22–29), concentrate on the sovereign purpose of God as determining the course of history and the fate of nations. Assyria is but his instrument (x, 5, 15). Jerusalem will survive, not through Egypt's help (xxxi, 1–3) but by Yahweh's mercy (i, 9) and in order that his sovereignty in the affairs of men and nations might be displayed (xxxvii, 29). What originally had been a threat, Shear-jashub, "*Only* a remnant shall survive" (vii, 3; x, 22–23), is turned into a promise, "A remnant *shall* survive" (x, 20–21; xxxvii, 31–32). A chastised people will have learned that faith in God is the only sure foundation of national security (xxviii, 16; xxx, 15).

Isaiah as Prophetic Literature.—The literary records of Hebrew prophecy in Isaiah make clear that prophecy means in the first instance and primarily a word or spoken message, proclaiming through a chosen messenger the will of God for those addressed. The predictive element of threat or promise is conditioned by the hearers' response (i, 18–20), or is offered as a "sign" of what is coming (vii, 14), because all that happens is finally subordinate to the purpose of God's will. II Isaiah makes much of the im-

potence of Babylon's gods, in contrast to Yahweh, to declare in advance what they intend to do and to do it (xli, 21–24; xlviii, 3). The predictions of the prophets are the announcement of the purpose of a living God rather than of man's predetermined fate.

Oracles.—The public pronouncement of Yahweh's "word" on a particular occasion is an "oracle." Most of the records of prophecy consist of collections of these oracles, as in Isa. i–v and xiii–xxiii. Each oracle usually has a single theme and a clearly marked beginning and end (*e.g.*, i, 10–20) and is in the form of a denunciation culminating in or implying a threat (*e.g.*, xxx, 9–14) or of exhortation and promise (xliii, 1–7). It is too brief to be a sermon or address, but its rhythmic and finished form shows that it was carefully prepared for delivery in memorable words. The prophet speaks like an ambassador delivering a message on behalf of a king (xxxvi, 4; *cf.* xxxvii, 21). Sometimes, as in the names given by Isaiah to his sons, the germ of an oracle may be seen as it presented itself to the prophet's mind in a striking phrase (vii, 3; *cf.* x, 22–23; viii, 3–4).

There are many variations in the form of the oracle. Sometimes a series of them make up a longer oracle with refrains, as in ix, 8, Heb. ix, 7–x, 4 and v, 24–25. Sometimes the prophet casts his "word" in the form of a vintage song (v, 1–7) or the instruction of a sage (xxviii, 23–29). Certain oracles are preserved only in prose form (*e.g.*, x, 20–27). In II Isaiah the oracles become so long and elaborate in structure that most scholars hold that they were written and meant to be read aloud rather than spoken, while still retaining the quality of rhetoric (*cf.* xl, 12–31).

Narrative.—In addition to oracles the Book of Isaiah preserves narrative records. These are of two kinds: (1) memoirs, in which the prophet speaks in the first person of his experiences; and (2) historical narratives or tales describing in the third person what he said and did. In ch. vi, one of the most striking and important passages in prophetic literature, Isaiah tells his own story of the experience in the year of King Uzziah's death, which was his call to be a prophet. Here, as in the further memoir material in viii, 1–8, 11–15, Isaiah distinguishes between what the divine voice said to him and what it commissioned him to proclaim. In vii, 1–17 there is what appears to be a selection from a prophetic biography, again incorporating oracles, as in the selection from II Kings in ch. xxxvi–xxxix which itself drew upon biographical accounts of Isaiah's ministry.

Other Materials.—In the long process through which the Book of Isaiah reached its present form still other materials, unrelated to either of its two principal authors, were added. Ch. xii consists of two short psalms; a psalm ascribed to Hezekiah, not found in II Kings from which its context is taken, appears in xxxviii, 9–20. In ch. xxxiii prophetic oracles alternate with prayers of entreaty and lamentation, in a kind of liturgical dialogue such as is envisaged in Jer. xxxvi, 6–7 and Joel ii, 15–17. In ch. lix a solemn admonition, verses 1–8, is responded to by a congregational confession in verses 9–15. In lxiii, 7–19 and lxiv, 1–12 appear two psalms of lament and entreaty which resemble the prayers for a fast day in the Temple preserved in Ps. lxxiv and lxxix. *See* also BIBLE.

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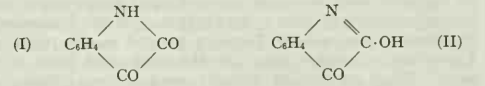
(R. B. Y. S.)

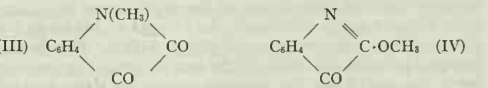
ISALLOBAR, a line entered on a meteorological chart connecting points having the same change in pressure in a given period of time preceding the time of observations represented on the chart. By international agreement, three-hour pressure changes or tendencies are transmitted by all stations and ships to the collecting-distributing centres with each observation. Isallobars may be drawn for these values or for those of 12-hour or 24-hour intervals obtained by comparison with pressure observations taken 12 or 24 hours previously. (H. R. B.)

ISAR (identical with *Isère,* in Celtic "the rapid"), a river of Bavaria, Federal Republic of Germany, and a tributary of the Danube, rises in the Tirolese Alps at an altitude of 5,840 ft. It winds in deep, narrow gorges through the Alps, and at Bad Tölz (2,100 ft.) enters the Bavarian plain, which it traverses in a generally northerly and northeasterly direction, and enters the Danube immediately below Deggendorf. It is 183 mi. long with a drainage area of 3,500 sq.mi. Below Munich the stream becomes a deep steep-sided valley 140 to 350 yd. wide and is studded with islands. It is not navigable, except by rafts. On its banks lie the cities of Munich and Landshut, and the ancient episcopal see of Freising. *See* also DANUBE.

ISATIN, in chemistry, an oxygenated derivative of indole (*q.v.*) prepared originally by oxidizing indigo with nitric or chromic acid. It crystallizes in orange-red prisms melting at 200°–201° C. Isatin is of practical importance in the manufacture of vat colours. For example, it yields Ciba red G (thioindigo scarlet G) by condensation with 2-hydroxythionaphthene and subsequent bromination of the condensation product. Isatin is also of outstanding scientific interest because it was one of the first recognized examples of tautomerism (*q.v.*). It is a chemical individual with two personalities. Certain of its reactions suggest the lactam constitution (I) whereas others indicate the lactim configuration (II).



Although isatin itself exists in only one form, it has two methyl ethers: pseudomethylisatin (III) made from dibromomethyloxindole, and methylisatin (IV) prepared by the interaction of methyl iodide and silver isatin.

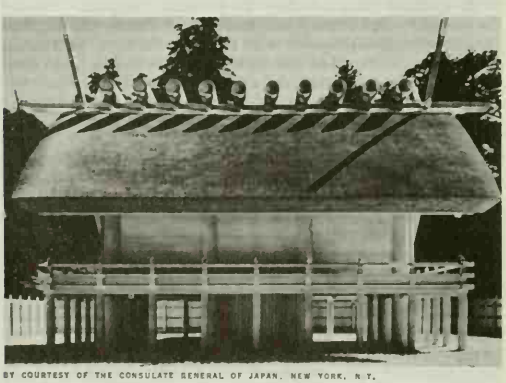


Isatin and its homologues are produced by condensing aniline and its homologues with hydroxylamine sulfate and chloral hydrate; an intermediate isatinimide is formed which on hydrolysis furnishes the corresponding isatin.

ISAURIA, the name in Roman times of a district in Asia Minor equivalent to parts of the *iller* of Konya, Icel and Antalya in modern Turkey. The nucleus of it was that section of the Taurus which lies directly south of Iconium (Konya) and Lystra. Lycaonia had all the Iconian plain; Isauria began at the foothills. When the Romans first encountered the Isaurians (early in the 1st century B.C.), they regarded Cilicia Trachea as part of Isauria, which thus extended to the sea; the whole basin of the Calycadnus (Goksu) river was reckoned Isaurian, and the cities in the valley of its southern branch formed the Isaurian Decapolis. Toward the end of the 3rd century A.D., however, all Cilicia was detached for administrative purposes from the northern slope of Taurus; Pisidia was also detached and made to include Iconium. In compensation Isauria received the eastern part of Pamphylia. Restricted again in the 4th century, Isauria ended as the wild district about Isaura Palaia and the heads of the Calycadnus. During the war of the pirates against Rome (1st century B.C.), the Isaurians took an active part and were reduced to submission. They were afterward placed under the rule of Amyntas, king of Galatia, and their territory was surrounded by a cordon of forts. In the 4th century they are described by Ammianus Marcellinus as the scourge of the neighbouring provinces; but they are said to have been effectually subdued in the reign of Justinian. Isauria passed into the hands of Turkmen and Yuruks with the Seljuk conquest, and is still one of the main haunts of the nomadic tribes of Turkey. The ruins of the capital city, Isaura Palaia, are mainly remarkable for their fine situation and their fortifications and tombs. Those of Isaura Nea have disappeared, but numerous inscriptions and many sculptured *stelae,* built into the houses of Dorla, prove the site. (WM. C. B.)

ISCHIA, an island at the west entrance to the Bay of Naples, in Napoli province, Campania region, Italy, 26 km. (16 mi.) S.W. of Naples and 11 km. (7 mi.) S.W. of the nearest mainland point, Cape Miseno, was known to the Greeks as Pithecusa ("island of monkeys"?) and to the Romans as Aenaria. Oblong in shape, it measures 10 by 7 km. (6 by 4 mi.), with a circumference of 34 km. (21 mi.) and an area of 46 sq.km. (17¾ sq.mi.). The island consists almost entirely of volcanic rock; its highest point, Monte Epomeo (2,585 ft.), is an extinct volcano. The date of its first eruption is estimated to have been about 2200 B.C.; an eruption of the 7th century B.C., according to Pliny, drove away the first Greek settlers, and the eruption of 470 B.C. put the Syracusan garrison to flight. There were several eruptions in Roman times. The last on record occurred in 1302, when all the population fled to Baia on the mainland and did not return for four years. There have been destructive earthquakes more recently, however, the last one in 1883 when the town of Casamicciola was entirely destroyed. The volcanic soils of the island are fertile, and the wine of Ischia, called "Epomeo," is famous. Wheat, olive oil and citrus fruit are the other crops of importance. The potter's clay of Ischia is believed to have been used by the ancient potteries of Cumae and Puteoli (Pozzuoli). The important towns are in the north of the island: Ischia, the administrative centre and seat of a bishop, consisting of the fishing village of Ischia Ponte, with its medieval castle on a tiny peninsula, and Ischia Porto, a spa known for its warm baths (pop. [1957 est.] 11,698 [commune]), on the east; Casamicciola Terme, a spa and seaside resort, and Lacco Ameno, another resort, on the north; and Forio on the west. There are regular shipping services from Naples and Pozzuoli to Ischia and a car ferry from Pozzuoli to Ischia Porto.
(G. Kh.)

ISE (called Uji-Yamada until 1956), a city of Mie prefecture, southern Honshū, contains the most sacred Shintō shrines of Japan. Between 1940 and 1960 the area of the city increased by amalgamation from 61 sq.km. (24 sq.mi.) to 177 sq.km. (68 sq.mi.) and the population increased from 52,600 to 99,026. The Ise-shima National park was established in the area in 1946. The Ise Shrines are in the city of Ise; the two main shrines are about four miles apart and are almost identical in their arrangements. The Outer Shrine is dedicated to Toyouke Ōmikami, goddess of agriculture and silk production. The Inner Shrine is dedicated to Amaterasu Ōmikami, the sun-goddess, traditional progenitor of the Japanese imperial family. The Inner Shrine was established in the late 3rd century, the Outer Shrine in the late 5th century. The former was founded by an imperial princess who was seeking a site for a shrine to house the Sacred Mirror, a part of the imperial regalia and the embodiment of Amaterasu Ōmikami. Until the 14th century the custodian of the shrines was always an unmarried imperial princess. At both shrines the main building is a thatched hut built in ancient Japanese style of unpainted Japanese cypress with only a few touches of gilding at the tips of the roof timbers.



BY COURTESY OF THE CONSULATE GENERAL OF JAPAN, NEW YORK, N.Y.

ISE SHRINE, THE MAIN BUILDING

Since the 7th century it has been the custom to reconstruct these buildings at intervals of about 20 years. Pilgrimages to these shrines are popular among the Japanese people and events of national importance are always communicated to the deities. *See* also Shintō. (A. E. T.)

ISENTROPIC CHART. The isentropic chart is used in weather forecasting and in problems of meteorological research. It was first suggested by Sir Napier Shaw in Great Britain in 1933 and later, in 1936, by Carl-Gustav Rossby in the U.S., when the network of weather stations taking upper air observations (*see* Upper Air Soundings) became sufficient to make construction practical. An isentropic chart shows the moisture distribution and flow of air along a surface of constant entropy, which in meteorology is also a surface of constant potential temperature. (*See* Meteorology.) The isentropic surface is not at a constant level but varies in height from place to place over the earth, the variation being indicated on the isentropic chart by lines (isobars) showing the pressure at which the isentropic surface is found. The moisture distribution is shown by lines of constant mixing ratio expressing the number of grams of moisture per kilogram of air (dry). The flow of air at the isentropic surface is represented by winds recorded from pilot balloon (*q.v.*) observations and stream lines computed from the field of pressure and temperature.

Air particles tend to flow along isentropic surfaces rather than at constant levels. By virtue of this fact the life history of air currents can be conveniently followed from day to day by means of isentropic charts. In addition, they give a lucid picture of the physical processes which produce the weather.

See Jerome Namias, *An Introduction to Air Mass and Isentropic Analysis,* American Meteorological Society (1940). (J. Ns.)

ISEO, LAKE (ancient Lacus Sebinus), a lake in Lombardy, north Italy, lies at the southern foot of the Alps, between the provinces of Bergamo and Brescia. The Oglio enters the northern end at Lovere and leaves the southern end at Sarnico to join the Po. Area 65 sq.km. (25 sq.mi.), length 16 mi., greatest width 3 mi., greatest depth 823 ft., height of surface above sea level 610 ft. On the island of Siviano in Lake Iseo is Monte Isola (1,834 ft.), crowned by a chapel. South of Siviano is the islet of San Paolo, occupied by the buildings of a small disused Franciscan convent, and north is the equally tiny island of Loreto, with a ruined chapel containing frescoes. At the southern end of the lake are the small towns of Iseo, 24 km. (15 mi.) from Brescia, and of Sarnico. Toward the head of the lake the deep, wide valley of the Oglio is seen, dominated by the glittering snows of the Adamello (11,660 ft.). There is a good road along the eastern shore.

ISÈRE, a *département* of southeastern France, formed in 1790 out of the northern part of the old province of Dauphiné (*q.v.*). Area, 3,180 sq.mi.; pop. (1962) 729,789. It extends from the high (Graian) Alps in the Pelvoux massif to the valley of the Rhône, and is bounded across that river by Ain to the north and by Rhône and Loire *départements* to the west. To the southeast and southwest respectively it is bounded by the Alpine *départements* of Savoie and Hautes Alpes, and to the southwest by Drôme lower down the Rhône basin. The Isère river, which receives an important Alpine tributary, the Drac, near Grenoble, crosses the *département* from northeast to southwest.

The *département* comprises diverse physical regions, including parts of the high, snow-capped crystalline mountains of the Belledonne, Grands Rousses and Pelvoux groups, and the Grande Chartreuse and Vercors blocks of the limestone Prealps, with the great longitudinal depression of Grésivaudan between, occupied by the Isère river and, beyond Grenoble, by its tributary the Drac. West of the Prealps is the foreland country of Bas Dauphiné, extending to the Rhône valley within its great bend at Lyons. This district is thickly coated with infertile glacial debris (*terres froides*) and there is much poor woodland and waste, but there are strips of richer farmland along the valleys of the Rhône, Isère and smaller rivers. These favoured tracts and the sheltered extension of the lowland in Grésivaudan are cultivated with cereals, fruit and vines but are especially devoted to meadows and fodder crops. At the foot of the Vercors mountains, near Grenoble, is a specialized area of walnut cultivation. The mountains, receiving

a high precipitation, are heavily forested up to heights of more than 6,000 ft. and timber is an important resource. In the high Alpine valleys, especially the Romanche, a pastoral economy prevails.

A small field of anthracite is worked in the Drac basin at La Mure, but more important is the development of hydroelectric power since the first plan was initiated near Grenoble in 1885. Although most of the power is transmitted from the generating stations in the mountains to the Lyons industrial area, some factories have been attracted to sites in the Alps. The industrial influence of Lyons extends over most of the lowland northwest of the Isère river, with much silk weaving carried on by means of electric power in dispersed workshops and the homes of the rural population. There are also cement works, paper mills, chemical and engineering industries, and the old-established glove manufacture of Grenoble. Persistent emigration from the Alpine valleys has been offset by the increase in industrial employment in the towns and within the textile province of Lyons, so the population of the *départements* is increasing.

Much of the northwestern part naturally looks directly to Lyons as its commercial and industrial capital, but the *préfecture* of the *département* is Grenoble (pop. [1962] 162,764 [commune]), the centre also of ecclesiastical, educational and judicial administration, with a cathedral, university and court of appeal. Situated at the head of the gap by which the Isère cuts through the prealpine range, it is an important route centre. Grenoble, Vienne and La Tour-du-Pin are the centres of the three *arrondissements* into which the *département* is divided. The famous Carthusian monastery of Grande Chartreuse is situated at 3,000 ft. in the mountains north of Grenoble. (Ar. E. S.)

ISÈRE RIVER, a left-bank tributary of the Rhône, in southeast France, 180 mi. long, descends about 8,000 ft. from the high (Graian) Alps on the Italian frontier to its confluence with the Rhône above Valence. It traverses the *départements* of Savoie, Isère and Drôme. Rising as a glacial torrent, its upper course in the high Alpine valley of Tarentaise zigzags across mountain ranges till it enters the great groove that lies between the crystalline Alps and the limestone Prealps. It flows southwestward along the lowlying floor of this depression, which is known as the Combe de Savoie above Montmélian and lower down as Grésivaudan. It receives the Arly tributary at Albertville and later the Arc, which issues from a similar high Alpine valley, Maurienne, which approaches the Mont Cenis crossing into Italy. At Grenoble, where it is 650 ft. above sea level, the Isère turns northwest through a gap in the Prealps, between the Grande Chartreuse and Vercors blocks. As it enters this gap it receives the drainage of the southern end of the Alpine depression by its tributary the Drac, which has collected the Romanche, draining another high Alpine valley (Oisans). Beyond the gap, at Voreppe, the Isère turns again southwest to approach the Rhône across the rather infertile lowland of Bas Dauphiné, and enters the Rhône after passing Romans. The Isère is of no use for navigation, but it has been harnessed, together with its tributaries in the Alps, at many places for hydroelectric power, large quantities of which are transmitted from the mountain generating stations to supply the Lyons industrial area. Electrometallurgical and electrochemical industries have also been attracted to sites in the Alps. (Ar. E. S.)

ISERLOHN, an ancient town of Germany, *Land* (state) of North Rhine-Westphalia, which after the partition of the nation following World War II became part of the Federal Republic of Germany, is situated on the Baar 29 km. (18 mi.) S.E. of Dortmund by road. Pop. (1961) 55,257. Although the town was burned down in the 18th century, surviving ancient buildings include the Oberste Stadtkirche (14th century), with a carved altar of Flemish origin, Gothic paintings and other works of art; and Pankratius church (11th century) with a stained-glass window given by the British garrison in 1959. The museum and the former labour office were patrician houses of the 18th century and the modern Roman Catholic Trinity church is of interest. Railways and bus services link the town with Hagen, Dortmund, Schwerte and other towns. There are manufactures of machinery, lamps and hardware. The town is 700 years old and its industries go back to the middle ages. Its guild of armourers was already described as "ancient" in 1443. (M. Sc.)

ISFAHAN (Esfahan), a city of Iran and capital of Isfahan *ostan* (province), is situated at 5,200 ft. above sea level along the north bank of the Zayandeh Rud ("the life-giving river"), about 252 mi. S. of Teheran. Pop. (1956) 254,708. The name Isfahan (now pronounced Esfahan) is probably derived from the Old Persian word *cpâdhâna*, meaning "army camp" or "gathering place for armies." Ptolemy gives the name as Aspadana and in the Pahlavi texts it occurs as Spahan. An ancient quarter of the city was known as Gadh or Gay, which may perhaps have been identical with Strabo's Gabae, where the Achaemenid sovereigns often resided.

History and Architecture.—Little is known of Isfahan until Sasanian times. Queen Shushan-Dukht, the Jewish consort of Yezdigird (Yazdegerd) I (A.D. 399–421), is said to have settled a colony of Jews there in a suburb called Yahudiyeh (the establishment of this colony has also been attributed to Nebuchadrezzar, but this seems far less probable). The Shahristan bridge, which spans the Zayandeh Rud a short distance east-southeast of the city, dates from the Sasanian era; the piers are, however, all that remain of the original structure, the upper part having often been rebuilt. When the Arabs captured Isfahan in 642, they made it the chief city of the great central province of Al Jibal ("the mountains"), which covered much of the former country of Media.

Under the Buyid (Buwaihid) rulers of Persia (10th century), who rose to power when the temporal authority of the Abbasid caliphate was on the decline, Isfahan became extremely prosperous. In the middle of the 11th century the Turkish conqueror Togrul Beg, the founder of the Seljuk empire and dynasty, captured Isfahan and made it the capital of his vast domains, and under his grandson Malik Shah (1073–92) the city increased still further in size and splendour. In those days the central point of the city was a square, or rectangle, situated some distance to the north of the later Maidan-i-Shah. It was bordered on the north by the great Masjid-i-Jami, or cathedral mosque, which is still one of the chief architectural glories of the city; at the southern end was the Masjid-i-Ali, of which only the tall minaret remains of the original building. The Nizam al-Mulk, Malik Shah's chief minister and the patron of Omar Khayyam, added to the Masjid-i-Jami a dome chamber of great beauty. Not to be outdone, his rival, the Taj al-Mulk, then built close to it a smaller, but even more beautiful, dome chamber which is said to have attained "the perfection of architecture."

Isfahan, unlike Nishapur and many other Persian cities, escaped destruction by the Mongol hordes in 1220. Nearly a century later the Mongol ruler Ulja'itu endowed the Masjid-i-Jami with a magnificent mihrab or prayer niche. In 1388 Timur (Tamerlane) captured the city but spared its inhabitants. When, however, the Isfahanis revolted, he slaughtered about 70,000 and is said to have made a huge pyramid of their skulls.

Meanwhile, the craftsmen of Isfahan had been making themselves famous not only as metalworkers, weavers and builders but also as experts in the making of faïence-mosaic and polychrome tiles (*haft-rangi*) of the highest quality. Although Isfahan had, after the fall of the Seljuk dynasty, been eclipsed by other Persian cities such as Tabriz and Kazvin it regained its pre-eminent position during the Safawid period (1501–1736).

The city's golden age began in 1598 when Shah Abbas the Great (1587–1629) made it his capital in place of Kazvin. He largely replanned and rebuilt it, making it one of the largest and most beautiful cities of the world at that time. As a fitting centre for his capital, he created the immense Maidan-i-Shah, which measures 1,674 by 540 ft., the long axis running from north-northwest to south-southeast. At the southern end of the Maidan is the famous Masjid-i-Shah or royal mosque, begun in 1611 but not finished until after Shah Abbas' death. This building, decorated with enameled tiles of great brilliancy, has in the 20th century been carefully repaired. On the eastern side stands the Masjid-i-Shaikh Lutfullah, the low dome of which is adorned with dark blue and white arabesques on a *café au lait* background. The interior is covered with a combination of a faïence-mosaic and painted tile.

Shah Abbas, who dedicated this mosque to his saintly father-in-law, used it for his private devotions. On the western side of the Maidan is the Ali Qapu ("the lofty gate"), a high building in the form of an archway crowned in the fore part by an immense *talar* or covered balcony which served as an audience hall and as a vantage point from which the shah and his courtiers or guests could watch games of polo or gladiatorial combats below. This archway leads into the gardens of the former royal palace, which covers a large area with courts and pavilions, one of which, the Chihil Sutun ("forty columns"), was famous as a verandah and throne room of Shah Abbas. At the northern end of the Maidan is a tiled gateway leading to the Qaisariyeh or royal bazaar. The spaces between these buildings are filled by two-storied buildings with arched recesses, all of uniform design.

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ALI QAPU GATEWAY AND COVERED BALCONY, ISFAHAN

Nearly 600 yd. W. of the Maidan-i-Shah and connected with it by a side road is the Chahar Bagh ("four gardens"), the avenue which Shah Abbas made to give access to his capital from the south (the shah had to purchase four gardens in order to construct it). The Chahar Bagh runs southward to the Zayandeh Rud which it crosses by means of the fine bridge built by Allahverdi Khan, one of Shah Abbas' generals. The northern part of this avenue, which is nearly 1 mi. long and 200 ft. wide, consisted of two alleyways with a promenade between; down the centre was a watercourse with basins and fountains at intervals. Shade was provided by several rows of trees. The two roadways and the promenade remain, but the watercourse and fountains have disappeared.

Situated to the west of the southern extension of the Chahar Bagh is the Armenian suburb of Jolfa (Julfa). In order that the trade and industry of his new capital might flourish, Shah Abbas forcibly transplanted 6,000 Armenian families from the town of Jolfa in northern Persia and settled them in this suburb which was given the same name. The shah granted these capable and industrious Christians many privileges, including complete liberty of worship. A number of the churches built at that time, such as the Bethlehem church, are still standing. All Saviours cathedral was originally constructed on a small scale in 1606 and rebuilt in its present form in 1657. The cathedral, a typical domed structure, is decorated with paintings in the Italian tradition. Besides establishing the Armenians in Jolfa, Shah Abbas allowed the English and Dutch East India companies to set up factories in the city.

With the death of Shah Abbas I in 1629 the decline of the Safawid dynasty began, though it was arrested for a time under Shah Abbas II (1642–66). He was responsible for the building of the most beautiful of the Isfahan bridges, the Pul-i-Khwaju, which crosses the river nearly a mile to the east of the Allahverdi bridge. The Khwaju bridge was designed to serve also as a weir; by closing the sluices, the level of the river could be raised sufficiently to form an artificial lake in front of the palaces and pavilions that stood on either side for some distance upstream. An observant and painstaking French Huguenot jeweler, Jean Chardin (who was afterward knighted by Charles II and became a fellow of the Royal Society), spent ten years in Isfahan between 1664 and 1677, and in his *Voyages* gave a detailed and graphic description of the city as it was at its zenith. It had then, he said, 102 mosques, 48 colleges, 273 baths and no less than 1,802 caravansaries.

Situated on the east side of the Chahar Bagh, midway between its northern extremity and the river, is the Madraseh-ye-Madar-i-Shah ("school of the Shah's mother"), a religious college built by the mother of the pious but effete Shah Sultan Husain (1694–1722) and also known as the Madraseh-ye-Chahar Bagh. It is a fine building, with a tiled dome flanked by two minarets. In 1722, only a few years after its completion, the Ghilzai Afghans, under their savage leader Mahmud, defeated the Persian army a few miles to the east of Isfahan. They then invested the city and took it after a long siege, in the course of which more than 100,000 of the inhabitants perished from famine and pestilence. Mahmud deposed the feeble shah and mounted the throne of Persia himself. Isfahan has never fully recovered from this calamity. For many years the greater part of the city was a heap of rubble, and its population dwindled to a fraction of what it had been in its day of glory.

In the reign of Reza Shah Pahlavi (1925–41) an industrial quarter was built, for the most part on the south side of the Zayandeh Rud. Care was taken to ensure that this development did not mar the beauty of the city, this quarter being far removed from the principal historic monuments. Credit is due to Reza Shah for giving orders for the systematic repair of all the historic buildings, a task which was carefully carried out. Although now provided with a number of modern streets and shops, the city still retains its extensive and fascinating bazaars through which a visitor can wander for miles and imagine himself back in the time of Shah Abbas the Great. A medical college, administered by the ministry of national education, was founded in 1949.

Isfahan is on the main north-south highway from Teheran to Shiraz and the Persian gulf, and is linked by a road east and southeast to Yazd, Kerman, Zahedan and so to Pakistan.

The city is famous for its handicrafts, such as silverware, copperwork and brasswork, as well as for its pottery. The old art of tilemaking has been successfully revived in order to enable the ancient monuments to be adequately repaired. Isfahan is also well known for its rugs and its *qalamkars* (cotton fabrics handprinted with various designs). Modern industry is represented by the textile mills to the south of the river.

ISFAHAN OSTAN is situated in central Iran and bounded southwest by Khuzistan, west by the mountainous general governorship of Chaharmahal (formerly Bakhtiari) and that of Lorestan, north by Kashan (part of Mazanderan *ostan*) and by Semnan-Damghan general governorship, east by Khurasan, southeast by Kerman and south by Fars. The country is mountainous to west and south, but Isfahan city stands on the eastern edge of the Zagros mountains in a fertile basin irrigated by the Zayandeh Rud, the waters of which have been augmented by tapping (by means of a tunnel through the mountain) one of the main sources of the Karun river on the farther (western) side of the watershed. The climate is relatively temperate, without great extremes of heat or cold.

The area of the *ostan* is 76,216 sq.mi. (197,403 sq.km.). In 1956 the population was 1,513,577 and was on the increase. The *ostan* is divided into six *shahrestans* (districts): Isfahan, Ardestan, Na'in, Yazd, Shahreza and Faridan (or Daran). Yazd (pop. [1956] 66,484) is the second largest city in the *ostan* and has a

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THE FERTILE BASIN OF ISFAHAN

substantial Zoroastrian community; next are Najafabad (30,422) and Shahreza (formerly Qomisheh, 29,311).

The Isfahan *shahrestan* is the most fertile area. It is well watered by the Zayandeh Rud and canals supplied by it, as well as by many wells. A considerable amount of grain is grown. Apart from the industries of Isfahan city, Yazd has carpet- and silk-weaving and shawlmaking industries and the manufacture of footwear known as *givehs* (similar to the Spanish *alpargata*).

(L. Lo.; X.)

ISHII KIKUJIRŌ, Viscount (1866–1945), Japanese diplomat who effectively championed cautious expansion of Japan and co-operation with the west in the decades immediately before and after World War I. Born in a village in Chiba, he was adopted by the Ishii family and sent to Tokyo university. He graduated in law in 1890 and entered the foreign ministry. After ten years of service in France, Korea and China he was recalled to Tokyo. In 1907 he was sent to the United States to investigate the rising anti-Japanese sentiment in Vancouver and San Francisco. He contributed to the "gentlemen's agreement" between Japan and the United States, by which the Japanese government promised to withhold passports from labourers intending to migrate to the United States.

After two years in Paris as ambassador Ishii was appointed Japanese foreign minister, 1915–16, and in 1917 was sent on a special mission to Washington, D.C. During these years Russian approval of Japan's new gains on the continent of Asia, resulting from the "21 demands" negotiations with China and seizure of German rights in Shantung, was secured in the secret agreement of 1916. (*See* China: *The Republic: Foreign Relations* [*1911–17*].) A somewhat ambiguous American approval of Japan's special interests in China was given in the Lansing-Ishii agreement of 1917, but Japan affirmed its respect for the open door policy and for the independence and territorial integrity of China.

From 1920 to 1927 Ishii represented Japan at Paris and at the League of Nations, and in 1933 he attended the London Economic conference. Although appointed to the house of peers and the privy council in 1928, he gradually withdrew from active political life. He died in an American bombing raid on May 25, 1945.

Ishii's grasp of modern international relations, his defense of Japan's imperial interests and his loyalty to the cause of international co-operation are well represented in his memoirs, *Gaikō yoroku,* which have been partially translated into English as *Diplomatic Commentaries.* (J. W. Mo.)

ISHIKAWA, a *ken* (prefecture) of western Honshū in central Japan noted for its textile industry, faces the Sea of Japan. Area 1,619 sq.mi.; pop. (1960) 973,418. In the southeastern part lies the western stretch of the Hida range. Although snowfall is abundant, temperatures are not low. Agriculture is characterized by the predominance of paddy fields, comparatively large landholdings per household and the progress of mechanization. Products include silk and rayon, *Yamanaka* and *Wajima* lacquerwares and the traditional *Kutani* china. The capital, Kanazawa (pop. [1960] 298,972), retains the characteristic features of a castle town. (R. B. H.)

ISHIM, a river of the U.S.S.R., a tributary of the Irtysh, 1,807 km. (1,123 mi.) long and draining a basin of 52,896 sq.mi. It rises southeast of Akmolinsk (North Kazakhstan *oblast*) in the Kazakh hill country and flows westward in a narrow, rocky valley, with frequent rapids. West of Atbasar the Ishim swings north across the level west Siberian lowland (Ishim steppe) to join the Irtysh 645 mi. from its mouth. In these middle and lower courses the river meanders greatly and is 80–130 yd. broad. The average annual discharge is 1,519 cu.ft. per second, with a very marked spring maximum from snow melt, which supplies 90% of the annual flow. Two large towns, Akmolinsk and Petropavlovsk, are built on its banks, but it is navigable only as far as Vikulovo.

Ishim Town stands on this river where it is crossed by the Tyumen-Omsk railway, in Tyumen *oblast.* Pop. (1959) 47,800. It is an agricultural centre with flour milling, distilling and butter-making industries. (R. A. F.)

ISHMAEL ("May God hear"; in the Douai version of the Bible, Ismael; Arabic Isma'il) is a significant figure in both the Old Testament and the Koran. He was the son of Abraham (Arabic Ibrahim) and his Egyptian concubine, Hagar (Hajar). According to the story in the Book of Genesis, through the jealousy of Abraham's wife Sarah (Sara), mother and son were driven from the tribe and saved from death by thirst through the miraculous discovery of a well (Gen. xxi. 8–20). Ishmael grew up an archer (xxi. 20) and a "wild ass of a man" (xvi. 12), living to the south and east of Palestine. He is the ancestor of 12 tribes of desert rangers (xxv. 12–18). "Ishmael," therefore, is used in a wide sense of the wilder, roving peoples encircling Canaan from the northeast to the south, related to but on a lower rank than the "sons" of Isaac. It is practically identical with the term "Arabia" as used by the Assyrians. Nothing certain is known of the history of these mixed populations. They are represented as warlike nomads and with a certain reputation for wisdom (Baruch iii. 23). Not improbably they spoke a dialect (or dialects) akin to Arabic or Aramaic.

According to Muslim tradition (which is acquainted with the story in Gen. xxi), Isma'il is the progenitor of *al-musta'riba,* the "arabicized" north Arabian tribes. The Koran (ii. 127) states that he helped Ibrahim to raise the foundations of the Ka'ba (*q.v.*).

ISHTAR (Sumerian Inanna), the great goddess of the Sumero-Akkadian pantheon, in name and attributes identical with Astarte. The meaning of her name is uncertain: a plural form of it, *ishtarati,* denotes "goddesses." Written ideographically in Sumerian, it is read Inanna, which may derive from Nin-anna, "Lady of Heaven." The Akkadian form Ishtar, first written syllabically about 2000 B.C., may derive from *Esh-tar.* How the early Semites in Sumer-Akkad thought of Ishtar is not clear, but Hammurabi, like the earlier Sumerian ruler Gudea, styles her "lady of battles." As such in Babylonia and Assyria she is represented on a lion, with a weapon in her hand. Ishtar is also the goddess of love. A lover of mortals, whom she exalts, she delights in bodily love, including prostitution (which was part of her cult, as Herodotus records). As identified with Venus, the morning star, she is represented or accompanied by a star with 6, 8 or 16 rays within a circle.

The morning is child of the night and of its god Sin, the moon. Inanna-Ishtar is, accordingly, daughter of Sin; she is also sister of Shamash, the sun-god, and forms with these deities the secondary cosmic triad. An earlier Sumerian myth, however, makes her the daughter of Enki (*see* Ea), god of Eridu, and goddess of Uruk (biblical Erech). From her father, Enki, she receives the divine laws, which she takes to Uruk, where her temple is Eanna, "House of Heaven" (or possibly "of the Date Clusters").

Inanna-Ishtar figures in the myths of the flood and of Gilgamesh, but chiefly in the "Descent of Ishtar to the Underworld," of which both an Akkadian and a shorter Sumerian version survive. The queen of the underworld, Ereshkigal (*q.v.*), is here the sister of Ishtar. The cult of Ishtar was universal in the ancient near east. She was the universal goddess par excellence, whom kings, native and foreign, delighted to honour in capitals and major cities at all periods of Assyro-Babylonian history.

See Babylonia and Assyria: *Religion: Sumerian Pantheon: Herding Regions* and articles on related figures: Aphrodite; Astarte; Atargatis; Great Mother of the Gods; *see* also references under "Ishtar" in the Index.

See E. (Paul) Dhorme, *Les Religions de Babylonie et d'Assyrie* (1949). (T. Fh.)

ISIDORE, SAINT, of Seville, in Latin called Isidorus Hispalensis (*c.* 560–636), Spanish encyclopaedist, theologian and historian, probably belonged to a family from Cartagena. He succeeded his brother Leander as archbishop of Seville in A.D. 600 and headed the Spanish synod of Toledo in 633. His summary of all knowledge accessible to him, *Etymologiae* or *Origines,* remained for many centuries one of the most important reference books: almost 1,000 medieval manuscripts of it are still in existence. In its 20 sections, Isidore handed down to posterity much that he had extracted from works of previous encyclopaedists (*e.g.*, Cassiodorus), specialists and Latin writers of all kinds, on the seven liberal arts, medicine, law, history, church matters, theology,

anthropology, zoology, cosmology, psychology, architecture, agriculture, etc.

Other special treatises by him were devoted to linguistic matters (*Differentiarum libri* and, perhaps, *Synonymorum libri*), to natural science and cosmology (*De natura rerum* and *De ordine creaturarum*) and to history (a continuation of Jerome's and Gennadius' *De viris illustribus;* a re-elaboration and continuation of Jerome's history, under the title *Chronica maiora;* and a *Historia Gothorum, Vandalorum et Sueborum*). As a theologian, he wrote *Quaestiones in Vetus Testamentum;* biographies of 86 persons of the Bible (*De ortu et obitu patrum*); a handbook of morals and theology in the form of a collection of *Sententiae,* mainly based on Gregory the Great's *Moralia;* a treatise *De fide catholica contra Judaeos; De haeresibus;* a liturgical work *De ecclesiasticis officiis;* and a *Regula monachorum.* It is not certain whether the original edition of the *Hispana* (*see* CANON LAW), sometimes known as the *Collectio canonum Isidoriana,* was in fact produced by Isidore, though it seems to have been compiled in Spain in his time. For the *Pseudo-Isidoriana* of the 9th century, *see* DECRETALS, FALSE.

Isidore was canonized in 1598 (feast day April 4) and formally declared a doctor of the church in 1722.

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See also E. Bréhaut, *An Encyclopaedist of the Dark Ages* (1912); *Dictionnaire de théologie catholique,* vol. viii, col. 98–111 (1924).

(L. M.-Po.; X.)

ISIDORE OF ALEXANDRIA (*fl. c.* A.D. 500), Neoplatonic philosopher, succeeded Marinus (the successor of Proclus) in the headship of the school of Plato at Athens. His main claim to distinction is that he was the teacher of Damascius, the last and one of the greatest of the Neoplatonic successors of Plato, who wrote Isidore's life in the customary enthusiastic manner of Neoplatonic biography.

Another Isidore, of Gaza, was one of the philosophers who accompanied Damascius to Persia after the closing of the schools of Athens in 529.

ISIN, an ancient city in Babylonia, probably to be identified with a large mound about 20 mi. E.S.E. of Diwaniyah in modern Iraq. An independent dynasty was established there *c.* 2030 B.C. by Ishbi-Irra, "the man of Mari." He originated a line of Amorite rulers of whom the first five claimed authority over Ur, which ceased to be paramount in Sumer after Ibbi-Sin, the last king of its 3rd dynasty, had been taken prisoner by the Elamites. Shulilishu, the second king of Isin, however, raided Elam and restored to Ur the statue of the moon-god Nanna, which had been carried off to Anshan. The fourth king of Isin, Ishme-Dagan (1966–46 B.C.), undertook substantial rebuilding of temples in Ur, and his son Enannatum dedicated a finely carved diorite statue to the moon-goddess Ningal, which was discovered *in situ.* The fifth of the Isin rulers, Lipit-Ishtar (1946–36 B.C.), is justly famous as having published a series of laws in the Sumerian language anticipating the code of Hammurabi (*q.v.*) by more than a century. Thereafter Isin became subject to the neighbouring city of Larsa (*q.v.*). There was a revival of the city's fortunes between *c.* 1150 and 1020 B.C. under its 2nd dynasty, a number of whose kings exercised authority in Babylonia. *See* also BABYLONIA AND ASSYRIA.

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ISINGLASS, a pure gelatin derived from the air bladders, or sounds, of fish. Russian isinglass, obtained from the sounds of various species of sturgeon, is considered the best. However, a satisfactory product is yielded by the sounds of catfish, carp, hake, cod, squeteague and other fish. Important amounts of isinglass are supplied by the U.S.S.R., the United States, Canada, Brazil, Venezuela, India, Penang and the Philippines.

In processing, the sound is cleansed and soaked in hot water to free it of mucous membrane. It is then cut open to expose the pure, lustrous inner membrane and dried. The outer membrane is removed from the dried sound by beating and rubbing. In open form the product is called "leaf" isinglass. Folded over it is termed "book" isinglass. Trimmings from leaf and book isinglass are compressed into "cake" isinglass. It may also be produced in sheets 6 to 8 in. wide and $\frac{1}{8}$ to $\frac{1}{4}$ in. thick or in ribbons $\frac{1}{64}$ in. thick.

The product has several commercial uses. By trapping in its gelatinous fibres substances causing turbidity, it serves as a clarifying agent in cider, wines and malt beverages. Isinglass dissolved in alcohol or acetic acid produces strong cements for mending pottery, glass, etc. Combined with gum, isinglass is utilized as a size for textiles, imparting lustre and stiffness to the material, and is also employed in various waterproofing compounds. (E. L. Y.)

ISIS, the Greek form of the Egyptian word meaning throne. In hieroglyphic writing the picture of the throne followed by the feminine signs stands for the name of the goddess, and the root meaning of the name is therefore the throne-woman; *i.e.,* the queen. In ancient Egypt inheritance of the throne was strictly matrilineal, descending from mother to daughter; the king became king only by right of marriage with the queen, who, as a royal ruler, was worshiped as a goddess.

EGYPTIAN STATE TOURIST ADMINISTRATION

RELIEF OF ISIS IN THE TEMPLE OF KALABSHA, LOWER NUBIA

The tradition that Isis and Osiris were not indigenous deities but came into Egypt from the north is probably founded on fact, and may record the introduction of a higher type of civilization and a new religious outlook. Little is known of her early cult for the objects and the inscriptions of the early periods are almost entirely funerary, Osiris and Anubis being the chief deities invoked. Even in the Pyramid texts—the earliest extant religious literature, first inscribed on the walls of the burial chambers of King Unas (at Saqqarah) in the 5th dynasty and continued by the kings of the 6th dynasty—intended solely for the protection of the dead king in the other world, Isis is hardly mentioned except as the mourner for Osiris. But the legends about her suggest that she was in origin an independent deity, for there are traces in them of contacts of her cult with those of Set (Setekh), Anubis, the northern Horus, the cobra-goddess Wadjit and the sun-god Re (Ra). In her aspect as the wife of Osiris she is the chief actor, but only after his death: she finds his corpse at Byblos, she finds the fragments of the dismembered body scattered throughout Egypt, she is the chief mourner at the funeral, she unites the fragments of the body and, by her divine power, brings Osiris to life again. In this connection Herodotus rightly equates her with Demeter (*q.v.*), for Osiris, as his ritual at Abydos shows, was the grain. Her chief aspect is that of the great enchantress, whose power transcended that of all other deities, even that of the sun-god himself. This magical (*i.e.,* divine) power is emphasized in the legend of the bringing of Osiris back to life, and she was invoked in all forms of illness, for even Anubis, the god of death, was subject to her. Her aspect as a mother was not specially important till the New Empire, for motherhood was one of the functions of all goddesses, but in the later periods she is commonly represented with "Horus the child" (Harpocrates) on her lap. It is not known when the name Horus was given to the child, but it is probably due to the similarity of the name that the northern Horus came to be regarded as the son of Osiris and Isis grown to manhood and making war on Set, the enemy of Osiris. In this war Isis greatly assists Horus by her irresistible magical spells (*see* HORUS).

Representations of the gods and the temples for their worship

are rare till the Middle Kingdom, probably because, as the Pharaoh was regarded as divine, his statues were the images of the deity while the mortuary and pyramid temples were for his worship. Representations of Isis are therefore infrequent until the New Empire, after which they become increasingly common. She was the most popular goddess from the time of Psamtik I (663–610 B.C.) till the coming of Christianity, by which time the naturalistic type of art had so ousted the old traditional Egyptian artistic conventions that it is sometimes difficult to distinguish between pagan and Christian figures of a mother and child.

Isis is represented as a woman with the sign of the throne on her head. As a mourner she kneels at the foot of the coffin, but as an independent goddess she is enthroned. As a rule she is represented as entirely human, but in the late periods she is sometimes equated with the goddess Hathor and wears the cow's horns on her head. Her cult seems to show that her dealings were with human beings rather than with crops: as mourner she was the chief person in all rites connected with the dead; as enchantress, she cured the sick and brought the dead to life; and as mother, she was herself a life-giver. Her cult appealed strongly to the Greeks and the Romans and, when Egypt came under Roman rule, it spread across Europe. The chief centre of her worship in Europe was in Rome, but smaller temples were founded elsewhere, even as far away as Britain. *See* OSIRIS; *see* also references under "Isis" in the Index.

(M. A. M.)

ISKENDERUN (formerly ALEXANDRETTA), a port, administrative centre of an *ilce* (district) and the largest town in Hatay *il* (province), Turkey, is situated on the eastern shore of the Gulf of Iskenderun, 27 mi. N. of Antioch (Antakya) and about 60 mi. S.E. of Adana. Pop. (1960) 63,736. Lying on an alluvial plain below the Amanus mountains (Nur Daglari), the town is modern with fine buildings and avenues decorated with subtropical plants. It is also a winter resort and has a military base. Iskenderun preserves the name but probably not the exact site of the city, Alexandria ad Issum, founded to commemorate Alexander the Great's victory over the Persians at Issus (333 B.C.). The name "Little Alexandria" may date from the 4th century A.D. The port was the main outlet for overland trade from Iran and India until the construction of the Suez canal. Its rapid growth after it was returned by France to Turkey in 1939 (*see* HATAY) was due to improved port facilities. It serves as a gateway to eastern and southeastern Anatolia and is connected by rail and road with other parts of Turkey. A main road to the south, crossing the Amanus range through the historic Belen pass, leads to Antioch, northern Syria (Aleppo) and thence Iraq. (N. TU.; S. ER.; E. TU.)

ISLA, JOSÉ FRANCISCO DE (1703–1781), Spanish satirist and Jesuit preacher whose picaresque satirical novel, *Historia del famoso predicador fray Gerundio de Campazas, alias Zotes* (1758) was so successful that the first printing was exhausted in a day or two, was born in Vidanes, León, but after his order was expelled from Spain in 1767 he lived mostly in Bologna, Italy, where he died. In *Fray Gerundio* . . . he aims at annihilating by ridicule the popular mendicant preachers who held large audiences by histrionic devices and by stuffing their absurd sermons with low jests, strained metaphors, learned references and Latin quotations. He was so successful that *"gerundio"* became used as a noun and adjective to describe pseudo-learned preachers or grandiloquent sermons, or, more generally, a bombastic and pedantic style. The mendicant orders denounced the novel to the Inquisition, which suspended the second printing of Part I (1760) and of Part II (1770), together with all the pamphlets discussing the work. At the end of the century, however, Isla was better known for his translation of Alain Le Sage's *Gil Blas de Santillana* (1787, posth.), mainly because of his unfounded claim, which provoked a long controversy, that he was restoring to its native country and language a work stolen from the Spanish.

See B. Gaudeau, *Les Prêcheurs burlesques en Espagne au XVIII^e siècle* (1891); F. Cordasco, "Llorente and the Originality of the Gil Blas," *Philological Quarterly* (1947). (EH. F. H.)

ISLAM (repeatedly used in the Koran in the sense of "surrender to God's will") is the name of the religion promulgated by Mohammed (*q.v.*). One who accepts Islam is a Muslim. There are no absolutely reliable figures for the Muslim population of the world, but the most reasonable figure is between 370,000,000 and 400,000,000. There is a striking unity or similarity of sentiment and attitudes among all the Muslims both within themselves and vis-à-vis the non-Muslim world, thus justifying the concept "Muslim world"; nevertheless, there are equally striking cultural and religious differences among different regions—the Arabs and the arabized Africans; the Turks and the Turkic central Asians; the Persians; the Pakistano-Indians; the Malay-Indonesians; and the Chinese. The most prominent fact of the 20th century for the Muslim countries is the strenuous and progressively successful endeavour to preserve or achieve independence from colonial rule, and in these endeavours the religious Islamic sentiment has played a fundamental role. For the history of the spread of Islam, see CALIPHATE and other articles referred to there.

For the Muslims, the Koran (*q.v.*) is the Word of God, confirming and consummating earlier revealed books and thereby replacing them; its instrument or agent of revelation is the Prophet Mohammed, the last and most perfect of a series of messengers of God to mankind—from Adam through Abraham to Moses and Jesus, the Christian claims for whose divinity are strongly rejected. Indeed there is no people to whom a prophet has not come. Although Mohammed is only a human creature of God, he has nevertheless an unequaled importance in the Koran itself which sets him only next to God as deserving of moral and legal obedience. Hence, his sayings and deeds (Sunna) served as a second basis, besides the Koran, of the belief and practice of Islam.

The Koran (which, for the Muslim, is the miracle par excellence of Mohammed, unsurpassable in form as well as in content) is a forceful document basically expressing an *élan* of religious and social justice. The early chapters (suras) of the Koran, reflecting Mohammed's grim struggle against the Meccans, are characterized by grave warnings of the imminent judgment, while the later suras, of the Medina period, are chiefly directed to regulating the internal and external affairs of the young Muslim community-state, besides narrating the stories of the earlier prophets.

The koranic theology is rigorously monotheistic: God is absolutely unique—"there is nothing like him"—omnipotent, omniscient, merciful. Men are exhorted to obey his will (*i.e.*, to be Muslim) as is necessarily done by all inorganic objects. Special responsibility is laid on man who willingly, although with his characteristically foolish pride, accepted "the trust," refused by all creation. Besides human beings and angels, the Koran speaks of the jinn, both good and evil, to whom sometimes the devil is represented as belonging (*see* JINNI).

MUSLIM THEOLOGY

The Creed.—The creed consists of five articles of faith: (1) belief in one God; (2) in angels; (3) in the revealed books; (4) in the prophets; and (5) in the Day of Judgment. To these was added, during the early development of the dogma, the belief in God's predetermination of good and evil. The profession of the faith (*shahada*) is: "There is no God but God and Mohammed is his apostle."

The Five Pillars.—These are the five obligatory duties: (1) reciting the profession of faith; (2) prayers; (3) paying of the *zakat* tax; (4) fasting; and (5) pilgrimage to Mecca.

The profession of the faith must be recited, at least once in a lifetime, aloud and correctly, purposively, with a full understanding of its meaning and with an assent from the heart.

The obligatory worship of God consists of five daily prayers preceded by necessary ablutions. Although the Koran (xxx, 17–18) expressly mentions only four, the actual practice of the Prophet was five: before sunrise, just after noon, in the late afternoon, immediately after sunset, and the last one, about two hours later. All these prayers are public and collective, although under necessity individual prayers are allowed. Each service, led by an imam, is offered with one's face toward the Ka'ba (the sanctuary at Mecca) and consists of two or more genuflection units. All the different physical postures and the materials to be recited, silent or aloud, have been fixed by tradition, including the first sura of the Koran which is to be recited in each unit, followed,

in some units, by another passage from the Koran. Under special circumstances such as illness, journey or war, modification or limited postponement is allowed. On Fridays, instead of the prayer just after noon, a congregational prayer is offered including a sermon (*khutba*) declaimed from the pulpit (*minbar; see* below). Special congregational prayers are offered in the middle of the morning on the two festival days called *'ids*, one immediately following the month of fasting and the other following the pilgrimage. Although not ordained as an obligatory duty, individual devotional prayers, especially during the night, are emphasized and have been carried to extreme limits by the Sufis.

The obligatory tax called *zakat* ("purification"; *i.e.*, that the payment of which renders the remaining property religiously and legally legitimate) is payable on food grains, money, etc., each year after one year's possession. The amount varies for different categories. Thus, on grains and fruits it is 10% if watered by rain, 5% if watered by irrigation; 2.5% on money is prescribed. Money so obtained is to be spent primarily on the poor and the needy. In olden times the collection and expenditure of *zakat* was a function of the state; since the general breakup of the Muslim religio-political power, it has been left to the individual. Besides these legal alms, the payment of charities (*sadaqat*) is stressed in the Koran and the Tradition.

The fast has been laid down (Koran ii. 183–185) for the entirety of the month of Ramadan "in which the Koran was sent down." The Koran also says (iii. 1) that "it was sent down on the Night of Determination [or Power; *lailat al-qadr*]," and Muslims generally observe this night during the night of 26–27th Ramadan. For a person who is sick or on a journey "another number of equal days" is prescribed. Feeding of one poor man is also required from "those who can afford it." The fast, during which all eating and drinking is forbidden, starts at daybreak and ends at sunset. (*See* also RAMADAN.)

The fifth pillar is the pilgrimage (*hajj*) to Mecca, which it is incumbent on every Muslim to perform once in a lifetime provided he or she can support himself during the journey and can also arrange for the provision of his dependents during his absence. The pilgrimage ceremonial begins every year on the 7th and ends on the 10th of the month of Dhu 'l-Hijja. When the pilgrim is about six miles from the holy city, he enters upon the state of *ihram;* he casts off, after prayers, his ordinary clothes and puts on two seamless garments; he walks almost barefooted and neither shaves, cuts his hair nor cuts his nails. The principal activity consists of a visit to the Sacred mosque (*al-Masjid al-Haram*); the kissing of the Black Stone (*al-Hajar al-Aswad*); seven circumambulations of the Ka'ba, three times running and four times slowly; the visit to the sacred stone called Maqam Ibrahim; the ascent of and running between Mt. Safa and Mt. Marwa seven times; the visit to Mt. 'Arafat; the hearing of a sermon there and spending the night at Muzdalifa; the throwing of stones at the three pillars at Mina and offering sacrifice on the last day of *ihram*, which is the *'id* of sacrifice (*'Id al-Adha*). (*See* also MECCA.) At other times in the year, it is considered meritorious to perform the lesser pilgrimage (*'umra*), which, however, is not a substitute for the *hajj*.

Development of the Shari'a.—The most important and fundamental religious concept of Islam is that of the *shari'a* which literally means a "path to the watering place" but in its religious application means the total way of life as explicitly or implicitly commanded by God. The word has been used in the Koran, which sometimes suggests that different religions have different *shari'as* but at other times that all religions have fundamentally one *shari'a*. The concept, as formulated by Muslim religious teachers, includes both the doctrine or belief, and practice or the law (*fiqh; see* ISLAMIC LAW). But historically the formulation and systemization of the law took place earlier than the crystallization of the formal theology. This, as shown below, had far-reaching consequences for the future development of Islam.

Bases of the Shari'a.—The formulation of the *shari'a* rests on four bases (*usul*):

1. The Koran.

2. The Sunna (the Way) of the Prophet as recorded in the Tradition (Hadith). Six collections of the Tradition, known as "the six genuine ones" (*al-sihah al-sitta*), are regarded by the majority of Muslims as especially authoritative. These are (*a*) the *Kitab al-Jami' al-Sahih* of al-Bukhari (*q.v.*), which is the most celebrated and most scrupulously compiled; (*b*) the *Sahih* of Muslim ibn al-Hajjaj (*q.v.*) with an introduction on the science of Tradition; (*c*) the *Kitab al-Sunan* of Abu Dawud (817–886); (*d*) the *Jami' al-Sahih* of al-Tirmidhi (*q.v.*); (*e*) the *Kitab al-Sunan* of al-Nasa'i (830–915); and (*f*) the *Kitab al-Sunan* of Ibn Maja (824–886). The Tradition, which constitutes the history of Islam for its earliest period and which is the mother of Muslim historiography, is under attack by certain modern reformist Muslim groups. (*See* also HADITH.)

3. The third basis of the *shari'a* is *ijma'* or the universal agreement which has been materially perhaps the most important factor in defining what the Koran and the Sunna mean (*i.e.*, in formulating the doctrine and practice of the Muslim community) but which itself has curiously remained the least clearly formulated religious institution of Islam. Its full nature and implications have never been adequately analyzed either in medieval Islam or by modern scholarship.

Two important points must be borne in mind. (*a*) First, although this is not inherent in the concept itself, *ijma'*, in the pre-modern Islamic usage, has always had reference to the past, near or remote, and does not denote a contemporaneous agreement. It is, therefore, a part of the mechanism of traditional authority and does not mean a present and ongoing democratic religious operation except to the extent of the present recognition and acceptance of the past. Since the majority of the companions of the Prophet lived in Medina, the beliefs and practices of the Medina community at an early date gained authority through the *ijma'* principle. In the modern Muslim usage of the term, however, *ijma'* has come to mean a democratic institution opposed to traditional authority. (*b*) Second, and consequently, far from working as a monolithic principle of unique standardization, *ijma'* came to operate as a principle of toleration of different traditions within Islam. For, in addition to the Medina community, a school grew up in Iraq soon after the early Muslim conquests. Moreover, the converts to Islam had brought with them many of the practices and even the beliefs of pre-Islamic times. These, at first tolerated probably in the hope of gradual assimilation, later became recognized as valid through the *ijma'* conception, which came to mean the acceptance on the part of each section of the community of the opinions of the other sections.

Yet it would be wrong to think of *ijma'* exclusively in this sense of different but tolerated traditions. The apparently subsidiary sense of *ijma'* noted above—viz., the recognition and acceptance of the past as authoritative—is itself an activity, which has produced a fundamental core of ideas and conduct; it is formally secondary to *ijma'* in the sense of an irrevocable past, but materially it is even more basic. Even the so-called *ijma'* known as the *ijma'* of the doctors and thinkers of Islam is, in the last analysis, subject to the *ijma'* of the community. This is supported by a prophetic tradition which says "my community shall never agree upon an error."

4. The fourth principle of the *shari'a* formulation, known as *qiyas* or analogical reasoning, is the genuine basis of interpretation and thought (*ijtihad*) in Islam. It is this which makes progressive *ijma'* possible. Its earlier form was personal thought and opinion (*ra'y*), which was criticized by many eminent traditional authorities as "arbitrary." There are discussions in Muslim methodology as to the nature and scope of this activity, which concerns itself with the deduction of new beliefs and practices on the basis of analogy with past practices and beliefs. The right of original thinking (*ijtihad*) in medieval Islam was restricted by the orthodox to the first few generations of Islam, although by the Shi'a (*see* below) it continued to be vested in their doctors (*mujtahids*). But even medieval Islam witnessed powerful rebels like Ibn Taimiya (*q.v.;* the Wahhabi movement arose under the influence of his ideas), who claimed the right for themselves and whose influence has increased manifold, supported by modernists.

Sciences of the Shari'a.—There are four sciences known as the

sciences of the *shari'a (al-'ulum al-shar'iya)*: the prophetic Tradition (Hadith), the koranic exegesis *(tafsir)*, theology *(kalam)* and law *(fiqh)*. The first two are the materials for theology and law. In the four schools of law, the Hanafi, the Maliki, the Shafi'i and the Hanbali *(see* Islamic Law), which took shape early—during the first two centuries of Islam—law and theology were a unity and were not separated, although theology at that time was merely a statement of the doctrine. But whereas the legal systems thus erected remained to satisfy practical exigencies of the vastly expanded Muslim empire, and have continued down to the present, the doctrine was exposed to wide and strong discussions, criticisms and interpretations in the mixed milieu of Iraq (1) between Muslims on the one hand and representatives of the Christian, Gnostic, Buddhist and Hellenic elements on the other, and (2) within Islam between the rationalizing schools of the Mu'tazilites on the one hand and the orthodox fundamentalists like Ibn Hanbal on the other. As a result, a cleavage occurred between the law and the doctrine, and the former, which ideally presupposed the latter as its base, came not only to be an independent discipline but to claim for itself the title of the science of the *shari'a* par excellence, and was even identified with the *shari'a* itself. Thus *fiqh*, which originally meant an understanding of the entire range of the faith, came to be applied to law alone.

Early Theological Controversy.—The earliest theological controversies, which were probably instigated by contacts with Christians, centred around the questions of human free will over against God's predestination (both of which appear in the Koran) and of the nature of God's unity—whether his attributes were eternal entities beside his essence. Those who championed the freedom and efficacy of the human will were called Qadarites; the predestinarians asserted otherwise. The Qadarite doctrine was considered to be heretical in the beginning, and one of its early exponents, Ma'bad al-Juhami, was executed in 699. But after the Omayyads, the free-will idea gained popularity. By that time there had arisen under Wasil ibn 'Ata' the Mu'tazilite (the "seceders") school which, besides championing the freedom of the human will, held as its corollary that it was against divine justice either to punish a good man or pardon an unrighteous one. They also denied the attributes of God over and above his essence. Hence they called themselves "the people of Justice and Unity (of God)." Above all, they believed in the autonomy of reason over against revelation and in the supremacy of reasoned *('aqli)* faith over against traditional *(naqli)* faith. They also declared the Koran to be a created thing—a consequence of their denial of attributes. Under the caliph al-Ma'mun, a great patron of learning and culture, Mu'tazilism was adopted as the state creed and its chief orthodox opponent, Ibn Hanbal *(q.v.)*, who rejected reason altogether in matters of faith, was persecuted. But during the caliphate of al-Mutawakkil, orthodoxy was rehabilitated and the Koran was declared uncreated.

The crystallization of the orthodox creed took place in the 10th century at the hands of Abu 'l-Hasan al-Ash'ari, who carried it to victory against Mu'tazilism *(see* Ash'ari, al-). Until his conversion to orthodoxy, or until his explicit formulation of orthodoxy, al-Ash'ari had belonged to the Mu'tazilite school and was a pupil of the famous Mu'tazilite master al-Jubba'i. But he rebelled against them, using their own weapons of dialectical theology. His system is essentially a mediation between the rationalization of the Mu'tazilites and the anthropomorphism of the traditionists. He reaffirmed the attributes of God but taught that these are unlike the human attributes of the same name, that they exist neither as being identical with God's essence nor as being different from it. He also taught that God will be visible to the sight of the faithful on the Judgment Day, as the Koran has it, but that its manner we do not know *(bi-la-kaif)*. On the question of freedom of the human will and its efficacy, he affirmed the former but denied the latter. The substance of his teaching is that human volitional acts are morally attributable to man, who is responsible for them, and ontologically attributable to God, who is the sole productive cause of all events. At first looked upon with suspicion and confounded with Mu'tazilism, Ash'arism slowly gained ground in Iraq and Persia—especially due to the influence of the great al-Ghazzali—and thence spread westward to Spain and Egypt under the Ayyubids and the Mamelukes and to Africa under the Almohad Ibn Tumart (1130).

After al-Ash'ari, the system was developed by Abu Bakr al-Baqillani, the qadi (d. 1012). Its chief subsequent criticisms and modifications were centred on the question of the efficacy of the human will. While Ash'arism has remained the chief umbrella symbol on the formal side, the content of theology was influenced later from other quarters, primarily philosophical. A system of theology closely resembling that of al-Ash'ari but somewhat more liberal is that of the Hanafi al-Maturidi (d. 944). In later individual writers Maturidism and Ash'arism have freely interacted. There has also existed a literalist (Zahiri) school of theology whose most famous exponent was the Spanish Ibn Hazm *(q.v.)* but which has not claimed many adherents.

Shari'a and Non-Shari'a Disciplines.—The main function of the thus established orthodox creed was to restore doctrinal equilibrium; it was more or less formal, and the theological base on which it was supported was also scholastic and formal. In the educational institutions that grew up all over the Muslim world theology and law were taught, but, whereas theology was learned for defensive and formal purposes, law came to be looked upon as the sole content of the *shari'a*, even though the theologian continued to contend that theology was the highest discipline. In the meantime both, living on sufferance of one another, were faced with real and strong forces in the concrete life of the people. Philosophy *(see* Arabic Philosophy), based on the spirit of free inquiry into the nature of things, threatened theology, and Sufism, rooted in the state of the heart, challenged law.

Sufism *(q.v.)*, yearning for a personal union with God, found the externalities of the law, divorced from a personal theology, very unsatisfactory and increasingly opposed its own way *(tariqat)* and its goal *(haqiqat)* to the *shari'a;* it similarly opposed its intuitionism *(ma'rifat)* to the rational deductions of formal theology. The main stream of the Sufis strove to remain within orthodoxy and declared that the observance of the *shari'a* law was indispensable; indeed, from the early period they had attempted to develop a scheme of partly antithetical and partly complementary categories ("annihilation and restoration," *fana' wa baqa';* "intoxication and sobriety," *sukr wa sahw*, etc.) to achieve a synthesis of the external and the inner. But the opposition of these two aspects continued to be emphasized. Later, under the influence of speculative mysticism, Ibn 'Arabi *(q.v.)* produced a system which created a complete chasm between the law and Sufism. In societies, such as Indian Islam, that had a strong pre-Islamic heritage of mysticism, this chasm became much wider. Sufism developed into dervish *(q.v.)* orders that remained influential until very recent times; their influence has waned sharply in the modern period, even though in the middle east and especially in Africa they combated the European penetration. In Turkey they were officially disbanded by the regime of Mustafa Kemal Ataturk.

Based upon a Neoplatonized version of Aristotelianism, a powerful, although individual philosophical movement arose in the 9th century. Its great figures—al-Farabi *(q.v.;* 10th century) and Ibn Sina (Avicenna [*q.v.*]; 10th–11th century) in the east and Ibn Rushd (Averroës [*q.v.*]; 12th century) in the west—constructed out-and-out rationalist systems of thought which came into conflict with certain dogmatic bases of Islam—the temporal creation of the world and the resurrection of the body, etc. Theologians rejected philosophy but were forced to support their dogmatic principles on some ground acceptable to reason. After al-Ghazzali's famous attack on philosophy, the latter lost vitality and in later development lived an impoverished life in liaison with speculative mysticism *(see* Ghazzali, al-). Significantly, al-Ghazzali's positive and voluminous work was entitled "The Revival of the Religious Sciences" *(Ihya' 'Ulumal-Din)* and not "The Revival of the Shari'a Sciences." He gave a definitely mystical emphasis to his influential interpretation of Islam. Thus, although his works won for Sufism a respectable place within the Islamic scheme, the inner dichotomy remained. This called forth, in the 14th century, a vigorous counterthesis emphasizing the *shari'a* (primarily in its newer sense of the term: external law) by Ibn Taimiya *(q.v.)*,

whose puritanical influence has been profound on modern Islam. In the 17th and 18th centuries some eminent men—Ahmad Sirhindi, 'Abd al-Ghani al-Nabulsi and Shah Waliy Allah of Delhi—made important attempts to reconstruct an "integral" Islam, on wider foundations.

Modern Islam.—These premodernist movements, arising entirely from an internal consciousness of religio-social and, in some cases, political degeneration, and culminating in the puritanical movement of Wahhabism (*see* WAHHABI), found a partial ally and partial opponent in the intellectual reformism of the modernists, who, after the middle of the 19th century, were also directly activated by western modern influences. The main points of agreement between the premodernist and modernist movements (between which there has been historical continuity) are a rejection of Sufism, a positive activist orientation and a stress on the unity of the Muslim community. With very rare exceptions, like that of Mohammed Iqbal (*q.v.*), there has been little deep-reaching philosophical rethinking of Islam such as may affect the basic religious issues. The main content of modernist reformism consists of sociopolitical reconstruction under the influence of western influence and criticism. On these issues, the early modernist work has been both reformist and apologetic—*i.e.*, designed to show that the modern western sociopolitical values are really identical with Islam as properly understood. Such problems as those of the status of women, of slavery and of political democracy were treated in this way. It was only in Turkey that a violent break with the past tradition occurred on the political-legal plane, although after 1950 a partial revision of the Turkish stand was in evidence. Elsewhere, the early modernists succeeded more in the apologetic direction than in the reformist, and a powerful reaction to early modernist reformism set in, generally speaking, after the second decade of the 20th century.

Primarily, the need was that of a psychological confidence vis-à-vis the west. However, with the gradual achievement of independence of the Muslim countries from European political hegemony, the concrete issues of sociopolitical construction and reform have confronted Muslims. Answers to such problems as those of the Islamic state and the status of the *shari'a* and the Tradition are pending. The relative inability to answer these questions stems from a lack of integration between the traditional learning and the modern secular educational centres, a problem to which the Muslim countries are beginning to address themselves.

At the educated middle-class, especially lower-middle-class, level, the results of the failure of early modernism and the onset of revivalism are blatantly evident. At this crucial point, which is the genuine point of entry to the as yet inert masses, new leaders, agitators and propagandists have taken over since the late 1920s and early '30s—people who have relentlessly and largely successfully exposed the weaknesses both of conservative Islam on the one hand and of the purely westernized sections (who are mainly at the helm) on the other. In actual practice, the newer leaders are more violently opposed to the latter than to the former, even though they themselves do not have any clearly worked out objectives. Such forces are the Jama'at-e-Islami in Pakistan and the Muslim Brotherhood (al-Ikhwan al-Muslimun) in Egypt. The latter was ruthlessly suppressed by the Egyptian regime in 1954 and the former was disbanded as a political organization by the military revolutionary government of Pakistan in 1958. It is clear, however, that neither measure, as it stands, can bridge the cleavage between the two wings and, in all probability, may even worsen the situation.

SECTS

The schools to which the various theological controversies gave rise did not express themselves in separatist sectarian organizations. The Mu'tazilites and the Qadarites were schools rather than sects. Sufism was a spiritual-social movement which, by and large, at least attempted to keep within the main body of Islam, called the Sunnis (*i.e.*, followers of the Prophet's way), even though the unorthodoxy of many Sufis on certain points is beyond doubt. The account given above, therefore, can be taken as the development of "central" Islam.

Kharijites.—Early in Islam, during the caliphate of the ill-fated 'Ali, two sects originated in Islam, which have remained to this day. When, after the battle of Siffin (657) between 'Ali and Mu'awiya over the succession to the caliphate (*q.v.*), the former submitted his claim to arbitration, a group from his supporters (called his Shi'a—*i.e.*, party) broke with him on the ground that "decision belongs to God alone" (Koran vi, 57) and not to human arbitrators. These were called the *Khawarij* (Kharijites). They taught that a perpetrator of a major sin no longer remained a believer and that faith consisted not only in belief but equally essentially in works. On the office of the caliphate, their view was that any Muslim, even a black slave, could fill it, provided he was otherwise qualified. They frequently rose in rebellion against the Omayyads and fought with remarkable if cruel heroism. But their power was slowly broken and only a few of them survive in north Africa and eastern Arabia. (*See* also KHARIJITES.)

Shi'ites.—The most important medieval sect, although numerically far smaller than the Sunnis (around 35,000,000), is that of the Shi'a, "the party of 'Ali." Their dissension was, in the first instance, political; they conceived of the caliph not as the executive chief of the community, as the Sunnis did, but as the infallible imam in whom worked a divine charisma restricted to the house of 'Ali. Politically, they came to represent the Persian reaction to the Arab ascendancy of the Omayyads. Theologically, they imported many Zoroastrian and Christian elements in their extreme subsectarian forms of Isma'ilism. The main body of the Shi'a is the "Twelvers" (Ithna 'Ashariya), who believe that the 12th and last imam, Mohammed al-Muntazar, disappeared in 878 but that he is still living and will appear before the last day to save the world. The Twelver Shi'a are found chiefly in Iran, Pakistan, Iraq and southern Lebanon. The Safavids established Twelver Shi'ism as the state creed of Persia in the 16th century and it has remained so.

The Shi'a have evolved their own system of law; they have their own canonized collection of the Tradition (Hadith). Some Shi'a have even believed that the text of the Koran, as it exists, is incomplete, that the part specifically devoted to the praise of 'Ali and his house has been expunged. To the creed, "There is no God but God and Mohammed is his apostle," they add "and 'Ali is his comrade [*waliy*, "chosen friend"]. An important doctrine is that of the *taqiya* or "hiding"; *i.e.*, the right of a Shi'ite to conceal his real beliefs in a hostile society without any risk of committing hypocrisy. As for practice, there are some modifications in the religious duties; the prescriptions of ritual purity (*tahara*) are given a prime importance. Pilgrimage to Mecca may be performed by a proxy or its place may be taken by a visit to the tombs of Shi'ite saints—of 'Ali at Najaf (Iraq), of Husain at Karbala (Iraq), of Rida (Riza) at Meshed (Iran) or of Fatima (daughter of the imam Musa) at Qom (Iran). Indeed, pilgrimages to the saints' tombs are a prominent characteristic of the Shi'a, although some Sufi practices in Sunni Islam come close to this. Public and collective prayers are not obligatory since there is no legitimate imam at present. The death of Husain (son of 'Ali) at Karbala is celebrated with meticulous care and vigour, accompanied by passion plays (*ta'zia; see* HASAN AND HUSAIN). Temporary marriage (*mut'a*), for a specified period—a year, a week or a day—is allowed and practised. (*See* also SHI'ISM.)

Under modern influences (*i.e.*, both modern thought and scholarship and political considerations of Muslim solidarity) there has grown an ecumenical sentiment between the Sunnis and the Shi'a with spasmodic actual efforts at *rapprochement*. This is further enhanced by the fact that, apart from Amir 'Ali, who rarely appears as a Shi'ite when he writes, the modern interpretations of Islam have been done mostly by Sunnis, who have influenced Shi'a writers.

Isma'ilis.—The Isma'ilis or the "Seveners" are the followers of Isma'il, whom they regard as the seventh imam, rather than his younger brother Musa (797) recognized by the "Twelvers." Their main body is led by the Aga Khan (*q.v.*), who is their spiritual and temporal head. Another branch, the Bohras, of India recognize their own separate leader. To the Isma'ilis belong also the Karmatians, the Fatimids of Egypt, the Assassins (the ancestors

of the main branch) and the Druze (*qq.v.; see* also ISMA'ILISM).

Zaidites.—The Zaidites, followers of Zaid, a grandson of Husain, are the nearest of the Shi'ites to the Sunni Islam. Although holding that the imamate belongs only to the descendants of 'Ali and Fatima (more than one of whom can be simultaneously imams), they accept Abu Bakr's and Omar's imamate as being justified by the circumstances. Their law also is close to that of the Hanafite Sunnis.

Ahmadiya.—In the modern period two important sects have arisen in Islam: Babism (*q.v.*), which, as the Baha'i Faith, has formally gone outside Islam, and the Ahmadiya, a sect founded by Mirza Ghulam Ahmad at the turn of the 20th century. He began by writing books against the Christian missionaries in defense of Islam but in 1879 began to claim that he was the promised Mahdi and the Messiah in the village of Qadian in the Punjab, India. Over against the general Muslim belief that Jesus was not actually crucified but was raised to heaven and will reappear on earth, Mirza Ghulam Ahmad claimed that Jesus, after escaping from crucifixion, went to Kashmir and died in Srinagar. He also claimed to be a manifestation (*buruz*) of Mohammed the Prophet and, for the Hindus, an incarnation of Krishna. Most probably he believed that he had come to unite all religions under Islam, and he positively disclaimed having any revealed book like the Koran or any new law; he accepted the Koran and the Islamic law. He reinterpreted the doctrine of *jihad* (*q.v.*) as being an exclusively pacific struggle "by the pen, not by the sword." In this doctrine and in that of the death of Jesus, he had been preceded by Sir Sayyid Ahmad Khan (*q.v.*), founder of the Aligarh Muslim college and of the modernist reform movement in India. In his claim to be a kind of prophet Mirza Ghulam Ahmad seems to have been directly inspired by the medieval Sufi Ibn 'Arabi. It is a common belief among the Indian Muslims that he was looked upon with favour by the British government.

The Ahmadiya sect, after the death of their first *khalifa* in 1912, split into two. The main body, called the Qadianis, recognized Mirza Bashir-ud-Din, a son of the founder, as the second *khalifa;* he proved himself a brilliant organizer. The smaller party, called the Lahore Ahmadiya, rejected the doctrine of Mirza Ghulam Ahmad's prophethood as well as his son as *khalifa* and moved closer to orthodoxy. Both parties have been very active missionaries of Islam especially in the west and in Africa. To would-be converts, the Qadianis do not present Islam as a specially sectarian affair but as the religion preached by the Prophet Mohammed; in Pakistan, however, where they have their headquarters, they declare as unbelievers all those Muslims who do not believe in Mirza Ghulam Ahmad. This led to serious riots and martial law in West Pakistan in 1953. Their number is very small.

MUSLIM INSTITUTIONS

Since Islam is a total way of life and admits of no division between religion and state, all its institutions are, in this sense, religious. Thus, the *zakat* tax, described above, is a socioeconomic measure enforced by the state, but it is also one of the prime religious duties.

The State.—The state itself is, indeed, a religious institution, having as its constitution and law the *shari'a—i.e.,* the religiomoral values of Islam. The form that the Islamic state assumed after the death of Mohammed is called the caliphate, with the caliph (*khalifa,* successor of Mohammed) at its head. The first caliph, Abu Bakr, was elected after a struggle between the Meccan Quraish (Kuraish, Quraysh, Koreish) and the Medina Ansar ("helpers"; *i.e.,* those who gave refuge to the Prophet and other Muslim emigrants from Mecca). Muslim orthodoxy, formulated later, held that the caliph must be from the Quraish. The caliph is neither a secular ruler nor the Muslim equivalent of the pope; he has the power neither to legislate nor to define dogma. He is the chief executive official of a religiously constituted community.

The caliph, theoretically, may be deposed if he proves incapable or violates some cardinal principle of Islam. In practice, however, there was no machinery either to declare a caliph unfit or to carry out the deposition. After the first four "rightly guided caliphs" (*al-khulafa' al-rashidun*), Mu'awiya introduced the hereditary principle, and the elective principle was reduced to a mere oath of obedience. The idealist *Khawarij* rose in rebellion against this several times, and in order to put an end to this internecine warfare orthodoxy was forced to adopt the principle that "an unjust ruler is to be tolerated rather than chaos" and that the peace and unity of the community may be broken at no cost. When, during the Abbasid period, the caliph gradually lost power and became a figurehead while the real power passed into the hands of the sultans (who recognized the caliphal authority only to the extent of reciting the Friday sermon, *khutba,* in his name and possibly using his name on the coins), the sultans exploited this very orthodox principle and elevated themselves as "the shadow of God" (*Zill Allah*) and "vicegerents of God." This change was helped undoubtedly by a revival of the Persian conception of the divine right of the king, so palpably embodied in the Fatimid theory of the caliphate.

The Ottoman caliphate arose out of a combination of this theory with the political extension of the Ottoman empire over the Muslim core lands, helped by the longevity of the dynasty. In the Ottomans, however, the sultanate and the caliphate remained two distinct powers, the one as a secular, the other as a religious function, and the caliphate never thereafter returned to its primal status. It was finally abolished in the 1920s by Mustafa Kemal Ataturk's regime, to the shock of the whole Islamic world, at the very moment when Indian Muslims were waging a fierce struggle against the British to restore the dismembered provinces of the Ottoman caliphate. Turkey established a secular state, claiming that this was sanctioned by Islam itself.

Ibn Taimiya, as early as the 13th century, had recognized that the world of Islam was no longer under one centre and probably could never be again. In modern times, although Islamic sentiment makes itself felt all over the Muslim world, the existence of different nationalisms in terms of separate political and cultural units is a fact. There are, however, innumerable Muslims who not only would like to see the Muslim world united but think that such union is achievable. Muslim modernists everywhere have been and are trying to establish genuinely Islamic states in modern democratic forms. This movement, for example, is largely responsible for the civil war that started in Indonesia in 1958. In Pakistan the political struggle for an Islamic state lasted from the country's birth in 1947 until 1956, when the constitution for an Islamic republic of Pakistan was adopted. This constitution was abrogated by the military revolution of 1958, and the problem of the status of Islam thereafter troubled officialdom in that country. Whatever decisions on this question the various Muslim countries may take, they cannot fail to affect both the future of Islam itself and the world at large.

Administration.—As for the techniques and the machinery of administration, the Muslims started very early to adapt these from the Persian and Byzantine systems of government. Thus, the second caliph, Omar, on the advice of the Persian prince Hurmuz, established a *diwan* to maintain records for the distribution of stipends to soldiers (*see* DIWAN). The Omayyads struck coins for the first time in the history of Islam. And as the task of administration became much more complicated, several *diwans* or *bureaux* were established for the purpose of collecting taxes and administering the law. The first Abbasid caliph, Abu'l-Abbas, appointed a vizier (*wazir,* a confidential administrator). Gradually a secretarial class arose, by and large Persian in origin, which became a powerful factor not only in state policies but also in influencing sociopolitical movements. The most important of these in the Abbasid period, the Shu'ubiya movement, was supported by the professional secretarial classes and directed against Arab hegemony. At times when a sultan became very powerful, he would take the place of the vizier under the title Amir-al-Umara'. The most celebrated viziers are the Barmecides (*q.v.*) of the Abbasid Harun al-Rashid and Nizam al-Mulk (*see* NIZAM AL-MULK) of the Seljuk sultan Alp Arslan.

The main tasks of the administration were (1) to collect and distribute revenues, (2) to administer law and (3) to perform

jihad or holy war. The taxes collected were the *zakat* from the Muslims, the poll tax (*jizya*) from non-Muslims and the land tax and the professional earnings tax (*kharaj*). For *jihad*—which came to mean not only war operations against non-Muslim states but also the suppression of lawlessness within—an army was kept and paid from *zakat* funds. In the beginning all able-bodied adult males were conscripted "in the path of God" and in Omar's time were paid regular stipends. These forces were kept as occupation forces in the conquered lands. But later paid soldiers were used. External *jihad* was strictly regulated by law (*see* JIHAD).

To keep a check on public morality, the office of the moral police or *muhtasib* was instituted. The *muhtasibs'* function was preventive; they tried to see to it that mischief did not occur. After the moral breach took place it was the qadi, often second in importance only to the head of state, who decided the case in court. The qadi interacted with another important officer, the mufti (*q.v.*), the authoritative interpreter of the law and, from this point of view, ranking religiously higher than the qadi, who was a purely judicial official. The qadi, as a judge, did not merely accept the statement of the mufti; in each individual case before him he exercised judicial interpretation himself and thus, in course of time, Muslim case law was built up and compiled in the several compendia of *fiqh*. The qadi also administered the religious endowments (*awqaf*) which became an important part of state administration. These charitable legacies were the main support (besides gifts from rulers and princes) of schools, mosques, various social-service institutions and the numerous Sufi organizations.

Education.—Education has occupied an important place in Muslim life, and the Hadith, supported by the Koran, set high value on knowledge and learning—*e.g.*, "seek knowledge even though it be in China." In the actual development of the educational system, however, a sharp division existed between primary and higher education (A. S. Tritton, *Materials on Muslim Education in the Middle Ages*, 1957), with the effect that there was no standardized and systematic feeding of the higher level by the lower. There is ample evidence of school education in existence in the first century of Islam. The ruthless but remarkable Omayyad governor of Iraq al-Hajjaj ibn Yusuf is reported to have been a schoolmaster after the profession of his father. Instruction included the inculcation of honesty, truthfulness and moral character in general. The subjects taught—at a rudimentary level—were reading and writing, the Koran, prayer, catechism, some law and arithmetic. Sometimes nonacademic training (*e.g.*, in swimming and archery) was also given, but practically no attention was paid to technical training. This latter was given, in medieval Islam, by the guilds (which became a very powerful institution, both socially and spiritually, for example, in Turkey), which provided training in arts and crafts through their apprentice system. In later medieval Islam, the establishment of a network of Sufi orders throughout the Muslim world resulted in Sufi training centres (*zawiyas*, *tekyes* and *khanqahs*) where spiritual training was often combined with academic instruction; in some even military training was given to effect *jihad* (*see* MARABOUT). There is a considerable literature on the theory of education, on the behaviour of the student and teacher vis-à-vis each other, even on the role of the parents.

But the pride of Islam was its university system, which produced the class of the *'ulama'* (ulema; *q.v.*) or learned men, the religious leaders of Islam. From this class were drawn the imams, the qadis and the muftis (and other high state-religious officials like the *Shaikh al-Islam*). The *'ulama'* were a very powerful class and at times decisively influenced important policies of even later sultans both in Turkey and in India. In modern times they have gradually lost much ground vis-à-vis the western educated classes, and in Turkey they were altogether abolished; elsewhere, however, their hold on the vast body of the conservative masses remains unshaken. One of the most crucial problems before modern Muslims is the creation of a new body of *'ulama'* capable of integrating tradition with modernity. For so far, in modern Islam, an almost complete cleavage has existed between the *'ulama'*, who know only the tradition, and the modern laity, which has been educated in and knows only modern secular subjects. The modernist religious thinkers (who have been isolated and have never constituted a school of thought) have not been able to bridge the gap. There are, however, incipient developments in various parts of the Muslim world (the first took place in the Ankara university of Turkey) to integrate the two educational systems.

As early as the first century of Islam a hall (*majlis*) for the teaching of tradition is mentioned—indeed, Muslim education began with the tradition, and "knowledge" (*'ilm*) meant for the early Muslims a knowledge of what the tradition (especially the prophetic tradition) had to say on all matters. Gradually, colleges and halls grew which catered only for religious education. In 830 the caliph Ma'mun established in Baghdad a research academy for philosophy and astronomy, etc.; the Fatimids established a similar institution in Cairo in the 12th century. For the rest, secular sciences such as philosophy, astronomy and medicine were cultivated and pursued only by certain outstanding individuals to whom princes and rulers extended patronage, providing funds and facilities. Hospitals developed, where much clinical work was done. Islamic philosophical and medical works had a deep and enduring influence on the European tradition through Latin translations made in Spain and Sicily. Princes vied with one another in gathering around themselves, besides poets, men of learning, and often built enormous libraries which they were permitted to use. But the whole phenomenon remained individual.

It was characteristic of students throughout medieval Islam to travel from one place to another, from one master (*shaikh*) to another, in search of knowledge. This was much more important in early Islam than sedentary education at a single institution, and students obtained from each master a certificate (*ijaza*) to teach either a book or a subject (or subjects) learned from him. Certain famous colleges, however, sprang up in Baghdad, Nishapur, Damascus, Cairo and many other centres throughout the Muslim world. The most celebrated of the relatively early colleges was the Nizamiya, founded in Baghdad by the famous Seljuk vizier Nizam al-Mulk in 1067. Built, in the first instance, to teach Shafi'i law, it soon added theology and tradition; the great al-Ghazzali was on its staff. More stately and sumptuous and far wealthier in endowment was the Mustansiriya at Baghdad, founded in 1234 with a large staff to teach the four schools of law, as well as other disciplines. The Azhar in Cairo, the most important representative of the medieval schools still in existence (although it now teaches some modern subjects as well), was completed as a mosque in 977 and 16 years later started functioning as a seat of learning. In the latter half of the medieval period, philosophy (and medicine) were also included in the syllabi, although original independent philosophy was suspect and discouraged and its level consequently degenerated. Indeed, philosophy was later completely thrown out of the Azhar and was only reintroduced through the efforts of Jamal al-Din al-Afghani toward the end of the 19th century.

The Arts.—From the description given above of the salient and central specifically Islamic institutions, it is clear that the influence of Islam has been pervasive in the lives of its followers. This must not, however, make the reader oblivious of the fact that in its administrative techniques and its institutions, in its law, generally in its developed thought and, indeed, in its art it borrowed heavily from the cultures it encountered in the new lands to which it spread with such astonishing rapidity. Its early administrative system, including monetary and postal systems, was altogether indebted to the Persian and Byzantine empires. But whatever Islam borrowed, it impressed its own unmistakable stamp upon it. Similarly, the over-riding principle under which Islamic art developed—under all the foreign influences—was the religious rejection of images, and, in general, of representative forms of art. The arabesque, so characteristic of Islamic art, may be said to represent nothing particular, and this negative aspect has been emphasized by modern critics; but it can be more positively said to remind one of the absoluteness, transcendence and unity of God. (*See* ISLAMIC ART.)

But Islamic art expressed itself, for the most part, in architecture, especially in mosque architecture. In Islamic architecture, indeed, may be seen both the centrality of Islam and its tendency to acquire diverse elements from different local cultures. Among the earliest monuments is the well-known Dome of the Rock

(691; not, however, a mosque but a memorial) in Jerusalem, the Mosque of 'Amr in old Cairo and the mosque of Kairouan, Tunisia (7th century). The early Syro-Egyptian type of mosque is a heavily columned construction with a pulpit (*minbar*) for the preaching of sermons and a niche (*mihrab*) oriented toward the Ka'ba sanctuary (which is not a mosque but "the House of God"; *i.e.*, the focal point of the divine contact with the earth). In north African and Spanish Muslim architecture, Syro-Egyptian elements are fused with Roman-Byzantine characteristics. In the famous Persian mosques, the specifically Iranian elements are apparent—the tapered brick pillars, the arches, each supported by several pillars, the huge arcades and the four sides, called *iwans* (an unmistakable reference to the palaces of the Khosraus). Turkey developed its cupola-domed mosques and its characteristic form of the college building (the *madrasa*) with four wings for the teaching of the four schools of Islamic law, converging in an unroofed centre. Early Muslim architecture in India is, in its interior—discounting the façade—hardly distinguishable from Hindu buildings, but after the Moguls Islamo-Persian supplanted native Indian elements. (*See* Islamic Architecture.)

Instrumental music was forbidden by Islamic orthodoxy, although the use of drums was allowed on special festive occasions such as marriage. Nevertheless, music, both vocal and instrumental was cultivated, especially at the courts of the caliphs and princes and later by the Sufi orders, which sought to legalize it under the name of *sima'* for the purpose of inducing the mystical state of trance (opposed no doubt by the orthodox). Greek music influenced Arab music and the philosopher al-Farabi is accredited with having constructed a well-known stringed instrument called the *qanun*. (*See* also Oriental Music.)

Drama was forbidden since it fell within the domain of representational art. Story literature was tolerated, and famous Indian storybooks—the *Thousand and One Nights* and the *Kalila wa Dimna*—were translated from the Persian, introducing secular prose into Islam. Didactic and especially pious stories were invented and widely used by the common traveling preachers even though the didactic stories too were religiously suspect. Pure fiction (*e.g.*, in the form of novels) for the purpose of entertainment was interdicted.

Besides architecture, the only form of fine art that flourished unhindered was poetry (even though not completely beyond suspicion because of the koranic saying "Poets are leaders of the errant ones: they stray about in every valley . . . except those who believe . . ."; xxvi, 224), a form of expression pre-eminently characteristic of the east. The Arab genius is almost natively poetical, with a strong and vivid imagination unshackled by the logical system and order that reason imposes upon the mind. Consequently, the favourite type of poetry was the lyric (*ghazal*) and the eulogy (*qasida*), wherein each verse is an autonomous unit with no logical dependence on the preceding or the succeeding verses and, as a pithy and succinct expression of a state of feeling, eminently capable of being used as a maxim. Nature poetry was absent, and the first epic work (the *Shah-Nama* of Firdausi) was only a Persian reaction against the Arab mind—spiritually and politically. This it is which renders intelligible the fact that the Muslims, who understood and developed Greek science and philosophy, failed completely to understand Aristotle's work on the poetic art. In the later centuries, poetry was used as a fascinating and powerful vehicle for communicating the spiritual message of the Sufis. (*See* also Arabic Literature.)

MUSLIM SOCIETY

From the time of origin of Islam, social reform, through the enunciation of moral principles and actual legal enactments, formed part of the central core of Islamic teaching. Islam, indeed, may be described as a socioeconomic reform movement backed by certain strong religio-ethical ideas about God, man and the universe. In Medina, as soon as conditions permitted him to do so, the Prophet set up a community-state with a constitution; and, as situations demanded, necessary legislation was supplied to it in the form of either koranic ordinances or the Prophet's commands, which usually were not issued without consulting senior members of the community. After the Prophet's death, when within a few decades Islam expanded into a gigantic empire, a whole complex of legal, social and administrative developments took place with astonishing rapidity.

Koranic Social Laws.—On the social side Islam laid a firm moral basis for a total, purposeful community. The intention of its initial legislation was to improve and reform the already existing customary law of the Arabs, which was in many respects left intact. The koranic reforms had particular reference to remedying certain serious economic and social ills. In economics the principle adopted was that wealth "should not be allowed to circulate among the rich only" (Koran lix, 7). Consequently, usury and other forms of exorbitant economic exploitation were severely forbidden; the *zakat* tax on wealth (*see* above) was imposed and helping the poor and the needy was insisted on. The drinking of alcohol was at first restricted, then totally prohibited; so was gambling. Emancipation of slaves was exalted as a cardinal virtue, and a general, quasi-legal injunction was given to allow slaves to purchase their freedom through a contract (*mukataba*). A rigorously moral state of affairs was sought in family life and relations between the sexes. The Koran ordains "a hundred lashes for the adulterer and the adultress," although tradition restricts this punishment to unmarried persons and for married people prescribes death by stoning (indicating the influence of Jewish law already existing in Medina; *cf.* Deut. xx, 22–23).

The most far-reaching reforms were introduced in laws of marriage. Of the different forms of marriage existing in pagan Arabia, Islam banned all that were morally questionable and restricted the number of wives to four. Legally, reform could go no further in that state of social organization, and the Koran had to content itself with moral enunciations to the effect that if a man could not do justice among wives, then he must take only one wife. The Koran sought to improve the lot of women by legislating for specific women's rights. It lays down a general principle that the rights of women against men must be commensurate with the latter's rights over women, adding, "But men are a degree higher." These words must be interpreted in the light of the actual social situation, in which man was not only the breadwinner but the essential operative factor. It is in the light of this situation, again, that the koranic injunctions should be understood to the effect that the evidence of one man equals that of two women because, "should one of them slip, the other may correct her" (ii, 282). In the matter of inheritance, daughters were allowed only half the shares given to sons. (*See* also Harem.)

In regard to food, the Koran emphatically starts with the principle that all "good" things must be allowed and then forbids four items: corpse, blood, meat of swine and of those animals slaughtered as offerings to others than God. The last prohibition is a direct consequence of the koranic monotheism and the third shows the obvious influence of Judaism. But the Koran categorically allows food of the "people of the book"—*i.e.*, Christians and Jews.

Egalitarianism and Aristocracy.—The most fundamental and dynamic factor of social ethic that Islam gave was egalitarianism: all members of the faith, irrespective of race, colour or social or economic status, are equal participants in the community. One great result of this outlook has been the very special concern of the community—in contrast to Christianity—to avoid the creation of a clerical institution. This does not mean that there did not arise in Islam a class of *'ulama'* (*see* above) who supplied religious leadership and offered expert interpretations of Islam. But these men had no title to a vicarage of God; they obtained recognition only on the basis of their individual attainments and only to the extent that they could exert intellectual and moral influence. A far-reaching consequence of this phenomenon was that, within the terms of the actual social legislation provided by the Koran—which has remained valid both in theory and practice up to the present—a tremendous diversity of cultural patterns and social behaviour was absorbed and islamized. Already in the early schools of law, "good custom" (*'urf*) was recognized as a source of law. This diversity was canonized a little later by an alleged tradition of the Prophet: "Differences among my community are a mercy of God."

Some of the most important social developments popularly as-

sociated with Islam by non-Muslims, but in some cases also by Muslims themselves, originate from the impact of different cultures on early Islamic society. A striking instance is afforded by the institution of the veil or purdah among the Muslims, which in both Muslim and non-Muslim eyes is a concomitant of Islam. All the Koran had enjoined was a sense of modesty, in contrast to pre-Islamic Arabian sex morality, and that women "should not make an exhibition of their beauty" (xxiv, 31); the Prophet's wives were ordered a more strict seclusion. As the Arabs settled outside Arabia, however, they were influenced by certain aristocratic habits of their conquered subjects in the neighbouring empires. To this period of acculturation and ensuing moral laxity must also belong that large body of traditions wherein the Prophet had allegedly warned against general moral and especially female corruption on the eve of Doomsday. Indeed, roughly in this period and in this milieu originates the bulk of that teaching which later came to constitute much of the warp and woof of Muslim social ethics—fatalism, Messianism, indifference to public affairs and a political docility and conformism. And yet it was from this very milieu that the idea of the community was confirmed and reinvigorated.

Certain other important developments of this type assumed a fairly general character throughout medieval Islamic society. The Arabs, when they first settled in Iraq and Egypt, were discouraged from doing especially manual work and agriculture; the purpose was to keep them as soldiers. Gradually they developed into the new aristocratic class while their non-Arab clients (*mawali*, "freed slaves") performed manual labour and especially agriculture. From this arose the myth that the Prophet had discouraged agricultural occupation. That this could not have been the case is obvious from the fact that the Medinese population was largely agricultural. Against this the non-Arab clients—who now claimed to be better Muslims than the Arabs themselves—exalted manual labour and put into circulation traditions which alleged that the Prophet himself had done all kinds of manual work. But the aristocratic tradition, when it reached other and new Muslim lands, was accidentally reinvigorated by certain local factors. In India, for example, where social stratification had already existed, where the conquering Muslim minority had to remain as an administrative and military aristocracy and where largely the local menial classes were converted, the social stratification was further intensified and, further, the Muslims were unable to develop a strong commercial class. In Ottoman Turkey "Turk" became more or less a term of contempt for the Turkish peasant as distinguished from a gentleman of the town.

Almost exactly parallel with this distinction ran another very important one which was connected with Islam as a specifically religious phenomenon: the Islamic educational institutions which turned out *'ulama'* and were also controlled by *'ulama'*—who were largely responsible for the creation and maintenance of Muslim intellectual culture—were all confined to urban life. Some modern scholars have, indeed, suggested that Islam is essentially an urban culture. Whether or not this is true, certainly during the middle ages of Islam (*i.e.*, up to at least the 18th century), by a conglomeration of causes, orthodox Islam remained confined largely to the cities. As a result, the unifying forces of Islamic culture hardly penetrated the countryside, which in each region presented a variety of beliefs and practices sometimes not even remotely connected with Islam.

Diversity in Local Practice.—When from the 12th century onward the Sufi movement spread rapidly, it took on the form of a tremendous thrust of popular religion against the orthodoxy represented by the *'ulama'*. Its almost uncontrolled latitudinarianism encompassed the various local practices and attitudes, whether compatible or incompatible with Islam. The *'ulama'* continued to exert steady pressure but could not make much headway until the tide of popular religion began to abate during the 18th and especially the 19th century. From the animistic practices of the African tribes, through the shamanistic rituals of the central Asians, to the Indian mystery-mongering cults—all had Sufi support. Under these conditions, the half-islamized and the nominally islamized groups, even though they still enjoyed a sense of solidarity with the community, could not be really and fully islamized when the influence of the modern west came to be felt in Muslim lands. In India, the custom of sati, by which widows burned themselves alive along with their deceased husbands (*see* SUTTEE), persisted among certain converted groups until the late Mogul period, as did a host of other pre-Islamic survivals. Both Hindus and Muslims continue to venerate certain shrines, and, indeed, until the 20th century there were pockets of illiterate "Muslims" in India among whom even the names remained Hindu. A definite continuation of Hinduism in Indian Islam has been the extreme dislike of widows to remarry. The large-scale disinheritance of women, in opposition to the provisions of the *shari'a*, is also due to local influences, although now the *shari'a* law has been officially reinstated in this respect. The tenacity and persistence of certain "national" customs and habits among the Turks is well-known, although the initiation rite of the Bektashi dervishes, using wine, bread and cheese in a clear survival from Christianity, may be an extreme example.

Indonesia affords a striking example of this phenomenon. Due perhaps to the late conversion of that region, Islamic social ethic and code have made headway only in matters of marital status; otherwise it is submerged under what is called *'adat*, or custom. Not only are several tribes still matriarchal, but, according to the generally prevailing *adat* law, even the *shari'a* marriage is not considered valid until it is followed by another ceremony surviving from pre-Islamic tradition. Culturally, many Indonesians still retain either the old Hindu or pagan traditions: for example, the Hindu epic Mahabharata is cherished as a literary and even quasi-religious work. In the archipelago also one meets with the sharpest division between the *shari'a* and the Sufi way: in the same home the wife may be found offering the obligatory ritual prayers of Islam, while the husband abstains from this paramount religious duty on the ground that, though his wife belongs to the *shari'a* ("religious law"), he himself adheres to the *tariqat* (the Sufi way). Since the 19th century, however, there has been a renascence of orthodox Islam in Indonesia because of fresh contacts with the middle east, and *'ulama'* groups have arisen exerting pressure for reforms and for the conformity of social practices and institutions to the norms of Islam.

Reform Movements.—Since the 18th century, indeed, there has been a general upsurge of reform in almost the entire world of Islam. Various more or less indigenous movements, harbingers of renascence, arose in different regions, the forerunner of all being the Wahhabi movement in Arabia (*see* WAHHABI). A fundamental characteristic of all these movements has been emphasis on the social content of Islam rather than on the purely spiritual side or eschatological doctrines that characterized medieval Islam. This is because the reformers saw degeneration in Islam as a society and not as a religious system. Their general aim, therefore, was to free the community from foreign accretions and un-Islamic influences and to return to the simple practice of the early community. It is this preoccupation with society that causes even the Sufi *tariqats* that arose in the 19th century to look more like social organizations than fraternities of spiritual adepts. This is true also of the newer African Sufi orders, especially the Senusis. The emphasis on society is remarkably illustrated by a letter from Sheikh as- Sanusi to a tribe, telling them that if the people simply cultivated truthfulness and carried out certain measures of social and economic justice they would be blissful. One great result of this new attention to the social side was a recession in the tide of Sufism as a purely spiritual discipline.

But these reforms, although important in themselves, were not enough: they were rather forerunners of the modernist reform programs. Their main contribution was to insist on *ijtihad* (*see* above, *Development of the Shari'a*), and thereby to liberate the minds from the shackles of the medieval schools; but, by insisting on a simple "return" to the early past in order to imitate it literally and re-create it, they often brought about a form of reaction which was bound to prove even more difficult to shake off than the conservatism of the medieval schools. The liberal modernist, in his social thinking, had, therefore, to take a further leap and enunciate the principle of a reinterpretation of Islam in the light of new situations. The main line of this reinterpretative activity has concen-

trated on the social institutions of family and slavery. The first task of the modernist was to emphasize the reform activity of the Prophet and the great improvement he made in these fields on the then *status quo*. This done, the modernist was ready to underline the spirit of Islamic legislation for modern society. This activity gave rise to much apologetic literature, as was inevitable.

On the question of polygamy, the modernists contended that the Koran had, to begin with, limited the maximum number of wives to four. But the Koran had also morally enjoined the Muslim to resort to polygamy only if he could do justice among different wives, which, it says, is impossible. By putting these two injunctions together, the modernist argument stated, we reach the conclusion that the Koran sanctioned restricted polygamy only for that society and that its real intention was to ban polygamy when conditions changed. The modernists argued on similar lines in the parallel case of slavery: a temporary legal sanction in view of then-existing conditions, but really a total ban. This argument is plausible, but one must conclude on its basis that the Muslim community subsequently failed to realize the intentions of the Koran—a conclusion which a conservative would most certainly reject. Thus modernism and conservatism came into acute conflict.

Slavery is not a real problem, and even in Saudi Arabia it has been banned, although not without the moral pressure of international opinion, mainly expressed through the United Nations. Polygamy has been either banned or severely restricted in many Muslim countries, although only in Turkey has the ban been imposed in complete disregard of the *shari'a* and on a purely secular basis. Other countries—Tunisia, Morocco, Syria, Lebanon, Pakistan and Iraq—have resorted to legislation through interpretation of the *shari'a*. While a law like that of Tunisia virtually amounts to a total ban on polygamy, other enactments, such as that of Pakistan, seek merely to restrict it sharply. There is little doubt that other Muslim countries will pass similar measures. But it is one thing to enact laws and quite another to make them effective or accepted. Indeed, even in Turkey, which prohibited polygamy as early as 1926, and where reforms are making steady headway, polygamy and unregulated "private" marriages still persist in large numbers.

It is social forces—the confrontation of the sexes in educational and vocational institutions, the steadily increasing economic independence of women, etc.—and not legal enactments that are changing the situation of polygamy, although, of course, legislation is helpful and necessary. But the forces of conservatism remain very powerful and must be expected to erupt from time to time even if they cannot actually reverse the process of modernization. With the passage of time, a modern innovation becomes good and settled tradition. The *'ulama'* resisted the education of girls; now, with widespread coeducation, education of girls seems good, conservative tradition. But in the transition period (as in the west) imbalances are bound to occur in Muslim societies. For example (though exact statistics are not available), the number of divorces and divorce cases in Malaya represent an astonishingly high percentage of marriages; though the high number of divorces actually granted may be a result of the particular judicial system connected with divorce, the really amazing phenomenon is the number of divorces sought, and this must be directly connected with the growing economic independence of women. On other social matters, such as that of inheritance, fresh thinking is going on and will certainly result in certain modifications.

See also references under "Islam" in the Index.

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ISLAMIC ARCHITECTURE. Islamic architecture may be defined as the architecture of the peoples who have embraced the Islamic faith. The term Arab should never be used in this connection for it is completely misleading. The conquering Arabs, when they did begin to have architectural ambitions, employed the local people and drew upon their technical skill and architectural traditions.

THE FIRST THREE CENTURIES

In the time of Mohammed the Arabs had nothing worthy of the name of architecture. Only a small part of the population was settled and these lived in dwellings which were scarcely more than hovels.

When the hostility of the people of Mecca had caused Mohammed to migrate to Medina in A.D. 622, he built a house for himself consisting of a mud-brick enclosure about 50 yd. square. Against the outer side of the east wall were *hujra* ("small huts") for his wives. There is a description of them by an eyewitness who saw them just before they were demolished by order of the caliph al-Walid I in 707: "There were four houses of mud brick, with rooms partitioned by palm branches, and five made of palm branches plastered with mud and not subdivided. Over the doors were curtains of black haircloth. One could reach the roof with the hand" (Ibn Sa'd, *Kitab al-Tabaqat al-Kabir*). The courtyard, which afterward served as a place of prayer, was at first open, but, as the Companions complained of being exposed to the burning heat of the sun, a shelter was erected, consisting of palm trunks used as columns supporting a roof of palm leaves and mud. Such was the house of the leader of the community at Medina. Nor did Mohammed wish to alter these conditions; he was entirely without architectural ambitions, and Ibn Sa'd quotes him as follows: "The most unprofitable thing that eateth up the wealth of a Believer is building."

The men who formed the armies of the conquest were mainly Bedouin, but even those who came from permanent settlements, such as Mecca and Medina, knew nothing of art and architecture. Their advance was fanwise: those who advanced northward entered territory which had been under Hellenistic influence for 1,000 years, and those who advanced northeast entered territory which had been under Persian influence for even longer. And not only the cultural but also the material conditions were different. Syria was a country of excellent building materials. Syrian limestone was the best of its kind and cedar wood was plentiful, for the Lebanon had not yet been deforested. So those who invaded Syria found themselves in a country of splendid buildings—churches of cut stone, with arcades on marble columns and gable roofs of cedar, and with large surfaces covered with coloured glass mosaic on a glistening gold background. On the other hand, those who invaded Mesopotamia and Persia met with buildings of brick, sometimes of mud brick, sometimes vaulted but more often with flat roofs of palm trunks, palm leaves and mud. Hence the duality observed in early Muslim architecture.

In these early days the invaders, when they conquered a town in Syria, usually took one of the churches and converted it, a very simple matter, for the *qibla* (direction of Mecca) being due south and the churches being turned toward the east, it was only necessary to close the western entrances, make fresh ones in the north side and pray across the aisles. That this is exactly what happened can be verified in the Great Mosque of Hama, where the west front of the Kanisat al-Uzma ("Great church"), which was converted into a mosque in 637, forms the west side of the sanctuary.

But the situation was different in Iraq, for there the Arabs founded new towns, so pre-existing buildings could not be em-

ployed. At Basra, founded *c.* 635, the first mosque was simply a rectangle marked out on the ground. According to another account it was enclosed by a fence of reeds. At Kufa, founded in 638, an area about 100 yd. square was enclosed not by walls but by a ditch only, the sole architectural feature being a shelter on columns (taken from the ruins of Hira) which ran along the south-west side of the mosque.

The first mosque in Egypt, the Mosque of 'Amr built in 641–642, was equally primitive. It measured 50 × 30 cubits (about 80 × 50 ft.) and had six doors and a low roof, probably of palm trunks resting on palm-trunk columns.

The first mosques worthy of the name of architecture were the second Great Mosques at Basra (665) and Kufa (670). The latter was built by a man "who had been one of the builders of Khosrau," and he designed the mosque with five rows of columns on the *qibla* side and two rows only on the other three sides. The columns, which were very tall, were not surmounted by arches, and it is obvious that the sanctuary must have looked like an apadana, or hall of columns, of the ancient Persian kings.

The oldest existing Muslim monument is the Dome of the Rock at Jerusalem, built by the caliph Abd-al-Malik and finished in 691. It is a concentric annular structure consisting of a wooden dome 20.44 m. in diameter, set on a high drum and pierced with 16 windows. The dome rests on 4 piers and 12 columns which are placed in a circle and so arranged that 3 columns alternate with each pier. This circle of supports is placed in the centre of a large octagon averaging 20.60 m. a side, formed by eight walls 9½ m. high (excluding the parapet which adds 2.60 m.), each pierced in its upper half by five windows. Between the outer octagon and the inner circle is an intermediate octagonal arcade, the arches being borne by 8 piers and 16 columns. It is not a mosque but a *mashhad* ("shrine"), built over the sacred rock that is regarded as the omphalos (navel) of the world. The decoration is of the most splendid kind. The exterior was originally covered to half its height by marble paneling, and from there upward with glass mosaic on a glistening gold background. Internally all the arcades were likewise decorated with mosaic and the walls with quartered marble paneling; *i.e.*, each slab was cut in half and opened like a book, the result being that the veining ran toward the joint. The process is then repeated so that four slabs make a unit. Although this is the most beautiful way of using marble for paneling, it does not appear to have been employed after 750.

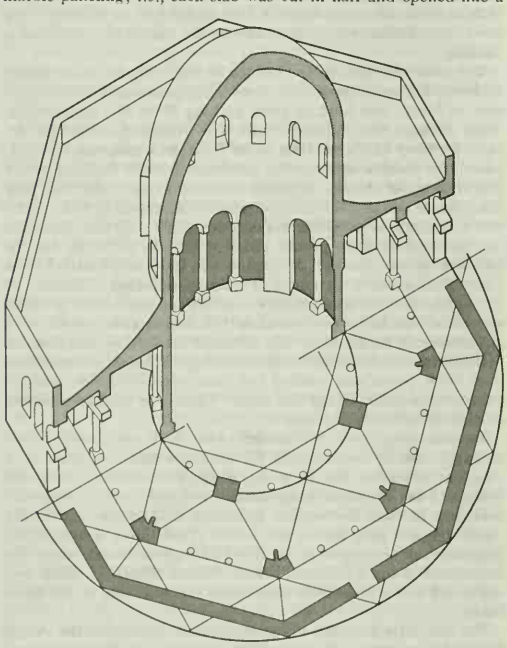


FIG. 1.—THE DOME OF THE ROCK, JERUSALEM

About 20 years after the completion of the Dome of the Rock, al-Walid (A.D. 705–715) built the Aqsa mosque (al-Masjid al-Aqsa) at Jerusalem and the Great Mosque at Damascus. In the former (which is not a conversion of a church built under Justinian I, as is often erroneously stated, for Justinian's church stood elsewhere and lasted until after 800), the arcades ran at right angles to the *qibla* wall, in the latter parallel to it. The arcades in both cases were built in two tiers in order to obtain a great height of ceiling with comparatively short columns taken from other buildings, a system adopted later at Córdoba, Spain. At Damascus the mosque was built in what had been the temenos, or sacred enclosure, of a pagan temple, measuring about 156 m. from east to west and 100 m. from north to south. Three arcades, cut through their centre by a transept, were built parallel to the south wall and a single arcade round the other three sides. Of the four axial entrances of the temenos, three were preserved in the mosque, the fourth being blocked up by the mihrab (prayer niche indicating the direction of Mecca). Here again the same splendid decoration in marble and mosaic was employed as in the Dome of the Rock at Jerusalem. At the four corners of the ancient temenos were four square towers; these became the first minarets in Islam. (At Medina, where there was no minaret until al-Walid's time, the call to prayer was made from the roof of a neighbouring house.) Ibn al-Faqih (903) says: "The minarets which are in the Damascus mosque were originally watchtowers in the Greek days. . . ." And al-Masudi says: "Then came Christianity and it (the temenos) became a church; then came Islam and it became a mosque and the four *sawami* (*i.e.*, the four corner towers) were not changed; they serve for the call to prayer at the present day."

The Omayyad caliphs were great builders of palaces, many of which have a fortified appearance externally. This is to be explained by the route taken by the armies of the conquest. They passed a long line of Roman frontier forts which ran from the Gulf of Aqaba to Damascus and beyond. Having been in the habit of occupying forts, the Omayyads apparently came to look upon a rectangular enclosure flanked by towers as a necessary feature of a princely residence. Their palaces were richly decorated with marble paneling and mosaics; *e.g.*, al-Walid's palace at Minya on the Sea of Tiberias (Sea of Galilee), Hisham's palace at Mefjir (4 mi. N. of Jericho). Some, like the one at Qasr 'Amrah, were even decorated with fresco paintings of human figures, for the prohibition against figural representation did not become formal until *c.* 800.

The fall of the Omayyad dynasty in 750 and the transfer of the capital of the caliphate from Damascus to Baghdad by the Abbasid caliph al-Mansur was as far-reaching in its effect as the transfer of the capital of the Roman empire from Rome to Constantinople. Hitherto the Islamic capital had been in territory which, since the time of Alexander III, had been in the sphere of Hellenistic culture. This was replaced by the cultural influences of Sasanian Persia, to which sphere Iraq belonged. This made itself felt in the design of the new capital, Baghdad, which was given a circular form like the Parthian capital Ctesiphon, Darab and Firuzabad. A mosque 100 m. square with wooden columns supporting a flat roof was built in the centre of the city, and the caliph's palace, 200 m. square, was built in contact with its *qibla* side, so that the caliph could go directly from his palace into the *maqsura* of the mosque, a screened-off area which included the mihrab and the pulpit. This was the scheme first adopted at Damascus and then at Basra, Kufa, Wasit, Merv and other places. About this time was built the earliest example of a building entirely constructed with free-standing, pointed-arched arcades of 38 arches supporting tunnel vaults: the Cistern of Er Ramle, the only Abbasid monument in Palestine, dated 172 A.H. (A.D. 789) by an inscription of Harun al-Rashid.

In 827 Abdallah ibn Tahir, the Abbasid governor of Egypt, doubled the size of the Mosque of 'Amr (at Al Fustat) by the addition to the west of its exact area in the same shape. It follows

Mosque of Ibn Tulun, Cairo; 876–879

Tschifte Minare, Sivas, Turkey; 1271

Mosque of Suleiman the Magnificent, Istanbul, by Sinan; 1556–66

Mosque and mausoleums of the sultans Barquq and Farag, Cairo; 1400–11

Cistern of Er Ramle, Palestine; dated 789

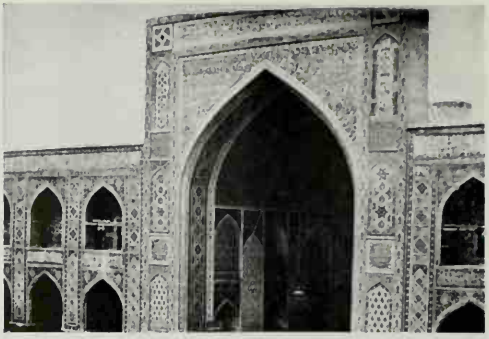
Great Mosque of Damascus by al-Walid; 705–715

MOSQUES AND MONUMENTS

BY COURTESY OF (TOP LEFT, CENTRE LEFT, CENTRE RIGHT, BOTTOM LEFT, BOTTOM RIGHT) K. A. C. CRESWELL

ISLAMIC ARCHITECTURE

Dome of the Rock, Jerusalem, by Abd al-Malik; completed in 691



Mosque of Gawhar Shad, Meshed, Iran; dedicated 1418

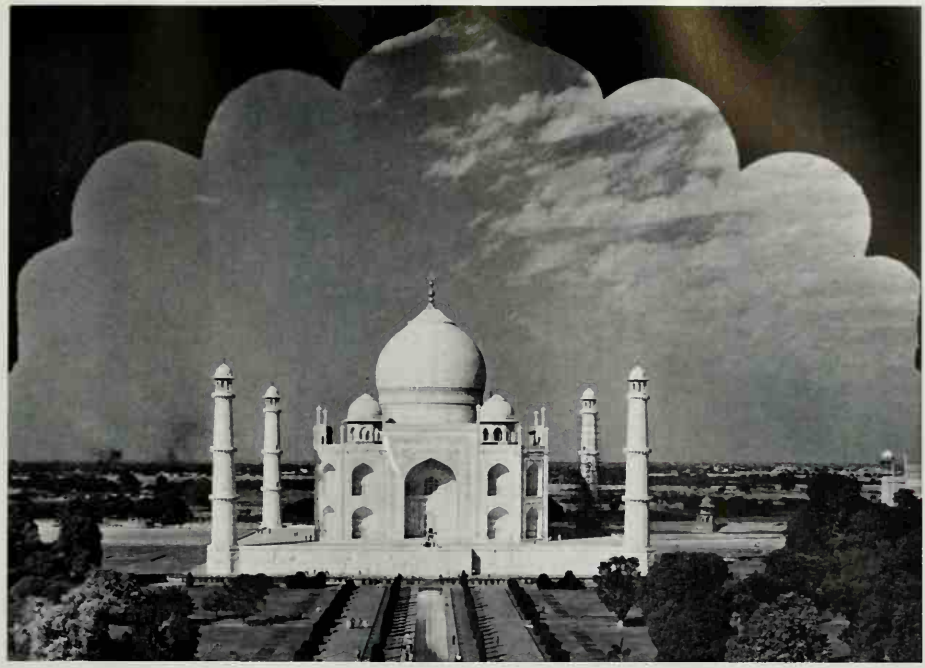
Sanctuary of the Great Mosque of Córdoba, Spain; 787

Mosque of Baybars, Egypt; 1266–69

Great Mosque of Kairouan, Tunisia; founded in the 7th century, rebuilt 836

RELIGIOUS BUILDINGS, 7TH TO 15TH CENTURIES

BY COURTESY OF (TOP LEFT, CENTRE LEFT, CENTRE RIGHT, BOTTOM) K.A.C. CRESWELL, (TOP RIGHT) A. U. POPE



The Taj Mahal (1632–43) near Agra, India, built by Shah Jahan as the burial place for his favourite wife, Mumtaz Mahal

THE TAJ MAHAL AND OTHER EXAMPLES OF ISLAMIC ARCHITECTURE

The Badshahi mosque, Lahore, Pakistan, built by Aurangzeb (17th century)

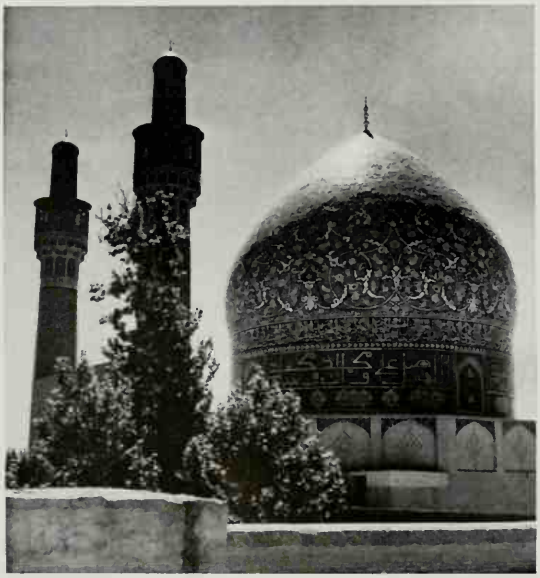
The mosque of Sultan Ahmed ("Blue Mosque," early 17th century), Istanbul, Turkey

PHOTOGRAPHS, (TOP) J. ALLAN CASH—RAPHO GUILLUMETTE, (LEFT) ROGER WOOD, LONDON, (RIGHT) ENRICO MARIANI

ISLAMIC ARCHITECTURE

The Khusru Bagh (Garden of Khusru, 17th century), Allahabad, India, containing (right) tomb of Prince Khusru, son of Emperor Jahangir, and two other mausoleums

ISLAMIC STRUCTURES IN INDIA AND IRAN



The Madraseh-ye-Madar-i-Shah ("school of the Shah's mother") (early 18th century), Isfahan, Iran

Gate inside the courtyard of the Masjid-i-Shah or royal mosque (17th century), Isfahan, Iran

BY COURTESY OF (TOP) INFORMATION SERVICE OF INDIA, PHOTOGRAPHS, (BOTTOM LEFT, RIGHT) HANS WILD

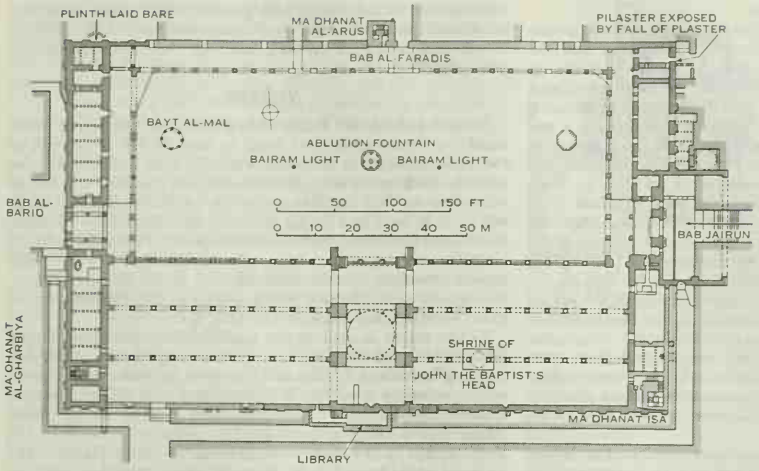


FIG. 2.—PLAN OF THE GREAT MOSQUE, DAMASCUS

that no part of the present structure lying to the right of a line drawn through its centre can possibly be older than 827. It then measured about 109 × 120 m., as does the present building. It is known (from excavations) that there were seven arcades on the southeast and northwest sides and four on the southwest side. On the northeast the arcades ran perpendicular to the court. The only decoration that has survived is that carved on the wooden friezes and the tie beams of a few windows. It consists of late acanthus ornament, derived from the Hellenistic art of Syria, and shows that the Abbasid art of Iraq, which is found 50 years later in the Mosque of Ibn Tulun, had not yet reached Egypt.

Like the Mosque of 'Amr, the Great Mosque of Kairouan was founded in the early days of Islam, but no part of the present structure (except the minaret) is earlier than the 9th century, for the whole mosque was rebuilt by the Aghlabid Ziyadatallah I in 836. The sanctuary consists of 16 arcades of 7 arches, each running at right angles to the *qibla* wall but without reaching it, for a transverse arcade runs at a distance of 6 m. from it, and it is against this arcade that the 16 arcades stop. The side aisles are about 3.30 m. in width as against 5.40 m. for the central aisle, which must have measured 6.60 m. before its width was reduced by two arcades built in contact with it, without any bond or liaison of any sort. This modification was the work of Ibrahim II in 862–863, who also built the dome in front of the mihrab and lined the latter with beautifully carved marble panels, expressly imported from Iraq.

The most famous work of the Abbasid caliphs was the foundation of Samarra on the Tigris river, about 70 mi. N. of Baghdad, in 836. The palace stands on the edge of the plateau which is about 17 m. above the alluvial valley. It is built partly of kiln-baked, partly of sun-baked, bricks and the decoration consists of dadoes, generally of molded stucco, except in the throne-room group where they are of marble slabs. The scale of the whole layout is immense.

This palace was followed by the two Great Mosques of Samarra and Abu Dulaf. The former, as rebuilt in 852, is the largest mosque in Islam. Its outer walls, 2.65 m. thick of kiln-baked bricks with half-round buttresses at intervals of 15–16 m., form an immense rectangle 240 m. deep and 156 m. wide, in the favourite Abbasid proportion of 3:2. The area is nearly 38,000 sq.m. The flat roof rested directly on octagonal piers of brick with marble colonettes at the four corners, making a support roughly 2 m. square. There were no arches. The mosque proper was surrounded by an outer enclosure or *Ziyada*, measuring 376 × 444 m., and in this enclosure on the northeast side rose the minaret, the famous Malwiya, a tower with a spiral ramp about 2.30 m. wide which rises 6.10 m. for each complete turn. The total height to the top platform is 50 m. Between 860 and 861 another immense mosque was built at Abu Dulaf to the north of Samarra. It is 135 m. wide and 213 m. deep. There the outer walls are of mud brick 1.65 m. thick, with half-round buttresses, but the flat roof rested on arcades of burned brick at right angles to the *qibla* wall. The minaret is a miniature of the Malwiya.

In Egypt Ahmad ibn Tulun, a Turk born at Samarra, who had been appointed governor in 864, shortly after declared himself independent and decided to build a mosque in Egypt, of which the scheme of the outer walls and windows is Egyptian, being based on the exterior of the Mosque of 'Amr of 827. The decoration, however, is directly derived from Samarra. The mosque proper forms a great rectangle 122 m. wide and 140 m. deep; it is surrounded on three sides by open courts or *Ziyadas* about 19 m. wide, the whole forming a rectangle 162 m. square (or 300 Nilometric cubits, the unit of measurement used for setting out the mosque).

The *sahn* ("central court") is roughly 92 m. square, with five rows of pointed-arched arcades on the *qibla* side and two rows on the other three sides. The door soffits are of wood decorated with Samarra ornament, and the borders and soffits of the arches are decorated with stucco ornament. There are 128 windows filled with stucco grilles of geometrical design of which, unfortunately, only about four are original.

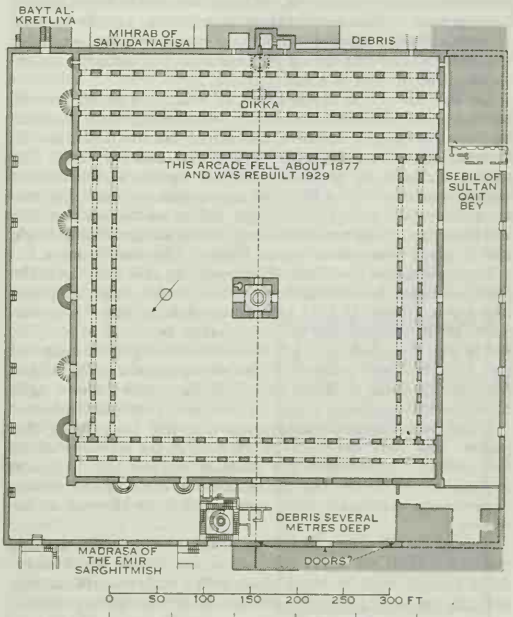


FIG. 3.—PLAN OF THE MOSQUE OF IBN TULUN, CAIRO

PERSIA

Only two mosques dating earlier than the middle of the 11th century have survived—the Tarik Khaneh at Damghan and the mosque at Nayin. The former consists of vaulted arcades on round piers running toward the *qibla* wall, the latter of arcades parallel to it, with stucco ornament derived from that of Samarra. But under the Seljuks in the last years of the 11th century, a new feature appears at Isfahan, a large dome 15 m. in diameter in front of the mihrab, covering nine bays of the sanctuary (3×3) and consequently opening into it on three of its sides by three arches. An inscription states that it is the work of Malik Shah (1073–92). This type is also found later at Gulpaigan, Ardistan (1158) and elsewhere. In the latter, part of an arcade on round piers with 4th-century stucco ornament has survived, proving that this great domed bay was an insertion into an earlier mosque.

The 12th and 13th centuries witnessed the development of faïence decoration. Dadoes were composed of star tiles in golden-brown lustre on a white background, and splendid calligraphic borders framed the mihrabs; *e.g.,* the famous mihrab of 1226 from the Maidan mosque at Kashan, once in the Preece collection but later moved to Berlin. But the 13th century also witnessed the greatest disaster that has ever befallen Persia—the Mongol inroads.

This Mongol terror caused an enormous migration of architects and craftsmen, not only to Asia Minor (where the inscriptions on the monuments of Konya and Divigri bear witness to it), but also to Cairo, which became the refuge of Islam from the Mongols. Al-Maqdisi says that "numbers of Orientals came to Egypt and built themselves homes on the banks of the Khalig and the Birkat al-Fil."

Persian mosques generally have a monumental entrance, consisting of a deep rectangular recess covered by a semidome resting on stalactites; *e.g.,* the Great Mosque at Veramin (1324) and the Masjid-i-Jami of Shah Abbas I at Isfahan. It seems probable that such portals are a development of the side bays of the caliph's palace (Bab al-'Amma) at Samarra, where this feature is seen in its simplest form—a rectangular entrance bay covered by a semidome on two squinches. During the Timurid period faïence tiles and faïence mosaic came more and more into use, and even greater surfaces were covered than had ever been before; *e.g.,* the Mosque of Jawhar Shad at Meshed in Khurasan, one of the finest examples of polychrome faïence mosaic ever executed, and similarly the remains of the Musalla at Herat.

The Safawid period (1501–1736), of which one of the greatest rulers was Shah Abbas I (1587–1629), was marked by his remarkable town planning at Isfahan; nothing of the sort had been attempted since the foundation of Baghdad and Samarra. The scheme included the great Maidan, or square, surrounded by vaulted bazaars, with the portal of his mosque opening in the centre of the south side, the Ali Qapu palace on the western side and the avenue over two miles long, known as the Chahar Bagh, with its plane trees and its famous bridge. (*See* also ISFAHAN.)

Many gilt domes date from this period; *e.g.,* the dome over the shrine of Imam Riza at Meshed. Jean Chardin (later Sir John) who was in Isfahan in 1673 after an earthquake, saw the copper-plates being made for the new dome: they measured 16×10 in. and he says that there were ten crowns worth of gold on each and that 3,000 had been ordered. Other examples exist at Najaf and Karbala (both due to Nadir Shah), Al Kazimiyah (due to Agha Mohammed Khan Qajar), Qum and Samarra (Fath Ali Shah).

Many truly monumental caravansaries were built during this period. Fine work was still being executed at the beginning of the 18th century, for example, the *madrasa* of Shah Sultan Husain at Isfahan (1700–10), but the disaster of the Afghan invasion hastened the decadence which was complete by the end of the century.

Persian minarets vary slightly in form—a tall, slightly tapering cylindrical shaft, of which the earliest example is the Minar-i-Ali at Isfahan, built by Malik Shah, with a little covered balcony near the top for the muezzin, who proclaims the call to prayer.

Persia was certainly one of the great creative centres of architectural development. For the science and skill shown in the construction of vaults, domes and pendentives, Persian architects must ever command respect and admiration, and in the field of polychrome decoration on the grand scale their achievements remain unrivaled.

TURKEY

Turkish architecture began when a branch of the Seljuk ruling family of Persia established itself in Asia Minor at the end of the 11th century. It therefore naturally bore a strong Persian imprint which was mixed in the 13th and 14th centuries with Syrian influences—in fact the Mosque of Ala ad-Din at Konya (1220) was actually built by a Syrian architect, Mohammed ibn Khaulan. In material the country had the advantage over Persia, for splendid limestone was available, hence the superb masonry and rich carved ornament of the monuments of Sivas, Divrigi, Konya, Kayseri, Amasya, Mardin, Nigde, etc.; *e.g.,* the Tschifte Minare (1271) and the Gok Madrasa (1271) at Sivas.

To this period also belong two magnificent caravansaries, Sultan Khan (1229) and the Ak Khan (13th century). One of the outstanding features of Turkish architecture is the monumental portal with a stalactite hood, but it is composed in a different manner from the Egyptian type. In addition there is nearly always a semicircular recess below to right and left, a feature never found in Egypt except in the *madrasa*-mausoleum of Sultan Hasan. The minarets were derived from those of Persia, together with the practice of having a pair flanking the entrance. In addition to Syrian influence, Armenian masons undoubtedly played an important part, and there can be little doubt that the many circular and octagonal mausoleums, domed internally but covered by a cone externally, were influenced by the *kempet* ("domes") of Armenian churches. The most pronounced example of Syrian influence is the Great Mosque (1375) of Aya Suluk near Ephesus, which is obviously based on the Great Mosque at Damascus.

With the conquest of Constantinople in 1453, an important change takes place in Turkish architecture. The supreme architectural qualities of Hagia Sophia had not led the Greeks to build other churches like it; it represented a line of development which had been, so to speak, frozen at birth. But after the capture of the city, the brilliant architectural instincts of the Turkish architects realized its supremacy over all other Byzantine monuments, and almost every important mosque built by them in their new capital is a variation of its theme. Apparently they wished to obtain a perfectly symmetrical building with one great dome, four semidomes and four small domes between them, and this was achieved in the Mosque of Ahmed early in the 17th century. But it is generally agreed that the most successful mosques built by them are those of Suleiman the Magnificent and of Selim II at Adrianople (Edirne), both designed by the famous architect Sinan (d. 1587). But whereas Hagia Sophia does not create a very good impression externally, below the springing of its piled-up dome and semidomes, the Turkish architects aimed at a good external effect also. The mosques of this period usually have four minarets, or even as many as six (*e.g.,* that of Sultan Ahmed), and the minarets usually have two and sometimes three galleries.

The most unfortunate event for Turkish architecture was the introduction of French and Italian architects and craftsmen by the French ambassador, the comte de Choiseul Gouffier, in the middle of the 18th century, the result of which can be seen in Istanbul in the Nuruosmaniye mosque of 1748–55 and later buildings.

EGYPT

In A.D. 969 the Fatimid conquest of Egypt took place, and the foundation of Cairo on unoccupied ground about 3 mi. N. of Al Fustat. The Mosque of Al Azhar was begun the following year, and although it has been much altered, it is easy to see that the original sanctuary was five aisles deep and the side aisles three; the north side was without a portico. A transept runs from the court to the mihrab, the five arcades stopping short on either side of it. The material used was brick, with stucco for the decoration.

Another great mosque was begun 20 years later and finished by the Fatimid caliph al-Hakim in 1003. It had a monumental entrance in the centre of the northwest side; there were also two

important lateral entrances flanked by several lesser ones. The sanctuary had five arcades resting on brick piers cut through the centre by a transept, at the end of which was a dome on squinches and there was a similar dome at each of the back corners of the sanctuary. The outer walls were of stone and the arcades of brick. There was a minaret forming a salient at the two ends of the main façade, as in the Great Mosque of Mahdia, the early capital of the Fatimids.

Cairo was refortified by Badr al-Gamali in 1087–92, the town having outgrown its original enclosure, and three splendid gates of fine masonry, the Bab al Nasr, Bab al Futuh and Bab al Zuweila (Zawayla), and about 400 yd. of the Fatimid wall still exist. Crusading influence is excluded, for they were built ten years before the first crusade left Europe.

One of the glories of Fatimid architecture was its ornamentation, both its decorative Kufic inscriptions and fine arabesque. It witnessed the beginning of Syrian influence, which increased under the Ayyubids and Mamelukes.

The Ayyubid period (1174–1250) was marked by the military architecture of Saladin, who built the mighty citadel of Cairo and part of the city walls, in which the most noteworthy feature is the bent-entrance (three in the citadel and two in the walls), the object of this device being to break the rush of a storming party. Other features of this period are the introduction of the *madrasa*, or theological college, the increasing use of hewn stone, the introduction of marble paneling for mihrabs, the development of stucco ornament in the direction of almost excessive fineness, the first use of glass in window grilles and the first steps in the evolution of the so-called stalactite pendentive.

The Ayyubid dynasty was followed by that of the Bahri Mamelukes (1257–1382). This period witnessed an important development in the mosque plan, in the Mosque of Baybars, where the small dome in front of the mihrab is replaced by a large dome covering nine bays (3×3) of the sanctuary. This feature was first introduced at Isfahan by Malik Shah and appeared later on at Ardistan (1158). It first appeared, outside Persia, in 1158 at Mayyafariqin, a region which was in close relations with the Egyptian court. This feature occurs again in Cairo in the Mosque of al-Nasir Mohammed in the citadel (1335) and in that of his cupbearer al-Maridani (1340). The Syrian number and arrangement of the doors (three axial ones) was also adopted. The stalactite portal was also introduced from Syria at this time.

A Persian architect was employed under al-Nasir Mohammed for the Mosque of Qusun, finished in 1330; this must be the explanation of the faïence mosaic which now appeared for the first time in Egypt, in the Mosques of al-Nasir Mohammed and Aslam al-Baha'i (1345), and in the mausoleum of Princess Toghai (d. 1349), and then suddenly died out. The period of the Bahri Mamelukes was also marked by the final development and gradual extinction of stucco ornament, and by the introduction of splendid dadoes of polychrome marble.

The architecture of the Burji Mamelukes (1382–1517) followed without any break in development. The rich stucco decoration, which had become extinct toward the end of the previous period, was not immediately replaced; at first the stone surfaces were left smooth and marble paneling was the chief enrichment, but when plastic skill in the new material was once acquired elaborate carved surface decoration once more became a regular feature. The stalactite pendentive underwent a change, the niches being set out Syrian fashion on a triangular frame; but, unlike Syrian pendentives, each tier is curved in plan instead of cutting across the corner in a straight line and there is a great increase in the number of tiers, seven, eight or nine being quite common. The domes of this period, always of stone, are without rivals for lightness, beauty of outline and richness of decoration; *e.g.*, in the mausoleums of Barquq, Qait Bey, Qani Bey, etc. Faïence decoration was employed again at the end of this period, but in the form of tiles instead of the more effective faïence mosaic of the previous century.

It has been the custom to belittle the Turkish period (1517–1798), but it is probable that the enormous reduction from the great amount of money spent by the rich Mameluke court was a more serious factor than an actual falling off in the quality of the work, and in Cairo the Mosques of Sidi Sariya in the citadel, Malika Safiya and Sinan Pasha at Bulaq justify this opinion.

FIG. 4.—PLAN OF THE MAUSOLEUM OF QAIT BEY, CAIRO, SHOWING (A) MIHRAB, (B) COURT, (C) SANCTUARY, (D) TOMB AND (E) HALLS

The houses of Cairo rarely had more than two stories: on the ground floor was the *salamlik*, or men's apartments, and on the floor above was the harem, or women's apartments. The chief feature of the façade, above the ground-floor level, was the attractive *musharabiya* balconies. The following rules are generally observed: (1) the principal rooms face north (the direction of the prevailing wind) and look into the court around which the house is built; (2) the passage leading from the street to the court is built with a right-angled turn to prevent passers-by from seeing into the court; and (3) the entrance to the harem is placed on the far side of the court or in a second court.

The first half of the 19th century witnessed the introduction of the Stambuli style under the dynasty of Mohammed Ali.

WESTERN ISLAM

The Muslim architecture of Spain began with the arrival of Abd al-Rahman I, the only one of the Omayyads to escape the hatred of the Abbasids. In 756 he established an independent amirate in Spain and in 787 built a mosque of cut stone at Córdoba. On the south side of the courtyard, which was not surrounded by porticoes until much later, was a sanctuary consisting of 11 aisles formed by 10 arcades of 12 arches each, at right angles to the *qibla* wall (there was no transverse arcade at the back as at Kairouan). The central aisle was wider than the rest. The supports were marble columns with many kinds of Corinthian and composite capitals, taken from other buildings. As these supports, with their capitals and bases, only measure about 3.80 m. an upper arcade was added, as in the Aqsa mosque, to obtain the height necessary to support a flat ceiling about 9.30 m. from the floor. The execution of this idea was carried out in a fashion somewhat different from that adopted in Syria, but it resembles the Aqsa mosque in that the aisles are roofed by parallel gable roofs with deep gutters between, which discharge by spouts placed above the piers of the façade on the court. The arches are built with stone voussoirs, alternating with composite voussoirs of four layers of red tiles ground down to a slightly tapering form. This alternation of colours is called *ablaq*. The existing Great Mosque of Córdoba consists of this original part of 787 to which have been added three enlargements, two to the south toward the river and a third consisting of eight more aisles which, space to the south being lacking, has been added to the whole length of the east side. The second enlargement, due to al-Hakam in 961, is of extraordinary richness, especially the part in front of the new mihrab, where a screen is formed of interlacing arches, supporting three elaborately decorated domes, each set on the square in a different way. The mihrab is decorated with carved marble panels and gold and glass mosaic, said to have been executed by craftsmen sent by the Byzantine emperor. The masterpiece of Muslim architecture in Spain is the beautiful Alhambra (*q.v.*).

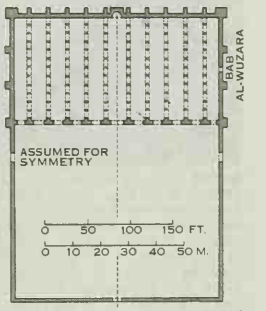


FIG. 5.—PLAN OF THE GREAT MOSQUE, CÓRDOBA, SPAIN

In north Africa the 12th century is marked by the decoration of the Great Mosque of Tlemçen (1135–36), which is of

extraordinary richness and beauty, especially the dome setting and the mihrab. A century and a half later came the superb decoration of the Great Mosque of Taza.

INDIA AND PAKISTAN

Although India was invaded by Mohammed ibn Qasim in A.D. 712 and again by Mahmud of Ghazni at the beginning of the 11th century, there is not a single example of Islamic architecture until the very end of the 12th century, when Mohammed of Ghor left Qutb-al-Din Aibak behind in India as the first sultan of Delhi. It is to him that the oldest part of the Quwwat al-Islam mosque is due, begun in 1193. This consists of a courtyard, measuring 105 × 142 ft., surrounded by pillared cloisters, short pillars from Hindu temples being superimposed to get the required height, the whole measuring 149 × 214 ft. externally. On the west (*qibla*) side the close setting of the columns is broken by five octagonal bays, presumably once covered by domes. All this was finished in 1196.

Then two years later a beautiful pointed-arched façade was built in front of the sanctuary, the central arch being wider and higher than the two to right and left. It was set in a rectangular frame which rose above the rest of the façade (a Persian concept known as a *pishtaq*, or frontispiece) and which consisted of bands of Hindu ornament and Nashki inscriptions. But these five arches are constructed with horizontal courses, for the Hindu masons employed by the conquerors were not acquainted with arcuate construction, and they employed the same technique for the arches when Iltutmish enlarged the mosque in 1229. It was in the mausoleum of Balban (*c.* 1280), however, that true arcuated construction made its first appearance. The mosque had three axial entrances and was accompanied by the first minaret in India, the famous Qutb Minar, closely related to those at Ghazni, Afg., and the minaret discovered at Jam (1163–74) in the 20th century.

This mosque, with its three axial entrances, cloistered courtyard and sanctuary with large central arch more or less set the standard type for India (*e.g.*, those at Delhi, Agra, etc.), except that this central arch is sometimes flanked by the massive bases of a pair of minarets (*e.g.*, at Ahmedabad, Dholka, Champaner, etc.). Indian minarets are generally tall, circular or octagonal towers, with several galleries and a domed pavilion at the summit.

Mausoleums form another outstanding feature of Islamic architecture in the Indian subcontinent. There are three main groups: a domed square; a domed central chamber surrounded by four smaller domes (*e.g.*, mausoleums of Khan Khanan, of Humayun and the Taj Mahal, *q.v.*); and concentric octagons (*e.g.*, mausoleum of Sher Shah Sur), the latter type being almost unknown outside India except for the Qubbat as-Sulaibiya at Samarra.

Unlike the Islamic architecture of Persia and Iraq, the Muslim monuments of India are characterized by their well-finished masonry and finely carved ornament, while the buff or red sandstone so frequently employed adds an attractive touch of colour.

See ISLAMIC ART; MINARET; MOSQUE; *see* also references under "Islamic Architecture" in the Index.

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ISLAMIC ART, the art of the followers of Mohammed, combined the influences of many regional cultures, extending from western Europe through the far east from the 7th century onward, into a unique style that attained its fullest development during the period between the 10th and 16th centuries. Islamic art is essentially an art of ornament.

Origins and Nature of Islamic Art.—In a world enclosed between desert and steppe and ruled by nomadic peoples, Islamic art inevitably followed an entirely different path from that of the west. Western classical art developed among settled tillers of the soil and in towns; it is intellectual. Characteristic of it is the clear structural consistency of architecture, which is carried on into architectural ornament. Naturalistic sculpture and relief, the portrayed figure, are preferred. The art of the nomads, on the other hand, proceeds from the tent and the loom, and for that reason the tectonics of Islamic architecture are limited to the primary forms, though they are frequently resolved into delightful shapes. Wall surfaces are adorned with purely geometrical decoration resembling rugs over the framework of a Kirghiz tent. Islamic decorative art is based on pure ornament, script, arabesque and intertwined bands. As in early Irish, Scandinavian and Romanesque art, representations of human beings and animals are combined with fillet and arabesque ornament, and in plastic art they appear only in low relief. Only in painting do they acquire an independent life under antique Sasanian and eastern Asian influences, but even so they are partly in the nature of calligraphy, against the background of an equally conventional, tapestrylike landscape.

Except in the most recent period, naturalism never existed. Added to this, the Arabian world had a dislike of figural art, already perceptible in eastern Christianity. Figural representations were absolutely prohibited in the early period of Islam and under the Berber dynasties of Africa and the Mamelukes of Egypt and Syria, though under the Omayyads and Abbasids and most of the Shi'ite and Turkish dynasties it was only excluded from public buildings. (*See* also BYZANTINE ART; ROMANESQUE ART.)

Plastic Art.—Plastic art on the larger scale therefore seldom fell under outside influences. Thus the Seljuks brought with them from eastern Turkistan a plastic tradition akin to the Buddhist art of central Asia; this tradition is represented by the few extant statues and reliefs of lions, double eagles, dragons, angels, etc., from the city walls of Konya and Baghdad, and by a few stucco plaques depicting scenes of court life. Apart from these, human and animal figures in low relief are found scattered here and there among the decorative carving on rafters and beams dating throughout the period from the 11th to the 14th century. Under the Mogul emperors in the 16th and 17th centuries Indian influence appeared in the elephant statues of Fatehpur-Sikri and Delhi. Sasanian influence appeared in the 19th century in the rock reliefs of Fath 'Ali Shah of Persia. Other plastic art, however, was entirely restricted to small-scale works, chiefly figures of lions, elephants and birds in glazed stoneware or bronze, strongly conventionalized as the nature of the material required, and used as water vessels or smoking appliances. A madonna with Mongolian dress and appearance, made of faïence, is an exception.

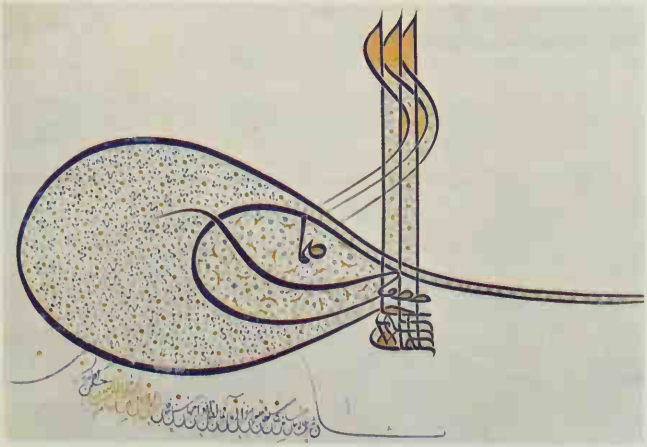
Painting.—Figure painting was much more important. It is true that it was excluded from public, political and religious edifices. In the private apartments, however—bathrooms and harems especially—painting was tolerated by the clergy, and found its expression in frescoes, illustrated erotic and edifying books, and household vessels, goblets, bottles, etc., adorned with figures. Even the caliphs decorated the private apartments in their palaces in this way. Thus between 712 and 715 the Omayyad al-Walid had the bathrooms in his desert castle of Qasr 'Amrah painted throughout with frescoes in the later antique style, depicting birth and death, the three ages of life, hunters and hunting animals, musicians and dancing girls, women bathing, the caliph on the throne, the emperors overthrown by Islam and so on. The latter group betrays the influence of Sasanian art, which dominated the harem frescoes reconstructed out of scanty remnants in the Abbasid residence at Samarra (836–876). There are found danc-

ISLAMIC ART OF THE 14TH AND 16TH CENTURIES

Albarello decorated in underglaze colours. Sultanabad, Persia; 14th century. Height 13 in.

Vase decorated in blue and turquoise. Isnik, Turkey; 1530–40. Height 15½ in.

Above and below: Painted lacquer bookbindings. Persia; c. 1540. Height 15½ in., width 9¾ in.



Calligraphy: ornamental cipher of the Ottoman sultan Suleiman the Magnificent (1520–66). Size 13½ x 24 in.

BY COURTESY OF (CENTRE) THE VICTORIA AND ALBERT MUSEUM (ALL OTHERS) THE TRUSTEES OF THE BRITISH MUSEUM

ISLAMIC ART

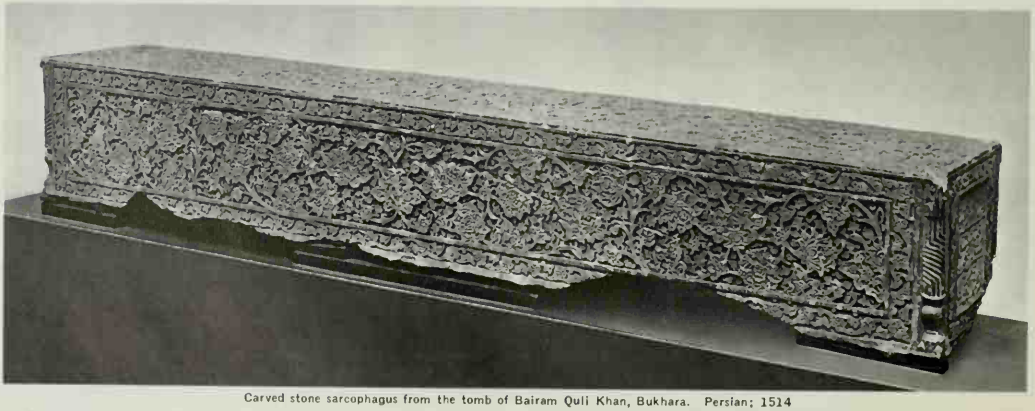
Ewer of brass inlaid with silver and copper. Mosul, Iraq; 1232. Height 12 in.

Shield of decorative basketwork with boss of damascened steel. Turkish; 16th century. Diameter 59 cm.

ISLAMIC ART FROM THE 10TH TO THE 16TH CENTURY

Rock crystal ewer, wheel-cut. Egypt; 11th century. Height 21.5 cm.

Bowl with decorative script in black slip on white ground. Nishapur, Persia; 10th century. Diameter 13 in.



Carved stone sarcophagus from the tomb of Bairam Quli Khan, Bukhara. Persian; 1514

BY COURTESY OF (TOP LEFT, SECOND ROW CENTRE) THE TRUSTEES OF THE BRITISH MUSEUM, (TOP RIGHT, BOTTOM) VICTORIA AND ALBERT MUSEUM, (TOP CENTRE) TOPKAPU SARAYI MUSEUM, ISTANBUL, © MUSEE DES ARTS DECORATIFS, PARIS, 1953, EXPOSITION "SPLENDEUR DE L'ART TURC"

ing girls in a variety of poses, naked and in flowing robes, with diadems and long braided hair, with floating veils, bowls and wine jars; huntresses and horsewomen, priests and warriors, and animals of every kind, in a heraldic style on medallions composed of intertwining tendrils and bands in endless repetition, symmetrical and hieratic.

In the Alhambra (*q.v.*) at Granada (13th–14th century) the last Moors of Spain were represented as noble knights and troubadours in roof paintings of an almost Gothic style. In the frescoes and faïence tiling of the castles of Isfahan and Ashraf, displaying exquisite calligraphy, and betraying strong eastern Asian influence, the amorous and oenophilous sentiment of the courtly youth of the Safawid era were represented. In India, the harem apartments of the 16th- 17th-century Mogul rulers were painted throughout with frescoes, though these were discarded about 1700 by the orthodox emperor Aurangzeb; but wall paintings, some with Buddhist subjects, have been preserved in the bedroom of Akbar's soon abandoned residence at Fatehpur-Sikri, and from a few contemporary miniatures are known the semi-European paintings that Jahangir caused to be executed at Agra. (*See* also PERSIAN ART: *Painting and Calligraphy.*)

Ornament.—Ornament is the centre of Islamic art. It supplanted all the other possibilities offered by different individual techniques. Utilizing them all, dependent on none, it is a self-contained world of form, which embraces indifferently the walls of mosques and castles, the backgrounds of figure paintings, the details of sculpture, glasses, pots and vases, furniture and bronze implements, arms and jewelry, bookbindings and calligraphy, a vast storehouse of forms, turning every technique, every material to its own uses in the most perfect taste.

The motifs from which this ornament grew came from the later antique, the ancient east and the barbarian migrations. In the earliest monuments, particularly the great frieze in relief at Mshatta, the prevailing feature, as in Byzantine and Romanesque art, was the spiral tendril springing from the vine, its spaces filled in with vine leaves and branches of grapes, and diversified with animal figures and large rosettes. In the frescoes and in the third style of the stucco wall facings in the Abbasid residence at Samarra the same motif is found, though greatly conventionalized.

Beside it, however, is encountered a new type of ornament undoubtedly traceable to the wood carving of the nomad tribes of the north, consisting of palm leaves, whose contours soon became an independent style, a complex of free curves. Under the Turks and the Arab dynasties that took their artistic notions from them (10th to 16th century), this developed into a purely abstract art of decoration; its leading motifs are the fillet, the arabesque and the palm leaf.

The fillet is the most important and is derived from the northern nomadic art. Plain or twisted, with herringbone or circular patterns, it divides every area into border and central field, angle and centre medallions, friezes, etc. It curves into circles and wavy lines, imitates the shapes of architectural vaults, piles up tendrilwise in vaulted arcades and forms complicated trellis patterns. This developed into the twined pattern of stars and rosettes favoured during the Mameluke period, which presents designs that, numerous though they are, are always mathematically accurate. The intervening spaces are filled with polygons, stars, garlands, rosettes, often plain or in simple patterns that secure their effect through colour contrast, and frequently are decorated with rich arabesques diversified with palm-leaf motifs.

The early twining vine leaf, the palm leaf, the tree of life of the ancient east, are combined in an inextricable dramatic unity, enriched since the Mongol period with completed palm leaves and even with distortions of these into diabolical masks, houses, etc., and Chinese cloud strata and shreds. Thus western Asia, especially Persia, was dominated by the arabesque, in delicate spirals, often of the shape of snail shells, with little rolled-up and not uncommonly pinnate leaves, and rosettes, and palm leaves radiating outward. It served also as a background for decorative figures of phoenixes and Chinese dragons, hunting animals and birds, musicians and dancing girls, but most of all for ornamental inscriptions.

The clumsy early Arabic script, the Kufic, with its numerous vertical and oblique strokes, produced an extraordinarily monumental effect, and for that reason, it continued to be employed as a decorative writing, and developed into a new form, used with special frequency in Persia—the floral Kufic, in which the top of the characters blossom into floral tendrils. This was also combined with the trellis ornament, a notable example being the stuccowork in the Alhambra at Granada. The later cursive *naskhi*, with its wealth of curves and twists, also proved a highly decorative script, the final letters of words being generally crossed with the long strokes of the initial letters like an ornament. They were also frequently used to provide a delicate background to the heavier characters of the Kufic. The shikasta and the animal figures which were artfully formed from the characters of some sentences (generally from the first sura of the Koran) were confined, however, to the Persian book-designer's art.

After the 16th century Islamic ornament began to decay. As early as the 13th century niches framed by arches and pillars, vases with bouquets of flowers, hanging lamps, cypresses, etc., had appeared sporadically; these now came into favour as decorative motifs, and their seminaturalism drove out the wealth of abstract ornament.

Architectural Ornament.—Since tectonic arrangement in architecture was confined to the broad lines, a wide field was presented for ornament. In the Omayyad period preference was given to the glittering glass mosaic and deep-shadowed pierced stone filigree work, both common in Byzantium. With the victory of the sun-dried brick under the Abbasids, these were superseded by stucco facing sometimes molded in the flat, sometimes likewise cut in high relief, as in the third style of Samarra and in wonderful inscriptions in floral Kufic from Persia, all originally richly painted.

Later, in the Turkish and Mongolian periods, stucco gave way to the cheaper substitute for the more costly mosaic, in freestone or brick, but most often in faïence tiling. The less important parts of the rough core of the wall, often carelessly put together, were overlaid with a particoloured mosaic of glazed bricks of varied shapes, making twined patterns and formalized Kufic words endlessly repeated; while the major portions were covered with mosaics of tiles cut skilfully to the exact shapes of the prevalent patterns, in harmonious colour schemes, particularly blue, or in combinations of faïence ornament on a stucco ground (in relief) or friezes of inscriptions in incised stucco in the intervals of faïence mosaic. Admirable also are the script friezes of glazed tiles with dark blue characters on a ground of golden-brown arabesques.

With the decay of ornament after the 16th century, this type of mosaic was generally supplanted by square faïence tiles with painted decoration. Apart from one or two magnificent portions of buildings, Syria, Egypt and the west were content with coloured stuccowork and mosaics of particoloured stone plaques, generally white and red or white and black. (For plan and tectonics *see* ISLAMIC ARCHITECTURE. *See* also ORNAMENT, ARCHITECTURAL.)

Furniture.—Another reason for this rich wall decoration lies in the almost complete absence of furniture, in the western sense of the term, in Islamic places of worship and dwelling houses. This, like the custom of sitting on the floor, was due to the nomadic habit. Household crockery was kept in stuccoed recesses in the walls, or on wooden shelves and in cupboards built into the walls.

Furniture was represented in private houses by small, low, round or oblong tables, and in India also by beds. Chairs came into use in the 17th century only in the highest circles. In the mosques the Koran was placed on a desk (*kursi*) like a campstool, and was often kept in a small circular cabinet; the pulpit (*minbar*) was a domed box at the top of a staircase, reached through a doorway that could be closed.

A feature of most of these objects is the way in which they are decorated with tarsia work of small boards, richly carved and inlaid with mother-of-pearl, ivory, etc. This was necessary because of the wood available and the danger of warping. The harem doors were worked in like fashion, often with rich bronze

ornamentation, and the balcony railings (*musharabiya*), made of small curved wooden pales. (*See* also Wood Carving.)

The remaining objects in the house comprised rugs and cushions, jewel cases and boxes, table utensils, lamps, smoking equipment, open charcoal pans (as stoves) and warming pans, candlesticks, etc., in bronze, faïence, glass, ivory and other materials. For rugs and woven fabrics, *see* Embroidery; Rug and Carpet; Textiles.

Ceramics.—The Islamic ceramic art built upon ancient oriental traditions, enriched them for its own religious purposes with a new and highly effective technique, and pursued its development under growing influences from eastern Asia.

The use of the coloured glazed brick was inherited from Babylon, as was the unglazed earthenware in the barbotin style (in which the pattern is made by applying bands of clay) with the tree of life and naked goddess (Astarte) motifs, enriched with Hellenistic and Sasanian elements, laurel and acanthus leaves, stubs of palm leaves, and later wreathed medallions centred with animal figures, griffins, eagles and the like. Examples are to be seen in the pottery of Samarra, though this is almost entirely in tiny shards. Echoes of this barbotin technique appear in the ware of Mosul down to the 14th century, and in the Gabri ware of Persia, in the sgraffito manner, often with lively painting, until *c.* 1200.

Contemporaneously, in Samarra, appeared the first lustreware. Early Islam was puritanical enough to proscribe gold—like silk—as a worldly luxury, and for that reason, in later times, faïence painted with a gold lustre changing to green, brown and violet was used as a substitute; in the earliest examples the forms of the magnificent golden and silver vessels of the Sasanian epoch can still be plainly traced. This style rose high in favour, particularly in the Seljuk and Mongol periods, but disappeared at the beginning of the 17th century. The Abbasid caliphs also imported porcelain, from China (Sung dynasty), and imitated in earthenware its white, yellow and green overflow glazing and its stippled, fish and other designs. With the Seljuks came a new wave of far eastern influence, the chief centre of the industry under their rule being Rhagae, the forerunner of Teheran.

Minai ware consisted of bowls, beakers, tankards and bottles with spirited painting and gilding on a white ground, often with rich figure compositions in bands. There are also vessels of similar types as well as some akin to the bronzes, in animal and human form; their design is left white, generally on a ground of violet lustre, and shows the classical arabesque and palm-leaf motifs, sphinxes and birds with crowned women's heads, peacocks, elephants, scenes of court life and war, and, above all, horsemen with their characteristic pigtails and their garments adorned with arabesques. After the destruction of Rhagae by the Mongols, Sultanabad and Veramin became the centres of the ceramic industry in the 13th and 14th centuries. Favourite types were not only *minai* and lustreware, but also faïence in green and dark blue tones, in many cases with molded ornamentation, and tiles richly decorated in lustre. From the 16th century onward, Chinese white porcelain with blue and gray designs was imported in large quantities and became a regular type. Its decoration was copied and freely developed, but porcelain itself could not be successfully manufactured, and a kind of semifaïence, closely resembling it, was made instead.

Persian pottery formed the basis of that of Syria, Egypt, Spain and Asia Minor. In the Arab civilization, figure motifs disappeared early, and bands of script or arabesque, arranged radially or in rings, became the prevalent form. In Spain, under Christian rule, this art developed still further, and absorbed Gothic motifs; the 14th- and 15th-century wares of Málaga (whence the name majolica) and of Paterna and Manises, two suburbs of Valencia, exercised a very strong influence on the majolica ware of the early Italian Renaissance. On the other hand, in the Ottoman pottery of Kutaiah and Isnik (Damascus and Rhodian ware), which flourished from the 15th century onward, relatively naturalistic tulips, carnations, roses, lilies, cypresses, etc., and also figure subjects, were preferred for purposes of decoration, cobalt blue, turquoise, green and manganese violet being used as colours, generally on a white ground. (*See* also Pottery and Porcelain.)

Glassware and Crystalware.—Unlike pottery, glassmaking was inherited from Hellenic antiquity and was centred in Syria and Egypt. The Fatimid period produced narrow-necked bottles, tankards and beakers, and scent bottles ornamented with externally applied bosses, threads and bands, or with spiral tendrils and animal figures molded into the glass. In addition, imitations were made (Hedwig glasses) of rock crystal vessels with ornament consisting of figures and circular tendrils, of Sasanian origin. Many of these came early into the possession of religious or noble houses in Europe and have thus been preserved. The finest work, however, was produced at Aleppo in Syria, under the Ayyubid and Mameluke dominations. Bottles, beakers, goblets and above all hanging lamps for mosques were covered with bands of arabesque and script and with medallions in enamel colours (white, red, blue and yellow) and gold; the subjects included figures of horsemen and others, and the coats of arms of the court offices. Modern Persian glass originated in the industry promoted by Shah Abbas I (*c.* 1600). (*See* Glass.)

Metalwork.—Here again oriental traditions, particularly those of the Sasanian empire and the far east, predominated. Most of the work was in bronze, iron being still used almost only for weapons. The use of gold and silver also was limited, because it was forbidden by the Koran; and although the prohibition was often ignored, the great value of such objects led to their early destruction and melting down. Islamic jewelry of the early period is therefore of extreme rarity, being represented only by a few buckles, bracelets, etc., of the Fatimid and Mongol periods, and such pieces as the Gerona silver chest (akin to the similar ivory coffers) in Spain and the Berlin silver tankard of the 13th century, with its embossed reliefs of Sasanian animal friezes. (*See* Jewelry.)

Bronzes.—Such animals in the Sasanian style, lions, dragons, sphinxes, peacocks, doves, cocks and the like, were also cast in bronze in three dimensions, and served, like their ceramic counterparts, as basins, braziers, etc. They were particularly sought after in the later Abbasid, Fatimid and Seljuk periods, and from Egypt they became the prototypes of similar European forms. It was the Seljuks, apparently, who introduced the round bronze mirror, the reverse of which shows in low relief either two sphinxes face to face—in the manner of the *minai* pottery—surrounded by a twined pattern, or two friezes with the astrological symbols of the seven chief heavenly bodies (sun, moon and the five nearest planets) and the 12 signs of the zodiac, surrounded by a band of script; this goes back ultimately to Chinese origins.

Early mugs, etc., were ornamented with animals in low relief, but engraving quickly supplanted this. Under the later Seljuks (particularly the Ortoqid Atabegs of Mosul) and the Mamelukes, engraving became almost the only form of decoration, but only to serve as a basis for the yet richer technique of inlaying: small silver plates and wires, themselves delicately engraved, were hammered into the ribs and surfaces, which were hollowed out and undercut at the edges.

In place of this, in an Ortoqid bowl in the provincial museum at Innsbruck the spaces are filled in with cellular enamel. This was a method of evading the prohibition of precious metals, just as gold lustre was in pottery. The ornament consisted of friezes and medallions in lattice and arabesque work, the interstices being filled with figures of warriors, hunters, musicians, animals and astrological symbols. These were superseded later by Mameluke coats of arms and inscriptions. In the 15th century the technique was imported from Syria to Venice, where productions of the same kind, *alla damaschina* or *all' azzimina*, were made right into the 16th century by Islamic masters, and were in great demand. In the east the process is still common, but both technically and artistically it has decayed.

In the 15th century there was a renascence of pure metal engraving, but the design—inscriptions and arabesques in the Timurid and Safawid styles—was not cut into the material, but left free in the manner of a relief, the background being etched in black. Decoration was applied to bowls, basins, mugs, vases, mortars, braziers, warming pans, candlesticks, smoking utensils, inkstands, jewel cases, Koran holders, mosque lamps and *kursis*. These are

generally in the simplest possible forms—spherical, cylindrical, prismatic—and are developed by cutting off corners, adding projections, narrowing and channeling the walls, and by reduplication; the subjects include motifs of vegetation and animal life—the former mainly in the necks and feet of vessels, the latter for handles and ears, feet and sometimes small spouts.

Weapons.—Ancient Islamic weapons of any artistic value are comparatively rare: most of the extant pieces date from the 17th or 18th or even early 19th century, while the period from the 14th to the 16th is represented by a fair number of fine examples. Islamic swords were famous even in antiquity for their wonderful blades of Damascus and Toledo steel. This high standard was attained partly by a laborious process of repeatedly welding together pieces of iron of different qualities, but ultimately it was due to the peculiar process used for smelting the Indian raw material—a method whose results have been surpassed only by those of the modern Bessemer process. The earlier blades are all straight; curved sabres and daggers did not become common until after 1500.

The blades were ornamented with inlaid work of gold and silver threads, arabesques, dressings and—on the celebrated Mongol blades—also phoenixes and dragons in the Chinese manner; at a later period the inlay was confined to the part near the hilt, the remainder being adorned with engraved reliefs. For the handle and guards, gold and cellular enamel were used, as on the magnificent Boabdil swords named after the last Moorish king in Spain (15th century), with their hooked guards, and many Ottoman and Persian daggers and sabres of the 17th and 18th centuries. Nephrite, ivory and silver plating with jeweled ornament were also used, especially for daggers.

Scabbards had ornaments to match the hilts, and were covered with nielloed silver plating, leather, snakeskin or rayskin. Battle-axes and maces are also found, though these were often mere symbols of command and high position. The former display not only inlay but also in many cases engraved relief and even filigree work. The heads of the maces were often made of rock crystal but more frequently were cast solid, in a smooth pear shape, with grooves or bosses, richly inlaid. Shields were round with a boss in the centre: in Egypt under the Mamelukes they were of inlaid iron, elsewhere generally of leather, with painted lacquer surface.

The armour, of Sasanian origin, consisted of a mail shirt, arm-pieces and greaves, a round breastplate and a pointed helmet consisting of several spangles riveted together. Not until a late period did a coat of four plates (*char-aina*), and even a cuirass in the Spanish manner, become common. From the 15th century onward the helmet was made in one piece, though there were in addition a number of movable parts such as nosepieces, cheek-pieces, neckpieces, etc. The decoration, however—grooves or medallions between radiating ribs on a broad frontlet—betrays the original construction. The earlier pieces (15th century) were broad and protuberant, and came so low down over the forehead that eye notches were necessary, the reason for this shape being that the turban was worn under the helmet; the later examples fitted closely, and were pointed or hemispherical with spikes attached, nosepieces and crests.

The usual ornamentation in the early helmets, most of which are ascribed to western Turkistan, consists of silver-wire inlay; later, in Persia, it is generally iron engraving, sometimes combined with inlaid work; and in the grooved Ottoman storm helmets, black etching. An offshoot of the last named is the *Zischägge,* often richly worked, which was used in the 17th century in Hungary, Poland and even Germany.

Bookbinding and Lacquering.—Koran manuscripts and also rich miniature books were all bound in leather, the edges being protected by a flap. A very old binding from Egypt shows inlaid work, but apart from this the usual decoration up to the 15th century consisted of stamping with beaded edges, medallions in the centre and in the corners triangular ornaments of unobtrusive script, plait and palm-leaf patterns. From the 16th century onward, however, this decoration was transferred to the inner side of the cover, in finely detailed filigree work against a brightly coloured background. On the outside it was replaced by opulent stamped gilding which was indeed of similar composition but was formed of arabesques and bands of clouds, and even of decorative figure groups; sometimes also the outside was covered in the Chinese manner with lacquerwork, which in the early period showed occasional dragons and phoenixes, and later flowers and romantic and genre scenes. From the end of the 18th century this technique was in high favour, and was applied not only to bookbindings, but also to writing cases, jewel cases, toilet accessories, and even shields and bows. (*See* also BOOKBINDING; LACQUER.)

Development and Influence.—In its early period Islamic art continued the assimilation of Hellenistic and ancient oriental motifs begun by the later Persians, and from the Abbasid era it fell almost wholly under the tradition of the Sasanian empire. With the rise of the Turkish dynasties the nomad character became increasingly marked, and from the Seljuk period onward the influence of eastern Asia grew in strength, particularly from the Mongol to the Safawid period. Meanwhile Islam fused all these influences into a completely individual abstract style, which reached its zenith, artistically and technically, between the 10th and 16th centuries. Thereafter decadence began, veiled in the 17th century by extravagance of external splendour but betrayed by a tendency toward some degree of naturalism and an increase of European influence. By the middle of the 19th century Islamic art was in complete decay.

During its greatest period, however, its influence extended through India as far as Java, to China, to the Sudan and to the whole of Russia. The European culture of the middle ages and the Renaissance was very largely derived from it. Islamic brocades and carpets, ivories (coffers and olifant horns), glasses and *aguamaniles,* etc., found their way from Spain, Sicily and Fatimid Egypt into the ecclesiastical and princely treasure houses of Europe; in the period from the crusades to the conquest of Granada the borrowings consisted mainly of Mameluke weapons and glass, *azzimina* bronzes, Toledo blades and majolica ware from Spain, albarellos, etc., and bookbindings. In the east the Tatars brought their culture and art, especially weapons and clothes, to the Russians. Further, through the Turkish wars various Islamic utensils and *objets d'art*—stuffs, costumes, rugs (Polish rugs), sabres, helmets, etc.—became naturalized in Hungary and Poland, and even in Austria, Saxony, Bavaria and Prussia. *See* also PERSIAN ART.

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ISLAMIC LAW. The life of a Muslim is traditionally governed by the twin sciences of theology and law. Theology teaches him all that he must believe, while law tells him all that he must do and leave undone. Law plays the primary role; for Islam has always been much more hesitant in its apprehension of the person of the God of revelation than in its elaboration of the precepts that he has revealed.

The sacred law (*shari'a,* literally "road to a watering place," hence the path of God) differs, therefore, from the western idea of law in three fundamental respects. The first is that it is much wider in its application, for it includes all human action in its scope. According to a widely accepted classification, every act or omission falls under one of five categories: what is commanded, recommended, left legally indifferent, reprobated or positively forbidden by almighty God. To the Muslim, therefore, the *shari'a* includes all that a westerner would term law—public and private, national and international—and a great deal which he would not regard as law at all, such as the details of religious ritual and

the ethics of social conduct. It is obvious, of course, that much of this amalgam of law and morals could never be enforced by any court, and much which falls even within the categories of things positively commanded or forbidden is regularly left to the sanctions of eternity.

Secondly, the *shari'a* differs fundamentally from western law in that it is not, in theory, man-made but grounded in divine revelation. In the strictest theory, indeed, there is no other means of evaluating the ethical quality of human actions; for not only is man incapable of perceiving this ethical value apart from divine revelation but human actions have no inherent virtue or vice except insofar as they have been commanded or forbidden by God. And to the orthodox Muslim the fount of revelation dried up forever with the death of Mohammed, a fact that of itself explains the third peculiarity of the *shari'a*, namely, that it is regarded as virtually immutable.

Origins.—In the classical theory, the law is believed to have rested, in the earliest days, on the Koran (*q.v.*; as the very word of God) and on the Hadith (*q.v.*), or traditions of the Prophet (as establishing his Sunna, or practice, which was also divinely inspired), together with the opinion (*ra'y*) of the earliest jurists on points not covered by the texts. But juristic opinion was soon felt to be too subjective and too fallible a source for the divine law; too subjective, so that the unfettered range of juristic opinion was soon restricted by precise rules of analogy (*qiyas*); and too fallible, so the view prevailed that, although an individual jurist might err even in his application of analogy, where the jurists as a whole could be seen (or considered) to have agreed, this was held to be a guarantee of divine authority. Thus, in the classical view, the four major sources from which the law was derived were the Koran, the practice of the Prophet, the consensus of the scholars and analogical deductions from these three.

Orientalists have shown, however, that this theory represents a considerably formalized, and even distorted, picture of how the law did in fact develop. For the first few decades after the death of Mohammed (A.D. 632) the Muslim community was too absorbed by the problems of administration arising from extensive military conquests to concern itself deeply with the elaboration of law. At a fairly early date, however, a class of pious scholars grew up who began to review the customary law and administrative practice of the Omayyad period in the light of Islamic norms and to accept, reject or modify them accordingly. They thus sought at the same time to Islamicize and systematize, and it was from their efforts that, around the end of the first century of the Muslim era, the *shari'a* began to take shape.

This explains how the *shari'a* could have been influenced—as, in part, it was—by Roman, Byzantine, rabbinic, canon and Sasanian law. It was not that the Muslim jurists deliberately studied and adapted other systems, but during the whole of the first century they were open to outside influences, whether in the form of the customary law of the conquered territories or the mental heritage of converts to Islam. It was thus that the replies of the learned (*fuqaha'*) in Islam followed the pattern of the *responsa prudentium* of the Romans (*see* ROMAN LAW), and it was thus that a number of specific rules of law of alien origin became incorporated in the *shari'a*.

Schools of Law.—Around the turn of the first century these pious scholars began to draw together on a regional basis and to form the ancient schools of law—the most important being those of Iraq, Syria and the Hejaz. In these schools the term *sunna* was primarily used for what has been termed the "living tradition" of the locality, and they strongly opposed the attempts of the traditionists to overthrow their doctrines by an appeal to alleged traditions of what the Prophet had himself said, done or allowed. It was only through the influence of al-Shafi'i (*q.v.*) that three major developments occurred. First, the basic thesis of the traditionists—that any "authentic" tradition of how the Prophet had himself behaved must be accepted as authoritative—came to prevail. Second, the classical theory of Islamic jurisprudence (which Shafi'i had himself elaborated) gained general acceptance, except only that he failed in his attempt to substitute the consensus of the entire community for the consensus of the scholars, so that it was still the jurists who decided whether an alleged tradition should be accepted as genuine or not. Third, the schools of Iraq and Medina, in imitation of the "companions of Shafi'i," began to call themselves after the names of two of their own leading scholars, Abu Hanifa (d. A.D. 767) and Malik ibn Anas (d. A.D. 795).

But although Shafi'i accepted the central thesis of the traditionists, he was much more exacting than they in his scrutiny of alleged traditions and fully accepted the need for the use of analogy, the rules for which he was the first to elaborate. And while his theory of jurisprudence won general acceptance, the Hanafis retained the doctrine of *istihsan* (juristic preference) as an alternative to the more obvious dictates of analogy, and the Malikis retained the doctrine of *istislah* (public welfare) as a principle to decide cases not directly covered by the texts. The more extreme traditionists, moreover, were far from content with Shafi'i's position, and the school of the Zahiris (now extinct) sought to discard analogy as a source of law and confine themselves to the indication (*madlul*) of the texts as a method of application. It was, however, the disciples of a traditionist named Ibn Hanbal (*q.v.*) who formed the only other school of law to survive in Sunni Islam. This school was strongly traditionist and, at the beginning at least, preferred to base its rules on even poorly attested tradition rather than on analogy; however, in the end it came to accept the same theory regarding the sources of the law as did the other schools.

Malik ibn Anas, the eponymous founder of the school of Medina, compiled the earliest extant legal text, the *Muwatta'*, while the earliest compilation of traditions as such is attributed to Ibn Hanbal. This is termed the *Musnad*, which signifies that the traditions are arranged according to the companion of Mohammed to whom they are traced back. Soon, however, a method of compiling books of traditions more convenient for the lawyer was devised, for in the collections called *Musannaf* the traditions are arranged according to their subject matter. The most famous of such collections are those of al-Bukhari and Muslim ibn al-Hajjaj (*qq.v.*)—both termed the *Sahih* (or authentic) and characterized by the acceptance of only those traditions which passed severe (but wholly inconclusive) tests of authenticity. Four other books of traditions, which adopted a considerably less exacting standard, eventually gained general acceptance along with these two as the six "canonical" collections. But J. Schacht and others have proved that the whole corpus of the traditions, while providing excellent evidence for the history of thought in early Islam, must be regarded as exceedingly dubious in its alleged attribution to the Prophet.

The four schools of law that have survived in Sunni Islam—the Hanafi, Maliki, Shafi'i and Hanbali—differ from each other in many particulars, yet each acknowledges the orthodoxy of its fellows. Their distribution is mainly, but not exclusively, geographical. The Hanafis are much the most numerous and widespread, partly because, whereas previously judges of different schools had coexisted in the main centres of Islam, the Ottoman empire accorded official recognition to the Hanafis alone. Most Muslims in central Asia, India and Turkey, and many throughout the middle east, are Hanafis; the Maliki school prevails throughout northern and western Africa, in the Sudan and parts of the Persian gulf; the Shafi'is preponderate in eastern Africa, parts of Arabia and throughout southeastern Asia; and the Hanbalis, now the least numerous, are chiefly limited to the Wahhabis of central Arabia and parts of the Persian gulf.

But besides the orthodox schools, various heterodox schools of law have also survived. Such are the Ibadis in Oman, Zanzibar and parts of northern Africa—the only survivors of the Khariji rebels of early Islam. Such, too, are the main subsects of the Shi'a: the Zaidis in Yemen, the Ithna 'Asharis in Iran, Iraq, India and elsewhere, and the Isma'ilis (*see* ISMA'ILISM), whether of the Nizari faction (who mostly acknowledge the Aga Khan as their leader, are commonly called Khojas and are found in India and eastern Africa) or the Musta'li faction (who are found in India and Arabia and are commonly termed Bohras). The Shi'i (Shi'ite) schools are chiefly distinguished by their attachment to

an imam as the infallible leader of the Muslim community. (*See* also SHI'ISM.)

Later Developments.—In the earliest days every adequately qualified jurist had the right to go back to the original sources and apply them to each problem which arose. This was known as the faculty of *ijtihad*, and one who exercised it was termed a *mujtahid*. But with the crystallization of the schools under the Abbasids this faculty was held, in orthodox Islam, to have fallen into abeyance from about the end of the third century of the Muslim era; all subsequent generations of jurists were held to be bound to accept the decisions of their great predecessors as authoritative. This is known as *taqlid*, and one who is bound by it is a *muqallid*. It was thus that, after the golden period of legal development, the law became more and more static and moribund; for, as the years passed, a dominant opinion asserted itself—in the texts, the courts and the *fatawa* (opinions) of the muftis (jurisconsults)—in almost every particular, in each of the four orthodox schools. The Shi'is never followed the Sunnis in this respect, and their leading jurists are still recognized as *mujtahids*, but in practice the Shi'i law is little more elastic than the Sunni.

Another salient feature in the *shari'a* is its remoteness, in many respects, from the daily life of the people. Developed largely by pious specialists and academic lawyers rather than based on the actual decisions of the courts, it grew up, in part at least, as a protest against current practice and was never really enforced as a whole. In particular, the maintenance of public order was, from a very early date, largely entrusted to the executive and the police; the *qadis* or regular judges were bound by the *shari'a* to so rigid a system of evidence and procedure (in theory at least) that no Muslim ruler would leave the administration of criminal justice wholly in their hands. Much the same was true of the life of the markets, where the merchants found the strict prohibition of usury and of speculative contracts impossibly restrictive. The gulf between law and practice was, indeed, partially bridged by a system of legal devices invented by the lawyers themselves, so that what would otherwise be forbidden might be accomplished indirectly and without any open infraction of the law. It was in the law of family relations—marriage, divorce, guardianship and succession—that the *shari'a* found its fullest expression.

Still, the fact remains that until about 1850 the *shari'a* was, in theory at least, the only law. Local customary law (*'adat*) or the commands of the executive (*qawanin*) might in fact prevail in this sphere or that, but only on the basis that all paid tribute to the *shari'a* as uniquely authoritative.

Modern Changes.—The situation was radically changed as a result of the *Tanzimat* legislation in the Ottoman empire. In 1850 a commercial code was promulgated and in 1858 a penal code, both based on European models; and frankly secular (*Nizami*) courts were set up to apply these codes under modern forms of procedure. Much the same happened in Egypt, which attained juridical independence under the khedive Ismail. Meanwhile the *shari'a* courts continued to apply the old law in the old way, but were confined in their jurisdiction to the family law of Muslim litigants. And the resulting dichotomy in both the courts and law was only partially bridged by the fact that in the Ottoman empire the codified law of obligations applied by the secular courts was based not on European law but on precepts derived from the *shari'a*.

It was not till 1915 that the reformers ventured to tackle the family law of Islam, but by then the miserable position of Muslim wives, bound by the dominant Hanafi opinion, made reform inevitable. A tentative beginning in 1915 led to the Ottoman Law of Family Rights (1917) and to subsequent reforms in most of the Arab countries. These reforms differ from the earlier ones in that they do not replace the *shari'a* by an open adoption of largely western law but contrive, by a variety of ingenious devices, to effect changes in the "immutable" *shari'a* itself as applied in the courts. And the most widely used of these devices is that of denying that the judge should be bound, in every respect, by the dominant opinion of his particular school, and of asserting instead that the legislature may specify which of the reputable dicta of the past—supplied in such abundance by the different schools and even individual jurists—should be applied today, in this matter or that, in the public interest. As a consequence the family law of Islam is now largely codified, in most Arab countries, on the basis of an eclectic choice between all the available dicta.

Then, just before the middle of the 20th century, a tendency appeared (in Egypt, Syria, Libya and Iraq) to adopt new civil codes which, although predominantly western in inspiration, incorporated as much as they could of precepts derived from, or at least consonant with, the *shari'a*. Thus the clear-cut dichotomy in both courts and law that prevailed in most of these countries from the 19th century onward began to break down. For the *shari'a* law, instead of being ascertainable only from a study of numerous medieval texts, has largely been reduced to statute law—which can easily be applied by judges trained in modern law schools and which is leavened, to some degree, by modern concepts—while the "foreign" law is being given a somewhat more indigenous appearance. It is scarcely surprising, therefore, that modern, nationalist governments (*e.g.*, in Egypt and Tunisia) are tending to abolish the old communal courts and to unify the judicature.

Such, then, is the position in the more progressive Arab countries in the early 1960s. Throughout most of the Arabian peninsula, on the other hand, the *shari'a* still reigns supreme. Only in Turkey, at the other extreme, has the *shari'a* been completely displaced before the courts since 1926—even in the sphere of family law—in favour of codes adopted wholesale from the west; but even in Turkey the *shari'a* is widely (if unofficially) followed in practice in the villages of Anatolia. (*See* also the administration and social conditions sections of the articles on individual Muslim countries.)

See also ISLAM.

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ISLAMISM: *see* PAN-ISLAMISM.

ISLAND, any area of land smaller than a continent and entirely surrounded by water. Islands may occur in oceans, seas, lakes or rivers. A group of islands is called an archipelago.

Islands may be classified as either continental or oceanic. Oceanic islands are those which rise to the surface from the floors of the ocean basins. Continental islands are simply unsubmerged parts of the continental shelf (*q.v.*) that are entirely surrounded by water. Many of the larger islands of the world are of the continental type. Greenland (840,000 sq.mi.), the largest island, is composed of the same materials as the adjacent North American continent, from which it is separated by a shallow and narrow sea. Likewise the world's second largest island, New Guinea (319,000 sq.mi.), is part of the Australian continental platform and is separated from it only by the very shallow and narrow Torres strait. A slight warping of the sea bottom in the vicinity of Torres strait would be sufficient to join New Guinea to Australia; conversely, a slight rise in sea level may submerge a hilly coast and leave the hilltops remaining as small islands just off shore (examples being those off the coast near Boston, Mass., and the islands off the Maine coast).

The islands which rise from the floors of the ocean basins are volcanic. Lava accumulates to enormous thickness until it finally protrudes above the ocean surface. The piles of lava which form Hawaii rise to as high as 32,000 ft. above the ocean floor.

Many of the world's archipelagoes are arranged in island arcs, and they constitute some of the most active volcanic and earthquake areas of the world. Examples are the Leeward and Windward islands at the eastern end of the Caribbean, the Aleutians, the Japanese archipelago and the Philippines. Physical geographers believe that these are the areas of continental growth.

Island life exhibits features of special interest. The sea is a barrier to some forms of life but acts as a carrier of others, which, once established in their new home, frequently develop new features in their isolated surroundings. A long-established sea barrier results in marked differences between the animal life and vegetation even of adjacent islands, and from these differences may be deduced the origin of an island. Further, any detailed map of the biological regions of the globe illustrates the importance of islands in the determination of the boundaries of animal-life and vegetational types. For example, to the west of a line (Wallace's line) running between Bali and Lombok and between Borneo and Celebes the islands are biologically Asian, but to the east of the line, notwithstanding the narrowness of the Lombok strait, the vegetation and animal life are Australian. Oceanic islands are usually colonized by only a few animal forms, chiefly sea birds and insects. They are often clothed with abundant vegetation, the seeds of which have been carried by air and water currents, birds, etc., but the variety of plants is by no means so great as that on the mainland. (W. C. C.)

ISLAY is the southernmost island of the Inner Hebrides, Argyll, Scot., 16 mi. W. of Kintyre and ¾ mi. S.W. of Jura, from which it is separated by the Sound of Islay. Pop. (1961) 3,866. Its maximum breadth is 15 mi. and the maximum length 25 mi. The sea lochs Gruinart and Indaal cut into it so deeply as almost to convert the western portion, the Rhinns district, into a separate island. It is rich and productive and has been called the "Queen of the Hebrides." The surface generally is regular, the highest summit being Beinn Bheigeir (1,609 ft.), but the shore is rugged. There are fresh-water lochs and rivers, which provide good trout and salmon fishing. Islay was the ancient seat of the "lord of the Isles," the first to adopt that title being John Macdonald of Isle of Islay (d. *c.* 1386); but the Macdonalds were ultimately ousted by their rivals, the Campbells, about 1616. Islay house, ancient seat of the Campbells of Islay, is at the head of Loch Indaal. Much business is done in stock raising, dairy farming and cheese-making; oats, potatoes and various green crops are raised. The chief difficulty in the way of reclamation is the great area of peat (60 sq.mi.). The island has several distilleries, producing large quantities of whisky. Local limestone is used extensively as fertilizer, but deposits of lead, iron, slate and marble are no longer worked. Bowmore is the chief town and administrative centre, and Port Ellen, the principal port, is a seaside and golfing resort. The U.S. troops and seamen who were lost in the "Tuscania" and "Otranto" in 1918 are buried on the island, and there is a memorial tower on the Mull of Oa, 8 mi. from Port Ellen. Port Askaig is the ferry station for Feolin on Jura. There are five lighthouses on the island. In addition to a regular steamer service there is also a plane service connecting Glenegedale airport, Islay, with Renfrew (Glasgow airport).

ISLES OF THE BLEST (FORTUNATE ISLANDS), placed, in Greek mythology, in the western ocean and peopled not by the dead but by mortals upon whom the gods had conferred immortality. Like the Phaeacian land in Homer or the Celtic Avalon and St. Brendan's Island, the Isles of the Blest have perpetual summer and abundance. No reference is made to the isles themselves by Homer, who, in the *Odyssey*, speaks instead of the Elysian Plain; but they are mentioned by Hesiod and Pindar. By medieval map makers, Madeira and the Canaries are sometimes named *Fortunatae insulae*. *See* ATLANTIS; ELYSIUM.

ISLINGTON, a metropolitan borough of London, Eng., which under the London Government Act, 1963, was to be amalgamated on April 11, 1965, with Finsbury to form a new London borough (*see* LONDON). Islington is bounded east by Stoke Newington and Hackney, south by Shoreditch and Finsbury and west by St. Pancras. Pop. (1961) 228,833. Area 4.8 sq.mi. It includes Holloway, Highbury, Barnsbury and Canonbury, whose names preserve those of ancient manors. In Canonbury, which belonged in the 13th century to the priory of St. Bartholomew in Smithfield, parts of the old manor house, including Canonbury tower, remain. The fields and places of entertainment in "merrie Islington" were popular with Londoners in the 17th century and later. At Copenhagen Fields a great meeting of labourers was held in 1834 and to this site the Metropolitan Cattle market was moved from Smithfield in 1855. The market square became the site of the Caledonian market, a large twice-weekly general market with more than 2,000 stall holders which existed until the outbreak of World War II; in 1951 this market moved to Bermondsey. The Royal Agricultural hall, Archway hospital, Pentonville and Holloway prisons and the Arsenal football stadium are in Islington. New River Head is the termination of the artificial channel by which Sir Hugh Myddelton (1561–1631) brought water to London from the upper Lea valley. Islington is mainly residential, but light industry has been developed. Islington returns three members to parliament.

ISMAIL I (1487–1524), shah of Iran from 1501 to 1524 and founder of the Safawid dynasty, was born on July 17, 1487, probably at Ardabil. Through his father, Sheikh Haidar, he was descended from the greatly revered Sheikh Safi al-Din of Ardabil, who had founded an order of Sufis there in the early 14th century. Sheikh Haidar, who was a fanatical Shi'ite, fell in battle against the Sunnis of Shirvan when Ismail was only one year old. After many hazardous adventures, in the course of which his two elder brothers perished, Ismail succeeded, with the support of seven Turkmen Shi'ite tribes, in establishing his authority in northwestern Iran and was crowned in Tabriz in July 1501. In a series of battles he gained control over the greater part of Iran in the next few years. He thereupon attacked the Sunni Uzbeks who had occupied part of northeastern Iran and defeated them near Merv in 1510. Although many of his subjects had at the outset been Sunnis, he converted the majority to Shi'ism, which became the state religion and served to bind the nation together.

When the Ottoman Turkish sultan Selim I savagely suppressed a revolt of his Shi'ite subjects in Anatolia and persecuted the survivors, Ismail marched to their assistance but his forces, which consisted only of tribal levies, were severely defeated in a hard-fought battle at Chaldiran in northwestern Iran (1514). Against Selim's well-trained janizaries and artillery Ismail had neither regular troops nor cannon. Selim marched on and occupied Tabriz, but a mutiny of his troops compelled him to withdraw to Turkey. Ismail recovered from this reverse sufficiently to prevent any further inroads by either Turks or Uzbeks, and when he died, at Ardabil in 1524, he left Iran a united nation strong enough to protect itself. His dynasty endured till 1736.

The Venetian traveler Giovanni Angiolello, who was in Persia in 1510, described Shah Ismail as "fair, handsome and very pleasing; not very tall, but of a light and well-framed figure. . . . He is as brave as a gamecock, and stronger than any of his lords."

See Ghulam Sarwar, *History of Shah Ismail Safawi* (1939).

(L. Lo.)

ISMAIL HADJI MAULVI-MOHAMMED (1781–1831), Indian Muslim reformer, was born at Pholah near Delhi. In co-operation with Syed Ahmed he attempted to free Indian Islam from the influence of the native early Indian faiths. The two men traveled extensively for many years and visited Mecca. In the Wahhabite movement they found much that was akin to their own views and on returning to India preached the new doctrine of a pure Islam. The official Muslim leaders objected, and the dispute led to the reformers' being interdicted by the British government in 1827. The party then moved to Punjab where they made Peshawar the capital of the theocratic community which they wished to establish (1829). Ismail Hadji fell in battle against the Sikhs amid the Pakhli mountains (1831). Some of his adherents are still found in the mountains of the northwest frontier.

Ismail's book *Taqouaiyat et Iman* was published in Hindustani and translated in the *Journal of the Royal Asiatic Society*, xiii, 1852.

ISMAILIA (AL ISMA'ILIYAH), a city and governorate of Egypt, located at the Isthmus of Suez where the Sweet Water canal from the Nile meets the Suez canal at Lake Timsah. It lies on the northwestern shore of the lake, a salt lagoon through which the Suez canal passes, and is 93 mi. N.E. of Cairo by rail, 48 mi. from Port Said and 52 mi. from Port Tewfik (Bur Tawfiq). Pop. (1957) 94,572. The town was established in 1863 by the

former Suez Canal company and named after the khedive Ismail. It shows French influence, being laid out on a gridiron plan, with squares, gardens and tree-lined boulevards. The company built for its employees houses, schools and a 200-bed hospital, and provided recreational facilities. The central position of the town favoured the establishment there of the Central Movement office, which regulates the daily movement of shipping in the canal. Ismailia was the scene of the first scientific attack upon malaria, which later practically disappeared. The town became a headquarters for the Allied forces during 1916 and has retained its military connections. On the other side of the lake are the so-called quarries of Hyenas, from which building material for the town was obtained.

Ismailia governorate (area 187 sq.mi.) was formed in implementation of the law of local government, 1960. It comprises the city of Ismailia with the addition of the areas Tel el Kebir (At Tall al Kabir), Al Qassasin al Jadidah and Al Qassasin al Qadimah. Pop. (1961 est.) 276,000. (A. B. M.)

ISMA'ILISM, a religious and political movement in Islam, being a branch of the Shi'ah movement and deriving its name from Isma'il (mid-8th century), son of the imam Ja'far al-Sadiq (*see* SHI'ISM). Isma'il's followers formed extremist sects during his lifetime, but the movement which gave fame to the Isma'ili name was organized in the middle of the 9th century, when missionaries went out to different parts of the Islamic world preaching the return of Mohammed, Isma'il's son (dead long since), as the expected Mahdi ("Messiah"). The best-known branch of the movement in its earlier period was that of the Karmatians (*q.v.*). In the meantime, however, a schism occurred when the leader of the movement declared himself imam and was acknowledged as such by the greater part of the movement—though some continued to hold fast to the figure of the expected Mahdi. 'Ubaydullah, the first of the Fatimid imams, established himself in Ifriqiya (mod. Tunisia) in 909, claiming descent from Mohammed, son of Isma'il (and through him from Fatima, daughter of the Prophet, whence the name of the dynasty), through a line of "hidden imams." His opponents, however, did not admit this claim and alleged that he was a descendant of a certain 'Abd Allah ibn Maymun al-Qaddah (an early Shi'ite notable), to whom, in addition, was ascribed a conspiracy aiming at the destruction of Islam—this latter trait being a manifestly false invention.

The Fatimids conquered Egypt in 969, and for two centuries their empire was a brilliant centre of Islamic civilization (*see* EGYPT: *History;* FATIMIDS). Though they did not succeed in converting the bulk of the population in their dominions to their creed, they did rally round themselves a widespread movement which had followers all over the Islamic world and which possessed a closely knit organization. The main doctrine of the sect concerned the allegorical interpretation of the Koran and of religious practices in which they tended to discover allusions to the imams and the organization of their movement. They also adopted some of the teaching of Neoplatonic philosophy, which had at that time great currency among Muslim intellectuals. The "Epistles of the Sincere Brethren," a philosophical encyclopaedia based on Neoplatonism, was composed by the members of a circle connected with Isma'ilism.

During the reign of al-Hakim (996–1021) the Druzes, who considered the imams as incarnations of the godhead (al-Hakim being the last of these), separated from the main body of Isma'ilism (*see* DRUZE).

A fatal schism split the movement over the successor of the caliph al-Mustansir (d. 1094). In Egypt the throne was occupied by his son al-Musta'li, but the Isma'ilis of Persia and Syria upheld the claims of his older son, Nizar (who died in prison in Cairo); henceforth there were two branches, the Musta'lis and the Nizaris. In Egypt Isma'ilism came to an end when the last Fatimid caliph was deposed by Saladin in 1171, but Musta'lian Isma'ilism survived in Yemen. There the sectarians (who had not acknowledged the last four Fatimid caliphs—those after al-Amir, al-Musta'li's son—as legitimate imams) believed that al-Amir's infant son al-Tayyib (who had presumably been done away with on his father's death in 1130) was alive and would return in the fullness of time; thus this branch has no line of imams after al-Tayyib and is governed by the chief missionary (*da'i*). Musta'lian Isma'ilism was carried from Yemen to India, and in the 16th century the *da'i* moved to that country; he resides in Surat, in Gujarat district. His followers in India are usually known as Bohras ("merchants").

The Nizaris, led by Hasan ibn al-Sabbah, obtained control of a number of fortresses in Persia and Syria, the chief of them being Alamut (1090), from which Hasan and his successors commanded the sect, which was organized as an order based on territorial possessions. They employed as a means of terror the method of assassinating prominent personalities, whence their nickname hashishi ("hashish-eater") passed into European languages in the meaning of "assassin" (*see* also ASSASSIN). Hasan's fourth successor, also called Hasan, declared himself a descendant of the imam Nizar and proclaimed the arrival of the eschatological period of "resurrection"; he and his successors were considered by their followers as manifestations of the deity. When the political power of the Assassins was broken in Persia by the Mongols (who captured Alamut in 1256) and in Syria by the Mamelukes, the sect survived, led by their imams, who were descendants of the rulers of Alamut. From the 14th century two rival lines existed. In the 16th century, Tahir Shah—of the minor line—emigrated to India, where his descendants, who commanded the allegiance of the Isma'ilis of Syria, can be traced for another two centuries. The imams of the major line lived in various parts of Persia, until in 1840 the imam (best known by his title of the Aga Khan; *q.v.*) went to India. He and his descendants, also known as the Aga Khans, have a numerous following (estimated at several millions) in India and Pakistan, the regions of the Pamir and the upper Amu-Darya, Iran, Africa (consisting of Indian emigrants) and Syria (where the sectarians rallied to their leadership at the end of the 19th century).

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ISMAIL PASHA (1830–1895), hereditary viceroy of Egypt under Turkish suzerainty, was the second son of the vali Ibrahim Pasha (*q.v.*). Born in Cairo on Dec. 31, 1830, he was educated in Paris and on reaching manhood undertook various diplomatic missions in Europe for the viceroy Mohammed Said Pasha, whom he succeeded in 1863. Ambitious to increase his prestige he obtained from the Ottoman sultan in 1867 the hereditary title of khedive, an honorific borne by his successors until 1914.

Beyond his frontiers Ismail pursued an expansionist policy. In 1865 he negotiated with the sultan the cession to Egypt of the ports of Sawakin (Sudan) and Massawa (Eritrea). He modernized the Egyptian army with Remington rifles and Krupp artillery and enlisted a corps of American officers who established a general staff, explored the Sudan and in 1877 prepared a notable map of Africa. In 1870–75 he extended Egyptian authority down the Red sea coast, planting garrisons at Harar and Berbera, but his attempt to occupy Kismayu in 1875 was prevented by Britain. In 1869 he commissioned Sir Samuel Baker to annex parts of Uganda; in 1874 Darfur was added to the Egyptian dominions. Ismail's territorial ambitions were thwarted in Equatoria where Baker's successor, Col. (later Gen.) C. G. Gordon, withdrew the Egyptian outposts from most of Uganda in 1876 and in Ethiopia where two Egyptian armies were disastrously defeated in 1875–76.

Ismail's westernizing domestic policy greatly benefited Egypt. Primary education was expanded in the provinces. The legal disabilities suffered by Egyptians under the capitulations were lessened by the institution in 1876 of mixed courts. An astute landlord of his vast estates and an enthusiastic town planner, he created the modern Cairo and in 1869 granted Alexandria a municipality. The summoning of a legislative assembly in 1867 marked the first approach toward constitutional government. His most spectacular achievements lay in the development of communications. He extended the railways, nationalized the postal service in 1865 and in the Sudan introduced telegraphs in 1866 and a short railway in 1875. In 1869 he presided over the opening of the Suez canal with lavish ceremonies.

His projects were often brilliantly conceived but they were compromised by his financial prodigality. By 1876 the Egyptian public debt exceeded £100,000,000. Pressed by Ismail's creditors the powers intervened and set up a dual control with a commission of the public debt. Ismail's resistance to the resulting encroachments upon his independence, culminating in his dismissal of the European commissioners, led to his deposition by the sultan at the instance of the powers on June 26, 1879.

Ismail died in exile at Istanbul on March 21, 1895. *See* also EGYPT: *History*.

See P. Crabitès, *Ismail, the Maligned Khedive* (1933); G. Douin, *Histoire du règne du Khédive Ismail*, 3 vol. (1933–41; unfinished). (R. L. HI.)

ISMAY, HASTINGS LIONEL ISMAY, 1ST BARON (1887–), British soldier who served in World War II as chief of staff to the minister of defense, was born at Naini Tal, India, on June 21, 1887, the younger son of Sir Stanley Ismay. Educated at Charterhouse and at Sandhurst, he was commissioned in 1905 and joined the 21st cavalry (Frontier force), Indian army, in 1907. Service on the North-West Frontier of India (1908) and in Somaliland (1914–20) was followed by appointments as assistant secretary (1926–30) and secretary (1938–40) of the Committee of Imperial Defense, and as chief of staff to the minister of defense (1940–46). He was promoted general in 1944 and created 1st baron in 1947.

In 1947 he returned to India as chief of staff to the last viceroy, Earl Mountbatten, and four years later became secretary of state for commonwealth relations (1951–52). Lord Ismay became secretary-general of the North Atlantic Treaty organization in 1952 and on vacating that appointment in 1957 retired from public life. His *Memoirs* were published in 1960. (C. N. B.)

ISMAY, THOMAS HENRY (1837–1899), English shipowner and founder of the Oceanic Steam Navigation company, which became famous as the White Star line, was born at Maryport, Cumberland, on Jan. 7, 1837. In 1867 he took over the White Star line of Australian clippers and in 1869 established, with William Imrie, the Oceanic Steam Navigation company. The firm having determined to enter the Atlantic trade, the first "Oceanic" (3,707 tons) was ordered from Harland and Wolff, of Belfast, Ire. The launching in 1870 marked a turning point in the development of the North Atlantic passenger liner; among the innovations introduced was the locating of passenger accommodations amidships. In 1892 Ismay retired from partnership in the firm of Ismay, Imrie and company, though he retained the chairmanship of the White Star line. He died near Birkenhead, Cheshire, on Nov. 23, 1899.

The White Star line continued until 1934, when it merged with the Cunard line to form Cunard White Star, Ltd. The assets of Cunard White Star were taken over by the Cunard Steam-Ship Co., Ltd. in 1950.

ISMET INÖNÜ: *see* INÖNÜ, ISMET.

ISNA (ESNA; ESNEH), a town of upper Egypt in Qina governorate lies on the west bank of the Nile, 36 mi. S. of Luxor. Pop. (1957) 22,128, mostly Copts. The town manufactures pottery and cottons and has large grain and livestock markets. Some trade is carried on with Kharga oasis (Al Wahat Al Kharijah) 110 mi. W.

Just below the town is the Isna barrage (1908), built to improve the irrigation of upper Egypt. The barrage, of granite and sandstone with 150 sluices, was reconstructed in 1948 and raises the upstream water level by 15 ft. (A. B. M.)

Isna takes its name from the ancient Egyptian Ta-Senet, but in Ptolemaic times it was called Latopolis, because the fish *Lates niloticus* was worshiped there. The ruins lie buried beneath the modern town, and only the pronaos of the temple has been cleared. Dedicated to Khnum, the ram-headed creator god, the temple took from about 180 B.C. to A.D. 250 to build. It is in Ptolemaic style, though the decoration is largely Roman. Always a Coptic centre, there is a Christian church in the desert, within ½ mi. of the modern town. The Coptic population suffered severely under Diocletian's persecution of A.D. 303. (M. V. S.-W.)

ISNEG (APAYAO), a Malayan-type people living in the mountains of northwest Luzon, Philippines. Isneg is the usual anthropological name, while Apayao is the district name and also that of the subprovince of Mountain province within which nearly all of them live. The Isneg numbered approximately 11,500 in the 1960s. They are short in stature and rather darkly pigmented, probably through minor mixture with Negrito groups adjacent to them. They have a distinctive language, with several dialect areas. The main body of Isneg lives on the Abulug or Apayao river system which drains most of their territory, but a group called the southern Isneg lives on the Matalag river system in the south of the subprovince. The Isneg economy is based on natural rainfall ("dry") cultivation of rice, corn and tropical roots in shifting gardens, supplemented by hunting, fishing, keeping livestock and trading tobacco and other products to the lowlands. Settlements are of hamlet size, scattered along the streams which drain the dense rain forests of the region. Each group of adjacent hamlets is crisscrossed by marriage and kinship ties. The region was noted for its head-hunting, with warrior bravery and head trophies the principal means by which males (if they survived) gained status, so that apart from a hamlet's immediate circle of friendly kinsmen all others tended to be enemies. The Isneg built substantial wood houses with high pitched roofs but also had huts in their rotating fields; they had distinctive dress and customs generally. Spanish missionaries worked up the rivers in the 17th and 18th centuries, but their converts were generally transferred to the lowlands; pacification was achieved by U.S.-Philippine constabulary forces in 1908–13.

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ISOBAR, a line on a map or thermodynamic chart, connecting points having the same pressure. Isobars for intervals of two to five millibars of pressure are important features of weather maps because of the relationship between pressure distribution, winds and weather. *See* METEOROLOGY. (H. R. B.)

ISOCRATES (436–338 B.C.), a famous writer and educationalist at Athens, who by the artistic form of his prose set a model which influenced many later writers. His father, Theodorus, was an Athenian citizen of the deme (township) Erchia; he owned a flute factory and was rich enough to perform expensive services to the state and to give his sons a good education. Isocrates' teachers are said to have included well-known sophists, but the details are uncertain. He must have been familiar with Socrates, although he does not appear to have been a member of the Socratic circle. Both sophistic and Socratic influences can be seen in his works. The family property was lost during the Peloponnesian War and, after the restoration of democracy in 403 B.C., Isocrates found it necessary to follow a profession. Physical infirmities prevented him from speaking in public and taking an active part in political life. For about ten years he wrote legal speeches for clients. It was an activity he despised and one to which he makes no allusion in his later works. About 392 B.C. he founded his famous school. It was highly successful and for over 50 years attracted pupils from all parts of the Greek world. He died soon after the defeat of Athens by Philip II of Macedonia at the battle of Chaeronea in 338 B.C.

Speeches.—Isocrates' extant works consist of 21 speeches (*logoi*) and nine letters. "Speech" is a convenient rendering of *logos*, but it is misleading. Only the six early forensic works are real speeches. It has been suggested that even these were rhetorical exercises, but most scholars believe that they were written by Isocrates, before he started his career as a teacher, for clients to deliver in the law courts. The rest are purely literary. Many by an artistic fiction are given the form of real speeches, but little attempt is made to keep up the illusion consistently. Some take the form of a hortatory address, others of a prose encomium. These literary speeches were presumably circulated as pamphlets among the Greek-speaking public. Isocrates seems also to have intended them to be recited by others to audiences. What are clearly instructions to reciters are to be found in the introductory part of the *Antidosis*. The literary speeches, the dating of which

can in most cases only be approximate, may be roughly divided into two groups according to their subject matter:

Political Speeches.—Panegyricus (*c.* 380 B.C.) and *Philippus* (346 B.C.) deal with Greek unity and war against Persia. *On the Peace* (*c.* 356 B.C.) and *Areopagiticus* (*c.* 355 B.C.) give advice on Athenian foreign and home policy, respectively. In *Plataicus* (*c.* 373 B.C.) a Platæan citizen urges the Athenians to restore Plataea after its destruction by Thebes. *Archidamus* (*c.* 366 B.C.) is supposedly delivered by Archidamus III of Sparta, who comments on conditions of peace offered by Thebes.

Speeches on Education, Ethics and Literary Criticism.—Isocrates' views on education are given mainly in *Against the Sophists* (*c.* 390 B.C.) and *Antidosis* (354–353 B.C.). *To Demonicus* (*c.* 370 B.C.?), regarded by some as spurious, contains moral precepts. *To Nicocles* and *Nicocles* (both *c.* 370 B.C.) outline the duties of a monarch and his subjects, respectively. *Busiris* (*c.* 390 B.C.), *Helen* (date uncertain, perhaps 390–380 B.C.) and *Evagoras* (*c.* 365 B.C.) are ostensibly encomiums, a genre of rhetorical literature then in vogue, but their main purpose is to advertise Isocrates' literary views. *Panathenaicus* (*c.* 339 B.C.), a long, rambling work of Isocrates' extreme old age, is partly an encomium of Athens, partly an exposition of his theories on writing and teaching.

Letters.—The letters, which are addressed to kings and rulers, serve the same purpose as the speeches: they advertise Isocrates' views on current affairs. They may have been actually sent to the individuals in question, but most of them at any rate were intended for a wider public. There seems to be little essential difference between the letters and the speeches except that the former are shorter and less elaborately composed. All were written in Isocrates' old age. Their authenticity has often been questioned, but most of them at least are now considered genuine.

Political Views.—The dominant theme in Isocrates' political writings is the policy of unifying Greece against Asia. A war against Persia, he claimed, would give the Greeks a common cause and put an end to their disastrous internal dissensions. In his most famous work, the *Panegyricus*, he urged Athens and Sparta to forget their quarrels and jointly lead Greece against the common enemy. His pleading was ineffectual, and in his subsequent efforts to find a champion of the Greek cause he turned first to Dionysius the Elder of Syracuse, then to Archidamus III of Sparta and finally to Philip II of Macedonia. From his third letter written shortly before his death it appears that even after the battle of Chaeronea he continued to hope that Philip would lead a united Greece against Persia. There seems no reason to doubt the authenticity of this letter. Two works concern Athenian politics. In the speech *On the Peace* Isocrates urged Athens to abandon its imperialistic ambitions and to recognize the right of Greek states to independence. In the *Areopagiticus* he deplored the degenerate Athenian democracy of his own day and advocated a return to the restricted democracy of Solon and Cleisthenes. His political writing had little influence on the conduct of affairs; he himself complains bitterly that the Athenians preferred to listen to the platform oratory of the active politicians.

Educational System.—Isocrates' educational writings are interesting and revealing. *Against the Sophists* was written at the beginning of his teaching career. Only the first part, in which he disparages other intellectual and educational systems by comparing them with his own, is extant. His own views are more fully expressed in the *Antidosis*, written, according to his own statement, when he was 82 years old. He dissociated himself from contemporary rhetoricians whose methods, he claimed, had no educational value. Their purpose was a purely practical one; they concentrated on legal oratory, which Isocrates despised, and treated rhetoric as a technique consisting of rules and precepts which could be imparted by a competent teacher to any diligent student. His own system, which he preferred to call "philosophy," was far broader and more humane. He held that speech composition should be regarded as a creative process allowing full scope for individual talent.

On the details of his educational methods there is little information, but an essential part must have been the composition of speeches modeled on his own. He insisted that students must avoid narrow, petty or specialized themes and choose those of universal interest and importance. These must be expressed in a pleasing form which had attractions analogous to those of poetry. For mathematics and the speculative sciences he had little regard and he derided the conflicting results produced by the researches of the scientists and philosophers. Scientific knowledge (*episteme*) he contended was beyond the powers of human knowledge; the most man could do was to learn by practical experience. He preached a high standard of morality, but morality he conceived in terms of an enlightened self-interest (*pleonexia*); those gained the true advantage who were righteous toward gods and men, in public and private life.

His pupils included sons of illustrious Greek families, men who became prominent in public life as orators and statesmen, and well-known historians, such as Ephorus and Theopompus. His success was remarkable, but he had many critics. Plato's Academy was founded shortly after Isocrates' school, and rivalry between the two establishments was inevitable. Covert attacks on Plato are found in Isocrates' works, particularly in the introductory part of the *Helen*. Plato's commentary on Isocrates comes mainly in the *Phaedrus*, but the allusions are veiled and scholars differ in interpreting them. Their general tenor, however, seems clear. Plato was willing to allow that artistically and morally Isocrates' humanism was on a higher level than the mere technique of other rhetoricians, but he considered his system unworthy of serious consideration because it was not founded on scientific method.

Conclusion.—Isocrates was not an original thinker. Nearly all his views, whether on politics or education, are adaptations of those already expressed by others. His greatest achievement was the artistic form he gave to his writings. The speeches written before his powers declined show infinite care both in structure and style. His method was to prepare a skeleton outline and build up the speech section by section, taking pains to avoid an abrupt transition from one subject to another. His style is an elaborate instrument of expression. Avoidance of hiatus and harsh collocations of syllables produces a smooth, harmonious flow of language. This is enhanced by a subtle use of rhythm which defies analysis. It suggests a fondness for certain clausulae but never so obtrusively as to reveal a fixed metrical scheme. He avoided the more extravagant ornaments which gave Gorgias' prose a meretricious appeal, *e.g.*, unusual words, startling metaphors, jingling assonance, but in building up his periods he indulged freely in balanced clauses and antithesis. With much reading the balanced periods become monotonous. He himself seems to have been aware of this. In his advice to reciters of his works he warns them to read only so much as will not weary listeners. His influence on subsequent prose writers, notably Cicero, was considerable.

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(H. L. H.-W.)

ISOGAMY, a term applied in biology to conditions in which the sex cells or gametes are alike, in contradistinction to heterogamy (*q.v.*) or anisogamy, in which the gametes are differentiated into male elements (spermatozoa or microgametes) and female elements (ova or macrogametes). Isogamy occurs in some of the lower algae and in certain Protozoa, but it seems that in most cases, if not in all, the gametes behave differently so that they are functionally anisogamous. *See* ALGAE; PROTOZOA; REPRODUCTION.

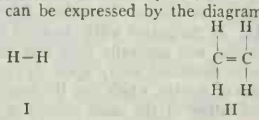
ISOMERISM. In the period when chemical analysis was first introduced, the belief was generally held that the properties of each pure substance depended solely upon its chemical composition. Two samples of matter, which had the same properties, and so were composed either of the same substance or else of mix-

tures of the same substances in the same proportions, were therefore supposed to be identical in composition. Conversely, any difference that could be detected in the properties of two substances under the same conditions was held to be due to some difference in composition.

The fundamental postulate that the properties of a pure substance are uniquely determined by its chemical composition was subsequently found, however, to be subject to certain well-defined types of exceptions. These may be classified under the three headings as: (1) polymorphism, where the difference of properties exists only in the solid state and is considered therefore to be caused by a different arrangement of identical molecules or ions in a crystal; (2) polymerism, where the molecules are of identical percentage composition but of different molecular weight; and (3) isomerism, where the molecules are of identical percentage composition and molecular weight but are considered to differ in their internal structure or configuration. (It should be noted that modern usage has somewhat altered the historical definition of the word "polymerism," given here. *See* POLYMERIZATION. The slight change in meaning thus introduced is, however, of no importance to the present article.) Although these three types of exception were grouped together at one time under the general term "isomerism," the distinctions outlined above are now commonly made, and the word "isomerism" is now restricted to the type (3). The present article will deal only with isomerism in this restricted sense. (For discussions of polymorphism, *see* CHEMISTRY: *Physical Chemistry;* for one of polymerism, *see* POLYMERIZATION.)

Structural Isomerism.—The field of isomerism is subdivided into two main divisions, structural isomerism and stereoisomerism. Two (or more) substances are said to be structural isomers of each other, or to be structurally isomeric, if they have the same chemical composition and molecular weight, but differ in structure; on the other hand, they are said to be stereoisomers of each other, or to be stereoisomeric, if they have the same composition, molecular weight, and structure, but differ in configuration. In order that the significance of this distinction may be made clear, the technical meanings assigned by chemists to the words "structure" and "configuration" must be discussed. The present section, however, will deal only with the concept of structure, since that of configuration is not required for an understanding of structural isomerism. (For the definition of configuration *see* the section below on *Stereoisomerism* and the more detailed article on STEREOCHEMISTRY.)

The structure of a substance (or, more precisely, of its molecules) is given by a detailed statement of the way in which each atom is linked by valence bonds to each of the other atoms of the molecule (*see* VALENCE). This statement may take any of several equivalent forms. One such form is based upon the use of purely verbal descriptions. Thus, the structure of the hydrogen molecule, H_2, may be expressed by the statement that the two univalent hydrogen atoms are joined to each other by a single covalent bond; the structure of the ethylene molecule, C_2H_4, may be expressed by the statement that each of the two quadrivalent carbon atoms is joined to the other by two covalent bonds, and also to two univalent hydrogen atoms by single covalent bonds; and so on. A verbal scheme of this sort, however, becomes too unwieldy for the description of the structure of a molecule of any complexity, and so a second, much more convenient, method of representation has been generally adopted. When this method is employed, any given structure is represented by a diagram, in which each atom is symbolized by the usual chemical symbol of the element in question, and in which each covalent bond is symbolized by a (usually straight) line drawn between the letters representing the appropriate atoms. Thus, the structures of the molecules of hydrogen and of ethylene, which were described verbally above, can be expressed by the diagrams I and II, respectively. Such symbols as these are usually referred to as the structures of the respective substances, although, in a strict sense, they are merely graphical representations of the structures of the corresponding molecules. (The more modern electronic structures, in which each line is replaced by a pair of dots, differ from the foregoing in no respect which is important to the present discussion. Such modes of description will therefore be ignored here. However, *see* VALENCE.)

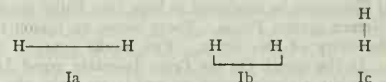


I II

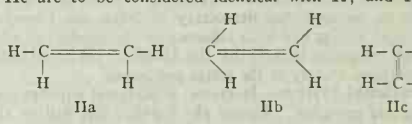
In the graphical scheme outlined above, no symbol for the representation of an ionic bond was mentioned. Actually, at the present time, the following convention seems to be generally adopted. If two or more parts of a molecule are not joined to each other in any way by covalent bonds, but instead are held together by only ionic linkages, then each of the parts (*i.e.*, ions) is represented separately by its corresponding symbol, and the various symbols are merely placed close together. The existence of the electrostatic attractive forces is shown by the presence of appropriate plus or minus signs, as superscripts, to indicate the charges on the ions. Thus, the structure III can be written for the molecule of sodium chloride, which exists in the gaseous but not in the solid state or in aqueous solution (*see* MOLECULE). If any ion contains more than a very few atoms, its structure is often surrounded by square brackets for the sake of clarity. Thus, the structure of the molecule of ammonium chloride (if such a molecule be capable of existence at all, *see* MOLECULE) may be given as IV.

III IV

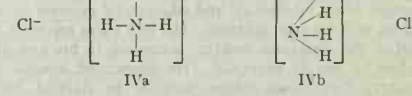
Significance of Structural Diagrams.—As has been explained, the function of a structure is to specify the pairs of atoms which are joined by valence bonds, and to state the number and type of the bonds which connect each of these pairs. Consequently, the exact geometrical properties of any diagram that may be written on paper are of no structural significance. In particular, the lengths of the lines which represent the covalent bonds, the angles between pairs of lines, and the relative positions on the page of the letters which represent the atoms must be ignored. The diagrams Ia, Ib and Ic, for example, represent exactly the same structure that I does; in the same manner, IIa, IIb and IIc are to be considered identical with II; and IVa and IVb are to be considered identical with IV. This fact is extremely important, since it greatly restricts the number of nonequivalent structures that can be written for a molecule containing a specified number of atoms of specified kinds. It must be constantly borne in mind, in fact, that diagrams which look entirely different superficially may actually represent the same structure. (The situation may be described in mathematical language by the statement that the chemical structures, as defined here, are topological diagrams and have no nontopological significance. *See* TOPOLOGY, GENERAL.)



Ia Ib Ic



IIa IIb IIc

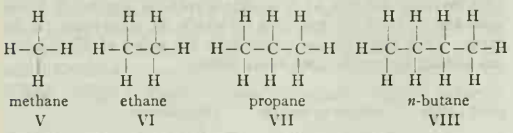


IVa IVb

The Number of Isomers.—A fundamental postulate of the

structural theory of chemistry is that two molecules which differ in structure must correspond to different substances with different chemical and physical properties. A corollary of this fundamental postulate is that the number of theoretically possible structural isomers which have a given molecular formula (*i.e.*, which have a given chemical composition and molecular weight, *see* MOLECULE) must be equal to the number of nonequivalent structures permitted by the rules of valence. The general procedure of calculating isomer numbers can be illustrated with a few examples. For the molecular formula CH_4, only the single structure V can be drawn if carbon and hydrogen are, as usual, considered to be quadrivalent and univalent, respectively. Similarly, for the formulae C_2H_6 and C_3H_8, only the single structures VI and VII, respectively, are possible. In agreement with expectation, only a single substance exists for each of these formulae.

On the other hand, for the formula C_4H_{10}, the two nonequivalent structures VIII and IX can be drawn, and, accordingly, two isomeric substances exist; these are known as normal butane and isobutane, respectively. Moreover, for the molecular formula C_2H_4, only the single structure X is possible, but, for the formula C_3H_6, the two structures XI and XII, and, for the formula C_4H_8,

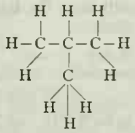


methane V

ethane VI

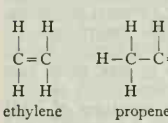
propane VII

n-butane VIII

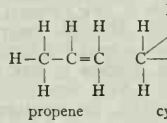


isobutane IX

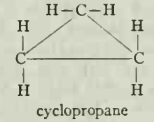
the five structures XIII–XVII, can be drawn. Again, the number of nonequivalent structures in each case is exactly equal to the number of existing structural isomers. This procedure, which can be extended in an obvious manner, and with uniformly satisfactory results, to all further types of molecular formula (however, *see* below), forms the basis of structural chemistry. Its success provides an important part of the experimental justification of the structural theory.



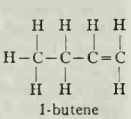
ethylene X



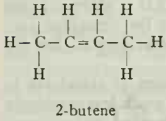
propene XI



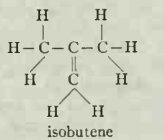
cyclopropane XII



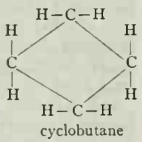
1-butene XIII



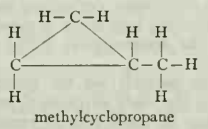
2-butene XIV



isobutene XV



cyclobutane XVI

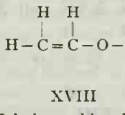


methylcyclopropane XVII

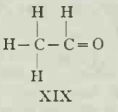
Anomalous Isomer Numbers.—The equality of the number of structures and of isomers corresponding to each molecular formula is subject to several different types of exceptions. The ideal situation would be that exactly one substance exist for each structure which can be drawn, and that, conversely, exactly one structure be associated with each substance which exists. Four types of exceptions to this ideal can be visualized, however, and examples of each type have been encountered: first, many structures which can be written correspond to no known substance at all; second, some structures must be associated with two or more different substances; third, some substances cannot be described by any structure of the usual type; and fourth, some apparently single substances behave as if they possess two or more distinct structures. If the prediction of the numbers of isomers is to be considered an essential function of the structural theory, these exceptions must be examined in order that their extent and significance may be evaluated.

(1) The fact that many structures can be written for which no corresponding substances are known is often merely the result of the fact that no chemist has as yet been sufficiently interested, or had sufficient time, to prepare samples of all the theoretically possible isomers. Even relatively simple molecular formulae may permit enormous numbers of structures; for example, it has been calculated that the formula $C_{20}H_{42}$ permits 366,319 structures and the formula $C_{40}H_{82}$ permits 62,491,178,805,831 of them! (Of course, such large numbers as especially the second of these are experimentally meaningless, since, even if a sample of each of the substances were available, there would be no way of proving that no two of them were identical. Only about 20 different substances that have the formula $C_{20}H_{42}$ and about 5 with the formula $C_{40}H_{82}$ are known.) The most complicated molecular formula for which all possible structural isomers have been prepared seems to be C_9H_{20}, with altogether 35 nonequivalent structures. For other formulae, incomplete sets of more than 100 known isomers are not uncommon, however. The essential point to be brought out here is that, in those cases in which a serious attempt has been made to prepare all the possible isomers, and in which the factors discussed below do not make success impossible, the theoretical isomer numbers have usually been confirmed experimentally.

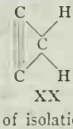
In some instances, however, attempts to prepare substances with certain structures have been unsuccessful in spite of repeated and varied attempts. For example, all attempts to prepare vinyl alcohol, XVIII, have led instead to the isomeric acetaldehyde XIX. Apparently, therefore, a substance with the structure



XVIII

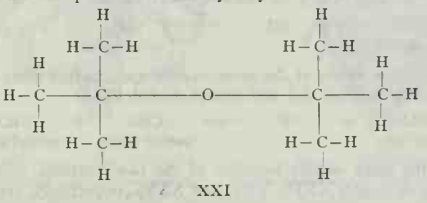


XIX



XX

XVIII is incapable of existence or, at any rate, of isolation, because it undergoes a rapid and spontaneous transformation into a different, isomeric substance. This phenomenon is discussed in the article TAUTOMERISM. In other instances, certain structures which can be written on paper correspond to molecules which would be so highly strained that they could not be expected to exist. A simple example of this is represented by the structure XX (of the unknown cyclopropyne); further examples are discussed in the article on STEREOCHEMISTRY: *Strain Theory*. Finally, certain structures correspond to substances for which no methods of preparation are known at present. In such instances, however, the substances might be capable of existence if only suitable methods of preparation could be devised. Thus, for about 50 years all attempts to make tertiary-butyl ether XXI led instead to



XXI

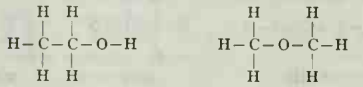
entirely different (and nonisomeric) substances, as a result of the failure of the chemical reactions to follow the desired courses; nevertheless, this substance was finally prepared in 1941. There is no obvious reason why the situation may not be similar with many other, as yet unknown, substances.

(2) The existence of structures which must be assigned to two or more different substances has made necessary a fundamental extension and broadening of the structural theory. The nature of the developments arising from this cause is discussed briefly in the section on *Stereoisomerism* below, and in greater detail in the article on STEREOCHEMISTRY.

(3) Some substances exist for which no structure of the usual type can be written. In nearly all instances, however, such substances have been brought successfully into the structural scheme by suitable extensions of the theory. For example, it is now recognized that carbon, although it is quadrivalent in most of its compounds, is occasionally trivalent, and that many other elements also have greater or less tendencies to display variable valence. A large number of substances, to which structures could not be assigned if each element were considered always to have the same valence, can therefore be taken care of without difficulty. These variations in valence are fairly well understood, so that chemists usually know in advance when they are to be expected (*see* FREE RADICALS). New types of linkage which were not envisaged originally, such as the so-called hydrogen bond (*see* VALENCE), have been discovered; these frequently make possible the assignment of definite structures to otherwise anomalous substances. Finally, the theory of resonance (*see* RESONANCE, THEORY OF) has served to clear up most of the remaining difficulties by introducing a more generalized concept of structure. Although many substances still exist to which no structures have as yet been definitely assigned, there are now no longer many which seem to lie completely outside the structural scheme. (However, *see* the boron hydrides discussed in the article on BORON.)

(4) The existence of apparently single substances which act as if they have two or more structures has given rise to the concept of tautomerism (*q.v.*).

Assignment of Structures to Isomers.—The structural theory would be of relatively little practical value if it permitted only the calculation of the number of isomers and not the assignment of a definite structure to each of the isomers in those instances in which more than one structure is possible. For the formula C_2H_6O, for example, the two structures XXII and XXIII



XXII

XXIII

can be drawn, and the two substances, ethyl alcohol and methyl ether, are known. It is gratifying that the number of structures is equal to the number of isomers, but the chemist would still like to know which structure is to be associated with each isomer. The experimental methods for the determination of structure are varied, and only a few of the salient features of some of the most important methods can be mentioned here.

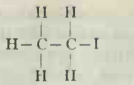
One of the most commonly applied methods for the determination of structure makes use of the chemical reactions of the substances in question. The assignment of structures to the isomeric ethyl alcohol and methyl ether, for example, can be made in the following way. The action of hydrogen iodide upon ethyl alcohol leads to ethyl iodide, C_2H_5I, and water, H_2O:

$$\underset{\text{ethyl alcohol}}{C_2H_6O} + HI \longrightarrow \underset{\text{ethyl iodide}}{C_2H_5I} + \underset{\text{water}}{H_2O}$$

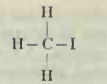
whereas the action of the same reagent upon methyl ether leads to methyl iodide, CH_3I, and methyl alcohol, CH_4O:

$$\underset{\text{methyl ether}}{C_2H_6O} + HI \longrightarrow \underset{\text{methyl iodide}}{CH_3I} + \underset{\text{methyl alcohol}}{CH_4O}$$

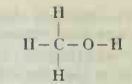
For the three organic products of the two reactions, only the single structures XXIV, XXV and XXVI, respectively, are possible.



ethyl iodide
XXIV



methyl iodide
XXV



methyl alcohol
XXVI

Comparison of these structures with XXII and XXIII shows that ethyl iodide XXIV is more closely related to XXII than to XXIII, and that methyl iodide XXV and methyl alcohol XXVI are more closely related to XXIII than to XXII. Consequently, the inference is drawn that ethyl alcohol has the structure XXII, since it leads to ethyl iodide, whereas methyl ether has the structure XXIII, since it leads to methyl iodide and methyl alcohol. In other words, the assumption is made that the courses of the chemical reactions are such that the least possible structural changes are produced. Although numerous exceptions to this rule of minimum structural change are now recognized (*see* MOLECULAR REARRANGEMENTS), it nevertheless forms at least part of the basis of most determinations of structure.

A second method for the determination of structure, which likewise involves the rule of minimum structural change, is based upon the study of the reactions by which the substances can be made. Thus, ethyl alcohol results from the action of dilute aqueous sodium hydroxide upon ethyl iodide:

$$\underset{\text{ethyl iodide}}{C_2H_5I} + \underset{\text{sodium hydroxide}}{NaOH} \longrightarrow \underset{\text{ethyl alcohol}}{C_2H_6O} + NaI$$

whereas methyl ether results from the action of concentrated sulfuric acid upon methyl alcohol:

$$\underset{\text{methyl alcohol}}{2CH_3O} + \underset{\text{sulfuric acid}}{H_2SO_4} \longrightarrow C_2H_6O + \underset{\text{methyl ether}}{H_2SO_4 \cdot H_2O}$$

Since the structures of ethyl iodide and of methyl alcohol have been shown (*see* above) to be XXIV and XXVI, respectively, the principle of minimum structural change again leads to the conclusion that ethyl alcohol must have the structure XXII and methyl ether must have the structure XXIII.

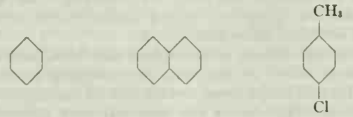
A third method, which makes no explicit use of the principle of minimum structural change, is based upon a comparison of the reactions of substances of unknown structure with those of other substances of known structure. Thus, ethyl alcohol and methyl alcohol resemble each other closely in their chemical properties, whereas methyl ether behaves quite differently toward most reagents. In particular, the two alcohols react with metallic sodium to give alkoxides, and with acid chlorides to give esters (*see* ALCOHOL), whereas methyl ether is inert toward each of these reagents (*see* ETHER). Consequently, the structures of ethyl alcohol and of methyl alcohol may be presumed to be similar to each other. Since that of methyl alcohol is necessarily XXVI, that of ethyl alcohol must therefore be XXII. Moreover, the remaining structure, XXIII, must belong to the remaining substance, methyl ether. The assignment of structures is thus the same as by the preceding methods.

Still a further procedure for the assignment of structures to isomers is somewhat more fundamental, but much less commonly used, than the ones just described. This method makes direct use of the numbers of isomeric derivatives that can be prepared from each of the isomeric substances in question. It has found its greatest use in the determination of the orientation of substituents in benzene.

Numerous further methods for the determination of structure are based upon the study of physical properties of various kinds. Mention may be made here of refractivities, molecular volumes, parachors, spectra, dipole moments, magnetic susceptibilities and nuclear magnetic resonance spectra. The diffraction of X-rays by crystals and that of electrons by gaseous substances has also been used in a number of instances for the establishment of structure. For further discussion of these methods, the reader is referred to the individual articles dealing with them.

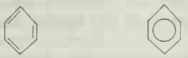
Abbreviated Forms of Structures.—The detailed structures such as XXIV, XXV and XXVI (as well as most of the pre-

ceding ones) are too cumbersome for practical use. Consequently, abbreviated forms have been adopted for the purpose of convenience in writing and printing. Thus, XXIV becomes CH_3–CH_2I or, more simply still, C_2H_5I; XXV becomes CH_3I; and XXVI becomes CH_3OH. Even the rather complicated structure XXI can be expressed simply as $(CH_3)_3C$–O–$C(CH_3)_3$ or as $[(CH_3)_3C]_2O$. In the aromatic series, the structure of benzene



XXVII XXVIII XXIX

(*q.v.*) is written as a simple hexagon, as in XXVII, that of naphthalene (*q.v.*) is written as in XXVIII, and so on; hydrogen atoms attached directly to the carbon atoms of the aromatic rings are usually not indicated explicitly, although other, heavier atoms and groups are always specified, as in the symbol XXIX for *p*-chlorotoluene. (The phenyl and naphthyl radicals, however, are frequently indicated by their formulae, C_6H_5 and $C_{10}H_7$, respectively.) Benzene is also frequently represented by the so-called Kekulé structure XXX or by the conventionalized diagram XXXI. Other aromatic hydrocarbons can be depicted similarly.



XXX XXXI

Stereoisomerism.—When the structural theory was first developed, the natural assumption was made by most chemists that two substances with not only the same chemical composition and molecular weight but also the same structure would necessarily have to be identical. Nevertheless, examples were soon encountered in which this assumption appeared to be contrary to the facts. One of the first examples of this further type of isomerism to be carefully studied was that exhibited by tartaric and racemic acids. These substances must be assigned the same structure, HO_2C–CHOH–CHOH–CO_2H, and yet they differ in a number of their characteristic properties. In particular, they melt at different temperatures and have different densities, solubilities and crystalline forms. Moreover, tartaric acid is dextrorotatory (*i.e.*, its solutions rotate the plane of polarization of plane polarized light to the right, *see* STEREOCHEMISTRY), whereas racemic acid is optically inactive (*i.e.*, its solutions have no effect upon the plane of polarization). In a relatively short time, many further examples of the existence of a greater number of isomers than can be accounted for by the structural theory came to light. The extent to which these anomalous isomers differ in properties varies greatly from case to case. Sometimes, as with the dextro- and levorotatory lactic acids (*q.v.*), CH_3–CHOH–CO_2H, they are identical in nearly all their properties except in their effects upon polarized light and their reactions with other optically active substances; on the other hand, as with the above tartaric and racemic acids, they may differ noticeably in nearly all their properties; and finally, as with fumaric and maleic acids (*q.v.*), $HO_2C-CH=CH-CO_2H$, they may both be optically inactive.

The detailed discussion of this further type of isomerism is given in the article on STEREOCHEMISTRY. Here, only a few of the most important features will be pointed out. The first fact that has to be established is, of course, that the substances under discussion are actually isomers of one another, in the restricted sense in which the word is used in the present article, and not either polymorphic or polymeric forms. Polymorphism is easily shown not to explain the observations, since the differences in chemical and physical properties and in optical activity are found to persist in solution and in the liquid and gaseous states. Polymerism also is shown to be not involved, since the substances have the same molecular weight. The conclusion can be drawn therefore that the substances are truly isomeric, and that, although they possess the same structure, their individual molecules are not identical. Such isomers are said to be stereoisomers, and their molecules are said to differ in configuration.

The only suggestion regarding the significance of configuration which has received serious attention is that it refers to the arrangement of the atoms in space. That the difference between the dextro- and the levorotatory lactic acids might be explained in some such manner was proposed in 1873 by J. Wislicenus; more complete theories, upon which all subsequent work in stereochemistry has been based, were brought forward the following year by two independent investigators, J. H. van't Hoff and J. A. Le Bel. For a description of their ideas and a further discussion of stereoisomerism, the reader is referred to the article on STEREOCHEMISTRY. *See* also references under "Isomerism" in the Index.

(G. W. Wd.)

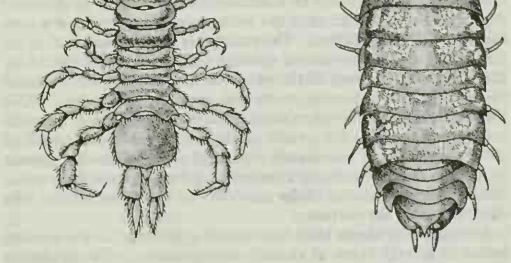
ISOPERIMETRY, a word originally used in geometry to refer to figures of equal perimeter; *e.g.*, a circle and an ellipse may have equal perimeters (circumferences) although not equal areas. One of the simplest of the problems arising in the study is to determine, from all plane figures having the same perimeter, the one that shall have the greatest area. This figure is the circle. Considered more generally, given any number of geometric figures, all defined in the same way, determine the form of the one possessing a maximum (or minimum) amount of a certain property; *e.g.*, of all the triangles having a given area (figures defined as plane, three-sided and of a given area), the one having the least perimeter is equilateral. (*See* CRITICAL POINTS.)

For the general definition and treatment consult works on the calculus of variations, where the theory is extended to include solid as well as plane figures.

ISOPODA, an order of crustaceans of the subclass Malacostraca (*q.v.*), including the familiar gribbles, wood lice (sow bugs) and slaters. Wood lice that curl up into a ball when disturbed are often called pill bugs. The body is characteristically dorsoventrally flattened, except in the suborder Phreatoicoidea, and ranges in size from $\frac{1}{36}$ of an inch (*Munna* species) to about 14 in. (*Bathyonomus*).

The majority of isopods are marine, but many, mostly of the suborder Asellota, live in fresh water. Most members of the suborder Oniscoidea are terrestrial scavengers, limited to damp surroundings (*see* WOOD LOUSE). A few isopods are cave dwellers; most of these are blind. The gribbles (*Limnoria* species) are important economically because of the great damage they do by burrowing in wooden structures in the sea. They are among the few animals capable of digesting cellulose.

The first thoracic segment is fused with the head, the remaining seven usually being free; each bears a pair of legs (pereopods). The abdominal segments are smaller and the last segment is united with the telson. The abdomen bears five pairs of pleopods, which



A B

BY COURTESY OF KUNKLE AND CONNECTICUT STATE GEOLOGY AND NATURAL HISTORY SURVEY

ISOPODA: (A) ASELLUS COMMUNIS, A COMMON FRESH-WATER ISOPOD; (B) CYLISTICUS CONVEXUS, A PILL BUG CAPABLE OF ROLLING INTO A BALL

function for swimming and/or respiration. The sixth pair of abdominal appendages, or uropods, may be slender and terminal (Asellota), may form a caudal fan with the telson (suborder Flabellifera) or may form a pair of platelike valves covering and protecting the pleopods (suborder Valvifera).

The eggs are carried in a pouch (marsupium) formed by overlapping platelike structures (oöstegites) attached to the bases of the pereopods. In some members of the families Sphaeromidae and Gnathiidae the marsupium is formed by invaginations of the ventral body wall and the oöstegites are reduced or absent. Newly hatched young lack the last pair of pereopods; otherwise they resemble the adults.

Parasitism has developed in several groups. Members of the family Cymothoidae live on the body surface or in the mouth or gill chamber of fishes; some even penetrate the body wall and bulge into the abdominal cavity, separated from it only by a thin membrane. Cymothoids are males when young and become females when fully grown. The suborder Epicaridea contains highly modified parasites of other Crustacea. Members of the most highly specialized family, Entoniscidae, live within the visceral cavity of crabs and are true endoparasites. *See* also CRUSTACEA.

(T. E. B.)

ISOPRENE, a colourless, volatile liquid that is made commercially by the thermal cracking of petroleum or coal gases and tars, and from the processing of isoamylene, propylene and acetone. It also can be made by the thermal decomposition of rubber and other terpenes. Liquid isoprene polymerizes readily to form rubberlike substances; *e.g.*, so-called synthetic natural rubber or butyl rubber. Such action seems to indicate that isoprene is the fundamental molecular unit of rubber. Isoprene has the formula C_5H_8; the specific gravity is 0.6808; and the boiling point is 34° C. *See* TERPENES.

ISOPTERA, an order of insects (*q.v.*), comprising the termites (*q.v.*) or so-called white ants of the tropics. *See* also SOCIAL INSECTS.

ISOPYCNIC, an adjective used in physics to mean constant density. In oceanography, isopycnic surfaces are considered in certain dynamic computations as the surfaces along which water particles actually move instead of along level surfaces, although the isopycnic surfaces are in most cases very nearly horizontal. The concept is similar to that of the movement of air on isentropic surfaces extensively used for computations and forecasting in meteorology. (H. R. B.)

ISORHYTHM (from the Greek *isos*, "equal," and *rhymos*, "rhythm"), the term used for a formal device of 14th- and 15th-century music consisting of a rhythmic pattern (*talea*) repeated throughout the work in different melodic forms. In the motets of Philippe de Vitry (1291–1361) the isorhythm is confined to the tenor part; in later works each voice often has its own *talea*.

ISOSTASY is a principle in earth science explaining why continents stand nearly three miles above the floor of the deep ocean, and why a major chain of mountains or an extensive plateau stands so high above the general continental surface. According to the principle, the solid rock underlying the deep ocean for a few tens of miles below sea level is heavier, volume for volume, than the average rock underlying a continent to the same depth, and still heavier than the average rock underlying a mountain chain or high plateau. The continents may be said to float on the earth's body, the needed upward pressure being supplied by the downward pressure of the heavy rocks under the ocean, aided by the weight of the water, muds and oozes of the sea floor. Also the weight of each broad mountain chain and plateau is approximately balanced by the weight of the somewhat heavier rock of the continent from which such high land rises. Thus the greater reliefs are almost perfectly compensated by corresponding variations of average density of the materials extending for several tens of miles below the surface.

Investigation shows that the balancing pressure is transmitted below in a weak layer of considerable thickness. To emphasize this weakness (largely caused by high temperature) the layer has been given the technical name asthenosphere. Since the continents and mountain chains are not flattening under their own weights, considerable strength must be ascribed to their rocks above the asthenosphere. Because such volcanic islands as Hawaii and St. Helena, representing enormous loads piled on the ocean floor, now show no sign of sinking, it seems clear that the solid rock under the deep-sea oozes is also strong. In both continental and oceanic regions many relatively narrow downwarps and upwarps of the rocky surface are not compensated and yet appear to be stable elements in the earth's topography. All around the earth, therefore, there is a strong surface layer of rock; this bears the technical name lithosphere.

The interface between asthenosphere and lithosphere is not level but is characterized by waviness, corresponding to the chemical composition and temperature (which control density) of the lithospheric rocks. To deduce the best reference spheroid for the figure of the earth, needed for accurate mapping, the geodesists have proved that the isostatic principle must be recognized; to allow for its influence they assume, for convenience in calculation, that the locus of compensation is a level passing through the lowest point at the bottom of the lithosphere. With that assumption these workers, using measured deflections of the plumb line and also measurements of the force of gravity at many stations on continents and islands and in submarines traversing the Atlantic, Pacific and Indian oceans, have greatly improved their conception of the earth's figure. (*See* GEODESY.)

By their own independent methods the seismologists have shown that the lithosphere under the oceans is decidedly denser than the average continental rock, and that the mountain chains are buoyed up by roots of rocky matter still lighter than the average rock of the continents.

In 1889 C. E. Dutton, a geologist, coined the name isostasy from the Greek *isostasios* ("in equipoise"; compare *isos*, "equal" and *statikos*, "stable"). He adopted the idea for two chief reasons: (1) the fact that the floor of each wide and thick mass of sedimentary rock laid on the lithosphere sinks by an amount not much smaller than the thickness of the mass; and (2) the fact that, when prolonged erosion removes a thick layer of rock from a broad mountain chain or plateau, the denuded area rises by a large fraction of the thickness of the vanished rock. From these facts he deduced the weakness of the asthenosphere and its ability to transmit the pressures caused by widespread loadings and unloadings of the lithosphere. The new name also meant for him that the major terrestrial reliefs are almost perfectly compensated by the horizontal variation of average density of the lithospheric rocks, allowance being made for the weight of the ocean water.

The isostatic principle is further illustrated by the basining of the lithosphere under the weight of the extensive icecaps that covered northwestern Europe and northern North America during the Pleistocene epoch, and by the recoil of the downwarped lithosphere since the loads were removed by melting.

The displacement of matter because of surface loading or unloading is called technically isostatic adjustment. The great viscosity of the earth's materials makes this a slow process. Recoil in the glaciated tract of Europe continues, though the icecap began to melt away 40,000 years ago and 7,000 years ago had only about 1% of its original weight. Time lag in adjustment for any transfer of surface load and the strength of the lithosphere are two manifest causes for some imperfection of isostatic balancing. Some investigators believe that a small degree of strength characterizing the asthenosphere itself is a third cause.

(R. A. D.)

ISOTHERM, a line on a map or thermodynamic chart connecting points having the same temperature. *See* THERMODYNAMICS; METEOROLOGY; WEATHER FORECASTING.

ISOTOPE. An isotope is one of two or more species of the same chemical element that have different atomic weights. Most of the elements, in the form in which they are found in the earth's crust and atmosphere, are mixtures of several isotopes. These mixtures are in almost unvarying proportions. For example, natural tin has ten isotopes, ranging in atomic weight from 112 to 124, but all specimens that have been examined have the average atomic weight 118.69. In other words, ordinary tin is nature's standardized blend of ten varieties of tin atoms, no two of which have

the same nuclear mass, although they are identical in all other respects.

The term isotopes was coined by F. Soddy in 1913 from the Greek *isos*, "equal," and *topos*, "place," to indicate substances occupying the same place in the periodic table of the elements; *i.e.*, having exactly the same chemical properties, but distinguishable from each other in some other way, such as mode of radioactive decay. With time the basic distinguishing feature of isotopes has been assigned to their respective atomic weights. Since chemical properties are determined by the positive charge on the nucleus (the atomic number) and by the consequent number of extranuclear electrons, this nuclear charge must be the same for isotopes. The differences in atomic masses of isotopes must therefore arise from differences in the masses of the nuclei involved.

Present-day usage tends to restrict the word isotopes to atoms having nuclei with masses differing by approximately whole numbers on the atomic weight scale. The general term for an atom characterized by the constitution of its nucleus is nuclide, although isotope has often been used loosely in the past for this purpose. An example of the correct usage lies in the following sentences: "The element chlorine has two isotopes with masses 35 and 37. These two isotopes are examples of nuclides with a mass difference of two."

This article will concentrate on the properties of isotopes related to the stricter interpretation of the name. For further information on atomic and nuclear structure and related topics, *see* MASS SPECTROSCOPY; NUCLEUS; RADIOACTIVITY.

Discovery of Isotopes.—Previous to the first decade of the 20th century it was generally assumed that the mass of a standard number of atoms of a chemical element (the atomic weight) was a fundamental characteristic of the element. It was furthermore usually assumed that all the atoms of an element were the same and, in particular, had the same mass. The fundamental importance attached to the mass in characterizing an element is illustrated by the periodic classifications of the elements, such as that of D. I. Mendeléyev, which were made by ordering the elements, with a few minor exceptions, according to their atomic weights.

The first evidence that two substances having the same chemical properties did not have to be physically identical came from the study of the radioactivity of the heavy elements. B. B. Boltwood in 1906 and, considerably more conclusively, H. N. McCoy and W. H. Ross in 1907 showed that ionium (a radioactive product of the disintegration of uranium) and radiothorium (a disintegration product of thorium) once mixed with thorium could not be separated from it by any chemical means. The two substances had radioactive properties quite different from those of thorium and could be shown to have atomic weights differing by several units from that of thorium. It was to cover situations such as this that Soddy devised the name isotopes.

Soon after the acceptance of these ideas as applied to the heavy chemical elements, there came indications that isotopy might exist in the main group of naturally occurring stable elements. J. J. Thomson, during a 1913 investigation of the behaviour of positively charged ions in electric and magnetic fields, found that whereas many substances, when ionized, did behave as if they were made up of identical molecules, the rare gas neon appeared to have a species in about 10% abundance that was 10% heavier than the main constituent. His student F. W. Aston first attempted to confirm this result by trying to change the atomic weight of neon by repeated partial diffusion of the gas through clay pipes. His results, although positive, were not definite enough to establish the idea of isotopy in light elements. Aston then went back to Thomson's methods and developed one of the first mass spectrographs (*see* MASS SPECTROSCOPY). With this he was able to show conclusively in 1919 that neon had two major constituents, one of mass close to 20 and the other with mass close to 22. The relative abundances were such as to explain the observed average atomic weight of 20.183.

The success with the element neon was followed by the discovery that chlorine had two isotopes (masses close to 35 and 37). Thereafter all the naturally occurring elements were examined and most of them were found to consist of more than one isotope.

Isotopes and Nuclear Structure.—With the discovery of isotopes, it became evident that all chemical elements that had atomic weights that were not close to integers consisted of mixtures of isotopes, each of which individually had a weight close to an integer. This finding has been confirmed and today it is well established that there are no isotopes with masses deviating from whole numbers by more than 0.1 atomic mass unit.

Modern ideas of nuclear structure picture the atomic nucleus as consisting of protons (*i.e.*, nuclei of normal hydrogen atoms) and neutrons. These two particles have nearly the same mass, close to unity on the atomic weight scale. This explains the integral masses observed for isotopes. The integer closest to the exact mass is known as the mass number (A) of the nucleus and is the sum of the number of protons (Z) and the number of neutrons (N) in the nucleus. The number of protons determines the positive charge and therefore the chemical properties of the atom.

Nuclei that have the same mass number are called isobars or isobaric nuclei; those that have the same number of protons, but varying numbers of neutrons, are isotopes; nuclei that have the same number of neutrons are known as isotones. The nuclear constitution of an atom is usually indicated by giving the chemical symbol (which determines the number of protons in the nucleus) with a superscript indicating the mass number and therefore, by difference, the neutron content of the nucleus. The superscript may be placed either before or after the chemical symbol. Thus Cl^{35} and Cl^{37} are the two stable isotopes of chlorine. The nuclei each have 17 protons. In the first isotope there are 18 neutrons, in the second 20 neutrons. The isotopes of hydrogen, H^1, $H^2 \equiv D^2$, $H^3 \equiv T^3$, have been given special names, protium, deuterium and tritium, respectively.

Finally we can define a class of nuclides that have the same number of neutrons and protons, and therefore the same mass number, but in which the nuclei are not in the same energetic state. Such nuclides are known as nuclear isomers.

Isotopes of an element differ among themselves (1) in any properties that depend on the mass; and (2) since the nuclear constitution is different, in all specifically nuclear properties. Thus they can be classified into stable isotopes and isotopes whose nuclei disintegrate spontaneously. The disintegration properties of radioactive isotopes, such as half life (time for half the isotope to disappear by decay) and modes of decay, are discussed under RADIOACTIVITY.

The stable isotopes are found as the constituents of the naturally occurring elements. They may also be produced by nuclear transformations. Although some radioactive isotopes exist in nature, most have to be prepared by artificially induced nuclear transformations.

Just as the nuclear stability varies from one isotope to another, so do other nuclear properties such as the nuclear radius, spin, magnetic moment and electrical quadrupole moment. Likewise the nuclear reaction probability often is very different in one isotope than in another. Thus, U^{235} undergoes nuclear fission when bombarded with slow neutrons; U^{238} does not. Similarly, only one of the eight isotopes of cadmium, Cd^{113}, has an extremely large probability of absorbing slow neutrons; the other isotopes are relatively inert. The stability toward spontaneous disintegration of the nucleus and, to a certain extent, nuclear reaction probabilities of isotopes are related to their energetic stability. According to the Einstein relation between mass and energy, the energy content of a system is determined by the mass—the lower the mass, the more stable the system. Although the exact masses of isotopes are close to whole numbers, the deviations are real and significant. In all known cases the mass is lower than that of the same number of separate neutrons and hydrogen atoms. Thus all known atoms are stable with respect to complete decomposition into neutrons and hydrogen atoms.

The detailed variations in mass of nuclides are conventionally measured in terms of the packing fraction, $f_{A,Z}$, of a nuclide of

atomic number Z and mass number A. The packing fraction is related to the exact mass, $M(A,Z)$, of the atom by the relation

$$M(A,Z)=A(1+f_{A,Z})$$

Packing fractions of nuclides (except for hydrogen and deuterium) lie between $+10\times10^{-4}$ and -10×10^{-4}. In the case of the stable isotopes of a given element, the packing fractions of the isotopes with masses of even numbers usually form a smooth curve as a function of A, with a minimum (and therefore increased stability) for the isotope of close-to-average mass number.

Variation in the Isotopic Composition of the Elements.—For most elements the relative amounts of the different isotopes in the natural mixture are very constant, irrespective of the source of the sample. In several cases the isotopic composition of elements in extraterrestrial sources such as meteorites has also been found to be the same as that of the same element on the earth's surface. However, elements that can be produced as a result of the few nuclear transformations (spontaneous or induced) occurring continually on the earth have been found to have varying isotopic content. Thus, the isotopic composition of lead depends on how much thorium or uranium has been nearby during geological time, and for how long (*see* RADIOACTIVITY, NATURAL). Likewise, since all the helium present today on the earth is the result of nuclear transformations, the relative amounts of He^3 and He^4 are not the same in the atmosphere as they are in helium from gas wells.

Smaller differences in the isotopic composition of the lighter elements arise from the effect of mass on the rates and equilibriums of naturally occurring chemical and physical processes (*see* below). Thus the deuterium content of hydrogen from the water of the Dead sea is higher than that of hydrogen from most other sources. Even an element as heavy as sulfur has been shown to have an S^{34}-to-S^{32} ratio varying by up to 7%.

Isotopic Composition of Elements.—In spite of such small variations in the constitution of the light elements and the variation in the composition of some others from special sources, the isotopic composition of the great majority of the chemical elements is very constant. The table indicates the isotopic composition of the elements as they occur naturally, giving for each element the mass numbers of the isotopes and the percentage of the atoms of the normal element that consist of that particular isotope. Unless indicated, all the isotopes listed are stable.

It is seen by examination of the table that there are stable representatives of all mass numbers between 1 and 209 inclusive, except for mass numbers 5 and 8. There are no stable isotopes of any element with these mass numbers. Elements of even atomic number have many more stable isotopes than those of odd atomic number. These latter never have more than two, almost always of odd mass number, whereas the even-atomic-numbered elements, except beryllium, have at least two isotopes and tin ($Z=50$) has ten.

The 85 naturally occurring chemical elements are made up principally of 287 isotopes, 271 of which are stable. The other 16 isotopes are radioactive with half lives comparable to the age of the earth ($\sim4.5\times10^9$ years) or longer. All the stable isotopes that are known occur in the chemical elements as we know them and in amounts that represent significant percentages of their respective elements.

An important theoretical interest in the isotopic composition of the elements arises from this being one of the few quantitative evidences available of the process by which all nuclei were originally formed. The relative cosmical abundances of nuclides differing in proton content (Z) have obviously been badly distorted by chemical and physical processes occurring during geological time. Compared with this, the isotopic composition of the elements is very constant. Any theory of the formation of complex nuclei must consider regularities such as the preponderance of neutron-rich isotopes in the heavy elements, the frequent preponderance of light isotopes among the light elements and the generally low abundances of odd-mass-numbered isotopes of even-numbered elements.

Relationship of Chemical Atomic Weights to the Existence of Isotopes.—The chemical atomic weight of an element is defined as the weight of a standard number of atoms of the element on a scale where the weight of the same number of oxygen atoms is 15.9994. (If this standard number of atoms is taken as Avogadro's number—$[6.02486\pm0.00016]\times10^{23}$ atoms—the actual weight in grams is the gram atomic weight.) These weights are of great practical value in chemical analysis. As mentioned above, because of the existence of the phenomenon of isotopy, they have lost their fundamental interpretation as accurate measures of the masses of individual atoms. Thus there is no chlorine atom that has a mass on the atomic weight scale of 35.453 (the listed chemical atomic weight of chlorine); instead normal chlorine consists of atoms that have a mass of either 34.96905 or 36.96733.

The existence of isotopes and the known or expected small fractionation of isotopes in chemical and physical processes set limits to the accuracy to which atomic weights have meaning, unless the exact isotopic composition is specified. It was pointed out by H. C. Urey and L. J. Greiff in 1935 that this limit had probably already been reached in the case of several light elements whose atomic weights were being quoted to a thousandth of an atomic weight unit. Even the standard element oxygen could be expected to show a variation in atomic weight in the fourth decimal place as a result of variations in isotopic composition.

Naturally Occurring Radioactive Isotopes.—Radioactivity occurring in nature arises from several sources. Thus there are the long-lived radioactive species (half lives greater than a few hundred million years) that have survived since the formation of the elements. The naturally occurring isotopes of thorium and uranium are of this type. Likewise potassium, rubidium and several other elements are slightly radioactive because of the presence of long-lived radioactive isotopes (*see* Table). Next there are the shorter-lived radioactive isotopes that are present because their disappearance by decay is balanced by continual replenishment from some source. Thus some of the isotopes of thallium, lead, bismuth, thorium and uranium and all the isotopes of the other elements between bismuth and uranium are radioactive and present in small amounts because they are being continually produced in the radioactive decay of very long-lived parents (isotopes of uranium and thorium). The most famous example of this type is an isotope of radium (Ra^{226}) that is present in uranium ores to the extent of 3.4×10^{-7} g. per gram of uranium.

Cosmic radiation incident on the earth's atmosphere is another such producer of slight amounts of radioactive isotopes. This, for example, is the source of the minute amounts of a radioactive isotope of carbon, C^{14}, that is present in all living tissue to the extent of about 12 disintegrations per minute per gram of carbon. The half life of this carbon isotope is about 5,570 years. W. F. Libby developed the radiocarbon method of age determination of archaeological and geological specimens, useful in the range from 1,000 to 30,000 years, from the presence of this cosmic-ray-produced C^{14}. (*See* also RADIOCARBON DATING.)

These and other less important sources make most matter very slightly radioactive. In addition to these natural sources, the use of nuclear energy is producing, as by-products, radioactive isotopes that may become significant supplements to the natural radioactivity of the surface of the earth. Thus the explosion of megaton nuclear devices scattered sufficient radioactive debris all over the world so that all humans absorbed detectable amounts of the radioactive nuclides Cs^{137} and Sr^{90}.

Radioactive Isotopes.—Radioactive as well as stable isotopes of all the elements have been prepared. By mid-20th century there was information on more than 1,100 radioactive nuclides, and the list was still expanding. Most of the radioactive nuclides are prepared by artificially induced nuclear transformations (*see* RADIOACTIVITY). The elements technetium ($Z=43$) and promethium ($Z=61$) and all the elements with atomic number greater than that of bismuth ($Z=83$) have only radioactive isotopes.

In the case of xenon, besides the 9 stable isotopes there are 20 known radioactive species with half lives ranging from about 1 second to about 35 days. Six of these are nuclear isomers. At the other extreme, hydrogen has only three known isotopes, two stable and one radioactive; one of the isotopes, tritium, occurs

Isotopic Composition of the Elements as They Occur in Nature

Chemical element	Atomic number (Z)	Chemical symbol	Mass number (A)	Isotopic composition (per cent of atoms)
Hydrogen*	1	H	1	99.986
		D	2	0.014
Helium†	2	He	3	0.00013
			4	100.
Lithium*	3	Li	6	7.42
			7	92.59
Beryllium	4	Be	9	100.
Boron*	5	B	10	18.7
			11	81.3
Carbon*	6	C	12	98.89
			13	1.11
Nitrogen*	7	N	14	99.63
			15	0.37
Oxygen*	8	O	16	99.759
			17	0.037
			18	0.204
Fluorine	9	F	19	100.
Neon*	10	Ne	20	90.92
			21	0.257
			22	8.82
Sodium	11	Na	23	100.
Magnesium	12	Mg	24	78.60
			25	10.11
			26	11.29
Aluminum	13	Al	27	100.
Silicon*	14	Si	28	92.17
			29	4.71
			30	3.12
Phosphorus	15	P	31	100.
Sulfur*	16	S	32	95.018
			33	0.750
			34	4.215
			36	0.017
Chlorine	17	Cl	35	75.53
			37	24.47
Argon†	18	Ar	36	0.337
			38	0.063
			40	99.600
Potassium*	19	K	39	93.08
			40‡	0.0119
			41	6.91
Calcium	20	Ca	40	96.97
			42	0.64
			43	0.145
			44	2.06
			46	0.0033
			48	0.185
Scandium	21	Sc	45	100.
Titanium	22	Ti	46	7.99
			47	7.32
			48	73.99
			49	5.46
			50	5.25
Vanadium	23	V	50‡	0.25
			51	99.75
Chromium	24	Cr	50	4.31
			52	83.76
			53	9.55
			54	2.38
Manganese	25	Mn	55	100.
Iron	26	Fe	54	5.84
			56	91.68
			57	2.17
			58	0.31
Cobalt	27	Co	59	100.
Nickel	28	Ni	58	67.76
			60	26.16
			61	1.25
			62	3.66
			64	1.16
Copper	29	Cu	63	69.1
			65	30.9
Zinc	30	Zn	64	48.89
			66	27.81
			67	4.11
			68	18.56
			70	0.62
Gallium	31	Ga	69	60.2
			71	39.8
Germanium	32	Ge	70	20.55
			72	27.37
			73	7.67
			74	36.74
			76	7.67
Arsenic	33	As	75	100.
Selenium	34	Se	74	0.87
			76	9.02
			77	7.58
			78	23.52
			80	49.82
			82	9.19
Bromine	35	Br	79	50.52
			81	49.48
Krypton	36	Kr	78	0.354
			80	2.27
			82	11.56
			83	11.55
			84	56.90
			86	17.37
Rubidium	37	Rb	85	72.15
			87‡	27.85
Strontium	38	Sr	84	0.56
			86	9.86
			87	7.02
			88	82.56
Yttrium	39	Y	89	100.
Zirconium	40	Zr	90	51.46
			91	11.23
			92	17.11
			94	17.40
			96	2.80
Niobium	41	Nb	93	100.
Molybdenum	42	Mo	92	15.86
			94	9.12
			95	15.70
			96	16.50
			97	9.45
			98	23.75
			100	9.62
Technetium	43	Tc	...	...
Ruthenium	44	Ru	96	5.57
			98	1.91
			99	12.7
			100	12.7
			101	17.0
			102	31.5
			104	18.5
Rhodium	45	Rh	103	100.
Palladium	46	Pd	102	0.96
			104	10.97
			105	22.2
			106	27.3
			108	26.7
			110	11.8
Silver	47	Ag	107	51.35
			109	48.65
Cadmium	48	Cd	106	1.22
			108	0.88
			110	12.39
			111	12.75
			112	24.07
			113	12.26
			114	28.86
			116	7.58
Indium	49	In	113	4.23
			115‡	95.77
Tin	50	Sn	112	0.95
			114	0.65
			115	0.34
			116	14.24
			117	7.57
			118	24.01
			119	8.58
			120	32.97
			122	4.71
			124	5.98
Antimony	51	Sb	121	57.25
			123	42.75
Tellurium	52	Te	120	0.089
			122	2.46
			123	0.87
			124	4.61
			125	6.99
			126	18.71
			128	31.79
			130	34.49
Iodine	53	I	127	100.
Xenon	54	Xe	124	0.096
			126	0.090
			128	1.919
			129	26.44
			130	4.08
			131	21.18
			132	26.89
			134	10.44
			136	8.87
Cesium	55	Cs	133	100.
Barium	56	Ba	130	0.101
			132	0.097
			134	2.42
			135	6.59
			136	7.81
			137	11.32
			138	71.66
Lanthanum	57	La	138‡	0.089
			139	99.911
Cerium	58	Ce	136	0.193
			138	0.250
			140	88.48
			142‡	11.07
Praseodymium	59	Pr	141	100.
Neodymium	60	Nd	142	27.13
			143	12.20
			144‡	23.87
			145	8.29
			146	17.18
			148	5.72
			150	5.60
Promethium	61	Pm	...	...
Samarium	62	Sm	144	3.16
			147‡	15.07
			148	11.27
			149	13.82
			150	7.47
			152	26.63
			154	22.53
Europium	63	Eu	151	47.77
			153	52.23
Gadolinium	64	Gd	152	0.20
			154	2.15
			155	14.7
			156	20.47
			157	15.68
			158	24.9
			160	21.9
Terbium	65	Tb	159	100.
Dysprosium	66	Dy	156	0.0524
			158	0.0902
			160	2.294
			161	18.88
			162	25.53
			163	24.97
			164	28.18
Holmium	67	Ho	165	100.
Erbium	68	Er	162	0.136
			164	1.56
			166	33.41
			167	22.94
			168	27.07
			170	14.88
Thulium	69	Tm	169	100.
Ytterbium	70	Yb	168	0.140
			170	3.03
			171	14.31
			172	21.82
			173	16.13
			174	31.84
			176	12.73
Lutetium	71	Lu	175	97.40
			176‡	2.60
Hafnium	72	Hf	174	0.163
			176	5.21
			177	18.56
			178	27.1
			179	13.75
			180	35.22
Tantalum	73	Ta	180	0.0123
			181	99.9877
Tungsten	74	W	180	0.135
			182	26.4
			183	14.4
			184	30.6
			186	28.4
Rbenium	75	Re	185	37.07
			187‡	62.93
Osmium	76	Os	184	0.018
			186	1.59
			187	1.64
			188	13.3
			189	16.1
			190	26.4
			192	41.0
Iridium	77	Ir	191	38.5
			193	61.5
Platinum	78	Pt	190‡	0.0127
			192‡	0.78
			194	32.9
			195	33.8
			196	25.2
			198	7.19
Gold	79	Au	197	100.
Mercury	80	Hg	196	0.146
			198	10.02
			199	16.84
			200	23.13
			201	13.22
			202	29.80
			204	6.85
Thallium	81	Tl	203	29.50
			205	70.50
Lead†	82	Pb	204	1.40
			206	25.1
			207	21.7
			208	52.3
Bismuth	83	Bi	209	100.
Thorium	90	Th	232‡	100.
Uranium	92	U	234‡	0.0056
			235‡	0.720
			238‡	99.276

*Isotopic composition varies slightly with source.
†Isotopic composition varies considerably with source.
‡Isotope radioactive.
Source: This table has been taken almost entirely from D. Strominger, J. M. Hollander and G. T. Seaborg, "Table of Isotopes," *Rev. Mod. Phys.*, 30:585, no. 2, part ii of 2 parts (April 1958).

naturally, however, in only minute amounts (*see* HYDROGEN).

Effect of Isotopic Substitution on Physical Properties of Substances.—The rather belated discovery of isotopes as well as the difficulty of separation is of course a reflection of the smallness of the effect of mass on most physical and chemical properties. For example, the electronic energy states of atoms or molecules depend on the nuclear mass through the reduced mass, μ, of the electron-nucleus system; μ is defined by

$$\mu = \frac{m_e m_n}{m_e + m_n} \approx m_e\left(1 - \frac{1}{1837A}\right)$$

where m_e and m_n are the electronic and nuclear masses and A is the mass number of the nucleus. It is seen that such effects are of the order of 5×10^{-4} for hydrogen and correspondingly smaller for heavier atoms. In the case of hydrogen, however, the shift in electronic energy levels in going from protium to deuterium is easily detected spectroscopically, and was in fact the mode of discovery of deuterium by Urey, F. G. Brickwedde and G. M. Murphy in 1931.

The other consequence of the presence of isotopes on the optical spectra of atoms arises from the interaction of the magnetic field of the nucleus, if it has one, on the electrons of the atomic system. The result is a splitting of a spectral line into several components (called the hyperfine structure). The number of components and the separations depend upon the spin and magnetic moment of the nucleus and on the nature of the electronic state. Since this phenomenon depends on nuclear properties it varies from isotope to isotope. It is most important for heavy elements, but even there it is difficult to measure. Analysis of hyperfine structure is an important method of determining nuclear spins and magnetic moments.

Molecular spectra are much more affected than are atomic spectra by the presence of isotopes, for these spectra reflect in part the vibrational and rotational energies of molecules. The quanta of vibrational and rotational energies are directly dependent upon the masses of the atoms involved and therefore upon the presence of isotopes. It was by examination of molecular spectra that several isotopes (for example, C^{13}, N^{15}, O^{17}, O^{18} and Si^{30}) were discovered.

The presence of isotopes affects physical properties other than spectroscopic. There is, of course, the direct effect of mass on the density of a substance. Because densities can often be measured extremely precisely, a density determination has been used in special cases to establish isotopic composition.

Another direct effect of mass on physical properties is the effect on the rate of diffusion of gaseous atoms and molecules. It has long been known that the rate of effusion of a gas through a hole of size smaller than the distance between the gas molecules varies inversely as the square root of the mass. It was by taking advantage of this property that F. W. Aston first achieved a partial separation of the neon isotopes, and basically similar processes are used today.

In general, other physical properties of substances are significantly affected by the presence of isotopes only at low temperatures and in the case of molecules of low molecular weight. Accurate measurements, however, are continually detecting small differences in physical properties of substances related by isotopic substitution. For example, deuterium melts at 18.65° K. and boils at 23.6° K.; the corresponding temperatures for hydrogen are 13.95° K. and 20.38° K. Heavy water (D_2O) has a melting point 3.8° higher and a boiling point 1.4° higher than ordinary water.

Regarding the incompletely understood phenomenon of superconductivity at low temperatures, it is of interest that the temperature at which certain metals transform to the superconducting state is affected by the isotopic composition of the metal.

Effect of Isotopic Substitution on Chemical Properties.—It has usually been assumed that isotopes and substances differing only in the presence of different isotopes have the same chemistry. However, accurate studies, particularly with deuterium, have indicated that the chemistry of isotopes is identical only in the limit of large masses and high temperatures. Whenever quantum mechanical effects are important, and in general they are most important for light masses and low temperatures, the masses of the atoms involved can be expected to affect the situation and, thus, the result to be sensitive to the isotope involved. This can be illustrated by the following example: The forces between atoms are derived from the electric and electronic structures of the atoms. As indicated in the discussion on electronic states of atoms, these are essentially indistinguishable for different isotopes of the same element. The actual motion of the atoms produced by these forces, however, is affected by the atomic mass. In a given potential, the frequency of vibration and, therefore, the quantum of vibrational energy will vary inversely as the square root of the mass of the system. This affects not only the vibrational spectrum but also means that the zero point energy, the lowest energy state of the system, will be lower for heavier isotopes.

In this way it is quite easy to calculate quantitatively that the energy needed to dissociate the gaseous D_2 molecules into atoms at absolute zero will be 1.81 kg.cal./mole ($\sim 2\%$) higher than that needed to dissociate the H_2 molecule. With elements heavier than hydrogen this effect becomes successively smaller. It remains always true, however, that, because of the lower zero point energy, more energy is required to break a chemical bond involving a heavier isotope than to break a bond involving a lighter one.

Using quantum mechanics to estimate the effects of mass, equilibrium constants can be calculated by statistical methods for so-called exchange reactions. These are chemical reactions in which the reactants and products differ only in the exchange of isotopes. For example, the reaction

$$CO_2^{18} + 2H_2O^{16} \rightleftarrows CO_2^{16} + 2H_2O^{18}$$

has an equilibrium constant given by

$$K = \frac{P_{(CO_2^{18})} \times P_{(H_2O^{16})}}{P_{(CO_2^{16})} \times P_{(H_2O^{18})}}$$

where $P_{(CO_2^{18})}$ designates the pressure exerted by CO_2^{18} at equilibrium, $P_{(H_2O^{16})}$ that of H_2O^{16}, etc.

The value of the equilibrium constant was calculated by Urey and Greiff in 1935 to be 1.128 at 0° C. and 1.110 at 25° C. It is seen that carbon dioxide in equilibrium with water will contain oxygen with slightly higher O^{18} content than does the water. It is also seen that at higher temperatures the oxygen in the carbon dioxide and in the water tend toward more equal isotopic compositions.

Predictions such as the above have been verified experimentally. Likewise it has been demonstrated that the rates of chemical reaction are affected measurably by isotopic substitutions. In general, the effects are greatest for the lightest elements and decrease with increasing temperature. Thus chemical reaction rates involving deuterium compounds may be up to several times slower than those involving the corresponding hydrogen compounds. This effect has been extensively used to investigate the mechanism of reactions that may involve transfer of hydrogen atoms. In view of the measurable effects of isotopes on both chemical equilibriums and the rates of chemical reactions, it is not surprising that the isotopic composition of the lighter elements in nature shows a definite variation from source to source.

Separation of Isotopes.—This term is generally taken to mean the production of an element with an isotopic composition significantly different from that of the natural element. In the extreme, such a process produces a relatively pure isotope. For most purposes, however, such as chemical or biological tagging experiments, complete separation is not necessary.

It has been mentioned that Aston first attempted to confirm Thomson's discovery of isotopes in neon by trying to separate them. He allowed part of a sample of normal neon to diffuse at low pressure through clay pipes and repeated the process many times on the fractions obtained. He reported in 1913 that in this way he had been able to change the atomic weight of neon by almost 0.5%. Subsequent attempts by many persons using many different methods on different elements did not produce significantly greater separations. Finally, G. Hertz, in 1932, used the same basic methods as had Aston originally but arranged the diffusing

units in a cascade (*see* below). He produced neon with the heavier isotope, Ne^{22}, more than twice as abundant as the lighter one, Ne^{20}. In normal neon, Ne^{22} has an abundance of only 10%. Since these pioneer achievements, isotope separations by various methods have become increasingly common. Today small samples of almost any element with distorted isotopic abundances are available for research purposes. A few isotopes, *e.g.*, D and U^{235}, are separated on a large scale as a part of nuclear energy programs.

In almost all the methods used for separating isotopes a basic step is repeated many times to achieve the desired extent of separation. A process is judged by two factors that have different relative importance in different situations. One is the separation factor per stage (f). This is defined as the ratio of the relative concentration of a given isotope after the basic step in the concentrated fraction to that in the stripped fraction. The latter is ordinarily indistinguishable from the original concentration entering the unit. Thus if the normal isotopic composition of an element is n_1 and n_2, and if, after one stage of the process, it becomes n_1' and n_2', then

$$f = \frac{(n_1'/n_2')}{(n_1/n_2)}$$

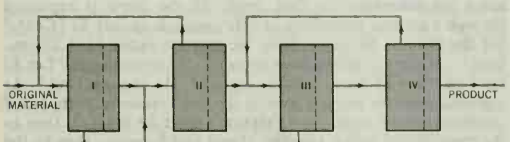
The second important factor is the amount of material processed per stage. In general, processes operating with good separation factors produce only small amounts of material and vice versa.

In order to achieve desired over-all separations with processes of low separation factors, many repetitions of the basic stage are necessary. For example, to get 90% U^{235} starting with normal uranium and a process with a separation factor of 1.0043 (a high one for a diffusion process), 1,660 stages are necessary.

Such large numbers of stages can be used only if they are arranged in a manner that does not waste material. Such an arrangement is the cascade used by Hertz in 1932 and thereafter in most of the large-scale separation methods. A cascade arrangement of four stages is illustrated in the drawing. The boxes I, II, III and IV represent units. Into one of them (*e.g.*, III) goes a certain amount of feed material from the left. As a result of the operation of the unit, a small fraction of this feed material comes out of the unit toward the right, concentrated in the isotope in question. It forms the feed material for unit IV. The great majority of the feed material for unit III is slightly depleted in the isotope and is returned to become part of the feed material for the unit II. As a result of the operation of the cascade, the material coming out at the right from unit IV is concentrated in one isotope; the material being rejected by unit I is depleted in the isotope. The theory of such cascades is similar to that of multiplate distillation columns and countercurrent solvent extractions.

Historically, of course, a unit in which a gas was diffused through small pores of a solid was the first type used in such a cascade (Hertz). Diffusion units are also used in the large-scale production of U^{235} in the United States. The gas employed is uranium hexafluoride. Diffusion processes, in spite of low separation factors, can be designed to handle large amounts of material and are susceptible to engineering for continuous automatic operation.

At the other extreme of separation factors is the electromagnetic separation process, which can produce small amounts of very enriched isotopes in one step. These units are simple mass spectrographs designed to collect the mass-analyzed beams instead of merely recording their presence. Large numbers of such units (called calutrons) were used in the United States in World War II together with the diffusion process to produce the U^{235} for nuclear bombs. In general, large-scale operations appear to be more



CASCADE ARRANGEMENT OF FOUR STAGES FOR SEPARATING ISOTOPES

economical with the diffusion process. On the other hand, the electromagnetic process is more versatile. It was used both in the United States and Europe to produce milligram quantities of almost any element with a distorted isotopic composition.

For the isotopes of hydrogen (deuterium and tritium) electrolysis of water solutions proved an effective way of separating isotopes. The liquid remaining after most of the water of, for example, an NaOH solution has been electrolyzed is concentrated in the heavier isotope. This water can be distilled away from the NaOH and made into a fresh NaOH solution and the process repeated. The separation factors in such a process depend upon the electrodes used and can be as high as seven. This, of course, is much higher than is ever encountered with other elements. The electrolytic process was used in Norway from the middle 1930s for the production of ton quantities of heavy water (D_2O). Libby used electrolytic concentration in his measurements of the tritium content of rains.

The chemical exchange method is another that often uses multistage cascades to increase the effect of a small separation factor per stage. Thus Urey made use of the exchange reaction

$$HC^{13}N(\text{gas}) + NaC^{12}N(\text{solution}) \rightleftarrows HC^{12}N(\text{gas}) + NaC^{13}N(\text{solution})$$

which has an equilibrium constant a little less than unity in a process that produces carbon with more than 20% C^{13} (instead of the normal 1.1%). Similar schemes were devised by Urey and co-workers to produce nitrogen and sulfur samples enriched in N^{15} and S^{34}. During World War II catalysts were found that would achieve equilibrium in the exchange reaction

$$H_2(\text{gas}) + D_2O(\text{gas}) \rightleftarrows D_2(\text{gas}) + H_2O(\text{gas})$$

The reaction has an equilibrium constant of about three. This exchange reaction process as well as the straight separation of D_2O from H_2O by distillation are much more economical in most places than the electrolytic process. They have been used to produce the ton quantities of D_2O needed for nuclear reactors.

In addition to the methods described, which have been used in relatively large-scale separations, isotope separations have been achieved using centrifugation and thermal diffusion (diffusion of gases in the presence of a thermal gradient).

Uses of Isotopes.—The uses of isotopes can be divided roughly into two categories. In one, application is made of some particular nuclear property of the isotope—either its radiations upon decomposition or some nuclear reaction probability. Since such uses do not depend upon the principle of isotopy, they will not be discussed in detail here.

The other class of application of isotopes depends on the fact that, to a very good approximation in most cases, all isotopes of an element have the same chemical properties. This makes it possible to label or tag an element by distorting its isotopic composition. The distortion is accomplished by the addition either of a radioactive isotope or of one of the stable isotopes of the element. The behaviour of this element can then be followed either by measurement of the radioactivity or by analysis with a mass spectrometer. The isotope added is often referred to as a tracer or indicator. The use of labeled atoms in this manner was introduced by G. von Hevesy and F. A. Paneth in 1913. They used a radioactive isotope of lead (radium D or Pb^{210}) to study the solubility of lead salts. Since then, with the availability of radioactive or stable isotopes as tracers for almost all the elements, the use of labeled elements for many chemical, biological and industrial purposes has become widespread.

A type of investigation made possible by the availability of isotopes is that of exchange reactions. In these there is no change in either the type or number of chemical species involved. Studies on the equilibriums and rates of such reactions are important not only for the separation of isotopes but also as a means of understanding chemical reactions in general and as a prelude to other applications of isotopes.

Isotopes have found extensive application in chemical analysis. An example is the isotope dilution method, used in many variations with both stable and radioactive isotopes. All the variations have in common the feature that the chemical separation procedures

used do not have to be quantitative in order to provide quantitative answers. Thus to analyze for an element A in a mixture, a known amount of a tracer for A is added at the start. A chemical separation of A is carried out, yielding A in a chemically pure form. The fraction of the added tracer recovered measures the efficiency of the process. This, together with the absolute amount of A recovered, as measured either by weighing or by other conventional means, determines the total amount of A present in the original mixture.

A second analytical application, often called activation analysis, involves nuclear reactions and actually analyzes for particular isotopes. If these are present in a normal element the result is an analysis for the element. Thus the production of a radioactive isotope of an element upon exposure of a sample to slow neutrons measures the amount of isotope of one lower mass number present in the sample. The method can be calibrated by exposing a known amount of the element to the same neutrons and measuring the production of the radioactivity involved.

A third analytical application of isotopes and particularly of radioactive ones arises from the sensitivity of detection instruments used in isotopic analysis. An activity of 100 disintegrations per minute (easily measured) of an isotope with a one-day half life corresponds to about 200,000 atoms. Several of the transuranium elements have been discovered through their radioactive properties and the complete experiments involved less than 100 atoms. More generally, the behaviour of elements at very low concentrations can be studied using radioactive isotopes. Also, starting with larger amounts of radioactivity, the occurrence of very improbable reactions can be detected.

Specific applications of the above and other techniques of tracer application are too numerous to cover in detail here. It is true, however, that isotopes, both stable and radioactive, play an indispensable role in research on photosynthesis. Another area that might be singled out is the study of the animal metabolism of different types of food. It was established through the use of tracers that there is a continual exchange between almost all injected substances and those present in the animal body. Even portions of bones and teeth are accessible to exchange with injected calcium and fluorine.

In medicine the principal applications of isotopes involve the radioactive ones. The use of radium in the treatment of cancer has a long history. Later other radionuclides became available in sufficient quantity and were also used for the same purpose. Probably the outstanding example of the application in medicine of a radioactive isotope is the use of 8.0-day I^{131} in the diagnosis and treatment of thyroid ailments.

The industrial applications of isotopes began in the 1950s. An accomplished development was the use of gamma-emitting radioactive isotopes such as radium or Co^{60} instead of an X-ray machine for the radiography of metal castings. Such sources have the advantage of compactness and ruggedness, which often make them preferable to electric machines. The convenience of radioactive isotopes in furnishing high-energy radiations in a small space has found application in several other situations. Thus the ionization of air produced by these radiations is used to prevent the accumulation of undesirable static electric charges. Similarly the scattering of these radiations by thin films, being a sensitive function of the thickness of the film, is used widely in thickness gauges.

Isotopes of Importance in Nuclear Energy Programs.—The development of nuclear energy for both weapons and power has often depended upon the characteristics of individual isotopes rather than that of the natural mixture occurring in elements. Thus U^{235} is the only isotope in natural uranium (in fact the only naturally occurring nuclide) that can support a chain reaction. In concentrated form (*i.e.*, separated from its diluent U^{238}) it can support a fast neutron chain reaction and therefore can be used for nuclear explosives. In its ordinary dilution it can be used to support a slow neutron (thermal) chain reaction. The extra neutrons in a chain-reacting pile can then be used either to make plutonium (Pu^{239}) from U^{238} or U^{233} from Th^{232}. Both Pu^{239} and U^{233} have fissionability characteristics comparable with those of U^{235} and so are usable either in weapons or as the basis for controlled release of nuclear energy.

In addition to these heavy nuclides, there are several isotopes of the light elements that are of importance in nuclear energy developments. They are useful either as moderators (to slow down neutrons) in uranium chain-reacting piles or as direct sources of nuclear energy. In the former category helium and carbon (in the form of graphite), and hydrogen, deuterium and oxygen (in the forms of light and heavy water) were the first to be used. In the second category, the large-scale conversion of D^2 into He^4 was first accomplished by the U.S. in Nov. 1952 in a hydrogen bomb explosion on a Pacific atoll. The next step was to achieve the controlled release of such thermonuclear energy.

Nuclear Isomers.—Nuclear isomers are nuclei which have the same charge (Z) and mass number (A) but represent different energy states. Atoms differing because of the presence of nuclear isomers as their nuclei are isobaric isotopes. One of two nuclear isomers must be unstable with respect to de-excitation. Although the existence of any excited state is in a sense an example of nuclear isomerism, the term is ordinarily applied only to cases where the excited state has a measurable half life for decomposition (greater than about 10^{-10} seconds). Such nuclei are called metastable and are usually designated by an asterisk (*) or an *m* after the mass number. Thus Br^{80*} and Br^{80} represent a pair of nuclear isomers. Br^{80*} decays to Br^{80} with a 4.5-hour half life.

The first case of nuclear isomerism was discovered by O. Hahn in 1921. He found two nuclear species having distinctive radioactive properties that had to be assigned the nuclear constitution expressed by Pa^{234}. By mid-20th century there were more than 160 pairs of nuclear isomers known, as well as a few cases of triple isomerism. Since nuclear isomers have the same charge and differ in mass by less than a few thousandths of a mass unit (isotopes differ from each other by at least one mass unit), it is unlikely that atoms differing only in the presence of nuclear isomers as their nuclei will have detectable differences in chemical or physical properties.

See also references under "Isotope" in the Index.

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ISPARTA, a town and capital of the *il* (province) of the same name in the southwestern corner of inner Anatolia, Turkey, lies on the edge of a fertile plain at the foot of the Aglasundag, 110 mi. W. of Konya. Pop. (1960) 36,201. It is an important centre for rose oil, of which the province is the leading producer in Turkey. The local animal husbandry has assisted the growth of rugmaking, the important home industry. The rugs, which have a wide reputation, are made chiefly by women and girls. The town has many woolen-yarn workshops including a large state-owned mill. It is connected by rail and road with Izmir, Afyonkarahisar and Egridir. On the site of the Byzantine town of Baris, Isparta was the capital of the amirate of Hamid in the 14th century. It suffered severely from earthquake in 1889.

ISPARTA IL is 3,193 sq.mi. in extent and had a population (1960) of 242,352. The chief food crops are wheat, barley and vegetables, and much fruit, especially cherries, is grown on the plain. There is inland drainage to the Egridir and Burdur lakes.

(N. TU.; S. ER.; E. TU.)

ISRAEL, in the Bible, is the name given to the patriarch Jacob (*q.v.*) as a surname (Gen. xxxii, 28) and to the people reckoned as his descendants. The etymology and meaning of the name are uncertain; in Gen. xxxii, 28 the name is explained through a popular etymology as "He contends against El [God]," but the form of the name, *yisra 'el*, suggests rather "Let El contend." Modern scholars have proposed the etymologies "Let El rule" and "Let El shine." Philo suggested "He who sees God." As a gentilic noun the name is given in the Old Testament to the tribal confederation of Israel (*see* TWELVE TRIBES OF ISRAEL), then to the monarchical nation ruled by David and Solomon, then to the northern portion of the divided kingdom which seceded *c.* 920 B.C. from the dynasty of David. The prevailing biblical use of the name, however, signifies a theological rather than a political con-

ception. In all periods of the Bible Israel was conceived as a theologically based society, never as a purely secular tribal or political society. This can be seen in the transfer of the title Israel to the kingdom of Judah after the fall of the kingdom of Israel *c.* 721 B.C.; for Judah was the heir and successor of the theological character of Israel, although its name as a political society remained Judah.

The theological character of Israel rests upon the relations between Israel and the God of Israel, Yahweh (*q.v.*). These relations were understood in a manner to which no true parallel appears in the thought of the ancient near east. The numerous biblical allusions which identify Yahweh as the God of Israel and Israel as the people of Yahweh are, of course, superficially no different from similar phrases to be found elsewhere in ancient near-eastern literature. The bond of union between Israel and Yahweh, however, is represented as election and covenant. The election is the antecedent and gratuitous choice by Yahweh of Israel to be his people (Isa. xli, 8–9). Yahweh is the God who was worshiped by the patriarchs, the ancestors of Israel, but in the traditions of the patriarchs he is a family god, not the god of a people. The act by which Yahweh makes Israel his people is also conceived as a creative act by which he brings Israel into existence (Isa. xliii, 15). Israel is the adopted first-born son of Yahweh (Ex. iv, 22).

The acceptance of the choice by Israel furnishes the terms of the mutual agreement or covenant by which Yahweh and Israel are united (Ex. xix, 1–8; *see* also COVENANT: *In Religion*). This agreement is more accurately described as unilateral rather than as mutual; it is conceived in terms of ancient near-eastern treaties in which an overlord imposes a covenant upon a vassal. While Israel freely accepts Yahweh as its god, it has no choice in the sense that it makes no difference whether it accepts Yahweh or not. Yahweh vindicates his claims upon Israel by delivering Israel from the bondage of Egypt. This deliverance entitles him to be called king and saviour of Israel (Isa. xliv, 6). A person is not entirely free to accept or to reject his creator, his saviour, his father. This becomes clear progressively as the people come to accept the faith that Yahweh is the one true God, the creator of the universe. The theme of power also is present, and Israel is the servant or slave of Yahweh (Isa. xli, 8–9). The title of slave in this context is not pejorative; it is given both in the Bible and in other ancient near-eastern literature to those officers who were most intimately associated with the king in government and in his household. To be a royal slave was a dignity, not a degradation. By the covenant Israel accepts Yahweh as its exclusive and sole god and pledges itself to worship no other god (Ex. xx, 2–3; Deut. v, 6–7). It acquires a sacred character and becomes holy to Yahweh, as a priest is holy among men (Ex. xix, 6; Jer. ii, 3).

In the literature of the Old Testament which is later than the fall of the kingdom of Israel (*c.* 721 B.C.) the title of Israel is used almost exclusively in a theological sense. The theological Israel becomes an ideal; and as an ideal it is the whole Israel of the 12 tribes. The messianic restoration of Israel includes all the 12 tribes of historic Israel (Jer. xxxi). In exilic and postexilic literature (after 587 B.C.) the name of the community as a real society is Judah, and its members are Judahites (Jews). This is the usual designation employed by Jews themselves when dealing with foreigners and by foreigners of Jews. The term Israel appears only within the community and then only in its ideal theological sense. In the literature of Hellenistic Judaism outside Palestine the term is rare in any sense.

The use of the title Israel in the New Testament reflects the usage of Judaism with modifications arising from the relations of the new faith to the faith of its origin. In the Synoptic Gospels and Acts i–xii the title is used of the people as a religious society. In other New Testament writings the schism between the primitive church and Judaism is reflected in the use of the terms Israel and Jews. "Jews" becomes the ordinary designation of the people even as a religious community. In Rom. ix–x the question becomes explicit whether the Jews after rejecting the Messiah Jesus are entitled to be called the people of God and therefore whether they are entitled to the name Israel. Paul distinguishes the Israelite by blood (Rom. ix, 6) or by the flesh alone (I Cor. x, 18). It is somewhat surprising that the New Testament writers do not explicitly claim for the Christian community the title of the new true Israel. The idea is approached in Gal. vi, 16, "the Israel of God"; but the force of the phrase is not altogether clear. The ideal Israel of the messianic restoration is retained in the New Testament. It is explicit in Rev. vii, 4–8 and xxi, 12 and is suggested in Matt. xix, 28 and Luke xxii, 30, where the apostles "judge" (*i.e.*, rule) the 12 tribes of Israel. The eschatological church and the eschatological Israel become one.

The political title is revived in its application to the Jewish state established in the British mandate of Palestine in 1948. The claims of the new state both to the title and to the territory are (at least for the Orthodox) implicitly theological as much as they are political. They rest not upon continuous occupation but upon a historic grant in virtue of which the sons of Israel settled in Canaan. The grant as described in Israelite traditions was not a grant from a political sovereign but from Yahweh, the God of Israel, who gave Canaan to his people for a possession.

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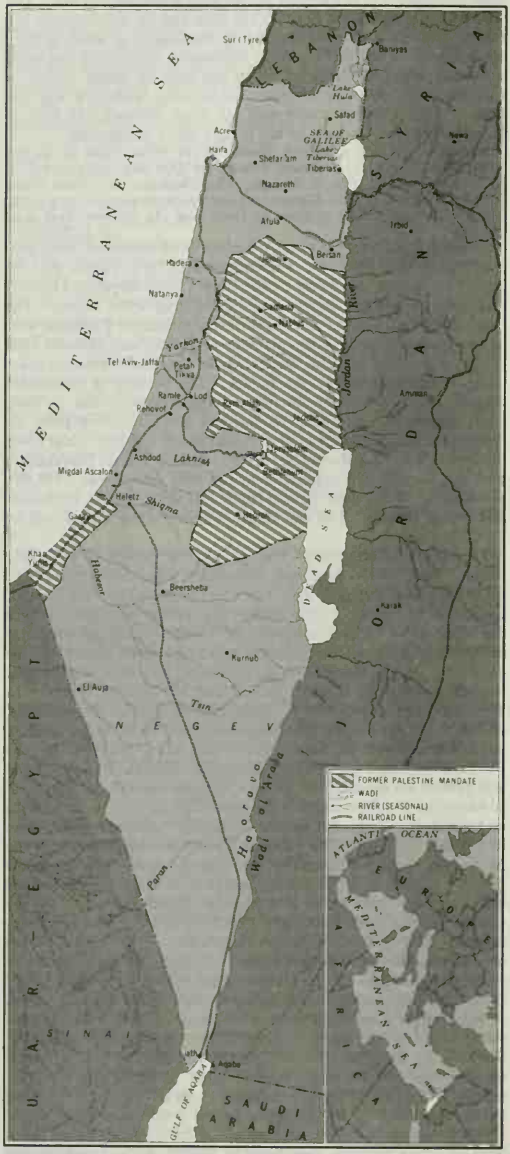
ISRAEL (MEDINAT ISRAEL), a republic of southwest Asia, proclaimed on May 14, 1948, is bounded north by Lebanon, east by Syria and Jordan, southwest by the United Arab Republic (Egypt) and west by the Mediterranean. Total area 7,993 sq.mi. The territory includes all the area of formerly mandated Palestine west of the Jordan except for the plateaus of Judaea and Samaria (annexed by Jordan) and the Gaza strip on the Mediterranean coast which is administered by the U.A.R. The country is subdivided administratively into six districts: Jerusalem, with the corridor from the coastal plain into the Judaean hills; Tel Aviv-Jaffa, including the southern part of the coastal plain; Central (chief town Ramle); Haifa; Northern (Nazareth); and Southern (Beersheba), with the Negev. The population at the 1961 census was 2,179,491 of whom 1,932,357 were Jews, 170,830 Muslims, 50,543 Christians and 24,282 Druzes. The seat of government is the Israeli part of Jerusalem (*q.v.*).

Physical Geography.—The geology of Israel is relatively simple. Most of the country is underlain by sedimentary rocks of Secondary and Tertiary age. In the coastal plain, the vale of Esdraelon and upper Jordan valley, Quaternary alluvium overlies the older rocks. The Secondary and Tertiary rocks are predominantly chalky or dolomitic limestones (laid down under marine conditions on the margins of the Arabian platform), which form the hill country of Galilee, Judaea and the central Negev. In Tertiary times folding arched up the hills along a north-south axis, and in the Negev along northeast-southwest axes, while faulting is responsible for the remarkable Rift valley occupied by the Jordan river, Dead sea and Gulf of Aqaba. The vales of Esdraelon and Jezreel are downfaulted along a northwest-southeast axis.

Along the Mediterranean is the coastal plain; it is narrow north of Acre and at Haifa, but widens southward in Sharon and Darom to a width of 20 mi. The vales of Esdraelon and Jezreel join the Acre plain to the Jordan valley, and like the coast plain are below 300 ft. Upper Galilee is the highest part of Israel, with rounded hills rising to 3,963 ft. at Har Meiron (Jabal Jarmaq). Lower Galilee lies between 1,000 and 2,000 ft., and its hills are more broken. The Galilean hills terminate eastward in a steep scarp overlooking the upper Jordan valley. A small portion of the limestone Judaean hills, the Jerusalem corridor, lies within Israel; between the Judaean hills and the coast plain is the foothill region of the Shefela (lowland) between 500 and 1,500 ft. The Jordan valley lies at 500 ft. above sea level at Dan on the northern border, but at Lake Tiberias (Sea of Galilee) the level is 696 ft. below sea level and the Dead sea surface 1,302 ft. below the Mediterranean. The Rift valley is continued south to the Gulf of Aqaba, but its floor rises to 500 ft. above sea level midway. The Negev (*q.v.*), or south, is clearly marked off by its aridity. Its northern limit is a line through Beersheba to Sodom. The northwestern Negev is a plain of sand dunes and stony desert. This rises gradu-

ally to the central Negev heights, at more than 3,000 ft.

The Jordan river rises north of the Israel-Lebanon and Israel-Syria borders. It flows through lakes Hula (Yam Hulata) and Galilee (Kinneret), enters Jordan south of Beisan (Beit-Shaan) and empties into the Dead sea. The inflow into the Dead sea is balanced by evaporation, thus accounting for the high salt concentration, eight times that of the average for the oceans. Other rivers in Israel are small and mostly seasonal (wadies), except for the Qishon, which enters the sea near Haifa, and the Yarkon (Auja), which enters at Tel Aviv. The Yarkon supplies water to Tel Aviv and Jerusalem and water is carried by pipeline to irrigate the northern Negev.



ISRAEL, SHOWING THE TERRITORY WHICH WAS FORMERLY A PART OF THE PALESTINE MANDATE

Climate.—Israel north of Beersheba has a Mediterranean climate, but the Negev is arid. The Negev lies south of the 8 in. annual isohyet; there cultivation is impossible without irrigation. In the plains rainfall decreases from 24 in. in the north to 16 in. at Ascalon (Ashkelon) and 10 in. near Beersheba. The Galilean hills receive up to 40 in. annually and Jerusalem 24 in. The Jordan valley is hotter and drier than the coastal region; the Dead sea has a rainfall of 2–4 in. The mild rainy season is from October to April with the maximum in December and January. Summers are dry and hot with midday temperatures of 29°–35° C. (85°–95° F.), but the coasts feel cooler with refreshing sea breezes. The Negev and Jordan valley have midday temperatures exceeding 38° C. (100° F.). On the coast mean midday maximums in winter vary between 15° and 18° C. (60°–65° F.), with minimum temperatures of between 7° and 10° C. (45°–50° F.). Occasional cold spells bring snow to the hills in most winters, but very rarely to the coast or Jordan valley. Hot spells in early summer are caused by dry winds (khamsin) from the Arabian desert or Sinai.

Vegetation.—The natural climax vegetation has largely vanished because of long cultivation and depredations of goats. The former oak forests of Sharon and Galilee are represented by isolated trees. Thin stands of Aleppo pine survive on Mt. Carmel, and there are some new forests of this tree in the Jerusalem corridor and near Nazareth. The hills are mainly covered with *maquis* and *garrigue* scrub. The coastal sand dunes and the Negev support only desert scrub. Most of the country north of Beersheba is under cultivation or hill grazing, and irrigated zones are green and fertile with citrus groves and fir, carob and eucalyptus plantations.

Animal Life.—Of the large wild animals once found in the country few survive; the most notable survivals are deer, wild boar, gazelle and ibex. Of the numerous species of birds the majority are migrants remaining for part of the year only. (C. G. Sm.)

History.—For the previous history, to the termination of the British mandate on May 14, 1948, *see* Palestine.

The New State.—Gen. Sir Alan Cunningham, the British high commissioner for Palestine, left the country on May 14, 1948, and on the same day the Jewish National council and the General Zionist council at Tel Aviv proclaimed the establishment of a Jewish state, to be called Israel, of which they would be the provisional government. David Ben-Gurion was appointed prime minister, and on May 16 Chaim Weizmann was elected president of the provisional council. The U.S. government immediately recognized the council as the *de facto* authority of the state, and *de jure* recognition by the U.S.S.R. followed on May 17. The five neighbouring Arab states—Egypt, Trans-Jordan (later renamed Hashemite Kingdom of Jordan), Iraq, Syria and Lebanon—announced that their armed forces would enter Palestine with the object of restoring order. The United Nations on May 20 appointed Count Folke Bernadotte af Wisborg as mediator, to bring about a settlement between Israel and the Arab states. The Arab forces occupied the areas in the south and east, which were not yet controlled by the Jews, and tried to blockade Jewish Jerusalem. The Arab legion of Trans-Jordan, despite a desperate defense by the Jews, obtained the surrender of the small Jewish quarter of the old (walled) city. The Jews, however, had won control of the section of the main road to Jerusalem in the Judaean hills and beat off all Arab attacks on their scattered settlements.

Count Bernadotte obtained a cease-fire of four weeks from June 11 and put forward proposals for settlement, which were rejected by both sides. The Arabs refused a prolongation of the cease-fire, and hostilities broke out again in July. The Jews gained lightning successes in nearly all sectors; they occupied Ramle and Lod, captured Nazareth and western Galilee (which had been allotted to the Arabs) and advanced their positions in the south. A second cease-fire was accepted on July 18. Count Bernadotte, assassinated in Jerusalem on Sept. 17 by Jewish terrorists, was succeeded as mediator by his deputy, Ralph Bunche of the UN secretariat. Despite the orders of the UN, the truce was not observed faithfully by either side, and by the early months of 1949 the Jews had occupied all the Negev up to the former Egypt-Palestine frontier, ex-

cept a strip of coast in the southwest corner between Gaza and Rafah, which remained in Egyptian possession.

The mediator secured separate armistice agreements between Israel and the Arab states (Egypt, Feb. 24, 1949; Lebanon, March 23; Trans-Jordan, April 3; Syria, July 20) and the Iraqi government withdrew its troops and transferred the areas occupied by them to Jordan. It was broadly agreed to fix a temporary frontier where the line had been at the beginning of the negotiations. Certain border areas were demilitarized, and the Jews secured adjustments in the western sector (so that the railway from Tel Aviv-Jaffa to Haifa was in their hands) and established a well-guarded corridor to Jerusalem. In Dec. 1948 the UN assembly appointed a three-member conciliation commission to promote a final settlement and to arrange an international regime for Jerusalem, but all its efforts were frustrated. By the armistice agreements, mixed commissions composed of Arabs and Jews, with a chairman from the UN staff, were established to deal with complaints of violation (*see* ARMISTICE). Israel was admitted to the UN on May 11, 1949.

Political Developments.—The provisional council of Israel organized elections in Jan. 1949 for a constituent assembly (*knesset*) of 120 members, elected by proportional representation, with the whole country treated as one constituency. Of the 12 parties represented, the largest were two wings of labour, divided on matters of foreign policy and the internal program: Mapai (Israel Workers), which won 46 seats, and Mapam (United Workers), more to the left, which won 19. The leader of Mapai, David Ben-Gurion, formed a coalition government with the Mapam, National Religious front and smaller centre parties.

The draft constitution was not discussed. It was decided to pass an interim organic law defining the legislative, executive and judicial powers and to let the constitution, insofar as it affected the rights of the individual, grow gradually. The *knesset* became a single-chamber parliament. The state was a republic. The president had the limited powers of a French president and appointed the prime minister after consultation with leaders of the parliamentary parties; the other members of the executive council (cabinet) were appointed on the prime minister's advice. The courts were independent of the executive and applied the law of mandated Palestine, which was largely English, subject to new legislation. Beside the civil courts, religious tribunals for Jews, Muslims and Christians had jurisdiction in personal status (which includes questions of marriage, alimony, divorce, succession and guardianship). Arabs had equal political rights and in 1956 and 1961 eight Arabs were members of the *knesset*. Nazareth, a predominantly Arab town, had an Arab municipality and an Arab magistrate.

Chaim Weizmann, the first president (elected in Feb. 1949), died in Nov. 1952. The second president was Isaac (Itzhak) Ben-Zvi (*q.v.*), a Mapai member of the *knesset* and a former president of the Jewish National council. He was re-elected for five years in 1957 and 1962. In the second assembly, elected in 1951, the General Zionists, a bourgeois party, gained seats at the expense of the extreme party of the left (Mapam) and of the right (Herut). The second coalition was largely composed of the same elements as the first, but after a year the General Zionists joined it. In Dec. 1953 Ben-Gurion retired into private life on a collective settlement in the Negev. Moshe Sharett, who was foreign minister, then took over the premiership in addition. Ben-Gurion returned as minister of defense in Feb. 1955, and after the third general election, held in July 1955, formed a coalition with four labour groups and the Progressives. In 1956 Sharett was forced to retire as foreign minister, and was replaced by Golda Meir (Myerson), then minister of labour. In the fourth general election, held in Nov. 1959, the position of Mapai, which had been the major party in every government, was strengthened, their representation being increased from 40 to 47 seats; Herut was the next strongest party with 17 seats. Ben-Gurion formed a coalition with Mapai as a nucleus and the same groupings as in the last cabinet. The government's program included regional disarmament and nonaggression pacts with Arab states, but nothing was accomplished.

The new coalition soon ran into trouble over an internal matter known as the "Lavon affair." The issue concerned the treatment of Pinhas Lavon, the secretary of the labour federation, who was forced to resign as minister of defense in Feb. 1955 for what was officially described as a "security mishap." The question of Lavon's responsibility was examined by a ministerial committee appointed by the cabinet and their report cleared him. Ben-Gurion, however, refused to accept the finding, which reflected on army officers, and demanded a judicial inquiry. He made cabinet acceptance of his view a matter of confidence and resigned, but was called back and Lavon was dismissed from his office. Ben-Gurion's action caused a rift in the Mapai party itself as well as with the other members. Ben-Gurion called for a general election in Aug. 1961, and the Mapai party lost five seats. Herut was again the second party with 17 seats, and a new Liberal party, compounded of the General Zionists and the Progressives, also had 17. The Communist party gained two places, which indicated the discontent of the Israeli Arabs. The new coalition was more limited than its predecessors and more dominated by Mapai.

Ben-Zvi died in April 1963 and was succeeded as president by his political associate, Schneor Zalman Shazar. A few months later Ben-Gurion resigned unexpectedly for personal reasons as premier and defense minister. He was succeeded by his minister of finance, Levi Eshkol, who promised to carry on the policies of his predecessor.

The principal enactments of the *knesset* in the early years included a Law of Return, which gave every Jew the right of immigration in accordance with the policy of "in-gathering the exiles"; education laws, which instituted free compulsory primary education for all children between 5 and 13 and a public-school system with two divisions, religious and secular; the National Service law (see *Defense*, below); and the Law of Nationality, which conferred Israeli citizenship on a wide basis.

The question of the international status of Jerusalem remained unsettled. From 1948 the city was divided into two completely separate sections, Jewish and Arab. Israel moved the *knesset* and most of the government offices (previously in Tel Aviv-Jaffa) to Jerusalem in Dec. 1949. The government declared itself willing to have the holy places put under the protection of a UN commissioner, but opposed international administration of the city. The kingdom of Jordan was equally opposed to an international regime. The UN, however, and many states did not accept the *de facto* position.

Relations With Arab States.—In 1950 the United States, Great Britain and France issued a tripartite declaration that they would maintain a balance of arms between Israel and the Arab states and would check any aggression whereby either side attempted to change the frontier fixed by the armistice agreements. From 1952 relations deteriorated, and frequent incidents on the Jordan and Syrian borders disturbed the peace, and were submitted by one side or the other to the Security council. Israel's plan to use the waters of the Jordan to irrigate the Negev by constructing a canal from Lake Hula provoked violent Syrian resistance, and the Soviet veto at the council prevented action. Attempts between 1953 and 1956 by Eric Johnston, the U.S. president's emissary, to get agreement on a comprehensive irrigation project for the use of the waters of Jordan and Yarmuk, for the benefit of Jordan, Israel and Syria, were frustrated by Arab intransigence.

The Sinai Campaign and After.—In 1955 the supply by the U.S.S.R. of jet aircraft and heavy armament to Egypt increased tension, and the efforts of the secretary-general of the UN in the spring of 1956 to obtain an unconditional cease-fire had only a very brief success. Raids by Arab commandos were resumed. After Col. Gamal Abd-al-Nasser's nationalization of the Suez canal in July, followed by parliamentary elections in Jordan which reflected his influence, and violent Arab threats of invasion, Israel mobilized its forces and on Oct. 29 invaded Sinai to destroy the hostile Arab bases there. In five days the Israeli army captured Gaza, Rafah, Al Arish and thousands of prisoners and occupied most of the peninsula east of the Suez canal.

To what extent, if at all, Israel was acting in collaboration with Great Britain and France in taking this action has not been established, although it appears that with the French government at least there was some understanding. A joint Anglo-French ultimatum was issued on Oct. 30 ordering Egypt and Israel to cease fight-

ing and withdraw ten miles from the Suez canal, failing which British and French forces would intervene. Further, Egypt was to allow British and French troops to occupy key points on the canal. (For the subsequent action taken by Great Britain, France and the UN *see* EGYPT; SUEZ CANAL; *see* also AVON, [ROBERT] ANTHONY EDEN, Earl of.)

As far as Israel was concerned the objects of the occupation of the Sinai peninsula, apart from the destruction of hostile bases, were to open sea communications in the Gulf of Aqaba and to put pressure on Egypt to negotiate peace. Under pressure of the UN Ben-Gurion stated on Nov. 8 that Israel would withdraw its forces from Egyptian territory when arrangements had been made for a UN emergency force to enter the area and replace British and French troops, which had seized part of the Suez canal.

Ben-Gurion delayed the withdrawal till he had assurance that the UN emergency force would be stationed within the borders of Egypt to prevent raiding from either side and to maintain free navigation in the Gulf of Aqaba. The emergency force of 4,500 men, under the command of Maj. Gen. E. L. M. Burns of Canada, took over its task in December. After further UN pressure the withdrawal of Israeli forces from Egyptian territory was completed in March 1957. For two years the frontiers were relatively quiet, but in 1959 tension again increased because of the seizure by Egypt of vessels in the Suez canal carrying cargo to and from Israel. There were also violent incidents along the northern borders. The blockade of the canal against Israeli shipping persisted. The UN continued their watch on Israel's borders.

By the early 1960s a remarkable feature in foreign relations was the development of economic and cultural links between Israel and the new states of Africa and the far east, with mutual agreements for technical help.

The country was stirred in 1960 by the abduction from Argentina of Adolf Eichmann by Israeli agents. Eichmann, who was taken as a notorious war criminal, a former head of the Jewish extermination department of the Nazi state secret police and principal instrument in the murder of 6,000,000 Jews, was brought to Israel to stand trial under an Israeli law of 1950. The trial opened in April 1961 before a special court of three judges and the court gave judgment in December, convicting him and sentencing him to death. An appeal was heard in March 1962 by the supreme court, which gave judgment on May 29 confirming the conviction and sentence. An appeal to the president for a reprieve was rejected and Eichmann was hanged on May 31.

Population.—After the state of Israel was created in 1948 the population increased considerably from an estimated 720,000 to well over 2,000,000 in the early 1960s, largely by means of immigration of Jews from Europe, Asia, Africa and America. Immigration during the period 1948–59 totaled well over 1,000,000. The first wave of immigrants came mainly from central and eastern Europe; the second from communities in oriental and Muslim countries (Yemen, Iraq, Egypt, north Africa). In 1959 oriental Jews comprised two-fifths of the Jewish population. These and Jews from many other countries have been greatly helped by the Jewish agency which was constituted in 1929 to promote Jewish settlement in Palestine. In the early phases of settlement many were placed in the homes and villages of the 700,000 Arabs who had fled during the Jewish-Arab fighting. The three main towns are the Israeli part of Jerusalem (the capital), Haifa and Tel Aviv-Jaffa (*qq.v.*).

The Arab community has small part in the socialist order of the state, except for the growth of co-operative societies in their villages. The Arab *fellahin*, who inhabited about 90 villages in the early 1960s, owned their land and enjoyed the social services of the government and equal civil and political rights, but they had a grievance as the majority remained under military administration for security reasons and required passes to move from one area to another. Arabic is the principal means of instruction in the Arab primary and secondary schools. An increasing number of Arab students are admitted to the Hebrew university and the Israel Institute of Technology.

The official languages are Hebrew and Arabic. The great majority of the Jewish population have acquired Hebrew. But newspapers are also published in Arabic, and in most of the European languages and Yiddish, which are the mother tongues of many immigrants. English is the principal foreign language, and is taught in primary schools from the age of nine through to university level. It is estimated that about 2,000 books are published in Hebrew annually. Besides Jews, there were in the early 1960s nearly 250,000 Arabs, of whom two-thirds were Muslims. The others were Druzes and members of different Christian communities. The ministry of religions assists the institutes of the various religious communities. The central shrine of the Baha'i world community, originally derived from Persia, is in Haifa. (For ethnical and cultural aspects *see* JEWS; JUDAISM; ZIONISM; HEBREW LANGUAGE; HEBREW LITERATURE; HEBREW RELIGION; JEWISH HOLIDAYS; JEWISH PHILOSOPHY; JEWISH ART.)

Administration and Social Conditions.—*Government and Constitution.*—Israel has no written constitution and follows the English tradition of letting constitutional law be formed pragmatically. Statutes lay down the functions of the cabinet, the ministers and the judiciary, the powers of the single-chamber parliament, the *knesset*, the system of election to the *knesset*, the right of all Jews to settle in Israel and receive immediate citizenship, and the principle of equal rights for women. The head of state is the president who is elected by a simple majority of the *knesset* in a secret ballot for a term of five years, and may be re-elected. The *knesset* (120 members) is elected by a system of universal adult suffrage and proportional representation. It sits for four years, but may be dissolved by statute during that period. The country is divided into administrative districts (*mehozot*) with subdistricts (*nafot; see* Table). There are three types of local government councils: municipal, local for larger villages and regional for agricultural areas. Each council can make bylaws, but these must be approved by the minister of the interior. It can also impose rates subject to the same approval. The councils are elected in the same way as the *knesset*, and hold office for four years.

The government, which is composed largely of representatives of the parties which created and control the labour organization, supplements the socialist structure. It has nationalized, in whole or part, the principal industries, electricity, the minerals of the Dead sea and the Negev, and chemical manufactures. It owns a great part of the land which belonged to the Arabs who fled in the war of independence. It shares ownership of rural land and of a portion of the urban property with the Jewish National fund (the pre-state instrument for acquiring land for agricultural settlements, housing quarters and public institutions). The nationalized land is leased to individuals or groups for a period not exceeding 49 years. The Jewish National fund is subscribed by the Jews of the

Israel: Area and Population (1961 Census)

District and Subdistrict (Subdistrict seat in parentheses)	Area (sq.mi.)	Population	Density
Northern District	1,279	337,058	263.5
Safad subdistrict (Safad)	255	45,579	178.7
Kinneret subdistrict (Tiberias)	201	43,296	215.4
Jezreel subdistrict (Afula)	462	120,123	260.0
Acre subdistrict	361	128,060	354.7
Haifa District	329	370,287	1,125.5
Haifa subdistrict (Haifa)	109	276,213	2,534.1
Hadera subdistrict (Hadera)	220	94,074	427.6
Central District	479	407,070	849.8
Sharon subdistrict (Natanya)	134	102,548	765.3
Petah Tikva subdistrict (Petah Tiqva)	110	136,503	1,240.9
Ramle subdistrict (Ramle)	115	68,304	593.9
Rehovot subdistrict (Rehovot)	120	99,715	830.9
Tel Aviv-Jaffa District (Tel Aviv-Jaffa)	66	699,289	10,595.3
Jerusalem District (Jerusalem)	215	191,894	892.5
Southern District	5,447	173,893	31.9
Ascalon subdistrict (Ascalon)	491	76,692	156.2
Beersheba subdistrict (Beersheba)	4,956	97,201	19.6
Total	7,815*	2,179,491	278.9

*Land area.

View of Hadar-Hacarmel, Haifa, with Mt. Carmel in the background. The domed building on the left is part of the Technion (Israel Institute of Technology)

Modern apartment buildings on Arlosoroff street in Zafon, a new residential quarter in Tel Aviv-Jaffa

Nuclear science building at the Weizmann Institute of Science, Rehovot, south of Tel Aviv-Jaffa

A new housing project under construction in the Negev, a vast wasteland being converted into fertile farmland by means of a pipeline through which water from the Jordan river will be diverted

MODERN ISRAEL

PHOTOGRAPHS, A. L. GOLOMAN—RAPHO GUILLUMETTE

ISRAEL

Fishermen of Tiberias hanging their nets to dry along the shore of the Sea of Galilee (Lake Kinneret)

Israeli farmers planting vineyards at Mevasseret Yerushalaim, co-operative village near Jerusalem

Bedouin girl of the desert of the Negev

Orthodox Jew writing prayers for phylacteries, small boxes worn by Jews during prayer

Boy riding his donkey down a narrow street in Nazareth, which is populated largely by Christian Arabs

Jewish youths, members of the ultraorthodox Jewish community in Jerusalem

VIEWS OF ISRAEL AND ITS PEOPLE

PHOTOGRAPHS, (TOP LEFT) PATELLANI—PIX FROM PUBLIX, (TOP RIGHT) RUBINGER—PIX FROM PUBLIX, (CENTRE LEFT) A. L. GOLDMAN—RAPHO GUILLUMETTE, (CENTRE) W. BRAUN—P.I.P., (BOTTOM LEFT) ERICH HARTMANN—MAGNUM, (BOTTOM RIGHT) © ENCYCLOPÆDIA BRITANNICA

world, and is an element of the partnership between Israel and outside Jewry.

Political Parties.—The *knesset* has included from the beginning of independence about a dozen parties, and every government has been a coalition. The major party throughout has been Mapai (Mifleget Poalei Eretz Israel), the central labour group. Next in numbers is Herut, the extreme right wing. Others are the National Religious party, which is partly socialist; the bourgeois General Zionists; the labour group, Ahdut Avoda, which is activist and Socialist; Mapam (Mifleget Hapoalim Hameuchedet), the left-wing labour group; and the Aguda, the fundamentalist religious group. The Progressives, formerly a liberal wing of the General Zionists, decided in 1961 to combine with the latter as a new Liberal party. The Communist representation in the *knesset* was five, two being Arabs; and three Arab parties, linked with Mapai, had five members. The Mapam members included one Arab.

Living Conditions.—Living conditions in Israel are of an increasingly high standard, remarkable in view of the pressure of constant immigration. New immigrants have to be housed and fed and also trained for some form of occupation. Housing plans are based upon the formation of new towns and the settling of the rural areas. Unemployment during the decade 1950–60 continued to fall until it reached and maintained a level lower than that of the U.K. and U.S. During the same period consumer prices and earnings in manufacturing rose to an appreciable extent reflecting the increasing prosperity and growth of the economy.

Israel inherited from the Jewish community of mandated Palestine a system of voluntary socialism without any coercion of the state. During the mandate period a federation of labour (Histadrut) was formed, including the co-operative and collective agricultural settlements and the greater part of the industrial workers. It includes also the organs through which the economic life of the settlements is ordered, the marketing and distribution agencies for consumer goods, materials and equipment, a vast construction enterprise which builds settlements and public institutions, credit societies and banks, trade unions and co-operative groups of every branch of work. Altogether it counts nearly 750,000 members, including several thousand Arabs. The Histadrut conducts, also on a co-operative basis and often in partnership with private investors, major industrial and public enterprises; *e.g.*, irrigation, shipping and mining. Separate trade unions have been established for most vocations, but they form part of the over-all labour federation. Apart from those in the Histadrut, there are smaller unions composed of members of the parties which are opposed to labour.

The Histadrut is also responsible for a health service and a system of social insurance, which grew up under the mandate and has survived in the state. The government supplements it by old-age and widows' pensions, maternity benefits, workmen's compensation and some types of hospitals. The Histadrut engages in educational and cultural activity, maintaining secondary and technical schools, a widespread system of adult education for immigrants, drama companies, and the publication of books, newspapers and technical journals. It also deals with wage rates and working conditions in private industry.

Justice.—The law of Israel was declared, in the first legislation in 1948 by the provisional council, to be the law pertaining to Palestine in May 1948, so far as that is not in conflict with any law passed by the Israeli legislature. The Palestine law was derived from three sources: Ottoman, English (common law and equity) and the ordinances of the Palestine legislature.

There are both civil and religious courts. The principal civil courts are: (1) magistrates courts, which have minor civil and criminal jurisdiction; (2) district courts in Jerusalem, Tel Aviv and Haifa, which deal with major civil and criminal cases; (3) the supreme court, sitting in Jerusalem, which hears appeals in civil and criminal cases from the district courts, and has jurisdiction in first instance in administrative matters touching the liberty of the subject and powers of officials. The religious courts have jurisdiction in matters of personal status, which differs with the communities. The Jewish Rabbinical courts have exclusive jurisdiction in matters of marriage and divorce, and concurrent jurisdiction with the civil courts in other matters of personal status, both for Israeli and foreign Jews who consent to the jurisdiction. The Muslim Shariah courts have exclusive jurisdiction in all matters of personal status of Muslims, including foreign subjects where their national law recognizes religious tribunals. Separate religious courts are established by the Christian communities, and have jurisdiction similar to that of the rabbinical courts. Where actions of personal status involve persons of different religious communities, the supreme court decides which tribunal has jurisdiction. Military courts have been invested with wide powers.

Education and Culture.—By the early 1960s about 500,000 children, including 50,000 Arabs, were in primary, secondary or technical schools. Primary education is free; secondary schools, in which fees are paid, are maintained by municipalities and voluntary bodies with government aid. There are five institutes of higher education: the Hebrew university at Jerusalem (founded 1918, inaugurated 1925), the religious Bar-Ilan university (1953) at Ramat Gan near Tel Aviv, the Israel Institute of Technology (Technion, founded 1912, inaugurated 1924) at Haifa, the Weizmann Institute of Science for basic and applied research (1949) at Rehovot and Tel Aviv university. The Hebrew university has six faculties: humanities, science and mathematics, medicine, law, agriculture and the social sciences. The Institute of Technology, which also gives degrees, has faculties of engineering and architecture. In the religious schools special attention is given to the teaching of traditional and rabbinical literature. But in all schools (apart from Arab state schools) the Hebrew Bible is the literary and historical foundation, and the Bible quiz is the most popular entertainment in the country. Biblical archaeology and geography are universally learned and for immigrants they provide a valuable link with the country and the feeling of having roots.

Defense.—The National Service law, 1950, as amended, introduced compulsory service for 2½ years for males between 18 and 26 years, and 2 years for those between 27 and 29 years. Unmarried women between 18 and 26 do 2 years service. For both men and women the service includes work on the land. Men up to the age of 49 and childless women up to 34 do service in the reserve. The war strength of the army is about 250,000. Israel's navy includes a few destroyers, frigates, submarines and motor torpedo boats. There is a naval officers' school at Acre. The air force has 12,000 men and about 400 aircraft, including French jet and supersonic fighters. Training planes are built in Israel under licence of the French.

The Economy.—Israel in 1948 was a country poor in agriculture, natural resources and industry. Its economy was beset by serious problems. For the maintenance of the population and its mass of immigrants the state had to import foodstuffs, consumer goods and raw materials. Because of the hostility of the neighbouring Arab states, a considerable portion of the national budget continues to be required for defense. The economy, based on a mixture of private and state enterprises with much financial assistance from the Jewish communities of the world, is heavily dependent on investment from abroad. However, a broad economic growth has been achieved and productivity is high.

Agriculture.—By the 1960s Israeli agriculture using modern techniques and irrigation methods supplies three-quarters of the home food supply. The export of citrus fruit, Israel's most valuable crop, was much increased and the cultivation of peanuts (groundnuts), sugar beets and cotton expanded. The proportion of the population living in rural areas rose from 15% to 20%; and of 800 Jewish agricultural villages, mostly collectives and co-operatives, the majority were founded after the creation of the state; more than 100 are in the Negev, which was before mainly arid and empty.

Industry and Mining.—Industrial expansion has been remarkable and provides employment for more than 160,000, excluding those engaged in building. Diamond cutting and polishing, the manufacture of textiles, chemicals, paper, tires and electrical goods, and light industries of many kinds are fostered.

The mineral wealth of the Dead sea (potash, magnesium and bromide) and of the Negev (copper and phosphates) is exploited.

Oil and natural gas have been struck several places in the northern Negev, and together supply one-fifth of Israel's needs. An oil pipeline was laid from Elath (Eilat) on the Gulf of Aqaba to the Mediterranean coast. Electricity, generated by thermal stations, is the main source of power for industry and irrigation.

Israel became the seventh nation to launch a rocket into the ionosphere when the Shavit (Meteor) 2, designed for meteorological research, was successfully fired on July 5, 1961. An atomic reactor has been constructed with U.S. assistance near Tel Aviv and a second reactor in the Negev with French help.

Trade and Finance.—The main imports are machinery, iron and steel products, rough diamonds, cereals and crude oil. Besides citrus fruit the principal exports are eggs, polished diamonds, textiles, chemicals, motor vehicles (assembled in Israel) and tires. While in 1949 the ratio of the value of imports to exports was 5:1, by the early 1960s it was 2:1. The chief trading partners are the U.S. and the U.K. Half of the citrus export goes to the U.K.

The adverse balance of trade, which in the early 1960s still exceeded $300,000,000 annually, was met by four sources: (1) reparations in kind paid by West Germany to Israel for ten years from 1953 ($80,000,000 a year) and compensation paid to individuals in Israel for property stolen and sufferings inflicted by the Nazis (about $30,000,000 a year); (2) the contribution of Jewish communities in all countries where they are free; (3) independence and development loans floated by the government of Israel in America and loans from foreign banks; (4) an American grant-in-aid and United Nations technical aid. While a large part of the investment capital comes from government and public bodies, private investment is encouraged by tax and customs concessions. The government since 1952 has balanced its working budget, including the heavy defense expenditure, which takes one-third of the revenue. Income tax, customs and excise, land and luxury taxes are the main sources of revenue; tourism is a factor of growing importance. The development budget is provided largely by foreign contributions.

Currency and Banking.—The Israel pound (IL.), divided into 1,000 *prutoth* and 100 *aguroth*, was originally equivalent to £1 sterling. The inevitable inflation brought a steep decline in the exchange rate, and in 1953 the government carried through a devaluation, fixing the rate at IL.5 to £1, or IL.1.80 to $1. Renewed inflation, due largely to armament expenditure, caused another decline in the free market and varying rates of exchange for different transactions until 1962, when the Israel pound was further devalued to IL.3 to U.S. $1 and IL.8.40 to £1. The cost-of-living index continued to rise, though after 1956 more gradually.

In 1954 the Bank of Israel was created; it issues notes and is the sole banker of the government. The other principal banks are the Bank Leumi (which has replaced the Anglo-Palestine bank), the Discount, Workers' and Barclays banks.

Transport and Communications.—The state-owned railways extend over 392 mi. and hard roads over 1,864 mi.

The merchant marine has been developed, and by the early 1960s had a tonnage of more than 600,000. The ships are built mostly in West Germany. In addition to the ports of Haifa and Tel Aviv-Jaffa, a harbour has been built at Elath with access to the Red sea and the Indian ocean. Air communications are centred at Lod international airport near Tel Aviv. Kol Israel (the Voice of Israel) is the national broadcasting station with studios in Jerusalem, Tel Aviv and Haifa.

See also JORDAN; DEAD SEA; and references under "Israel" in the Index. (No. B.)

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ISRAELI, ISAAC BEN SOLOMON (*c.* 850–950), Jewish physician and philosopher, was born in Egypt and became court physician at Kairouan (Kairwan). His medical works were translated by Constantine the African (1087) and include a *Book on the Fevers* much esteemed in the middle ages. His extant philosophical writings are: a *Book of Definitions and Descriptions* (Hebrew trans. by Nisim ben Solomon; Latin version by Gerard of Cremona, edited by J. T. Muckle in *Archives d'histoire doctrinale et littéraire du moyen âge*, vol. xii–xiii, 1938), mainly based on al-Kindi; a *Book on the Elements* (Hebrew trans. by Abraham ha-Levi bar Hisdai; Latin version by Gerard of Cremona); a *Treatise on Spirit and Soul*, probably part of an exegetical work in which Israeli sought to adduce scriptural support for his philosophical doctrines; the *Book of Substances;* and a treatise designated in Hebrew as *Chapter on the Elements*. The latter two works (edited by S. M. Stern and by A. Altmann, *Journal of Jewish Studies*, vol. vii, no. 1–2, 1956) are based on a pseudo-Aristotelian source otherwise lost which offers an important variant of Neoplatonism. Israeli's doctrine had a pronounced influence on the 13th-century Jewish mystics in Gerona. Ibn Gabirol too seems to be indebted to it.

For medical and philosophical treatises extant in Latin see *Opera omnia Isaci* (1515). *See* also J. Guttmann, *Die philosophischen Lehren des Isaak ben Salomon Israeli* (1911). (A. AN.)

ISRAELI LAW. In ancient times, when the people of Israel lived in their homeland, they created their own law: the law of the Torah (*see* PENTATEUCH) and—as a historical development of the Torah—the law of the Mishnah and the Talmud (*q.v.*). Then came the separation of land and people for more than 1,800 years. The law left the land together with those who had created it and the land acquired other laws, changing from time to time with the change of consecutive conquerors. The Jews took their law with them wherever they went, continued to develop it and submitted to it wherever their communities enjoyed any measure of autonomy. It had been one of their national, cultural treasures and remained so during the centuries of the Diaspora. Therefore, when the Jews eventually returned to their ancient land in the 20th century, they brought back with them a dual legal heritage: that of the historic Jewish law and that of the laws of the countries in which they had been living.

Before Independence.—Until the end of World War I, Palestine was ruled by the laws of the Ottoman empire. Some of these were derived from Muslim religious sources; others were based on Turkish customary rules; many had been taken over from European, mainly French, legislation. In matters of personal status (marriage, divorce, maintenance, guardianship, succession, etc.), the Ottoman empire permitted religious courts to exercise jurisdiction and to apply their religious law.

During the 30 years of British administration (from 1922 to 1948 under the mandate for Palestine of the League of Nations), the law of the country became much anglicized. Large and important parts of Ottoman law were gradually replaced by legislation based on English law, including the whole of commercial law, criminal procedure and the law of torts. A provision of the Palestine order-in-council of 1922 enjoined the civil courts to apply "the principles of common law and the rules of equity prevailing in England" wherever Ottoman or mandatory legislation would "not extend or apply." Under this rule modern English rules of contract were added to the Mejellah, the Ottoman-Muslim code of civil law; equitable doctrines of ownership and specific performance became coupled with forms of Ottoman land tenure. Prerogative writs with their judicial protection of civil rights and liberties—unknown in the Ottoman system—were also introduced and firmly established.

Under the terms of the mandate for Palestine, the Jewish agency was recognized as an official representative body with certain functions of public law but without the right to take part in legislating. On the other hand, in their voluntary organiza-

tions, the Palestinian Jews developed certain legal institutions which were to have a considerable impact on the future Israeli law. Equality of men and women in family, work, defense and political life; a general tendency toward the structure and activities of a modern welfare state; the peculiar land tenure of the Jewish National fund, the national land-holding corporation—these are among the basic features which were firmly, though not statutorily, established well before the state of Israel came into existence.

After Independence.—When independence was proclaimed in 1948, the law which had been in force in Palestine at the end of the mandate was declared to remain in force in the new state "subject to such modifications as may result from the establishment of the state and its authorities," and some of the Ottoman enactments and much law of English origin continued to be applied. English ceased to be the predominant legal language and was immediately replaced by Hebrew. The law was henceforth made by the democratic authorities of the autonomous state which, in spite of an Arab minority of nearly 10%, is Jewish in conception, way of thinking and purpose. Yet, as a legal system, Israeli law is a mixture of various, frequently contradictory elements among which original Israeli law covers a relatively small, though important, part of the field.

Institutions and Offices.—The first and principal task of lawmaking was concerned with the new authorities of the state. A one-chamber parliament of 120 members, called the *knesset*, was set up and its constitution defined. General, direct, equal and proportional elections, to be held every four years, were regulated. There was created the office of president of the state, elected by the *knesset* for five years with mainly representative functions. The government, to be formed on the initiative of the president of the state by one of the *knesset* members, was declared to be responsible to the *knesset* and to depend on its confidence. The office of state comptroller, with broad supervisory tasks, was also established and a national bank, the Bank of Israel, set up.

Immigration and Citizenship.—New, and fundamental, also was the approach to immigration and citizenship. Instead of the heavy restrictions on Jewish immigration into Palestine which had been one of the main policies of the mandatory administration during its last years and the foremost issue on which the Jewish population had fought for independence, it was now proclaimed, by the Law of Return of 1950, that "every Jew shall have the right to come to Israel as a permanent settler." And under the Nationality law of 1952 every Jew who came to the country permanently, or was born in it, became an Israeli citizen.

In immigration and automatic acquisition of citizenship Jews are constitutionally privileged in Israel. In all other respects there is no distinction between Jewish, Arab and other non-Jewish inhabitants of the country. This is true of the right to vote and to be elected to the *knesset* or the municipalities; acquisition of property, including immovable property; the right to work and other civil liberties and their protection; education; social services, etc. Certain restrictions on free movement in certain parts of the country are emergency measures of security, maintained because of the state of armistice, not of peace, between Israel and the surrounding Arab states.

Courts.—The organization and jurisdiction of the courts, both civil and religious, and the appointment and tenure of judges also were the object of legislation, but the previous system was, on the whole, maintained. Courts are composed of professional judges only, the jury being unknown. Civil courts are organized on three levels: magistrates courts dealing with certain civil matters and offenses punishable with imprisonment up to three years; district courts in the three principal cities, with general jurisdiction in civil and criminal matters; and the supreme court in Jerusalem, deciding appeals from inferior courts and exercising, as court of first and only instance, jurisdiction as high court of justice. There is no appeal from a judgment of the supreme court, but it may allow a case to be reheard before itself with an increased number of judges.

Religious courts continue to be competent in matters of personal status, with some minor changes in the scope of jurisdiction of the rabbinical courts. In certain cases, mainly in suits concerning marriage or divorce, the jurisdiction of these courts is exclusive; in others it is concurrent with that of the civil courts and depends on the submission of the parties concerned. In matters of social security and in various other administrative matters, committees, all of them headed by judges, act as administrative tribunals whose decisions are subject to review by the supreme court.

Civil and religious judges are chosen by committees composed of members of the highest tribunal, members of the government, members of the *knesset* and members of the bar association. Formal appointment, which is for life, is by the president of the state.

Constitutional Law.—Israel has no formal constitution, mainly because of a reluctance to take permanent decisions on basic issues at a period when the prime purpose of the state is the ingathering of its prospective inhabitants and their integration into a homogeneous nation. Constitutional matters are, accordingly, regulated by ordinary legislation which may, with very few exceptions, be freely amended at any time by a simple majority of the *knesset*. The system is, in this respect, comparable to that prevailing in England and appears to work satisfactorily.

In another aspect of constitutional law, the lawmaking function of the high court of justice was of outstanding importance, for the body of decisions of that court defined and safeguarded the human rights and civil liberties of the citizen. A law enjoining statutory authorities to state their reasons whenever they refuse an application for the exercise of their powers helped the courts and administrative tribunals better to perform this task.

Other Developments.—In administrative law, legislation covers most subjects with which the legislature of a modern welfare state is concerned, including education, compulsory military service (for men and women) and national insurance. Particularly important for the economy of the country are the Water law and the law on the Encouragement of Capital Investments, both of 1959. Laws dealing with collective bargaining, labour exchanges, protection of wages, safety regulations, etc., are the nucleus of a code of labour law.

With regard to civil and commercial law, criminal law, procedure and evidence, the *knesset* confined itself to piecemeal amendments of the previously existing law. Among the outstanding departures from the Ottoman-English heritage are: the abolition of the death penalty for murder and the introduction of suspended prison sentences; a new way of taking evidence of minors in trials of sexual offenses; an amended and reduced form of preliminary inquiry in felonies; liability of the state in torts and the application to the state of various enactments from which it had been exempted; legal recognition and regulation of the payment of key money; the tenure of co-operative houses with separate ownership of flats; a law fixing the minimum marriage age of girls at 17; a law on the duties of maintenance between relatives; and a law on women's equal rights. The last-mentioned law contains only a few, general provisions. Details and the ensuing legal organization of the family are left to the determination of the courts. They must be treated by comprehensive legislation of which drafts were prepared and published; by 1961 only portions, such as the Maintenance law, had been enacted.

Jewish law as such continued to be applied by the rabbinical courts within their jurisdiction in matters of personal status; it is applied also by the civil courts when called upon to deal with such matters concerning Jews. In other fields of law it is not applied as the law of the land; nor was it given secular force by restatement of its rules in any of the enactments of the *knesset*. It serves, however, as an important source for the shaping of new rules of law, both by the *knesset* and in the creative decisions of the courts. At the same time, modern laws of various other nations are consulted and used for comparison, and decisions of foreign tribunals, not necessarily of English courts, are frequently cited as persuasive authorities. *See* also ISRAEL: *History; Administration and Social Conditions.*

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ISRAËLS, JOZEF (1824–1911), Dutch painter and etcher, leader of The Hague school of peasant genre painting which flourished in the Netherlands during 1870–90, was born at Groningen of Jewish parents on Jan. 27, 1824. He began his studies in Amsterdam, but admiration for Ary Scheffer led him to Paris (1845–47), where he worked under F. E. Picot, Horace Vernet and H. Delaroche. He first tried to establish himself as a painter of portraits and of conventional history pictures, but had achieved little success when in 1855 ill-health compelled him to quit Amsterdam for the fishing village of Zandvoort, near Haarlem. The change of residence revolutionized Israëls' art and henceforward he became the painter of Dutch fisherfolk and peasants. In 1871 he moved to The Hague, often working in nearby Scheveningen. He died at The Hague on Aug. 12, 1911. Israëls' style was one of sentimental naturalism and he preferred pathetic themes, like "The Shipwrecked Mariner" (1861, National gallery, London). (A. Bs.)

ISSACHAR, in the Old Testament, Jacob's ninth son, his fifth by Leah (Gen. xxx, 18), is the eponymous ancestor of one of the northern tribes of Israel. Issachar played an insignificant part in Israelite history, and the name hardly occurs in later times. *See* TWELVE TRIBES OF ISRAEL.

ISSERLES, MOSES BEN ISRAEL (*c.* 1525–1572), known as the ReMA, who played an important part in codifying Jewish law, was born in Cracow, Pol., and was head of the great *yeshiva* founded there by his father. Most of the codes had been written by Spanish Jews (those of Isaac Alfasi, Maimonides and Jacob ben Asher being the best known and most authoritative), and though they were studied all over the Jewish world, they had become progressively less acceptable north of the Alps. This was due to the fact that the many customs (*minhagim*) that had been developed in the Rhineland and the east by the Germano-Polish (Ashkenazic) Jews were largely ignored by the Spanish (Sephardic) codifiers. Jacob ben Asher's code (*Arb a'ah Turim*, or *Tur*) had been commented on by the Spanish Joseph Qaro, taking little note of Ashkenazic customs. To remedy this, Isserles wrote his own commentary to the *Tur*, "The Paths of Moses" (*Darkhe Moshe*), in which he based many decisions on Ashkenazic customs. Subsequently Qaro published, for popular use, his own code, *Shulhan 'Arukh* ("The Well-Laid Table"; 1555), which was greeted with strong opposition from the Germano-Polish scholars. It was Isserles' commentary to this code, called the *Mapo* ("The Tablecloth"), utilizing Ashkenazic customs, that made the *Shulhan 'Arukh* acceptable all over the Jewish world and, since that time, the final source of decision for Orthodox Jewry.

Isserles was also interested in philosophic and cabalistic studies, considering both these disciplines to be varying expressions of the same religious truth. His chief works, in addition to the commentaries on the *Tur* and the *Shulhan 'Arukh*, are numerous *responsa* (legal opinions, collected after his death), *Toras Chatas* ("Law of the Sin-Offering," on ritual law), and *Toras ha'Olah* ("Law of the Burnt-Offering," a philosophic symbology of the ritual in the Temple at Jerusalem). He died at Cracow on May 1, 1572.

Isserles was greatly revered, and the phrase on his tombstone was frequently used in reference to him (as it had been to Maimonides and later was to Moses Mendelssohn): "From Moses [Maimonides] to Moses [Isserles] there was none like unto Moses." (S. B. FR.)

ISSUS, BATTLE OF. The battle of Issus was fought in Nov. 333 B.C., on the coast of the modern Gulf of Iskenderun, Turk., between the armies of Alexander the Great of Macedonia and Darius III of Persia. For a general account of the invasion and the composition of the Macedonian army *see* ALEXANDER III.

Hearing that Darius' army was east of the Amanus (Nur Daglari) range, Alexander left his sick at Issus at the head of the gulf and moved southward along the coast, but at Myriandrus (near Iskenderun) he heard that Darius had turned northward, crossed the Amanus by the northernmost pass and come down to Issus and was now in his rear. The army returned hastily northward to meet Darius' army, which had reached the Pinarus (either Payas or Deli) river.

There are no reliable figures for either side. Darius and his entourage were in the centre of the Persian line on the river bank with the Greek mercenaries, perhaps numbering 30,000, flanked by Persian light-armed (Cardaces). Other Persian infantry stood behind the line, and a detachment was placed forward along the Amanus foothills to harass Alexander's right. The cavalry, originally stationed across the Pinarus, was withdrawn on Alexander's approach, largely to the right wing, there being no room on the left because of the foothills.

As the coastal plain widened, Alexander extended his line. On the left, under Parmenion, were Greek and allied cavalry and Cretan archers; then came the infantry phalanx and the hypaspists; to the right of these were the Companion cavalry under Alexander, the lancers and the Paeonian cavalry. Seeing the concentration of Persian cavalry against his left, Alexander sent the Thessalian cavalry from the right behind the line to reinforce them. Behind the right wing at an angle were Agrianian javelin men, archers and cavalry to clear the foothills.

The Macedonian line moved slowly until within bowshot, when Alexander led the charge across the river, breaking the Persian left. The Persian right, however, rode across the river and fiercely engaged the Thessalians, and the Greek mercenaries drove the phalanx (now in some disorder) back into the river. Alexander therefore turned left against the mercenaries. Darius fled and the rest of the Persian army followed; many of the Greek mercenaries broke through southward, 8,000 escaping to Egypt. The Macedonian dead are said by Arrian to have numbered 450; Alexander himself was wounded. There are no reliable figures for the Persian losses. Darius escaped, but his family was captured.

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ISSYK-KUL, a lake in the Kirgiz Soviet Socialist Republic (*q.v.*) of the U.S.S.R. The basin of the lake formerly constituted the central part of the *oblast* of Issyk-Kul, occupying much of the high Tien Shan mountainous country of Kirgizia, including the Kungei-Ala-Tau and Terskei-Ala-Tau ranges. This *oblast* was however abolished by a decree of Jan. 27, 1959. The lake lies at an altitude of about 1,650 m. (5,400 ft.) and is one of the largest mountain lakes in the world. Area 6,200 sq.km. (2,394 sq.mi.); length 182 km. (113 mi.); maximum width 58 km. (36 mi.); maximum depth 702 m. (2,303 ft.). It lies in a deep basin apparently of tectonic origin. The surface water of the lake is brackish and relatively warm, 20° C. (68° F.). The lake never freezes (Issyk-Kul = "warm lake") and the prevailing climate is temperate. A large number of small streams and part of the waters of the Chu river flow into the lake.

The climate of the basin is mild with warm summers, but that of the mountain ridges is cold and the temperature may fall below freezing point even in July. About 3% of the area is wooded and the vegetation of most of the remainder is of the steppe type. Sheep and horses are bred in the mountain valleys and wheat and poppies are grown along the eastern shores of the lake. Coal is mined on a small scale at Kadzhi-sai and Dzhirgalan. There are food processing plants at Rybachye and Przhevalsk. Fishing, mainly of carp and bream, is carried on in the lake. The Frunze-Bystrovka railway was extended to Rybachye in 1949. Motor transport is used extensively and a metaled road encircles the lake. There is a regular steamer service between Rybachye in the west and Przhevalsk port in the east. The latter is named after N. M. Przhevalsky, the famous Russian traveler who died there in 1888. (G. E. WR.)

ISSY-LES-MOULINEAUX, an industrial suburb of Paris, lies on the left bank of the Seine and is approached by the Porte de Versailles, 6 km. (3½ mi.) S.W. of Notre Dame by road. Pop. (1962) 51,440. Formed from the two originally separate communities of Issy and Les Moulineaux, the town retains several buildings of interest. Among these are the church of St. Étienne, begun in 1635, and the seminary, built on the site of a château

where Marguerite de Valois spent the end of her life, with a chapel imitating that of the château at Versailles. The seminary, once a dependant of Saint-Sulpice, is now the École Supérieure de Théologie Catholique. Ernest Renan (*q.v.*) studied there. The public library is in the orangery of the former château. There are fine views from the park. The manufacture of cigarettes and automobiles are the chief of many industries.

ISTANBUL (formerly CONSTANTINOPLE), the largest city and seaport of the Turkish republic and the capital of Turkey until 1923.

The old walled city of Istanbul is situated on the western (European) shore of the Bosporus, a strait about 18.6 mi. long linking the Black sea with the Sea of Marmara (Marmora). Guarding the Marmara end of the strait, it strategically occupies a triangular promontory, washed on the north by the Golden Horn (Halic), a narrow inlet, about 4.5 mi. deep, which forms an excellent harbour. A broad valley, through which there once flowed a small stream, the Lycus, divides the promontory from west to southeast into two masses of elevated ground: a long ridge overlooking the Golden Horn and an isolated hill in the southwest. The ridge consists of six eminences, so that, altogether, there are seven hills upon which Constantinople, like Rome, is said to be enthroned. The first hill has the Seraglio palace, Hagia Sophia and the Hippodrome; the second the column of Constantine and the Nuruosmaniye mosque; the third the university and the mosque of Sultan Suleiman; the fourth the mosque of Mahmud II Fatih; the fifth the mosque of Sultan Selim; the sixth, which is the highest (250 ft.), the Edirne or Adrianople gate and Mihrimah mosque; the seventh, called in the middle ages Xerolophos ("dry hill"), is occupied by the quarter of Alti Mermer.

The Golden Horn, which is spanned by the Ataturk and the Karakoy-Eninonu bridges, divides old Istanbul, which contains the greater part of the city's archaeological heritage, from the quarters of Galata, once a separate walled city, and Beyoglu (formerly Pera). Facing Istanbul on the Asiatic side are Uskudar (ancient Chrysopolis) and Kadikoy (ancient Chalcedon). "Greater Istanbul," as it may be called, embraces not only these localities but an almost uninterrupted, though narrow, ribbon of settlements on both sides of the Bosporus and, for a considerable distance, on both the European and Asiatic shores of the Sea of Marmara. The inhabited areas stretch from old Istanbul to Kucukcekmece, about 18 mi. to the southwest and, on the opposite shore, from Uskudar to Pendik, a distance of about 16 mi. Close to the Asiatic shore of the Sea of Marmara, about 10 mi. from Istanbul, lie the Kizil Adalar or Princes Islands (*q.v.*), a cluster of four big and five small islands, used as a summer resort. Suburban developments have rapidly expanded, especially after World War II. The area enclosed by the municipal boundaries is 98 sq.mi., of which only approximately 9 sq.mi. are occupied by the old city.

Climate.—By virtue of its situation, Istanbul is influenced both by the climate of the Mediterranean and by that of the Black sea. The climate shows great variation depending on the prevailing wind: the north wind (*poyraz*) is the most frequent, resulting in a generally temperate climate. The south wind (*lodos*) is warm and damp, sometimes causing storms in the Sea of Marmara. In the winter a northwest wind (*karayel*) often blows from the mainland, bringing snow and short periods of intense cold. In general, fine weather lasts from May until October and often later. The most pleasant season is the autumn. The average annual temperature is 14° C. (57° F.), the average temperature of the coldest month (February) is 5° C. (41° F.) and of the warmest months (July and August) 23° C. (73° F.). Istanbul is subject to severe earthquakes which over the centuries caused great damage to the monuments of the city.

HISTORY

Byzantium was the original name of the city before it was renamed Constantinople. The origin of Byzantium (allegedly so called after its mythical founder Byzas) is to be sought in the context of trading relations between Greece and the Black sea. Greek colonists, largely from the cities of Miletus and Megara, set up trading posts on the shores of the Propontis (Sea of Marmara) from the end of the 8th century B.C. onward. Byzantium was a Megarian colony. According to tradition, it was founded about 657 B.C. against strong resistance on the part of the native Thracian tribes. Byzantium fell under the sway of the Persian empire at about the time of the Scythian expedition of Darius I (512 B.C.). Persian domination, temporarily interrupted during the Ionic revolt, continued until 478 B.C. when the city was captured by a Greek fleet. Thereafter Byzantium became part of the Athenian confederacy; its growing prosperity is evidenced by the Athenian tribute lists in which Byzantium figures as one of the most important contributors. In 411 B.C., however, with the decline of Athenian power during the Peloponnesian War (*q.v.*), Byzantium acknowledged Spartan supremacy. The city was recaptured after a siege by Alcibiades (*q.v.*), but after the total defeat of the Athenians, it fell once more under Spartan domination (405 B.C.).

In 377 B.C. Byzantium joined the Second Athenian League. In 340 B.C. it was unsuccessfully besieged by Philip II (*q.v.*), king of Macedonia, whose failure ensured the independence of the city throughout the Hellenistic period. Even after the Roman conquest of the east, Byzantium remained free until its autonomy was taken away by Vespasian (A.D. 70–79), although it was later restored. In 196 Byzantium, which had sided with the usurper Pescennius Niger, was captured after a long siege by Septimius Severus. Its walls were razed and its inhabitants massacred. For a while it ceased to be a city and was annexed to Perinthus (Heraclea). But Severus soon changed his mind: Byzantium was not only restored but even enlarged, and renamed Antoninia after Severus' son M. Aurelius Antoninus (Caracalla).

The civil war between Constantine and Licinius was decided on the banks of the Bosporus. It was at Chrysopolis that Licinius suffered his final defeat (Sept. 18, 324). Immediately after this, Constantine, who must have been impressed by the strategic advantages of the straits, decided to make Byzantium his new capital. The foundation rites were celebrated on Nov. 8, 324; on May 11, 330, the imperial city, greatly enlarged, was officially inaugurated. It then bore the names of the New Rome and Constantinopolis (from the Greek Konstantinou polis, "Constantine's city").

Practically nothing remains of ancient Byzantium The city occupied the tip of the promontory and was protected by a line of walls (renowned in antiquity as being among the strongest of Greece) which described an arc starting approximately at modern Sirkeci and ending on the Sea of Marmara east of the Hippodrome. The walls were rebuilt by Severus who carried them forward to the point later occupied by Constantine's forum (Cemberlitas). Severus also built a number of public monuments including the Hippodrome, which he left unfinished, the baths of Zeuxippus (next to the Hippodrome), a theatre and an arena for the exhibition of wild animals, and streets lined with porticoes. (*See* also BYZANTIUM.)

Constantinople.—The city, as rebuilt by Constantine, covered a much larger area. The walls extended from roughly the quarter of Fener on the Golden Horn to that of Samatya on the Sea of Marmara. Inside this enlarged circuit Constantine erected the buildings appropriate for an imperial capital. In the centre of an elliptical forum was placed a porphyry column (still standing) which supported the radiate statue of the emperor as Apollo Helios. Next to the forum rose the Senate house. The Hippodrome was completed and alongside it was built an imperial palace which remained the residence of the Byzantine emperors until the 12th century; this was known as the Great or Sacred palace. The palace opened onto a square called the Augustaion. Constantine also founded the church of Irene (Peace), which still stands although not in its original form, and the church of the Holy Apostles (now replaced by the Fatih mosque). The city was decorated with a multitude of statues that were removed from the principal towns of the eastern Mediterranean. New settlers were attracted by free distribution of bread and the granting of citizenship rights.

Constantinople experienced a period of rapid growth and build-

ing activity under Constantine's immediate successors. By the end of the 4th century Constantine's walls were already too narrow to contain the sprawling city. This factor, combined with the rising danger of barbarian invasion, dictated the erection of a new line of walls, which was done in the reign of Theodosius II by the praetorian prefect Anthemius (413). The walls along the shores of the city were constructed in the same reign by the praetorian prefect Cyrus (439). The area enclosed within the new walls was so large that no further need arose to extend them. The Theodosian walls are still standing.

The peak of medieval Constantinople was reached in the reign of Justinian I (527–565). The population of the city at the beginning of his reign may be estimated at about 500,000. In 532 a large part of the city was burned during the Nika insurrection, a bloody uprising of the Hippodrome factions. This gave Justinian an opportunity to indulge his passion for building. The basilica of Hagia Sophia (St. Sophia), probably built A.D. 360 by Constantius, son of Constantine, and dedicated not to a saint but to Divine Wisdom, was re-erected on a colossal scale (532–537). In addition, Justinian's building activity is represented today by the churches of St. Irene and SS. Sergius and Bacchus (Kucuk Ayasofya Camii) and by two great underground cisterns, that supposedly were built by Philoxenus (Binbirdirek), and the Cisterna basilica (Yerebatan Sarayi). But these structures represent only a fraction of the buildings that Justinian put up in Constantinople, and which included upward of 20 churches, among them the famous basilica of the Holy Apostles (originally founded by Constantine), palaces, hospices, administrative buildings, colonnades and harbours.

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GATE OF KUCUK SU PALACE ON THE BOSPORUS

The subsequent decline of Constantinople dates from the great plague which struck the city in 542 and is said to have killed 300,000 persons. As for the rest of the Byzantine empire so with Constantinople, the late 6th, 7th and 8th centuries were a period of extreme hardship and privation, followed by slow recovery in the 9th century. Building activity in Constantinople followed this curve; it was almost at a standstill during the period of decline, except for necessary works of fortification, then picked up again in the 9th century and continued until the end of the 12th, though on a smaller scale than in the period from Constantine to Justinian.

Throughout the middle ages Constantinople underwent a number of sieges, the most serious being: by the Persians and Avars in 626, by the Arabs in 674–678 and 717–718, by the Bulgarians in 813 and 913, by the Russians in 860, 941 and 1043, by the Pechenegs in 1090–91. All of these were successfully resisted; it was not until 1204 that Constantinople fell to a foreign foe. For later sieges *see* below.

In 1082 the Venetians were given special trading privileges and quarters in Constantinople; they were followed by the Pisans, Amalfitans, Genoese and other Italians. Maritime trade, upon which the prosperity of Constantinople depended, was henceforth to be in the hands of westerners. Friction between the native and foreign elements culminated in a terrible massacre of the latter in 1182.

In 1203 the armies of the fourth crusade, deflected from their objective in the Holy Land, appeared before Constantinople ostensibly to restore the legitimate emperor, Isaac II. The city fell, but for a year remained under Byzantine government. On April 13, 1204, the crusaders once more captured the city and this time gave themselves to indiscriminate pillage and massacre. A western emperor, Baldwin of Flanders, was then chosen to rule in Constantinople, while the church fell under the control of the Venetians who had been the prime instigators of the crusade. The Byzantines retrenched themselves in Nicaea and in the Epirus, while the remainder of their empire was partitioned by the westerners. The period of Latin rule (1204–61) was the most disastrous in the history of Constantinople; the city was systematically ransacked, all valuables and especially sacred relics were removed to the west, even the bronze statues were melted down for coin.

In 1261 Constantinople was retaken by Michael VIII Palaeologus, Greek emperor of Nicaea. For the next two centuries the shrunken Byzantine empire, threatened both from the west and by the rising power of the Ottoman Turks in Asia Minor, led a precarious existence. Some building was carried out at the end of the 13th and beginning of the 14th century, but thereafter the city was in a state of complete decay, full of ruins and tracts of deserted ground, contrasting with the prosperous condition of Galata across the Golden Horn, which had been granted to the Genoese by Michael VIII. When the Turks crossed into Europe in the mid-14th century the fate of Constantinople was sealed. The inevitable end was retarded by the defeat of the Turks at the hands of Timur (*q.v.*; Tamerlane) in 1402; but in 1422 Sultan Murad II laid siege to Constantinople. This attempt failed, only to be repeated 30 years later. In 1452 Sultan Mahmud (Mohammed) II proceeded to blockade the Bosporus by the erection of a strong fortress at its narrowest point; this fortress, called Rumeli Hisari, still forms one of the principal landmarks of the straits. The siege of the city began in April 1453. The Turks had not only overwhelming numerical superiority but also cannon which breached the ancient walls. The Golden Horn was protected by a chain, but the sultan succeeded in hauling his fleet by land from the Bosporus into the Golden Horn. The final assault was made on May 29 and, in spite of the desperate resistance of the inhabitants aided by the Genoese, the city fell. The last Byzantine emperor, Constantine XI, was killed in battle. For three days the city was abandoned to pillage and massacre, after which order was restored by the sultan.

As an ecclesiastical centre, Constantinople became the seat of a patriarch in 381 (*see* CONSTANTINOPLE, ECUMENICAL PATRIARCHATE OF). His rank was defined as being next only to that of the bishop of Rome. The patriarch of Constantinople is still the nominal head of the Orthodox Church. A patriarch of the Armenian Church also resides there. Constantinople was the seat of three ecumenical councils, the second (381), fifth (553) and sixth (680–681), as well as of many important local councils. The famous fourth ecumenical council was held in a suburb of Constantinople, at Chalcedon in 451 (*see* COUNCIL).

Istanbul.—At the time of its capture Constantinople was almost deserted. Mahmud II took measures to repeople it by transferring to it populations from other conquered areas such as the Peloponnese, Salonika and the Greek islands. By *c.* 1480 the population rose to between 60,000 and 70,000. Hagia Sophia and other Byzantine churches were transformed into mosques. The Greek patriarchate was retained, but moved to the church of St. Mary Pammacaristos (Fethiye Camii), later to find a permanent home in the Fener. The sultan built the Old Seraglio (Eski Saray), now destroyed, on the site occupied at present by the university, and a little later the Seraglio (Topkapi Sarayi) which is still in existence; he also built the Eyup mosque at the head of the Golden Horn and the Fatih mosque on the site of the basilica of the Holy Apostles. The latter mosque was destroyed by the earthquake of 1766 and was subsequently rebuilt. The capital of the Ottoman empire was transferred to Constantinople from Adrianople (Edirne) in 1457. The Turkish name Istanbul or Istanbol, attested before 1453, is a corruption of vulgar Greek *Stimboli (eis tin polin)*; *i.e.*, "in the city."

After Mahmud II Istanbul enjoyed a long period of peaceful growth, interrupted only by earthquakes, fires and pestilences. The sultans and their ministers devoted themselves to the building of mosques, palaces, charitable foundations and fountains, so that the aspect of the city was soon completely transformed. The most brilliant period of Turkish construction coincides with the reign of Suleiman the Magnificent (1520–66).

The next major change in the history of Istanbul occurred at the very beginning of the 19th century with the approaching dismemberment of the Ottoman empire, the liberation movements in the Balkans and the era of internal reforms (*tanzimat*). The reforms were accompanied by serious disturbances, such as the massacre of the Janizaries in the Hippodrome (1826). With the triumph of the progressive Sultan Mahmud II over the conservative opposition, the westernization of Istanbul started apace. There was an ever-growing influx of European visitors who, since the 1830s, could reach Istanbul by steamship. The first bridge across the Golden Horn was built in 1838. In 1839 Sultan Abdul-Mejid I issued the charter of Gulhane guaranteeing to all his subjects, whatever their religion, the security of their lives and fortune. The process of westernization was further accelerated by the Crimean War (1853–56) and the quartering of British and French troops in Istanbul. The latter part of the 19th and beginning of the 20th century were marked by the introduction of various public services: the European railroad extending to Istanbul was built in 1871; the underground tunnel joining Galata to Pera in 1873; a regular water supply for Istanbul and the settlements on the European side of the Bosporus was brought from Lake Terkos on the Black sea coast (29 mi. from the city) by the French company, La Compagnie des Eaux, after 1885; electric lighting was introduced in 1912 and electric streetcars and telephones in 1913 and 1914. An adequate sewage system had to wait until 1925 and later.

In the first quarter of the 20th century Istanbul experienced various disasters marking the death of the Ottoman empire and the birth of modern Turkey. In 1908 the city was occupied by the army of the Young Turks who deposed the hated sultan Abdul-Hamid II. During the Balkan Wars (1912–13) Istanbul was nearly captured by the Bulgarians. Throughout World War I the city was under blockade. After the conclusion of the Armistice (1918) it was placed under British, French and Italian occupation which lasted until 1923. The Greek-Turkish war in Asia Minor, as well as the Russian Revolution, brought thousands of refugees to Istanbul. With the victory of the Nationalists under Mustafa Kemal Ataturk, the sultanate was abolished and the last sultan, Mahmud VI, fled from Istanbul (1922). After the signing of the Lausanne treaty, Istanbul was evacuated by the Allies (Oct. 2, 1923) and Ankara was chosen as the capital of Turkey (Oct. 13, 1923). On Oct. 29 the Turkish republic was proclaimed. Because of Turkey's neutrality during most of World War II, Istanbul suffered no damage, although a German invasion was feared after the Balkans had been conquered by the Axis. In 1955 Istanbul (as also Izmir) was the scene of severe anti-Greek riots, related to the differences between Greece and Turkey over Cyprus, in which Greek shops and property were wrecked. The influx of automobiles brought acute traffic problems to Istanbul, especially after World War II. By the mid-1960s large tracts of the city had been demolished or cleared to make way for modern highways.

MONUMENTS

Byzantine Monuments.—The most impressive vestige of secular Byzantine architecture in Istanbul is the city walls. The land walls, about 4.5 mi. long, consist of a double line of ramparts, the inner one erected in 413, the outer one in 447, and a moat. The inner wall is about 40 ft. high and 15 ft. thick, and is guarded by towers, about 60 ft. high at intervals of about 180 ft. The outer wall, which is lower, is also provided with towers. The walls were repaired at different periods and bear inscriptions to that effect. The seaward walls consist of a single line. Those along the Sea of Marmara are well preserved, while those along the Golden Horn have almost disappeared. Near the junction of the land walls with the Marmara walls stands the Golden gate, a triumphal arch flanked by square marble towers, erected *c.* 390.

The Byzantine palaces have almost completely perished. An excavation on the site of the Great palace, carried out by a Scottish expedition starting in 1935, has resulted in the discovery of a peristyle with a magnificent mosaic pavement probably dating from the late 6th century A.D. The only reasonably well-preserved example of Byzantine palace architecture in Istanbul is the so-called Tekfursarayi, attached to the land walls not far from the Golden Horn. It is the shell of a three-story rectangular building, and dates from *c.* 1300.

Of the famous Hippodrome only its curved end remains as well as three monuments on its longitudinal axis: the granite obelisk of Theodosius I, originally erected at Karnak in Egypt by Thutmose III (*c.* 1504–1490 B.C.), the masonry obelisk of Constantine VII (A.D. 913–959), once covered with bronze plaques, and the mutilated Delphic serpent made after the battle of Plataea (479 B.C.). Of the many monumental columns which decorated Constantinople there remain only Constantine's porphyry column near the Nuruosmaniye mosque, the base of the column of Arcadius (395–408) in the Cerrahpasa quarter, the column of Marcian (450–57), known in Turkish as Kiztasi (column of the virgin), in the Fatih quarter, and a perfectly preserved Corinthian column in the grounds of the Seraglio presumably dating from the reign of Claudius II Gothicus (268–270).

Istanbul has a great number of underground Byzantine cisterns. These usually have vaulted roofs supported on columns. The most impressive of these are the Cisterna basilica near Hagia Sophia, which has 336 columns and still contains water, and the cistern of Philoxenus near the Hippodrome, which has 224 columns; the Philoxenus cistern is now dry. There are also four enormous open-air cisterns, one of which is outside the city.

Of the Byzantine churches the most important is Hagia Sophia, rebuilt 532–537, converted into a mosque in 1453 and into a museum in 1935. It is a rectangle 252 ft. long, 234 ft. wide, covered with an immense dome 110 ft. in diameter, rising to a height of 186 ft. The uncovering and cleaning of the mosaics of Hagia Sophia has been carried out by the Byzantine Institute of America, which began this work in 1931. There are about 25 other Byzantine churches in Istanbul, many of which are still used as mosques. The most interesting are: the ruined basilica of St. John of Studius (Imrahor Camii), founded in 463 by the patrician Studius, once the seat of a famous monastery; the octagonal church of SS. Sergius and Bacchus, built by Justinian between 527 and 536; the church of St. Irene, built in its present form by Justinian and used until about 1950 as a military museum; Church of the Saviour Pantocrator (Zeyrek kilise Camii) of the 12th century, with a magnificent inlaid pavement; the Virgin Pammacaristos (Fethiye Camii) of the 11th and 14th centuries, with interesting mosaics; and the Church of St. Saviour in Chora (Kahriye Camii), restored in the 11th century and extensively remodelled in the 14th. Kahriye Camii, now a museum, has a splendid mosaic decoration dating from *c.* 1320; this too has been cleaned and consolidated by the Byzantine Institute of America. (*See* also BYZANTINE ARCHITECTURE; BYZANTINE ART.)

Turkish Monuments.—The sultans' Seraglio (Topkapi Sarayi) is now a museum. With its gardens it occupies the entire tip of the promontory and is enclosed within a fortified wall. Begun by Mahmud II in 1462, it served as the residence of the sultans until the beginning of the 19th century. The Seraglio consists mostly of small buildings grouped around three courts. The most significant buildings are the Faience kiosk (Cinili kosku) built in 1472, the Audience chamber (Arzodasi), the Hirkaiserif, a sanctuary containing relics of the prophet Mohammed, and the elegant Baghdad kiosk (Bagdat Kosku) commemorating the capture of Baghdad in 1638. The Seraglio houses the sultans' treasure and has important collections of manuscripts, china, armour, textiles, etc. After the abandonment of the old Seraglio, the sultans built for themselves palaces along the Bosporus, such as the Beylerbey palace (1865), the lavish Dolmabahce palace (1853), the Ceragan palace built in 1874 and burned in 1910 and the Yildiz palace which was the residence of Abdul-Hamid II.

It is to its mosques that Istanbul owes its distinctive skyline. Architecturally, they may be separated into three groups: those built before *c.* 1500 reproducing the archaic formulas that had been applied by the Turks in the mosques of Nicaea (Iznik), Bursa and Adrianople (Edirne); the "classical" group which extends into the 17th century and is influenced by Byzantine architecture, especially by Hagia Sophia; later mosques marked by the introduction of western, first baroque and then neoclassical, elements. The principal mosques of the first period are Mahmud Pasa Camii (1464),

BY COURTESY OF TURKISH INFORMATION AND TOURIST DEPARTMENT

DOLMABAHCE MOSQUE, BUILT IN 1853, ON THE EUROPEAN SIDE OF THE BOSPORUS, WITH CLOCK TOWER AND DOLMABAHCE PALACE LEFT BACKGROUND

Murad Pasa Camii (1466), Atikalipasa Camii (1497) and, a little later, Sultan Selim Camii (1520). The "classical" period opens with Sultan Beyazid Camii (1501–05), and finds its highest expression in the work of the architect Sinan, viz. Sehzade Camii or Princes' mosque (1544–48), Suleymaniye Camii (1550–57), the masterpiece of Ottoman architecture in Istanbul, Mihrimah Camii and Rustempasa Camii (both middle of the 16th century), the latter famous for its Iznik faïence tiles, Ahmed Pasa Camii (1555), Sokollu Mehmed Pasa Camii (1572), and Kilicalipasa Camii at Tophane (1580), a close replica of Hagia Sophia. The classical style is continued in Sultan Ahmed Camii (1616), popularly known as the Blue mosque and having six minarets, more than any other mosque of Istanbul; and Yeni Valide Camii or New mosque (1614–63), at the head of the Eminonu bridge. The most important specimens of the baroque period are Nuruosmaniye Camii (1755) near the Grand bazaar, Laleli Camii or the Tulip mosque (1763) and Fatih Camii (1767–71). Later mosques are of lesser interest.

Other curious examples of Turkish construction are the numerous fountains, the most elaborate being that of Sultan Ahmed III (1728) behind the apse of Hagia Sophia; the mausoleums of the sultans and their relatives, usually attached to mosques, especially those of Mahmud II by the Fatih mosque, Suleiman the Magnificent and his wife Roxelana by the Suleymaniye Camii, Murad III and Selim II by Hagia Sophia and Ahmed I on the Hippodrome; other appendages of mosques such as schools (*medrese*) and hostels for the poor (*imaret*); and bazaars, like the labyrinthine Grand bazaar (Buyuk Carsi) and the Egyptian market (Misir Carsi) at Eminonu. (*See* also ISLAMIC ARCHITECTURE: *Turkey*.)

Archaeological Museums.—In addition to historical monuments which have been converted into museums, Istanbul possesses an important Archaeological museum containing Greek, Roman and Byzantine antiquities. Its most prized possession is the so-called Alexander sarcophagus of the 4th century B.C. as well as other sarcophagi found at Sidon. A special section of the museum is devoted to oriental antiquities; *e.g.*, Hittite, Assyrian, Babylonian and Egyptian.

POPULATION, ADMINISTRATION AND ECONOMY

Population.—Istanbul has always been a cosmopolitan city. Although census figures are not always reliable, it appears that the population of Istanbul was on the increase until World War I; thereafter it dropped, but has been increasing steadily since 1930. The count of 1876 showed 873,565 persons within the city limits; that of 1927 showed 690,857, of whom 447,851 were Muslim Turks and 243,066 non-Muslims (mostly Greeks, Jews and Armenians), including foreigners. The non-Muslim element has been dwindling; in 1945, out of a total population of 860,558, there were 663,278 Muslims, 147,568 Christians and 49,239 Jews. In 1960 the total population was 1,466,535.

Administration.—The municipal prefect of Istanbul is also the governor of the province (*il*) and is appointed by the president of the republic. The municipality (*belediye*) is divided into 12 circumscriptions (*kazas*), each governed by a *kaymakam:* Eminonu, Fatih (in the old city), Eyup, Bakirkoy, Beyoglu, Sisli, Besiktas, Sariyer (on the European side), Beykoz, Uskudar, Kadikoy, Adalar (on the Asiatic side).

Education.—Istanbul possesses a university founded in 1846 with faculties of letters, science, law, medicine and forestry; it is located in the buildings of the former Seraskerat (war ministry). There are also a Technical university on the Galata side of the Horn, an Academy of Fine Arts, schools of technology, commerce and economics. Foreign educational institutions include the American Robert college for boys (founded 1863) and the American college for girls (founded 1871), both on the Bosporus; an English high school for boys and one for girls; and the French-Turkish lycée of Galatasaray (founded 1867).

Commerce and Communications.—Istanbul is the largest port of Turkey as well as being the industrial centre of the country. Maritime traffic, affected by the international situation, has remained somewhat sluggish owing to restricted intercourse with the Black sea countries. There are shipbuilding yards in the Golden Horn. Goods manufactured in the city include textiles, pottery, leather, cigarettes, liqueurs, flour, cement, glass and soap. Another growing source of revenue is tourism.

Istanbul is the terminus of the international rail service (the former Orient Express) Paris-Milan-Belgrade-Sofia or Salonika-Istanbul, and the starting point (at Haydarpasa on the Asiatic side) of the Baghdad railway. The city is served by numerous maritime lines. From the airport of Yesilkoy, 17½ mi. W. of the city, there are services to most of the major cities of the world.

Internal communication of the city is served by buses which have now replaced streetcars, and an extensive network of ferries connecting the Galata bridge with the villages of the Bosporus, the Asiatic coast as far as Yalova, the Princes Islands and the Golden Horn.

Istanbul Province.—The *il* of Istanbul lies between longitude 28° and 30° and latitude 40° 45′ and 41° 45′, covering an area of about 2,080 sq.mi. It is bisected by the Bosporus and includes on the European side the towns of Silivri and Catalca, and on the Asiatic side Sile, Kartal and Yalova. The area has small deposits of metal and lignite. Agriculture is not developed apart from vegetable and fruit growing. The population of the province was 805,707 in 1927 and 1,542,941 in 1955.

See also references under "Istanbul" in the Index.

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ISTHMUS, a narrow strip of land connecting two larger land areas otherwise separated by the sea. Unquestionably the two most famous are the Isthmus of Panama, connecting North and South America, and the Isthmus of Suez, connecting Africa and Asia. Historically the Isthmus of Corinth was of major importance because it connected what otherwise would be the island of Peloponnese with the rest of the Greek peninsula. Isthmuses are of great importance in plant and animal geography because they offer a path for the migration of land plants and animals between the two great land masses that they connect.

(W. C. C.)

ISTRIA, a peninsula in the northern Adriatic, has an area of 1,390 sq.mi. After 1918 it became the Italian province of Pola in the region of Venezia Giulia. In 1947 most of Istria passed to Yugoslavia when it was divided along ethnic lines between Croatia and Slovenia. It includes most of the Istrian peninsula stretching into the Adriatic between the Gulf of Trieste and the Gulf of Kvarner (Quarnero) and the islands of Cres (Cherso), Losinj (Lussino) and others. The coast line extends for 267 mi. Pop. (1953) 271,996. Istria is mainly a plateau and a great portion lies in the karst region, flanked north and east by mountains and sloping south and west in undulating terraces toward the Adriatic. The highest mountain is Ucka (Monte Maggiore), (4,580 ft.). In the west are the gulfs of Koper (Capodistria), Piran (Pirano) and Pula (Pola) and in the east that of Rasa (Arsa). The climate is on the whole warm and dry, the yearly rainfall varies between 25 and 57 in. The coasts are exposed to the sirocco from the south-southeast and the bora from the northeast. Wheat, maize (corn), rye, oats, figs and olives are grown. The olive oil in Istria was famous in Roman times. Cattle are bred, and beech and oaks grown for timber, oak bark and cork. Istria has one of the largest mercury mines in Europe, at Idrija. Fishing, producing salt from sea water, and shipbuilding are other occupations. The most important town and harbour is Pula, which has a Roman amphitheatre. Opatija (Abbazia) and Brioni are best known as seaside resorts.

Istria was the ancient Istria or Histria, subdued by Rome only by 177 B.C. after two wars. Under Augustus the greater part of the peninsula was added to Italy. It was annexed to the Frankish kingdom of Pepin in 789; in the middle of the 10th century, it passed to the dukes of Carinthia, then successively to the dukes of Meran, the duke of Bavaria, the patriarch of Aquileia and the republic of Venice. It remained under their rule until 1797 when Austria added to it the northeastern part of the peninsula which had fallen to its share as early as 1374. It remained under Austrian rule until 1918. (V. De.)

ITÁ, an important town of the Central department of southern Paraguay, was founded in 1536 by members of Pedro de Mendoza's expedition as one of the original fort settlements of Paraguay. It later became a centre of Jesuit missionary activity. Pop. (1960 est.) 5,983.

Located on the southern flank of the Cordillera de Altos, the highland country which projects westward to Asunción, and in the valley of one of the headstreams of the Tebicuary river, Itá is an important farming and processing centre. Tobacco, fruit, sugar and cotton are among the crops grown in the district; and rum, edible oils and leather are manufactured. Although without rail connections, it is a significant road centre, and is also the capital of the *partido* of Itá, an administrative unit of the Central department. Roads link the city with the port of Villeta on the Paraguay river, and with the Central Paraguayan railway at Pirayú.

(G. J. B.)

ITACOLUMITE, a variety of porous yellow sandstone or quartzose schist occurring at Itacolumi, in the southern portion of Minas Gerais, Brazil. The rock is of interest for two reasons: it is believed to be the source of the abundant diamonds of the district, and it is the best-known example of a flexible sandstone. If a piece 1 ft. in length and about ½ in. thick is supported at its ends, it will gradually bend under its own weight; if it then is turned over, it will bend in the opposite direction. The cause of the flexibility is ascribed to the porous character of the rock and the interlocking of the sand grains. (P. G. H. B.)

ITAGAKI TAISUKE, Count (1837–1919), Japanese political leader known primarily for his pioneering efforts in the early democratic movement from which emerged in 1881 Japan's first political party, the *Jiyūtō* or Liberal party. Because of his efforts to disseminate the doctrines of the French philosopher Rousseau and other western liberals, together with his ability to inspire a following, he came to symbolize the early democratic movement. This movement was rooted in personal, economic and social grievances, but ran counter to the main stream of Japanese political development. Itagaki's role was complicated by his enthusiasm for national strength and territorial expansion, two objectives that came to predominate over his liberalism after the mid-1880s. Thus he could be classified as a "national liberal." He resisted pressures to lead revolutionary efforts and thought of himself as a reformer.

Born in the castle town of Kochi in Tosa fief on Shikoku Island, April 17, 1837, Itagaki was in his early years a troublemaker among other young samurai but in 1860 he entered the service of his lord. He emerged from factional struggles to become the top military commander in Tosa.

When the restoration overthrew the Tokugawa family in 1868 and restored the focus of national authority in the emperor, Itagaki led Tosa's army in this national effort. Afterward he stood as one of a dozen powerful young leaders on the national scene. After serving from 1868 to 1873 as an official in the new government he broke with it and began the opposition movement in which he was to continue, except for brief intervals in 1875, 1895 and in 1898, when he accepted cabinet positions. In 1878 he established a private school devoted to teaching the principles of democratic government and came to be known as the Rousseau of Japan. The peak of his fame was attained in April 1882 in Gifu when knife wounds by an attacker drew forth his declaration, "Itagaki may die but liberty, never." He was raised to the nobility with the rank of count in 1887.

With the beginning of parliamentary government in 1890 Itagaki served as the symbolic head of a party which frequently cooperated with Itō Hirobumi (*q.v.*) of the government oligarchs. Although accused of having abandoned his fight for a government patterned after the British model, he and his party felt a first responsibility to demonstrate to the west that the Japanese were capable of parliamentary government. After retirement in 1900 he wrote articles on current problems and agitated for social reform. He died in 1919. *See* also Japan: *History*.

(C. E. Co.)

ITALIAN INDEPENDENCE, WARS OF (1848–1870), the series of wars by which Italy was politically unified as a kingdom under the house of Savoy (*see* Italy: *History*).

From the beginning of the middle ages the Italian peninsula had been a prey to foreign invasion and had been divided among several states. Since the invasion by the French king Charles VIII in 1494, northern Italy had been the natural battleground where the Austrian Habsburgs and the Valois and Bourbon kings of France had settled their quarrels. The Habsburg-Bourbon conflict, meanwhile, had enabled the dukes of Savoy, rulers of Piedmont on the Italian side of the Alps, to play one side off against the other; and it was largely because of Piedmont's value to Eu-

rope as a buffer state that the dukes were granted the royal title as kings of Sardinia (*see* SAVOY, HOUSE OF). After the French Revolutionary and Napoleonic wars, however, the French were excluded from Italy, and Piedmont's freedom of action and marginal importance as a makeweight in the balance of power was thereby diminished. In the period 1815–59, Austria was by far the strongest among the Italian powers, directly possessing Lombardy and Venetia and exercising a powerful influence almost everywhere else by either treaty, family tie or conservative interest. Almost inevitably Sardinia-Piedmont's independence seemed to be threatened by the fact that the power balance was so upset, and King Charles Albert was thereby forced to abandon a pro-Austrian policy and adopt an anti-Austrian policy. Political motives were then supplemented by commercial interests. Piedmont needed the plain of Lombardy as a source of food and an outlet for wine and other produce. She countermanded an agreement on the salt trade (a royal monopoly in Piedmont), thus provoking Austria to put a heavy duty on imports of wine from Piedmont. The Austrians tried to build up Venice as a road and railway centre for the goods of Lombardy and central Europe, and this was a threat to the Piedmontese port of Genoa. The house of Savoy had for many years been waiting for the moment when Lombardy could be annexed. It needed only the resurgence of France as a rival to the Habsburg empire before a war against Austria became conceivable. When a French garrison appeared at Ancona in the papal states in 1832, after Austrian intervention against revolutionary disturbances, Franco-Austrian rivalry in Italy again became a factor in politics, and the rulers of Piedmont were given a lever which one day they might be able to employ.

The War of 1848–49.—In Italy and elsewhere in Europe, 1848 was a year of revolutions and for this there were many causes. Some Italians were beginning to agree with Giuseppe Mazzini that the peninsula of Italy ought to be politically unified. Many more agreed with those in Piedmont who at least wanted Italy more independent of foreign influence and Austria excluded. The so-called Neo-Guelphs wanted to federate Italy under the pope. Economists wanted a customs union and an integrated railway system. On the other hand many Sicilians of all classes were on the verge of rebellion to break free from their political connection with Naples. In many Italian states there was a parallel movement among the middle classes for more representative government, and there was also a convulsive agitation among the people in the countryside, who were often on the edge of starvation and had almost nothing to lose by revolt. These and other feelings of restlessness in 1848 were sometimes mutually contradictory, but together they produced a situation in which a spark might touch off a major revolution. One such spark was the elevation of Pius IX to the papacy in 1846, for he had just enough of the reputation of a liberal and a nationalist to make people see him momentarily as the harbinger of a new order. Another more explosive spark was an insurrection in Sicily in Jan. 1848. When a political revolution broke out in Vienna itself in March, Austria appeared to be tottering, and the inhabitants of Milan, who had long resented foreign rule and efficient Austrian tax collection, rose on March 18 in a spontaneous and surprisingly effective revolt against their Austrian garrison. The Austrian commander was Josef Radetzky, one of the ablest military commanders of the time in Europe. He had a garrison of nearly 12,000 men in Milan, but even so he was forced to evacuate the town in order to regroup his forces. Venice had also risen against the Austrians (*see* MANIN, DANIELE). The Milanese asked Piedmont for help.

Charles Albert was torn between his instinctive desire to avoid revolution and his ambition to expel the Austrians. Public opinion in Turin pressed him to take the risk, and so on March 24–25 some advance units of the Piedmontese army crossed the Ticino river into Austrian Lombardy, with Charles Albert himself as commander in chief. The king, however, had few qualifications for military command, and his army was ill-trained and ill-equipped. His aim was to cut Radetzky off from the reinforcements arriving from the Tirol and at the same time to attack the Quadrilateral of fortresses (Mantua, Peschiera, Verona and Legnago) on which the whole Austrian military command was pivoted. Radetzky (one-third of whose troops were Italians), managed to overwhelm one isolated group of his opponents under Giovanni Durando on June 10, and then defeated the main body of Piedmontese troops near the village of Custoza, not far from Verona on July 23–25. Milan was reoccupied on Aug. 4, and an armistice was agreed at Vigevano on Aug. 9 after the Piedmontese had been driven out of Lombardy.

This defeat dampened the hopes of Italian nationalists and was a great blow at Piedmont's prestige. Far from having annexed Lombardy, Piedmont had aroused strong resentment among the Milanese republicans, who accused Charles Albert of having entered the war only to destroy their republic and to impose his rule on Lombardy. Desperately trying to retrieve the situation and completely overrating his own force and ability, the king rashly decided to reopen the war on March 20, 1849. This time he gave the effective command to Albert Chrzanowski, a Polish general then employed as a kind of *condottiere*. Advance units of the Piedmontese army at once moved into Lombardy, thinking that Radetzky would again retreat on the quadrilateral. Instead Radetzky took the offensive. By judicious feints he was able to divide the Piedmontese troops and to induce some of them to cross the Ticino near Magenta. He then destroyed the bridge, cutting off Girolamo Ramorino from Chrzanowski's main army, while his own forces had crossed the river farther downstream at Pavia and advanced into Piedmont. At once he forced Charles Albert into a decisive encounter at Novara. The Austrians had not waited to regroup and were at first heavily outnumbered, but Radetzky was able to concentrate his men and won a quick, overwhelming victory. This was on March 23, only three days after the war had been resumed. An armistice was arranged at once to forestall an Austrian advance on Turin, and Charles Albert abdicated in favour of his son Victor Emmanuel II in order to save the monarchy. Rome, where a republic had been proclaimed in February, fell to French troops in June, despite a heroic defense by Giuseppe Garibaldi; and the Venetian republic was overthrown by the Austrians in August.

Charles Albert's campaigns had been fought on the correct assumption that Piedmont had very little to lose, since a buffer state on the Alps was needed by France and Austria alike. The false assumption had been that Piedmont alone could win against Austria. Piedmont needed help from either France or Great Britain and also needed a more liberal government, since Charles Albert's reactionary reputation had little appeal to Italians in other provinces; and there was further an imperative need to play down motives of Piedmontese aggrandisement. These facts were recognized by Cavour, who became prime minister of Piedmont in 1852.

Cavour liberalized the government of Turin, welcomed refugees from elsewhere in Italy and convinced some of Mazzini's followers that the only way of unifying Italy was to ally themselves with the Piedmontese army and Piedmontese ambitions. One not particularly successful move on his part, in 1855, was to join with France, Great Britain and Turkey in the Crimean War where no Italian interest was at stake; but this did at least give the impression that Piedmont was of more European significance than the other states of Italy. Cavour also pledged the finances of his tiny country in a rearmament program, building up a huge national debt in the process. Against much opposition in Piedmont, he fortified La Spezia, Casale Monferrato and Alessandria, even occasionally bypassing parliament in order to conceal what was afoot and to ensure that military resources should be greater than in the disastrous campaigns of 1848–49. In 1856 he tried to involve Great Britain in war against Austria. When this failed, he eventually fell in with French plans to prepare a joint war of conquest.

The War of 1859.—The main initiative for the War of 1859 came from Napoleon III, emperor of the French, who summoned Cavour to Plombières in July 1858 and there agreed that they would somehow contrive to fight Austria in the following spring. At last the balance of power between France and Austria was sufficiently restored to make Piedmontese chances much more favourable and a Piedmontese alliance more desirable than ten years earlier. Italy once again was shown to be the natural battleground

for France and Austria, and Napoleon III then had his opportunity to undo the humiliating settlement of 1815. He further persuaded Cavour to promise him the Sardinian kingdom's two provinces of Savoy and Nice in return for Lombardy and Venice, which were to be conquered from Austria and annexed by Victor Emmanuel II. Cavour's part of the bargain was to engineer the actual outbreak of war and do it in such a way that Europe would not think the allies aggressive. His plan was to go on being provocative, mobilizing troops and stirring up unrest, so that Austria would lose patience and give an excuse for war by asking Piedmont to disarm. There was some hurry from Cavour's point of view, for the Austrians under the archduke Maximilian were gradually liberalizing the government of Lombardy, and delay might lose Cavour any excuse that he might have in the form of Lombard resentment against Austrian rule. So *agents provocateurs* were sent to stir up insurrections in Austrian-controlled Italy, in order to make Piedmontese aggression seem more like a war of liberation than of imperialism.

The Franco-Sardinian treaty arranging this war was signed in Jan. 1859. It provided that Napoleon III was to be commander in chief. Cavour agreed to pay all the French costs and to put 100,000 soldiers into the field. Cavour's inability to honour these promises perhaps helps to explain the differences between the allies that made the war something less than a full success. The war began on April 26, and the Austrian army under Ferencz, Graf Gyulai, crossed the frontier into Piedmontese territory next day. He had a fortnight to defeat the Piedmontese before the French army could arrive on the scene, and the Piedmontese generals knew that their positions were defenseless; but Gyulai delayed too long, and soon an army of 150,000 French and 60,000 Piedmontese was arrayed against about 170,000 Austrians. Henceforward Gyulai was on the defensive in the plain of Lombardy where the Austrian positions had been designed for defense. He crossed the Ticino back into Lombardy at the beginning of June. The first major engagement was at Magenta on June 4, when the Franco-Piedmontese army was crossing the river. The French numbers there were decisive, though the Austrians were able to retire in good order. Meanwhile Garibaldi's volunteers won a minor engagement at Varese. On June 8 the allies entered Milan, while the Austrians retired to the Mincio. Gyulai was now superseded and the emperor Francis Joseph I took command, with Heinrich, Freiherr von Hess, as his chief of staff.

A second battle was fought at Solferino on June 24, where the Austrians lost 22,000 men and the allies 17,000, the Austrians being forced back behind the Mincio. Napoleon III then unexpectedly proceeded to make an armistice at Villafranca on July 8, and the preliminaries of peace were signed on July 11, followed by the treaties of Zürich on Nov. 10. Whether he was afraid of Prussian intervention, worried by the lack of enthusiasm among Italians or annoyed that Cavour was secretly trying to start revolutions in Tuscany and the papal states, Napoleon had decided to stop the war before he had overrun the Quadrilateral or entered Venetian territory. He did not consult Cavour nor inform him of his intentions. But he did arrange that Austria should hand most of Lombardy over to the French, who then gave it to Piedmont. Apart from the promise of Savoy and Nice, Napoleon had won very little for France from this war. Cavour was indignantly ungrateful to him, but in fact France had done most of the work and Piedmont had reaped all the gain from the actual fighting.

The War of 1860.—As a consequence of internal revolutions in 1859, Parma, Modena, Tuscany and the formerly papal Romagna were annexed to the kingdom of Sardinia in March 1860. Then Garibaldi and his volunteers landed in Sicily in May, conquered it from the Bourbon forces and proceeded to invade the Neapolitan mainland. After the fall of Naples (Sept. 7), the Piedmontese army under Enrico Cialdini invaded papal Umbria and the Marches, defeated the pope's tiny army at Castelfidardo (Sept. 18) and joined Garibaldi's forces in the south. Garibaldi then presented his conquests to Victor Emmanuel. After the fall of Gaeta, the last Bourbon stronghold, in Feb. 1861, the new kingdom of Italy could be proclaimed at Turin. Rome, however, remained in the hands of the pope, under French protection; and Venetia was still held by Austria. An attempt by Garibaldi in 1862 to take Rome by volunteer enterprise was defeated by Italian forces at Aspromonte (Aug. 29).

The War of 1866.—It was to win Venetia that in 1866 the Italian government signed a treaty with Prussia directed against Austria, and war soon broke out according to plan (*see* SEVEN WEEKS' WAR). Austria had to fight on two fronts, and therefore the Italian army considerably outnumbered the Austrian troops confronting it. Yet there were serious faults of planning, and Victor Emmanuel proved to be an incompetent commander. Bismarck had hoped that the Italians would co-operate in his strategic plan, but instead they decided to organize a head-on attack against the Quadrilateral. The Italian army was divided into two commands under Generals Alfonso La Marmora and Cialdini, between which there was almost no liaison at all. The archduke Albert led the Austrian army. Once again Custoza proved to be the main battlefield, the Austrians scoring a notable victory there on June 23. Such was the demoralization in Italy that the war on Austria's southern front thereafter remained static, and Austrian troops could be drawn off to reinforce the army fighting Prussia in the north. Demoralization, too, was the main reason why the Austrians also won a sea battle at Lissa on July 20 when Adm. Wilhelm von Tegetthof with inferior forces defeated Adm. Carlo Persano in the Adriatic. Nevertheless, Prussian success in the north soon forced Austria to accept an armistice; and Venetia, under the treaty of Vienna (Oct. 3, 1866) was handed over to the French, who then gave it to Italy. The results of this war were thus favourable to Italy, even though the Italians had won only a small-scale military success, namely that achieved by Garibaldi, who again had been allowed to raise volunteers and to fight on a separate front. He had reached the outskirts of Trento when the peace forced him to withdraw.

The Fall of Rome (1870).—The province of Trentino-Alto Adige and the cities of Rome and Trieste were still outside the geographical boundary of the kingdom of Italy as it existed after the war of 1866. Austria had been driven out of the peninsula except for a small enclave south of the Brenner Pass, and the sole major obstacle remaining to national unification was the pope's position in Rome. Another Garibaldian attempt on that city in 1867 was defeated by French and papal troops at Mentana (Nov. 3). Finally, however, Rome was captured for Italy. The outbreak of the Franco-German War in that year had forced Napoleon III to withdraw the French garrison, and against merely token resistance by papal troops Gen. Raffaele Cadorna bombarded and stormed the Porta Pia on Sept. 20. At the price of a few dozen casualties the Italians thus acquired a new national capital, and papal sovereignty was henceforward confined to the few acres of the Vatican city. Trento and Trieste had to wait until World War I before they passed from Austria to Italy, but the *Risorgimento* wars of independence can be considered at an end in 1870.

(D. M. SH.)

ITALIAN LANGUAGE is the standard language used for official, formal and literary purposes throughout Italy, taught in schools to natives and foreigners. The common everyday speech is either a local Italian dialect different from the standard, or the standard influenced by local usage. The less formal the occasion and the less educated the speaker, the greater are the deviations from standard Italian; many persons cannot speak standard Italian at all. All speech forms called Italian belong to the Romance languages (*q.v.*).

The Dialects.—The number of dialects is very great, and the differences are so profound that many are mutually unintelligible. Thus the word "dialect" here connotes much more radical variations than it normally does in reference to English. The dialects may be divided into six major classes:

1. Gallo-Italian: (*a*) Piedmontese; (*b*) Ligurian; (*c*) Lombard; (*d*) Emilian.
2. Venetian: (*a*) Veneziano; (*b*) Trentine; (*c*) Istrian.
3. Tuscan: (*a*) Florentine; (*b*) Western Tuscan; (*c*) Southern Tuscan.
4. Corsican.
5. Central Italian: (*a*) Northern Latian; (*b*) Umbrian; (*c*) Marchigiano; (*d*) (Modern) Roman.

6. Southern Italian: (*a*) Southern Latian; (*b*) Abruzzese; (*c*) Campanian; (*d*) Calabrian; (*e*) Apulian; (*f*) Sicilian.

Different classifications are possible, as are further subdivisions.

Italian dialects are also spoken in the Swiss canton Ticino and on Corsica, and were spoken on the Adriatic island of Veglia (Krk) and in Dalmatia until the 19th and 15th centuries, respectively. (Some consider the last a separate Romance language.)

Italian in its various forms is spoken natively by about 50,000,000 persons. A considerable number of Italian immigrants to the United States and to Argentina continued to speak Italian, and used the language of their new homeland as a second language, but the succeeding generations became progressively monolingual speakers of English or Spanish. Since the loss of Italy's African colonies at the end of World War II, Italian, once the official language there, though not the mother tongue of the natives, has been on the wane.

The linguistic fragmentation of Italy and the tenacity of the dialects have historic causes. Although Italy was latinized by the conquering Romans, it is certain, though evidence is scanty, that the numerous pre-Latin languages of Italy persisted for some time after the Roman conquest and continued in certain local pronunciations of Latin. Furthermore, not all Italy was occupied by the Romans at the same time, hence it was not all exposed to the same kind of Latin, nor latinized with equal thoroughness. There was no policy of linguistic acculturation in annexed regions. Linguistic decentralization was intensified by the extreme and enduring political dismemberment of the peninsula after the fall of the Roman empire, and enhanced by the rugged geography of the country and the physical difficulties of communication.

The Standard Language.—Classical Latin, after the dissolution of the Roman state and the breakdown of secular education, became the property of a diminishing number of educated persons, largely of the clergy; it became unintelligible to the common man, whose vernacular continued to change, as all language does. When it became urgent to employ, for state and private business, a language other than Latin which all could understand, and when literary men wished their works to appeal to a greater listening, if not reading, public, it became necessary to reduce previously unrecorded contemporary dialects to writing. This is a difficult task, even with the methods of modern linguistics, which is aggravated when the effort is deprecated as an attempt to replace a noble tongue by an allegedly vulgar patois.

In *De vulgari eloquentia* "About Popular Speech," written in Latin early in the 14th century, Dante, having skilfully surveyed the languages of Europe and Italy, proposed to establish for all Italians a literary language which should be constructed from all the dialects, preserving a core of common features and discarding extreme local peculiarities. But, contrary to his own theory, Dante himself wrote in his native dialect, Florentine. Thus almost single-handed he made Florentine the literary standard language of Italy, albeit without being fully aware of it. The elevation of a dialect to a literary language because of some prestige accrued to it is the usual phenomenon rather than the procedure Dante suggested. And Florentine acquired the necessary prestige mainly through Dante's own *Divina Commedia*, and later Boccaccio's *Decamerone*, and Petrarch's *Canzoniere*. But Florentine had to compete with other dialects in which meritorious works had been composed, such as the poetry of the Sicilian school, which flourished in Palermo at the court of the German emperor Frederick II (1194–1250) and ended with the Hohenstaufen dynasty. The dialect of the original poems is uncertain, most of the extant manuscripts being from Tuscany and liberally tuscanized. Florentine, however, was aided by the poetry in the *dolce stil nuovo* "sweet new style," produced by a Tuscan school; one of its leaders, Guido Guinizelli, a Bolognese, wrote in Florentine.

Graver obstacles were: the opposition of the learned men who did not wish to see Latin losing ground; the relatively slow spread of Dante's works due to extensive illiteracy and the cost of books before the invention of printing; the seeming needlessness of a national language in the absence of a nation; the cultural climate favouring a renascence of antiquity, which led one humanist of Florence to denounce the *Divina Commedia* as a vulgar piece written in a vulgar tongue, and Italian as a language unfit for poetry. (Petrarch himself was prouder of his Latin than of his Italian works.)

Thus developed the discussions of the *Questione della lingua* "Problem of the Language," which sought to decide whether Latin or Italian should become the national idiom, and, if the latter, which dialect and how "pure" (*i.e.*, free from archaisms, at issue especially from the Renaissance on, and gallicisms, which began to come into Italian and other European languages in the 18th century) it should be. In practice, however, Dante had already decided the quarrel in favour of Florentine. In 1525 the Venetian Pietro Bembo, by publishing his *Prose della volgar lingua*, fulfilled the two pressing requirements for a standard language (now one that was to be printed in relatively cheap books), an orthographic and a grammatical codification.

Even a standard language, which is by purpose conservative, must not be inhospitable to revision if it is to remain useful. Once adopted, standard Italian was prevented from evolving, and was nearly stifled by its grammarians. It became unwieldy, crammed with formulas and phrases thought beautiful or noble (*cf.* even the modern formal style in letters and officialese), and alienated from reality; it became inadequate over the centuries for the demands of a changing world and new literary trends. Some writers once more had recourse to the uninhibited, lively dialects, and a growing dialect literature in the 18th and 19th centuries threatened to reduce Italian, like classical Latin, to a dead language. It was resuscitated by the Milanese author Alessandro Manzoni (1785–1873), who wrote the second edition of his novel *I promessi sposi* "The Betrothed" in standard Italian. But he saw to it, in practice and also in numerous theoretical essays, that the language was reformed and revived, that it was allowed to fill its gaps, and that it would be nurtured by the stream of life it was to reflect and to serve. Manzoni's endeavours were succoured by the awakening nationalism.

Modern standard Italian is still basically the dialect of Florence (minus peculiar localisms like *la hasa* for *la casa*, *amaθo* for *amato*), but constantly enriched by borrowings from other dialects. Naturally, the dialect of Rome, the capital of the nation after 1870, is particularly influential. Some characterize current standard Italian as *lingua toscana in bocca romana* "Tuscan tongue in Roman mouth." Pronunciation is far from uniform in Italy, but in morphology and syntax all Italians can either speak or learn to speak the same language. Few people speak literary Italian natively, though the Tuscans, for obvious reasons, come nearest to the standard. With rapid improvements in education and communication, and the spread of newspapers, radio and television into remote areas, linguistic standardization of Italy, for better or for worse, should progress apace.

Linguistic History.—It is impossible to set a date for the end of Latin and the beginning of Italian; the development was uninterrupted and boundaries are arbitrary in spoken language. But in written texts a beginning of Italian may be discovered in the midst of Latin. Some writers realized that the spoken and the written idioms were not two kinds of Latin, the "good" written form (as nearly classical as authors could make it) and the "bad" spoken form, but were really different languages. Attempts were then made to write the spoken vernaculars also. The earliest evidence is a set of court records of the 10th century, in which the clerk put down the proceedings in customary subclassical Latin, but inserted the decisive deposition of witnesses verbatim in the language of the speakers, which was Italian (a southern dialect) rather than Latin. From then on, documents and monuments in the *lingua volgare* or *rustica* ("vulgar or rustic language") were more frequent, without completely replacing Latin, however, for many centuries, especially in learned works. Galileo (1564–1642) was the first to use Italian for scientific works.

Toward the end and after the fall of the Roman empire, the incursions and occupations by speakers of foreign dialects and the growing number of foreigners in the civilian population and the army were bound to modify native idioms, although the extent of the linguistic changes was small (much less than the trans-

formation of English after the Norman Conquest).

The most important invasions of Italy during the middle ages were those by the Visigoths (5th century, moving from the north to Calabria, but abandoning Italy after the death of their king Alaric), the Ostrogoths (later 5th and early 6th centuries, founding a kingdom with the capital in Ravenna, but after Theodoric's death in 526, overcome by Roman power revived by Justinian), and the Lombards (who remained longest, 568–774, founding a loosely integrated kingdom with the capital in Pavia, which was terminated by the Franks allied with the papacy); these Germanic invaders were followed in southern and central Italy by Arabic-speaking Muslims and by Norman *condottieri* whose sovereignty lasted until the 12th century. None of these significantly changed the Italian language; their only important traces are in lexical borrowings, of which the German, numbering about 1000, are the strongest contingent. This ineffectualness was due in part to the small number of invaders, but mainly to the cultural incompatibility of natives and invaders. The Germans were so awed by the superior Roman civilization that they did not even attempt to impose their ways.

Thus the dialects of Italy, including Dante's idiom, underwent little change through foreign influence. And since Italian has changed little since the 13th century, modern Italian diverges least of all the Romance languages from Latin.

Each dialect has its own linguistic history, although all are Romance, in particular Italian, dialects. All Italian dialects, together with the other Romance idioms, partook of the common Romance changes (*see* ROMANCE LANGUAGES). Beyond these, the history of standard Italian is fairly simple, the complexities arising mainly from dialect mixture. For a more detailed historic description, Florentine is the obvious choice.

Phonology.—The accented *e* and *o* vowels of late spoken Latin, if open and in free position (*i.e.*, at the end of syllables) were diphthongized: *pĕdem* > *piede*, *bŏnum* > *buono*; in checked position they remained: *cĕrtum* > *certo*, *mŏrtem* > *morte*; if close, regardless of position, they remained: *pĕsum* > *peso*, *vocem* > *voce*, *firmum* > *fermo*, *mŭltum* > *molto*. The *a* remained, except in some northwestern dialects where, as in Northern French, *e* appeared in its place: infinitive *-are* > *are*, or *-e(re)*. The *i* and *u* (resulting from earlier long *ī* and *ū*, the short *ĭ* and *ŭ* appearing as *ę* and *o*, respectively—except in some southern Italian areas) also remain: *filum* > *filo*, *murum* > *muro*. It is typical of Florentine, though not of other Tuscan dialects, that a following palatal or nasal element produced *i* and *u* instead of the expected *e* and *o*, respectively: *lingua* > *lingua*, elsewhere *lengua*; *ungula* > *unghia*, elsewhere *onghia*. Southern dialects are noteworthy for metaphony, that is, the influence of an unstressed upon the preceding stressed vowel: *bonum* > *buono*, but *bonam* > *bona*. Piedmont and Lombardy have, again like French, the so-called umlauts *ü* and *ö* (so transcribed after the German orthography).

The (unstressed) vowels tend to weaken, except for *a*, so that *e* and *i*, *o* and *u* often merge. Their development depends largely upon their position in the word: pretonic, posttonic, initial, final, intertonic. In southern dialects all final unstressed vowels may fuse into the schwa-sound *ə* (pronounced like the second vowel in English "father").

The most striking phenomena among consonant changes are these: the palatalization and affricatization of stops before *e*, *i*, or yod, and of yod itself: *certum* [kertum] > *certo* [tšerto] (brackets enclose a phonetic transcription), *cibum* [kibum] > *cibo* [tšibo], *nationem* [natyonem] > *nazione* [natsione], *gentem* > *gente* [džente], *gyrum* > *giro* [džiro], *iurare* > *giurare* [džurare], *-arium* > *-aio*, *vinea* > *vigna* [vinya]; the palatalization of consonant plus *l*: *plus* > *più*, *florem* > *fiore*, *clarum* > *chiaro* [kyaro]; and the loss of most final consonants. In southern dialects *-nd-* and *-mb-* appear as *-nn-* and *-mm-*: *quando*—*quanno*, *gamba*—*gamma*, peculiarities often cited as attesting an Oscan substratum. In the north, single voiceless intervocalic consonants appear voiced, and long ones (spelled double; "long stops," a contradiction in terms, are really stops articulated with retarded explosion, *e.g.*, the two t's in English "put to" as opposed to "putting") are shortened. In the northeast *tš* and *dž* appear as *ts* and *dz*. In the south *-ll-* appears as a long cacuminal stop, generally spelled *-dd-* (transcribed *-ḍḍ-*) as in *Turiddu* for *Torello*.

Where standard Italian has forms divergent from the expected ones, dialect borrowings are often the cause. Sometimes doublets with different meanings are retained, such as *stazione* "station" and *stagione* "season," both from *stationem*.

Morphology and Syntax.—Beyond the common Romance developments listed in ROMANCE LANGUAGES, Italian has undergone few radical changes. It may be pointed out that the plural of nouns and adjectives is derived from the Latin nominative case, as in Rumanian but not in other Romance languages. The Latin *ille* "this (one)" and its paradigm become the Italian definite article. The use of subject pronoun is optional; it may convey emphasis.

Vocabulary.—This is, as mentioned, overwhelmingly Latin. In the later middle ages and in the succeeding centuries, Italian borrowed (to the sorrow of the purists) from various European languages, especially French and Spanish during the periods of political and cultural ascendancy of these nations. The number of borrowed words is not great, but the frequency of occurrence rather high because among them are common words: *giardino* "garden," *mangiare* "to eat," *giallo* "yellow," *flotta* "fleet." Arabic words, often coming by way of Spanish, are recognizable by the prefix *al-*, Germanic words by *gu-* from Germanic *w-* (*cf.* the English doublet "guard" and "ward," the first being a Romance borrowing, the second the native German word): Italian *guerra*—English "war."

Numerous learned words are later borrowings from Latin especially during the Renaissance (again often leading to doublets: *circulum* > *cerchio*, later borrowing *circolo*), and modern scientific terminology uses many Latin roots.

Modern Italian spelling employs the regular Latin alphabet. But Italian (quite unlike English) orthography is almost phonetic; once the regular equivalences of sound and spelling are mastered, Italian can be read and written correctly: there are no exceptions. Identical spellings for different sounds, as in English *rough*, *though*, *through*, *bough*, *cough*, *ought* do not occur in Italian, nor do different spellings for identical sounds as in English *through*, *zoo*, *shoe*, *flew*, *flue*, *do*. Placement of the stress may offer some difficulty: it is unpredictable (except where there is a grave accent on the final stressed vowel: *città*, *molteplicità*). Certain etymological spellings, like *ph*, *th*, *y*, have been abolished in favour of *f*, *t*, *i* (*fotografia*, *teologia*, *sistema*). Italian grammars often stress the difference in the timbre of open versus close *e* and *o*, which is not apparent in the spelling; but this distinction is not significant and varies from region to region. The significant opposition of long versus short consonants, however, is regularly indicated (*sera* "evening": *serra* "he tightens"; *fato* "fate": *fatto* "done"; *casa* "house": *cassa* "box"; *capello* "hair": *cappello* "hat"), except where such lengthening occurs in transition from one word to another, as in *a casa* "at home," which is pronounced *accasa*. (In some compositions the double spelling has been standardized, so that *della* stands for *de la* "of the" and *dammi* for *da mi* "give me.") Italian spelling has no devices like the French cedilla or the Spanish tilde; such variations in sound are indicated by letter spellings. The grave accent is used regularly on the final stressed vowel, and occasionally to distinguish a verbal form *dà* "he gives" from a nonverbal *da* "from." The circumflex appears only in older writing as on *fogli*, now *foglii* or *fogli*, plural of *foglio* "sheet." *See* also LATIN LANGUAGE and references under "Italian Language" in the Index.

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ITALIAN LAW. The law of Italy belongs to the tradition of Roman law, harking back to the methods and principles of the emperor Justinian's *Corpus Juris Civilis*, elaborated by medieval jurists, modernized by the Code Napoléon and influenced by Ger-

man legal doctrine. The history of Italian law can be divided into six periods: the Gothic-Byzantine (from the fall of the Western empire to the Lombard invasion A.D. 476–568); the barbarian, until 1056; the communal, until 1492; the period of foreign domination, until 1792; the Risorgimento, until 1870, when Rome was annexed to the kingdom of Italy; and the contemporary period.

During the communal period, Roman law, through the work of the glossators, became the general law of the land, along with the statutes, local customs and canon law. Legal science flourished in Italy and spread to the rest of Europe, thus giving rise to the civil law (*q.v.*).

Civil Law.—The glossators, the earliest of whom was Irnerius (b. *c.* 1055), interpreted and annotated the *Corpus Juris Civilis.* Strict textual interpretation began in the 12th century with Bulgarus, and greater attention to questions of practice and equity with Martinus Gosia. Many famous jurists lived during this period, among them Burgundius Pisanus and the Mantuan Vacarius who taught Roman law at Oxford for a time, Jacobus Balduinus, the Bolognese Odofredus and Azo. Greatest of them all was the Florentine Franciscus Accursius, teacher at Bologna, who with his *Glossa ordinaria,* also called *Magna glossa* (1220–50), concluded the work of the glossators. (*See* also GLOSSATORS, LEGAL.)

Among postglossators, the followers of Accursius or *accursiani* (1250–1321), though still tied to the *glossa,* began to move from the exegesis of the Roman texts to the discussion of principles, drawing from additional sources such as canon law, the statutes and legal practice. Outstanding among these men were Rolandinus Passeggeri, famous for his *Summa artis notariae,* Gulielmus Duranti, the canonist and author of *Speculum iudiciale,* and Albertus Gandinus, who introduced the study of criminal law.

The *commentatori,* or commentators (1321–1492), even more independent of the *glossa,* elaborated in their notes the various sources of Italian law. Bartolus of Sassoferrato, Petrus Baldus de Ubaldis and Paulus de Castro were the best known.

During the period of foreign domination two currents emerged. The theoretical jurists foreshadowed and witnessed the growth of humanist culture, and used philological and historical methods to study the texts of Justinian. This new scientific direction began with the Milanese Andreas Alciatus who, from 1518, taught in Avignon and Bourges; his *Commentum ad Pandectas* is a model of critical comment on the *Digest.* This contrasts with the movement of practical jurists represented above all by the Genoese Giuseppe Casaregis (1670–1737) for commercial law, and the Roman Prosper Farinaccius (1544–1618) for criminal law.

The modern period, for private law at least, began when, in the wake of French conquest, the Code Napoléon (*q.v.*) was introduced in Italy (1800–10). Sardinia and Sicily remained exceptions. After the collapse of Napoleon's empire French law was abrogated, but the Code Napoléon was the model for the new codes of the kingdom of the Two Sicilies (1815), of the duchy of Parma, Piacenza and Guastalla (*Codice civile Parmense,* 1820), of Piedmont and Sardinia (*Codice Albertino,* 1837) and of Modena (1857). After the Risorgimento wars and the annexations made by the kingdom of Sardinia, the law of the new united Italian state developed on the lines of the French codification.

The civil code of the kingdom of Italy, enacted in 1865, reproduces in structure and content the French civil code. The main differences are: retention of emphyteusis (permanent lease against a yearly rent); exclusion of divorce; separation of conjugal property; prohibition of gifts between spouses; various rules of succession; and the unconditional equality of foreigners and citizens. Finally, the Italian code has some rules on conflict of laws, largely expressing the principles of Pasquale Stanislao Mancini (1817–88) and his school on private international law; thus citizenship, and not residence, is the criterion for deciding what personal law applies.

The French commercial code of 1807 had been introduced in Italy in 1808, and formed the basis of those of the Two Sicilies (1819), the kingdom of Sardinia (1842) and Modena (1851). In 1865 the Sardinian code was extended to the whole kingdom of Italy. In 1882 it was replaced by a new code combining features of the French code with some aspects of the German commercial code which was more advanced, especially in the law of exchange.

The codes in force during the early 1960s go back to reforms made in the Fascist era, except for amendments due mainly to the subsequent change in political regime. As regards private law these changes were not radical, except in the case of labour legislation on collective contracts, which was a part of the corporate system. Unlike the code of 1865, the civil code of 1942 included much commercial law: only maritime and aeronautical law were dealt with in a special navigation code (1941), and bankruptcy was governed by a separate law (1942).

Set against the civil code of 1865, that of 1942 appears inspired by less individualist views; for instance, in property law, where the social aspects are stressed, and in labour legislation. The code is prefaced by some general remarks on the sources of the law and on its application. Here the rules on conflict of laws (principles already laid down in the introduction of the 1865 code) are completed and made more precise, though in a less liberal and less international vein; thus equality of foreigners with citizens in civil rights now hinges on reciprocity. The code proper is divided into six books: personal and family law, succession, property, obligations, labour relations and protection of rights (registration, proof, property guarantees, legal proceedings, limitations of actions). The concordat with the Vatican (1929) established a new kind of marriage, celebrated by a Catholic priest but valid as a civil act, over which ecclesiastical courts retained jurisdiction.

Criminal Law.—In this field medieval Italian jurists had been mainly concerned with practical ends; in the 16th century some went beyond casuistry and evolved a system, as for instance Farinaccius in his *Praxis et theoria criminalis.* Trends toward reform derived new strength from *Dei delitti e delle pene* (1764) by Cesare Beccaria, a work which criticized the death penalty and the traditional forms of barbaric punishment. Among works aiming to humanize and modernize criminal law was *Genesi del diritto penale* by Domenico Romagnosi, based on the needs of social self-defense. The more technical approach was revived by Francesco Carrara who, with his *Programma del corso di diritto criminale,* founded the "classical" school of criminal law. Those who followed this view regarded punishment as retribution and interpreted the rules then in force by a strict logic, leaving aside nonlegal factors.

Against this tradition there arose, in the 19th century, the "positive" school, which went deeper into the anthropological and sociological aspects of crime and punishment, regarding the latter as society's way of protecting itself and re-educating the criminal. This trend was widespread in other countries too and greatly influenced legislators. The first code of the kingdom of Italy (1889) was inspired mainly by the classical doctrines with some concessions to the new ideas; but the criminal code which replaced it in 1930 struck more of a balance between traditional rules and positive tenets. This new code upheld the basic principle that the individual is responsible, which makes punishment depend on guilt; more specifically, the code considers the capacity of the culprit to commit the crime in order to assess the degree and kind of punishment, judicial pardon, conditional release or suspension. Safety measures are provided to guard against dangerous criminals. Work done by prisoners was regarded as an incentive to civil re-education.

Procedure.—Since the constitution of the kingdom of Italy three codes of criminal procedure have been in force: that of 1865 (preceded by the extension of the Sardinian code of 1859), that of 1913, and finally that of 1930. This last has undergone some changes, especially after the fall of the Fascist regime and after the partial reform of 1955.

The prosecution of criminals takes place in two stages. First come preliminary investigations by the judicial police to ascertain the facts. The trial is normally instituted officially, by the public ministry as representative of the state, sometimes with the cooperation of the interested parties who have the right to institute proceedings and to claim damages. With some offenses trial can take place only through action by an individual.

The first code of civil procedure in the kingdom came out in

1865. It was based on the French code of 1806 but contained some Italian elements. It has been variously modified. Debtors' prisons were abolished in 1887 and commercial courts in 1888. New laws were added concerning justices of the peace (1892 and 1895), summary proceedings (1901), recognition of foreign sentences (1919) and injunction procedure (1936). Practice was greatly influenced by the exegetic works of Luigi Mattirolo and Ludovico Mortara. In 1942 the code was largely redrafted and brought into line with the doctrinal revision. This had begun in the late 19th century on the model of German legal science, but soon took a turn of its own under the impulse of Giuseppe Chiovenda.

Civil matters of minor scope are dealt with by *conciliatori* (justices of the peace) or by *pretori* (magistrates). The *tribunali* (high courts), for more serious cases, consist of a president and two judges. The courts of appeal consist of a president and four *consiglieri* (councillors) and hear appeals from decisions of the *tribunali*. The *corte di cassazione* (supreme court of appeal), of which since 1923 there has been only one, sits in Rome. At each sitting it consists of a president and six *consiglieri* whose task is to review the law (but not the facts) in the finding on appeal.

In criminal matters, the *pretori* are competent for all offenses with maximum punishment of three years or a fine only. The *tribunali* deal with cases outside the jurisdiction of *pretori* and courts of assize. For offenses carrying penal servitude or prison for at least eight years there are courts of assize which consist of a *consigliere d'appello* as president, a judge from a *tribunale* and six *giudici popolari* (jury members, subject to certain qualifications). Courts of appeal review cases from the *tribunali*, and appeal courts of assize (set up in 1951 and presided over by a *consigliere di cassazione*, with a *consigliere d'appello* and six jury members) those from courts of assize. As last instance there is the *corte di cassazione*.

To safeguard the citizen's rights and interests against public authority, there are the council of state and provincial boards with jurisdictional powers.

Administrative Law.—This derives from French sources and was modified under the influence of the great German school of public law of the late 19th century. Modern Italian doctrine became gradually more independent. In the study of international law this movement was led by Dionisio Anzilotti (1867–1950). From the time the kingdom was proclaimed in 1861 until 1887, administrative institutions, based on the Piedmontese model, were unified by stages. From 1888 to 1915 a more democratically inspired overhaul took place, with greater awareness of social problems. In the Fascist period (1922–43) the administrative structure became more authoritarian and centralized. Emergency laws were introduced to meet the needs of World War II and of the period immediately after. Under the republic democratic principles were restored and greater decentralization and autonomy encouraged. For constitutional law, *see* ITALY: *Administration and Social Conditions*.

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ITALIAN LITERATURE. This article is a historical survey of Italian literature from its beginnings in the 12th century to modern times, and is divided into the following main sections:

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I. THE BEGINNINGS

Vernacular Italian literature had its beginnings in the 13th century. Until then almost all literary work was in Latin, written by men trained in the schools, mainly ecclesiastical, which continued to function after the fall of the Roman empire and throughout the middle ages. An important part of the education given in the schools consisted in the study of classical Latin writers, and of the rules for writing Latin, either verse or prose, in a style suited to the subject matter and occasion. Attempts at greater freedom of expression in Latin and modification of syntax were usually followed by reaction. (*See* also LATIN LITERATURE: *Medieval and Renaissance Literature*.)

In Italy in the late middle ages even Latin writing was predominantly practical in nature, and in literary quality and variety cannot be compared with that produced in France, for example, where as early as the latter half of the 11th century an important vernacular literature also began to appear. Small fragments only of Italian vernacular verse are to be found before the end of the 12th century, although the vernacular does appear in a number of legal documents. To the late 12th or early 13th century belong the *Ritmo laurenziano*, the song of a Tuscan jongleur who asks a bishop for the gift of a horse, the *Ritmo Cassinese* and the *Ritmo di S. Alessio*, probably composed in the Marches, a narrative of the life of St. Alexis. All these betray French literary influence, especially in their verse form. More significant for the development of Italian literature are the *Contrasto bilingue*, a dialogue between a Provençal lover and a Genoese lady, and the *Discordo plurilingue*, both by the Provençal Raimbautz de Vaqueiras (Raimbaut de Vaqeyras). The first has verses alternately in Provençal and in Genoese dialect, and the second uses a literary Italian alongside Provençal, French, Gascon and Galician.

1. "Franco-Italian" Literature of the 13th Century.—French romances both in prose and verse enjoyed great popularity in Italy from the 12th to the 14th centuries. Stories belonging to the Carolingian and Arthurian cycles, and others freely adapted from the classics, were popular reading among the cultured, and

the Carolingian stories in particular were often recited in verse by French jongleurs to the accompaniment of the *vielle* in the public squares of north Italy. The development of a "Franco-Italian" literature in the 13th century was the result of the popularity of these stories. Italian writers often copied the French stories with adaptations or additions; they produced new versions varied by considerable fresh invention; and sometimes they created new romances in French about the characters in the original French stories. Such are the *Entrée d'Espagne*, the work of a Paduan, the *Prise de Pampelune* by Niccolò da Verona, the *Aquilon de Bavière*, in prose, by Raffaele Marmora of Verona and the various versions of the *Huon d'Auvergne*. There are also poems on classical themes, the *Hector*, *Pharsale* and *Attila*. In all this literature, though the language used is French, it is a French adulterated to a greater or lesser degree according to the writer's knowledge of the language by elements of his own dialect.

Important prose works written in French by writers much better acquainted with the language include the encyclopaedic work which Brunetto Latini wrote in France, *Li Livres dou Trésor*, Martino Canale's *La Cronique des Véniciens*, which traces the history of Venice to 1275; and the travels of Marco Polo, written down by Rustichello da Pisa who shared Marco's imprisonment in Genoa.

2. Imitators of the Provençal Lyric.—In cultured Italian circles the Provençal courtly love lyric enjoyed equal popularity with French romances. It became known not only through actual visits of Provençal troubadours to Italy, but through anthologies, which were studied with great care. Glossaries and books on Provençal grammar and versification were much in demand, and already early in the 13th century Italian poets were writing lyrics on similar themes in Provençal, revealing an exact knowledge of language and technique. The best known of these poets are perhaps Rambartino Buvalelli of Bologna, Lanfranco Cigala of Venice and Sordello of Mantua. (*See* also PROVENÇAL LITERATURE; TROUBADOURS.)

3. The Sicilian School.—The Italian vernacular lyric tradition had its real beginnings in Sicily at the court of Frederick II, ruler of the kingdom of Sicily from 1208, and, from 1220 until his death in 1250, also Holy Roman emperor. The court was open to all currents of learning, knowledge and culture. The Provençal courtly love lyric was well known and appreciated there but Frederick does not seem to have welcomed the troubadours themselves to his court, which was drawn mainly from Sicily and southern Italy. In this refined society poems which both in form and content follow Provençal models were written in the poets' own vernacular, purified as far as possible from narrowly local elements and using a number of words characteristic of the troubadour tradition. Provençal as a language was much less remote from the dialects of southern Italy and Sicily than from those of the north, and the speech of the cultured society of the south was well suited to aristocratic verse. The texts of most of these poems in the form in which they are preserved have been altered to some extent by Tuscan scribes. Significantly, it was the love poetry of Provence and not political poetry which was imitated in Sicily. Poetry was a pastime and an escape from the serious matters of life. The emperor himself, author of at least two poems, seems to have used it in this way and his chancellor, Pier della Vigna, wrote of political theory in Latin prose and of love in Sicilian verse.

Love itself was not treated very seriously by the Sicilian school in general. Many of their poems were stiffly conventional, though Jacopo da Lentini and Giacomo Pugliese in particular sometimes wrote with delightful freshness. The former is among those credited with the invention of the sonnet. Other poets of this group were Rinaldo d'Aquino, Guido delle Colonne, Jacopo Mostacci and Mazzeo di Riccio. Nothing is known of the obviously cultured author of the poem "Rosa fresca aulentissima" attributed to Ciclo d'Alcamo. It is a dialogue between two lovers who try to speak in high-flown gallicized language but often lapse into an unpolished dialect, itself a hybrid of the author's invention.

Sicilian poetry continued to be written after the death of Frederick II, especially in the time of his son Manfred (d. 1266), though the centre of interest in Italian literature had by then moved to Tuscany. A poem "Pir meu cori alligrari" by Stefano Protonotaro of Messina who died sometime before 1301 has come down in a pure Sicilian text.

4. The Italian Lyric and Allegorical Poem in Tuscany.—As the Sicilian lyric became known in Tuscany it aroused great interest and found some imitators, among whom the most notable are Guittone d'Arezzo, Chiaro Davanzati of Florence and Bonagiunta Orbicciani da Lucca. Guittone was the centre of an admiring circle, but though he experimented with elaborate and difficult verse forms his language, which mingles local dialect elements with latinisms and Provençalisms, has none of the beauty and refinement of that used by the Sicilian school. The love poetry of Guittone and his followers is dull and unoriginal in its following of courtly love conventions. Guittone, who entered the religious order of the Cavalieri di Maria, or Frati Gaudenti, in 1261 and thereafter gave up love poetry, was more accomplished as a religious poet. The most notable thing about the new Tuscan poets is their use of political themes for poetry, a subject treated by the troubadours but not by the Sicilians. This no doubt reflects the different situation of the free communes of central Italy which were rent by factions and jealous of each other. Guittone d'Arezzo's "Ahi lasso! or e stagion di doler tanto," written after the Florentine defeat at Montaperti in 1260, is a noble poem.

Allegorical Poems.—In addition to lyric verse Tuscany produced some longer allegorical poems. Brunetto Latini, in his *Tesoretto*, imagines himself meeting and being instructed by Lady Nature. *Il fiore* and *Il detto d'amore* are both poems based on the French *Roman de la Rose* (*q.v.*).

5. The "Stil Novo."—While Guittone and his "school" were still writing, something quite new came into Italian love poetry—a new seriousness about love and a concern for precise and sincere expression. It has become customary to talk about a "school" of poets of the *Dolce stil novo* or *nuovo*, an expression used by Dante in *Purgatorio* (Canto 24, line 57). In an imaginary discussion about poetry between himself and Bonagiunta da Lucca in Purgatory, Dante talks of the difference between the two styles of love poetry. He characterizes himself as one who

> quando
> Amor mi spira, noto, e a quel modo
> ch'e' ditta dentro vo significando.
> (*Purgatorio*, Canto 24, lines 51–54)

(". . . hearkens when
Love prompteth, and I put thought into word
After the mode which he dictates within.")
(Translated by Laurence Binyon, permission to print granted by The Society of Authors and Mrs. Cicily Binyon)

His emphasis thus seems to be on a delicacy of expression suited to the subject of love. Those who are usually classed as *stil novo* poets are Guido Guinizelli of Bologna, Guido Cavalcanti, Dante, as author of the *Vita nuova*, Cino da Pistoia and the lesser poets Lapo Gianni, Gianni Alfani and Dino Frescobaldi. It is convenient to treat them as a group. They were certainly much aware of each other's poetry.

Guido Guinizelli, a versatile and sometimes playful poet, is best known for the *canzone* "Al cor gentil ripara sempre amore" which poses—perhaps not too seriously—the question of the relation between love of woman and love of God. In the lovely sonnet "I' vo' del ver la mia donna laudare" he touches lightly on the idea of the lady as mediating divine truth. These poems were immediately appreciated by the Florentine Guido Cavalcanti, a serious poet of love and, as a lyric poet, at least as fine as Dante. Most of his poems are tragic and deny the ennobling effect of love. Dante, who was ten years younger than Cavalcanti and greatly admired his poetry, has much more in common with Guinizelli in his concept of love—a concept which was developed by his love for Beatrice. The *Vita nuova*, which is the story of that love told in poems linked by a framework of exquisite prose put together *c.* 1293, has as its theme the question posed by Guinizelli in his *canzone*. God is the "root" of Beatrice, so she is able to mediate to him God's truth and love and inspire in him a love for God—but her death is necessary for his purification. The story begun in the *Vita nuova* is completed in the *Commedia*. The other important *stil novo* poet, who continued writing lyric poetry after Dante had gone on to the *Commedia*, and who was highly regarded by Dante,

is Cino da Pistoia. Cino uses the vocabulary characteristic of the *stilnovisti* but in his own original and more lighthearted way. His poetry expresses a very attractive personality.

A comparison of the language of the *stilnovisti* with that of the *Guittoniani* shows that great progress had been made in the refining of Tuscan dialects for literary use. Purely local characteristics had disappeared and what came to be the standard literary language of Italy had been created.

6. "Comic" Poetry.—In complete and often deliberate contrast with serious love poetry is the kind of verse usually called *giocoso,* which is purposely unrefined, using the much more colloquial and often even vulgar language of the dialects chosen by these writers as being more appropriate to their humbler and less refined themes. This kind of verse belongs to a European and not merely an Italian tradition, and seems to owe something to the influence of the "Goliard" poets of the 12th and 13th centuries, who wrote their Latin verses in praise of worldly pleasures or in vituperation of women, family or personal enemies (*see* GOLIARD). The Italian "comic" poets—whose usual verse form is the sonnet—were all cultured men. The earliest of them is the Florentine Rustico di Filippo who wrote between 1260 and 1290 and produced both courtly love poetry in refined style and very much coarser and sometimes obscene verse of the "realistic" kind. The best-known and most versatile of the "comic" poets is Cecco Angiolieri of Siena, a contemporary of Dante, whose love poetry often skilfully parodied the *stil novo* writers and whose other favourite subject was his father's meanness. Meo dei Tolomei, also of Siena, was another master of the art of what the Latin schools called *vituperium.* Folgore di S. Gimignano was known for his sonnets (again following Latin models) on the worldly pleasures that he considered as suitable to the different months and the different days of the week. A more serious aspect of the work of the "comic" poets was the fervent interest in politics which some of them expressed in poems of great directness and satiric force. This aspect was revealed most markedly in the Lucchese Pietro dei Faitinelli, who also wrote a few poems of the more traditionally "comic" kind. Dante himself in his *Tenzone* (correspondence) with Forese Donati wrote in "comic" style.

7. Religious Poetry.—The beautiful and famous *Cantico di frate sole* ("Canticle of the Sun") or *Laudes Creaturarum* of St. Francis, written probably *c.* 1225 near the end of the saint's life, is one of the earliest Italian poems. It is really written in rhythmical prose which uses assonance in place of rhyme, and is in Umbrian dialect. God is praised through all the things of his creation. It is probable that St. Francis also composed a musical accompaniment to the *Laudes.*

After the death of St. Francis the *lauda* or *laude* came to be a common form of religious song used especially by the confraternities of lay people who gathered to sing the praises of God and the saints and to recall the life and Passion of Christ. Collections of songs, often following the cycle of the liturgical year, were kept by the single confraternities which were numerous in central Italy, and some *laudi* are to be found in a number of collections. They are in verse and are almost all anonymous and not artistically outstanding. Little *laude* music has survived.

The one real poet of the *laude,* who almost certainly did not set his *laudi* to music or intend them to be sung, was Jacopone da Todi. Jacopone was a Franciscan and a mystic, and his *laudi* were, for the most part, concerned with the theme of poverty—the human response to God's own self-emptying and the opening out of the soul to be filled by God. Though Jacopone does not seem to write with conscious art, some of the *laudi* are very fine. One of them which begins "O amore muto . . ." expresses powerfully and with great simplicity the sense of the presence of the infinite and ineffable God in the soul which loves him without measure. Other *laudi* castigate corruption in high places in the church and the lowering of ideals within the Franciscan order.

In north Italy religious poetry was mainly didactic and moralistic, and pervaded by a pessimism which may be rooted in those heretical ideas derived from Manichaeism which saw this world and the body as being evil and under the control of Satan. Gerardo Pateg (or Patecchio) of Cremona, Uguccione da Lodi and Giacomino da Verona all belong to the early or mid-13th century. Giacomino, a Franciscan, author of *De Jerusalem celesti* and *De Babilonia infernali,* was the liveliest and most imaginative of them. Bonvesin da la Riva, a Milanese of the third order of the *Umiliati* who lived from sometime before 1250 to *c.* 1313, wrote a number of works in Latin and the vernacular, some of which are religious in inspiration. Two of the most interesting are a dialogue or *contrasto* between the Virgin and Satan and one between Soul and Body. All this north Italian verse was written in a language which is quite distinct from central Italian dialects but which avoids elements which are too narrowly local or colloquial.

8. Prose in the 13th Century.—The use of vernacular prose for literary purposes began in the 13th century, though Latin continued to be the language most used for writings on theology, philosophy, law, politics and science. Much early Italian prose consisted of translations from French and Latin. Translations from French were mainly narrative, and included the so-called *Tristano riccardiano,* the *Tavola ritonda, Fatti di Cesare* and *Istorietta troiana,* as well as collections of chivalrous and moral tales—*e.g.,* the 20 *Conti di antichi cavalieri* and the 12 *Conti morali*—more freely adapted from the originals. The latter reveal the originality and liveliness of their Sienese compiler. There was much translation from Latin, and this proved very important in the development of Italian prose style because of the influence, especially of classical Latin writers, on the sentence structure and artistic consciousness of the translators. Particularly notable are Brunetto Latini's translations from Cicero, made *c.* 1260, which include part of the *De inventione* translated as *Rettorica.*

The earliest original literary prose consists of letters, which follow medieval rhetorical rules for Latin prose and make use of the *cursus* (*i.e.,* rhythmical patterns for the ending of clauses and sentences), rhymed or assonanced prose and abundant figures of speech and play on words. The founder of Italian rhetorical prose style was Guido Faba of Bologna, a teacher of rhetoric, who in his *Gemma purpurea* and *Parlamenti ed epistole* illustrated his teaching by examples of prose styles in Bolognese. Faba's most notable follower in epistolography was Guittone d'Arezzo, though Guittone's lack of taste leads him to extravagance.

In complete contrast with Guittone's style is the clear scientific prose of Ristoro d'Arezzo's *Composizione del mondo,* written in 1282, and the simple narrative of the collection of tales known as the *Novellino,* written probably between 1281 and 1300. It is not certain that all the stories are by the same author, but the compiler was certainly Florentine. Many of the tales were drawn from the Bible or from classical or French legend and history, but others were anecdotes about fellow Florentines. The real masterpiece of 13th-century prose is Dante's *Vita nuova.* Though Dante was not yet completely at ease in vernacular prose and was oc-

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DANTE. MUSEO NAZIONALE, NAPLES

MANSELL—ALINARI

"DANTE AND HIS WORK" BY DOMENICO MICHELINO; 1465. FLORENCE CATHEDRAL

casionally involved or overdid the repetition of words, the style of the prose parts of this little book at its best combined simplicity with great delicacy and a poetic power that derived from the mysterious depth beneath certain key words. (S. Rs.)

II. THE 14TH CENTURY

The literature of the 14th century in Italy is dominated by three great names: Dante, Petrarch and Boccaccio. For a full account of their work, and its impact on European literature and culture the reader should consult the articles on them. Here they will be chiefly considered in the context of their place in the Italian literary development of their time.

1. Dante.—All earlier Italian literature, in both prose and verse, seems poor when compared with the poetic achievements of Dante's masterpiece, the *Commedia*. Dante's minor works, however, fit naturally into the context of contemporary literature both in form and in spirit. The *Vita nuova* (*c.* 1293), a collection of lyrics alternating with prose passages, in which the author narrates the story of his love for Beatrice, is obviously inspired by the theories on love and the literary forms of the *stil nuovo* (*see* above). The same is true of most of his *rime* not included in the *Vita nuova*. It was only after his exile (1302) that Dante set out to write more ambitious works which show the widening of his horizon from a Florentine to an Italian and even European one. Of these works, the *Convivio* (*c.* 1304–07), a product of the author's detailed knowledge of scholastic philosophy, was the first great example of a treatise written in vernacular prose: its language avoids both the ingenuity of popular writers and the artificiality of the translators from Latin. The *De vulgari eloquentia*, written about the same time, contains the first theoretical discussion and definition of the Italian literary language. Both these works remained unfinished. In a later doctrinal work, the *Monarchia* (1310–12?), Dante expounded his political theories, which demand the co-ordination and mutual independence of the two medieval powers, pope and emperor. Dante's genius found its fullest development in the *Commedia* (1307?–21), an allegorical poem in *terza rima*, which can rightly be described as the literary masterpiece of the middle ages and one of the greatest products of any human mind. Although the central allegory of the poem is essentially medieval (Virgil symbolizing the human reason leading men to earthly happiness, and Beatrice the faith by which humanity attains heavenly felicity), the author's moral attitude and creative powers confer on his work a value which transcends any limitation of period.

Technically, Dante's poem belongs to the allegorical and didactic poetry which was being cultivated in his time. The anonymous *Intelligenza*, very probably composed in the first years of the 14th century, and Francesco da Barberino's *Documenti d'amore* (*c.* 1310) and *Reggimento e costume di donna* (*c.* 1318–20) were obviously written independently of the *Commedia;* these poems are on an entirely different level from Dante's masterpiece. The same is true of other 14th-century didactic poems such as Cecco d'Ascoli's *Acerba* (written in opposition to the *Commedia*), Fazio degli Uberti's *Dittamondo* (1346–67) and Federigo Frezzi's *Quadriregio* (*c.* 1400).

2. Petrarch.—A comparison between Petrarch and Dante reveals that Petrarch's intellectual interests were literary rather than philosophical; his political views were more realistic than Dante's and his poetical technique more elaborate though less powerful. Petrarch's impact on Italian literature was enormous and his influence lasted for centuries. At the same time, he represents a link between the Paduan pre-humanists, such as Lovato Lovati (1241–1309) and Albertino Mussato (1261–1329), and the Italian humanists of the following century. The discovery of Cicero's *Epistolae ad Atticum* and of two of his orations was due to Petrarch, and humanist ideals inspired his Latin poem *Africa*, from which he expected lasting fame, and his historical writings, such as the *De viris illustribus* and the *Rerum memorandarum libri*. As his models Petrarch took the Fathers of the Church as well as the classical Latin authors (while rejecting the scholastic philosophy of the middle ages). This convergence of interests can be observed in his philosophical and religious works, among which the autobiographical *Secretum* is most important for a full understanding of the poet's intimate and conflicting ideals. These find their poetical expression in the *Rerum vulgarium fragmenta*, later known by the titles of *Rime* or *Canzoniere*, a collection of 317 sonnets, 29 *canzoni*, 9 *sestine*, 7 ballads and 4 madrigals, to which should be added the so-called *Rime disperse* that were published separately. Although this collection of vernacular poems was intended to tell the story of the poet's love for Laura, it was in fact an analysis and evocation, not of the poet's present love, but of the passion that he had already overcome. The main element of this poetry was therefore in the elaboration of its art, even if it always reflected the genuine spiritual conflicts exposed in the

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PETRARCH; DETAIL FROM A PAINTING, SCHOOL OF BELLINI

Secretum. In addition to the *Canzoniere* Petrarch wrote in the vernacular an allegorical poem, the *Trionfi*, which is in the medieval tradition but lacks the moral and poetical inspiration of Dante's great poem.

The literary phenomenon known as "Petrarchism" developed very quickly in Italy, even in the poet's lifetime, and continued to grow during the following three centuries, deeply influencing also the literatures of Spain, France and England. This was not mere imitation but, for the most part, an acceptance of the rigorous literary discipline practised by Petrarch—a discipline without which the European literary Renaissance would be unthinkable.

3. Boccaccio.—Boccaccio was not an "intellectual" like Petrarch; his writings are purely literary, without any ideological implications. The style of his minor Italian works shows his progress toward the narrative maturity of the *Decameron*. His first novel, *Filocolo*, derived from the legend of *Flore et Blanchefleur*, was little more than literary experiment. An inability to write on an epic scale is evident in his two poems in *ottava rima*, the *Filostrato* (1338?) and the *Teseida* (1340–41?), while his *Ninfale d'Ameto* (1341–42), a novel written in prose and verse, and his *Fiammetta* (1343–44?), a prose novel, show the influence of his knowledge of classical literature on the formation of his style. Among Boccaccio's minor works, his *Ninfale Fiesolano* (1344–46?), a poem in *ottava rima* concerning the origins of Fiesole and Florence, shows genuine poetic gifts. The author's literary experience culminates in the prose of the *Decameron*, a collection of 100 stories divided into ten "days," which was composed between 1349 and 1351. The *Decameron* is a masterpiece of narrative literature: its treatment of contemporary urban society ranges from the humorous to the tragic and it might be called a *comédie humaine* of the late middle ages. Boccaccio's constant approval of human cleverness was perfectly natural in an age which witnessed the rise in Italy of a skilled merchant class. Stylistically the *Decameron* is the most perfect example of Italian classical prose; its influence on Renaissance literature was enormous.

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GIOVANNI BOCCACCIO. DETAIL FROM A PAINTING BY ANDREA DEL CASTAGNO. SANT' APOLLONIA, FLORENCE, ITALY

Boccaccio shared the humanist interests of his age, as is shown in his Latin works: the epistles, the *Bucolicum carmen*, the treatises *De casibus virorum illustrium*, *De claris mulieribus*, *De montibus, silvis*, etc., and *De genealogia deorum gentilium*. An admirer of Dante, he also wrote a *Trattatello in laude di Dante* and a commentary on the first XVII cantos of the *Inferno*. He contributed to allegorical poetry with a poem in *terza rima*, the *Amorosa visione* (1342–43).

4. Other 14th-Century Literature. *Lyric Poetry.*—Apart from Petrarch, Italian lyric poetry in the 14th century was of poor quality. The manner of the *stil nuovo* still affected the Florentine Cino Rinuccini (d. 1417). Petrarchism made its first definite appearance toward the end of the century, but Petrarchan echoes can be observed in all the poetry of the period. Petrarch's political poems (included in his *Canzoniere*) were echoed by the Sienese Bindo di Cione del Frate in his *Canzone di Roma* (1355?), as well as by Fazio degli Uberti of Pisa. Fazio, already mentioned as the author of the *Dittamondo*, also wrote some love poems influenced by Petrarch, the Provençals and Dante's *Canzoni petrose*. The Paduan Matteo Correggiaio, who lived in the first half of the century, reveals in his poems some originality of psychological observation. Courtly poetry was still cultivated in the north; the most distinguished of such poets were the Ferrarese Antonio Beccari and the Paduan Francesco di Vannozzo. The last of these courtly poets was the Sienese Simone Serdini, who died about 1420.

In the north literary activity was characterized by a great variety; it drew its inspiration both from medieval traditions and pre-humanist tendencies. The teachers of grammar worked side by side with the Averroist philosophers, such as Pietro d'Abano, and the new political writers, such as Marsilius of Padua. The contact with French learning still operated; and German influence began to be felt in the time of Charles IV who was crowned emperor in 1355.

Florentine Literature.—During the second half of the century, Florence remained a vigorous centre of culture, but this culture developed a more popular and less aristocratic character than at the end of the previous century. The best-known representative of this development was Antonio Pucci (d. 1388), whose vast production included, in addition to a number of autobiographical sonnets and *sirventesi*, the *Centiloquio*, a versification of Giovanni Villani's *Cronica*. A more elegant but less spontaneous aspect of this literature was the development of *rime per musica* (ballads, madrigals and caccias). Francesco Landini, Niccolò Soldanieri and Alesso di Guido Donati were among the most famous of the poets writing in this style, which was cultivated also by Petrarch and Boccaccio.

Narrative literature is represented in Florence by the *Pecorone*, a collection of stories written by Ser Giovanni Fiorentino according to the pattern established by Boccaccio, and Franco Sacchetti's *Trecentonovelle, i.e.*, 300 stories of which, however, only 223 are extant. Sacchetti also wrote poetry, *rime per musica*, letters and the *Sposizioni di Vangeli*. His stories belong to the last years of his life and they provide a colourful and lively description of people and places. Outside Florence, the influence of Boccaccio is noticeable in Giovanni Sercambi (Lucca, 1347–1424), whose unpolished stories are of interest only as a repertory of popular tales.

Romance Literature.—The free recasting of the Carolingian and Arthurian cycles continued along the lines established during the 13th century. The compilations in Italian prose and verse became more frequent, and Franco-Venetian literature gained in literary value. The epic legends were turned into romanesque stories to conform with public taste; it should be recalled that these stories were recited in the squares and other public places. Such, for instance, were the novels of Andrea da Barberino (*c.* 1370–*c.* 1431), author of the *Guerrin meschino*, the *Storie Nerbonesi*, the *Reali di Francia*, etc. The *cantari* with legendary subjects, such as those by Antonio Pucci, and the anonymous *Pulzella gaia*, *Bel Gherardino*, *Donna del Vergiù*, *Liombruno*, etc., were the work of professional authors; they were usually written in the popular style consistent with their practical aim. Similar to these works in style and character were the prose and verse compilations with classical subjects, such as the *Fatti di Cesare* and the versions of the *Roman de Troie*. The most accomplished of these compositions is perhaps the *Fiore d'Italia*, written by Guido da Pisa in the first half of the century.

Religious Literature.—Closely connected with this popular literature was the religious literature of the period: it consisted of sermons, treatises, moral epistles, hagiography, *laude* and *sacre rappresentazioni*. None of the many authors of *laude* rose to the poetical heights reached by Jacopone da Todi; Bianco da Siena, who died at the beginning of the 15th century, reveals, however, an original personality. Even more popular in spirit and style were the versifications of episodes from the Gospels, such as the *Fanciullezza di Gesù Cristo* and the *Passione*, ascribed, respectively, to a Felice da Massa and to Niccolò Cicerchia of Siena.

The religious prose of the 14th century is far more interesting than the corresponding literature in verse: the 19th-century Italian purists considered it a model of Italian prose. The most important writer of religious prose was the Florentine Jacopo Passavanti; his *Specchio di vera penitenza* consists of a collection of sermons preached during the Lent of 1354. Less polished, but of greater literary value, were the anonymous *Fioretti di San Francesco* (*Little Flowers of St. Francis*, a collection of legends translated into Italian from a Latin text of the late 13th century). Minor anonymous works (*Considerazioni delle gloriose Stimmate*, *Vita e detti del beato Egidio*, *Vita di frate Ginepro*, etc.) are usually

published together with the *Fioretti*. Domenico Cavalca translated into the vernacular the *Vite dei Santi Padri* and other Latin texts, as well as composing, in the same remarkable style, a number of moral treatises: the *Specchio di Croce, Trattato di trenta stoltizie, Pungilingua, Specchio dei peccati*, etc. Apart from anonymous religious legends that have some affinity with Cavalca's *Vite*, the work of the Sienese Giovanni Colombini is of particular religious interest. His letters to the nuns of the Convent of St. Bonda belong rather to the history of the Christian life than to that of literature. This is also true of the letters and the *Dialogo della Divina Providenza* of St. Catherine of Siena; the letter in which she describes the execution of Niccolò di Tuldo is a famous example of her forceful style. Some literary interest attaches to the letters of Giovanni delle Celle and of Lapo Mazzei of Prato.

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HUMANISTS AT THE COURT OF LORENZO DE' MEDICI: ANGELO POLIZIANO, GENTILE DE' BECCHI, CHRISTOFERO LANDINO AND MARSILIO FICINO. FROM THE FRESCO ON THE SOUTH WALL OF THE CHOIR IN STA. MARIE NOVELLA, FLORENCE, BY GHIRLANDAJO

Chronicles.—From a literary point of view, the vernacular historiography of this period can be described as popular literature; it reflects 14th-century Italian civilization, apart from its significance as historical evidence. Florence was the main centre of historiography; the two principal chroniclers were the Florentines Dino Compagni and Giovanni Villani. Compagni wrote his *Cronica delle cose occorrenti ne' tempi suoi* between 1310 and 1312, after having taken part in the political struggles of his town. His dramatic account of the episodes in which he participated and the liveliness of his prose make his *Cronica* the most original work of medieval historiography. Villani's *Cronica*, in 12 books, is less personal; it followed the medieval tradition by beginning the narration with the building of the Tower of Babel and included many legends. The last six books, which cover the period from Charles of Anjou's (Charles I of Naples and Sicily) Italian expedition (1265) to the author's own time, are of great importance to historians, particularly to the historians of Florence. Villani's prose lacks the dramatic power of Compagni's but his work may be described as the greatest achievement of Italian vernacular historiography during the middle ages. After Villani's death, the *Cronica* was continued by his brother Matteo and by the latter's son Filippo.

Apart from historical narratives such as the *Commentari del tumulto dei Ciompi* (traditionally attributed to Gino Capponi and more recently to Alamanno Acciaiuoli), the family chronicle of Donato Velluti (1313–70) deserves to be included in the Florentine historiography of the period. Outside Florence, among the many local chronicles written during the 14th century, the anonymous *Storie pistoresi* (from 1300 to 1348) and the anonymous chronicle in Roman dialect (from 1327 to 1354) are of special interest. The accounts of journeys to the Holy Land by Niccolò da Poggibonsi (1345) and by three Florentine merchants, Leonardo Frescobaldi, Simone Sigoli and Giorgio Gucci (1384), find a legitimate place beside the historical writings of this century.

From Boccaccio's death to about the middle of the 15th century, Italian poetry suffered a decline. The following period was to be characterized by critical and philological activity. (G. A.)

III. THE 15TH CENTURY

1. The Influence of Humanism.—Taken as a whole, the 15th century in Italy was a period that created few works of art and it has come to be regarded as the century without poetry. The period, nevertheless, is of very great importance because it is the century in which a vision of human life, embracing a new conception of man and science as well as new fundamental principles of ethics and politics, found its theoretical and practical expression. This vision of life was the result, on the one hand, of an ever wider and deeper study of classical antiquity, associated with the great discoveries of Latin and Greek manuscripts, and, on the other hand, of political conditions quite different from those of the previous centuries, associated with the progressive emergence of social classes which had hitherto remained on the margin of history. Nearly all the Italian princes of this century vied with each other in promoting culture by patronizing research, by founding libraries and, even more important, by offering generous hospitality and financial support to the literary men of the time: as a consequence, their courts became centres of research and discussion, thus creating the conditions which made possible the great cultural revival of the period. The most important of these courts were those of Florence under Lorenzo de' Medici, known as the Magnificent (1449–92); the court of Naples, under the kings of the Aragonese dynasty; the court of Milan, first under the Visconti and later under the Sforza family; and finally the Roman *Curia*, which from the pontificate of Nicholas V (1447–55), with short interruptions, gave protection and support to a large number of scholars both Italian and Byzantine.

The search for lost manuscripts of ancient authors, which had already yielded such striking results in the second half of the previous century, was tirelessly continued and extended throughout the 15th century. Researches and journeys were undertaken which made it possible to bring to light a great number of works which had for long been lamented as lost. The most important figures in the recovery of Latin and Greek manuscripts were Poggio Bracciolini and Giovanni Aurispa respectively. These discoveries led to an extraordinary revival of interest in classical antiquity: in particular, much research was devoted to Plato and Aristotle, who began to be read and studied in the original or in the new elegant Latin translations made by the humanists. Early in the century a considerable number of Plato's and Aristotle's works

had been translated by Leonardo Bruni; later a new Latin translation of Aristotle's work was undertaken by several humanists, while the work of Plato was translated into Latin by Marsilio Ficino (1433–99), the guiding spirit of the Platonic academy in Florence. An additional and indeed vital contribution to this renewed study of the two philosophers was made by Byzantine scholars who introduced into Italy their centuries-old polemics on the respective merits of Plato and Aristotle; these polemics continued throughout the 15th century and gave rise to a large number of pamphlets, mostly of little value, but also to some outstanding works, among which are the *Comparationes philosophorum Aristotelis et Platonis* (*c.* 1455) by Georgius Trapezuntius, which is a forthright attack on Plato's thought and life, and the polemical answer evoked by it, Cardinal Bessarion's *In calumniatorem Platonis* (1469). The great mass of studies carried out in this field succeeded in freeing Plato's and Aristotle's philosophies from many of the misguided and ill-directed interpretations of the previous centuries; it did not however succeed in freeing them from the harmonizing interpretations of the Neoplatonic school which continued to predominate throughout the Renaissance. (*See* also CLASSICAL SCHOLARSHIP.)

The main trend of the new culture in the 15th century is to be found in a revaluation of man. Humanism emphatically opposed the medieval view of man as a being with no intrinsic value, and extolled his dignity as the true centre of the universe, the power of the human soul as the link between the temporal and the spiritual, and earthly life itself as the realm in which the human soul applies its powers. These conceptions were the outcome of the new interest in Plato and in classical antiquity generally, and throughout the century they were the subject of a large number of treatises, the most significant of which are *De dignitate et excellentia hominis* by Giannozzo Manetti (1396–1459), the *Theologia Platonica* by Marsilio Ficino, *De hominis dignitate* by Giovanni Pico della Mirandola (1463–94) and the *Disputationes Camaldulenses* by Cristoforo Landino (1424–98). The humanist vision of life which evolved during this period condemned either explicitly or implicitly many of the religious tenets of the middle ages which were still widely prevalent in the 15th century: the monastic ideal and asceticism in particular were constantly attacked by humanists such as Leonardo Bruni, in his pamphlet *Adversus hypocritas*, Lorenzo Valla, in his dialogue *De professione religiosorum*, and Poggio Bracciolini, in his *Contra hypocritas*. Unreserved and outright though these attacks were, it would certainly be going too far to conclude that Humanism was essentially and intentionally anti-Christian: indeed the humanists, with few exceptions, remained faithful to Christian orthodoxy, or so they believed, and a constant and sincere effort to reconcile the Christian faith with the new ideals is clearly discernible in most of them. And the Roman *Curia* itself regarded humanism as a force to be assimilated rather than as an enemy to be defeated: an unpublished work of Timoteo Maffei, *In sanctam rusticitatem litteras impugnantem*, dedicated to Pope Nicholas V, marks the beginning of this new attitude.

In the first half of the century the humanists, carried away by their enthusiasm for Latin and Greek literature, had almost without exception a disdain, as complete as it was unjustified, for the vernacular. Their poetic production, all more or less inspired by classical models, written for the most part in Latin, or, less often, in Greek, was extremely abundant, but of little value. Writing in a dead language, closely and deliberately following a culture to which they had made themselves slaves, the humanists rarely showed any originality as poets. The only notable exceptions are Giovanni Pontano and Michele Marullo Tarcaniota, to whom may be added Angelo Poliziano (Politian; *q.v.*) and Jacopo Sannazzaro, who are, however, renowned mainly for their works in the vernacular: gifted with an unusual poetic personality, they sometimes succeeded in creating a sincere poetry in which the constant themes of the 15th-century lyrics are expressed with original notes of intimacy and fervour.

2. Vernacular Literature.—For a variety of reasons the numerous poets and writers in the vernacular also failed to produce any particularly noteworthy works in the first half of the 15th century: detached from the living current of the new culture represented by Humanism, they did no more than continue the literary trends and themes of the previous century, almost invariably without any originality. Toward the middle of the century, however, the vernacular gradually began to oust Latin. The *Certame coronario*, a public poetry competition held in Florence in 1441 with the intention of proving that the spoken language was in no way inferior to Latin, marks a definite change of attitude. In fact in the second half of the century, Italian literature produced a number of works of considerable merit which derived their inspiration either from the chivalrous epic of the Carolingian legends or from the new humanist culture.

The chivalrous epic, which had degenerated into a sterile collection of worn-out clichés, was given a new lease of life by the works of two poets of very different temperament and education: Matteo Maria Boiardo, whose *Orlando innamorato*, begun *c.* 1476, was published in an incomplete edition early in 1483; and Luigi Pulci, whose *Morgante* was begun *c.* 1460; a first edition of it being published before 1480. There is a profound difference between these two poets, both of whom drew their subject matter from the Carolingian legends: the *Orlando Innamorato* reflects, at least up to a point, the chivalrous and courteous ideals of the past and also the standards of conduct of the contemporary courts of northern Italy, while the *Morgante* is pervaded by the spirit of a more modern society, in which a new bourgeois and popular morality was beginning to emerge.

The new artistic ideals brought to light by the humanists found their most complete interpreters in Angelo Ambrogini, known as Poliziano, in Jacopo Sannazzaro and in Leon Battista Alberti, three outstanding figures who combined a wide knowledge of classical antiquity with a personal and often profound inspiration. Poliziano's most important work in Italian is undoubtedly the *Stanze per la giostra*, composed in honour of Giuliano de' Medici. This is devoted to the creation of a mythical world in which themes and concepts of classical origin are relived in a new and often very original way. The same may be said of Sannazzaro's *Arcadia*, a largely autobiographical work, composed partly in verse and partly in prose, which was to remain a widely influential source of inspiration up to the 18th century. A more balanced and faithful adherence to contemporary reality is to be found in Alberti's prose works: *Teogenio, Della famiglia, Della tranquillità dell'animo, De iciarchia*. All these works present a more or less gloomy picture of human life, dominated by man's wickedness and the whims of fortune: the author's mind is, however, constantly turned toward classical antiquity, and the picture he draws is at times relieved by a Stoic moral ideal, which derives mainly from Cicero and Plutarch, and at times coloured with a wit and satire reminiscent of Lucian. To these names may be added that of Lorenzo de' Medici, in whose vast poetic output are mingled widely differing sources of inspiration—classical and contemporary themes, popular and bourgeois ideals, sensuality and realism, satire and caricature—but the importance of whose work lies rather in its documentary than its literary value.

See also RENAISSANCE, THE. (G. P. G.)

IV. THE 16TH CENTURY

The literary technique developed by the 15th-century humanists produced its full results during the following century, when Italian writers, from Ariosto to Tasso and from Machiavelli to Galileo, produced outstanding works in the fields of poetry and philosophy. The new classicism which characterized the writings of the 16th century, and made them synonymous with what is generally known as the Italian Renaissance style in writing, no longer consisted in attempts at reproducing Latin models but in the creative use of the vernacular. This, however, drew its strength from the authors' training in humanistic studies as well as from their own spontaneous inspiration.

1. The Humanist Tradition.—Although the actual use of Latin in purely literary works began to become less relevant at the end of the 15th century, and Ciceronianism became obsolete, particularly after 1528, when it was ridiculed by Erasmus, the philological tradition remained alive among classical scholars such

as the Florentine Pier Vettori and linguists such as Vincenzo Borghini, also of Florence, not to mention antiquarians such as Fulvio Orsini and Onofrio Panvinio, or historians such as Carlo Sigonio and Scipione Ammirato. Latin humanist literature was also composed, particularly during the first half of the century: examples of 16th-century humanist historiography are Pietro Bembo's *Historia veneta* (publ. 1551), and the *Historia sui temporis* and the *Elogia virorum illustrium* of Paolo Giovio (Paulus Jovius) (Como), while Latin lyrical poetry was still cultivated by such authors as Bembo, Ariosto and Castiglione, who are better known for their vernacular works.

2. Bembo and the Discussion on the Language.—Pietro Bembo of Venice (1470–1547) wrote in the vernacular, beside the *rime* and his love treatise *Asolani* (1505), his most famous work, the *Prose della volgar lingua* (publ. 1525), one of the first grammars of the Italian language (G. F. Fortunio's *Regole della volgar lingua* had appeared in 1516). The *Prose* can be described as the manifesto of Italian Petrarchism. It was in fact the theoretical assessment of the classicist tendencies of the time: Bembo demanded an Italian literary language based on 14th-century Tuscan models, particularly Petrarch and Boccaccio. His theories were opposed by those who thought that this literary language should be based on the existing linguistic developments, among whom were Vincenzo Calmeta, in his treatise, now lost, *Della volgar poesia*, Baldassare Castiglione, in his *Il Cortegiano*, and, above all, Giangiorgio Trissino (1478–1550). Trissino published a translation of Dante's *De vulgari eloquentia* and in his dialogue, *Castellano* (1529), developed Dante's theories on the literary vernacular, opposing the idea of an "Italian language" to that of a "Florentine language." In practice the problem was not linguistic but stylistic. Among other contributors to the *questione della lingua* were Niccolò Machiavelli, who composed a *Dialogo intorno alla lingua* (1514?) which remained unpublished until 1730; Ludovico Martelli, who developed Machiavelli's ideas in favour of the Florentine language in his *Risposta all' epistola del Trissino* (1524); and Claudio Tolomei, who rejected the theory of a courtly language in his dialogues *Polito* (1525) and *Cesano* (1528; publ. 1555). Pierfrancesco Giambullari expounded the rules of the Florentine language in a treatise published in 1551, while Giambattista Gelli, in his dialogue, *Sopra le difficultà dell' ordinare la lingua* (1551), differed from Bembo's judgment on 14th-century models, observing that the vernacular had been much developed since that time. A *Difesa della lingua fiorentina e di Dante* by Carlo Lenzoni was published posthumously in 1556. A virulent polemical exchange between Annibale Caro (*Apologia;* 1558) and Ludovico Castelvetro also belongs to these discussions. Bembo's theories, developed in 1542 by Sperone Speroni (1500–88), triumphed in the second half of the century. This was due largely to the activity of the Florentine Accademia della Crusca (1583) and to the writings of Benedetto Varchi (*Ercolano*, publ. 1570) and Lionardo Salviati, whose *Avvertimenti sopra il Decameron* (1584–86) assert the superiority of tradition over the spoken language. At this stage a more philological approach to the *questione* is evident: it resulted in the first edition (1612) of an Italian dictionary by the Accademia della Crusca.

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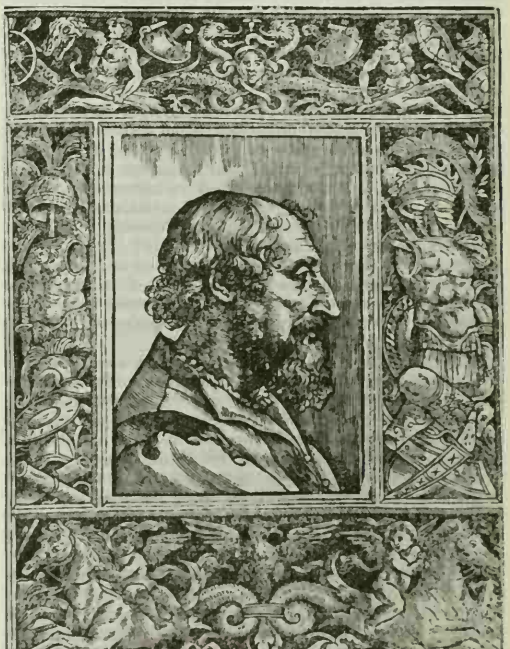
PIETRO BEMBO

3. Renaissance Poetic Theory.—During the first decades of the century a number of treatises on poetry were still composed according to humanist ideas and the teachings of Horace. It was only after 1536, when the original text of Aristotle's *Poetics* was first published, that a gradual development became apparent in aesthetic theory. This was mainly the result of the various interpretations of Aristotle put forward after that date. Imitation was now considered, according to humanist theories, to mean imitation not only of nature in the traditional sense, but also of classical authors. The three unities of tragedy (time, space, action) are among the rhetorical rules which were then re-established. Each literary genre (lyrical poetry, epic poetry, comedy, tragedy, pastoral drama, etc.) became subject to a number of more or less strict rhetorical rules. The classical conception of poetry as a product of imagination supported by reason was in fact at the basis of 16th-century rhetoric, while the pedagogical theory developed, particularly during the second half of the century, according to the principles of the Counter-Reformation. On the other hand, creative freedom of expression was sought by Michelangelo Buonarroti in line with the Platonic tradition, and later by Giordano Bruno in his dialogue *Degli eroici furori* (1585). But it was the classicist conception of poetry revived by the new Italian literature that triumphed in France, Spain and England during the following century.

4. Ariosto.—The most refined expression of the classicist taste of the Renaissance is to be found in the *Orlando furioso*, the epic poem meant to continue Boiardo's *Orlando innamorato*, on which Ludovico Ariosto worked from not later than 1507 to 1532. Ariosto's poem, written in *ottava rima*, according to the Italian epic tradition, embodies a multiplicity of episodes derived from popular epics of the middle ages and early Renaissance: unity is, however, preserved through the poet's sustained inspiration and masterly technique. As a result of his detached attitude all the characters are treated with a measure of irony. The *Orlando furioso* can be regarded, both in form and in spirit, as the most perfect expression of the literary tendencies of the Italian Renaissance before the ideas of the Counter-Reformation had altered its character. It exercised enormous influence on later European Renaissance literature. Besides his great poem, Ariosto composed five comedies—*Cassaria* (1508), *I suppositi* (1509), *Negromante* (1520, 1528), *Lena* (1528) and *Studenti* (published posthumously



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DRAWING OF LUDOVICO ARIOSTO BY TITIAN FROM THE 1532 EDITION OF ORLANDO FURIOSO. IN THE BRITISH MUSEUM

under the title of *Scolastica*)—which, by introducing imitation of Latin comedy, mark the beginning of Renaissance drama in the Italian language (*see* also DRAMA: *Modern Drama*). Ariosto's seven *Satire* (1517–25), inspired by Horace's *Sermones*, deal with episodes in the poet's life and criticize some aspects of contemporary society. They are inferior to the *Orlando furioso* but show the nostalgia and irony characteristic of Ariosto.

5. Machiavelli.—Niccolò Machiavelli's works reflect Renaissance thought in some of its most original aspects, particularly in the objective analysis of human nature. Machiavelli has been described as the founder of a new political science: politics as divorced from ethics. His own political experience was at the basis of his ideas, which he developed, however, according to general principles such as the concepts of *virtù* and *fortuna*. He considered *virtù* to be a power of which the aim was practical: it should struggle against *fortuna*, which, according to him, was a violent and irresponsible force. The treatise *De principatibus*, or *Il principe*, composed between July and Dec. 1513, is the one of Machiavelli's works in which the author's prophetic attitude, based on an observation of contemporary affairs, becomes most apparent. The *Principe*, by offering a description of a model ruler, remained a code of European absolutism for the following two centuries: it marked the starting point of the discussions on the *ragion di stato* and was much read and imitated, even by those who were scandalized by its conclusions. Machiavelli's *Discorsi sopra la prima deca di Tito Livio* (composed between 1513 and 1521?) show the same realistic attitude: public utility is placed above all other considerations and political virtue is distinguished from moral virtue. His seven books *Dell' arte della guerra* (1521), concerning the creation of a modern army, are a more technical work, while his historical works, including the *Vita di Castruccio Castracani* and the *Historie Fiorentine* (publ. 1532), exemplify the theories expounded in his treatises. Apart from the literary value of his theoretical and historical writings, Machiavelli belongs to the history of literature also for his specifically literary works: the *Canti carnascialeschi*, the *rime*, the *Capitoli*, the allegorical poem *Asino d'oro*, the already mentioned *Dialogo intorno alla lingua*, and, above all, the *Mandragola* (publ. 1524?), which is one of the outstanding comedies of the century. Less important are the *Clizia*, a comedy inspired by Plautus' *Casina*, and the *Andria*, a translation of Terence's comedy of the same title.

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NICCOLÒ MACHIAVELLI

6. Guicciardini.—Although more of an individualist and pragmatist than Machiavelli, Francesco Guicciardini is the only 16th-century historian who can be placed within the framework of the political theories which he constructed. Both as a historian and as a diplomat Guicciardini focuses on the self-interest (the *particolare*) of those involved in political actions: an attitude which reflects the actual conditions of contemporary Italian society. This attitude makes Machiavelli's theories appear by contrast utopian. Guicciardini's main works are the *Storia d'Italia*, published posthumously in 1561–64, and the *Ricordi*, published between 1576 and 1585. The *Ricordi*, characterized by an extreme clarity of exposition, is one of the most original literary works of the century.

Minor historians are Jacopo Nardi, the last representative of the Livian tradition, and Donato Giannotti. In the second half of the century Tacitus replaced Livy as a historical model; Giorgio Dati translated the *Annales* (1563) and Bernardo Davanzati all of Tacitus' works. Specialized historical works include the *Vite de' più eccellenti pittori scultori e architettori* of Giorgio Vasari, still a fundamental source for the history of art. Among autobiographical works, the *Vita* of Benvenuto Cellini is of interest for its spontaneous style and use of popular Florentine language (*see* also AUTOBIOGRAPHY).

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FRANCESCO GUICCIARDINI

7. Moral Literature.—The highest moral aspirations of the Renaissance are expressed in the *Cortegiano*, the famous treatise which Baldassare Castiglione, of Casatico, near Mantua, wrote between 1513 and 1518. It deals with the perfect courtier, the noble lady and the relationship between the courtier and the prince. It became one of the most influential books of the century and found immediate favour outside Italy. Monsignor Giovanni della Casa, born in the Mugello, near Florence, was the author of another famous treatise, the *Galateo* (1550–55), in which both the author's witty mind and the refinement of contemporary Italian society find their full expression. It had a strong influence on the European literature of manners. The Florentine Giambattista Gelli also belongs to the moralist literature of the Renaissance, although with a more limited outlook. In his *Ragionamenti* (or *Capricci*) *di Giusto Bottaio* (1548) and *Circe* (1549) he tried to popularize contemporary knowledge.

By contrast, but also in some ways similar, may be mentioned here those professional writers—such as Pietro Aretino, Niccolò Martelli, Ludovico Domenichi, Niccolò Franco, Ludovico Dolce, Antonfrancesco Doni, etc.—in whose works the life of the period is vividly reflected. The most interesting is Aretino, who did not hesitate to use his pen as a means for blackmailing rulers (Ariosto called him "the scourge of princes"). His realistic *Ragionamenti*, which are his masterpiece, are written in a spontaneous style and show the author's sensuous and unscrupulous nature.

8. Poetry.—*Lyric Poetry* in the 16th century was dominated by Petrarchism; this was due to the general acceptance of the Renaissance theory of imitation and to the teaching of Bembo. Beside Bembo himself, almost all the principal writers of the century—including Ariosto, Castiglione, Bandello, Caro and Tasso—wrote lyric poems in the manner of Petrarch's *Canzoniere*. Some originality is to be found in the *rime* of Monsignor della Casa, the author of the *Galateo*, whose poetical technique was admired even by Ugo Foscolo. Galeazzo di Tarsia is distinguished from contemporary versifiers by the vigour of his style. Among women poets, besides the well-known ones, such as Veronica Gambara (1485–1550), Vittoria Colonna, Gaspara Stampa (1523–54) and Veronica Franco, special note must be made of Isabella di Morra, whose *rime* genuinely express her personal sufferings. Among the other lyrical poets, a certain originality can be found also in the *rime* of Michelangelo Buonarroti and in those of Luigi Tansillo.

Humorous and Satirical Poetry.—The tradition of autobiographical, humorous and satirical *rime* was kept alive during the 16th century, when it reached the dignity of a literary genre thanks to Francesco Berni, whose burlesque poems, most of which deal with trivial or obscene subjects, manifest his stylistic skill. Among those who cultivated this new genre, which came to be called *bernesco*, the following should be mentioned: Anton Francesco Grazzini, called "Il Lasca" in the Accademia degli Umidi of which he was one of the founders; Cesare Caporali; and Ercole Bentivoglio, who was a friend of Ariosto.

Didactic Poetry.—The tradition of didactic poetry, a genre

already cultivated by humanist writers, from Pontano to Fracastoro and Vida, was continued during the 16th century. Giovanni Rucellai wrote the *Api*, a recasting of the 4th book of Virgil's *Georgics;* Luigi Alamanni, six books *Della coltivazione;* Bernardino Baldi (1553–1617), the *Nautica*. Among other didactic poems of this century may be noted the *Balia* and *Podere* by Luigi Tansillo, of Venosa.

Epic Poetry.—During this period there were attempts to renew the epic by the return to certain elements in its classical past, and by submitting the tradition of chivalry to the Aristotelian rules of composition. Giangiorgio Trissino, already mentioned for his theories on the language, was the author of a poem written according to the strictest Aristotelian rules: the *Italia liberata dai Goti*, published between 1547 and 1548. Luigi Alamanni tried to focus the narrative on a single character in both *Girone cortese* and *Avarchide*. Bernardo Tasso, father of Torquato, based his *Amadigi* (1560) on a 15th-century Spanish novel. Giambattista Giraldi (known also as Cinzio) wrote a *Discorso intorno al comporre de' romanzi* and tried to apply his theories in his poem *Ercole* (1557). The translation of the *Aeneid* by Annibale Caro might be considered an excellent example of how an epic poem should be written according to 16th-century theories.

9. Drama.—*Tragedy.*—Trissino's *Sofonisba* (1515), written in *"endecasillabi sciolti,"* is the first authentic tragedy of Italian vernacular literature: its dramatic structure derives from Greek models; the unities of time and action (but not of space) are observed in it. Its poetic quality is mediocre, and the same is true of the later tragedies by Rucellai, Martelli, Alamanni and others. Toward the middle of the century Giraldi Cinzio began a reaction against the imitation of Greek drama by proposing Seneca as a new model. In his nine tragedies and *tragicommedie*—written between 1541 and 1549—he showed some independence from the Aristotelian rules without, however, attaining striking stylistic results. The same can be said of the *Canace*, written by the Paduan Aristotelian Sperone Speroni, and of the tragedies composed in the second half of the century. Aretino's *Orazia* (1546), written without any academic preconceptions, is certainly one of the most remarkable 16th-century tragedies.

Comedy.—The Italian comedies of the 16th century, inspired by Latin models, possess a much greater literary value than the tragedies, partly because they reflect contemporary life more fully; they had imitators outside Italy and can be considered as the starting point of the modern European drama. The comedies by Ariosto and Machiavelli have already been mentioned; to these may be added a lively play, the *Calandria* (1513), by Cardinal Bernardo Dovizi da Bibbiena, and the equally amusing five comedies written by Aretino between 1525 and 1542. The seven comedies of Grazzini and the *Aridosia* of Lorenzino de' Medici are, on the other hand, no more than literary exercises. Although the development of the comedy was mainly by Florentine authors, it was by no means restricted to them: the Venetian Ludovico Dolce wrote *Ragazzo* and *Fabrizia;* the Sienese Alessandro Piccolomini, *Amor costante* (1536) and *Alessandro* (1554); Annibale Caro, from the Marches, *Straccioni* (1544); while from Naples came the comedies of Giambattista Della Porta and Giordano Bruno's *Candelaio* (1582). Anonymous plays are the *Ingannati* (1531), the plot of which recurs in Shakespeare's *Twelfth Night*, and the *Venexiana*, almost entirely written in the Venetian dialect. The Paduan Angelo Beolco, called Ruzzante, and the Venetian Andrea Calmo also wrote plays in their respective dialects.

10. Narrative.—The classicist trend established by Bembo also affected narrative literature, for which the obvious model was Boccaccio's *Decameron*. Some originality and much liveliness of expression are to be found in the 22 stories of Grazzini's *Cene*. Agnolo Firenzuola (Florence) produced ten stories in his unfinished *Ragionamenti d'amore*, written in a highly ornate style; his *Dialoghi delle bellezze delle donne* is a document of 16th-century aesthetic ideals; his *Prima veste dei discorsi degli animali* and his recasting of Apuleius' *Golden Ass* are more interesting as literary works. Matteo Bandello started a new trend in 16th-century narrative: his 214 stories are rich in dramatic and romantic elements and their style does not aim at classical dignity. This new trend was partly followed by Giraldi Cinzio, who collected 112 stories in his *Ecatommiti* (1565).

11. "Fidenziana" and Macaronic Poetry.—*Fidenziana* poetry derives its name from the *Cantici di Fidenzio Glottocrisio Ludimagistro*, by Camillo Scroffa, who wrote in a language consisting of a combination of Latin words and vernacular form and syntax; while macaronic poetry—first used by Michele Odasi in his *Macharonea*—consists instead of Italian words used according to Latin morphology and syntax. Teofilo Folengo (Mantua) is the best representative of macaronic literature: his masterpiece is *Baldus*, a poem in 20 books, published under the pseudonym of Merlin Cocai. A tendency to parody, aiming at ridiculing the excesses of humanist literature, is present both in the *fidenziana* and in macaronic poetry.

12. Tasso.—Torquato Tasso was the last great poet of the Italian Renaissance and one of the greatest of Italian literature. In his epic *Gerusalemme liberata* he summed up and developed a literary tradition which was typical of the Renaissance: the classical epic was renewed by him according to the spiritual interests of his own time. Tasso was tormented by a conflict between his genuine desire to express himself poetically according to classical ideals and his strong moralizing tendency based on Counter-Reformation principles. Before this conflict arose in his mind Tasso's works reflected his spontaneous inspiration. The *Aminta*, a pastoral drama produced in 1573, is the best example of Tasso's youthful poetry, not yet overshadowed by rhetorical and moralizing considerations. (The *Aminta* belongs to a new literary genre, developed by Giovanni Battista Guarini, author of the famous *Pastor fido*, 1590; *see* also PASTORAL.) The *Gerusalemme liberata* (1575) is the result of a moment of balance between the poet's conflicting aspirations: here a Christian subject is dealt with in a classical way. Such a conflict—which might well recall, in a different cultural context, the one which afflicted Petrarch—should be more suitable to lyrical expression. But if on the one hand the very choice of a Christian epic subject reveals the poet's religious preoccupations, on the other it must be recognized that a lyrical note does in fact predominate in Tasso's epic: his poetic language is largely Petrarchan. Under the title *Gerusalemme conquistata* (1593) Tasso recast his poem according to the strict Aristotelian rules imposed by contemporary critics and to Counter-Reformation ideals. Tasso's personal conflict had ended in the victory of the moralist principle: poetically the new poem was a failure. Tasso's minor poetical works include, apart from the *Aminta* and the *rime*, which were written throughout his life, a youthful epic, *Rinaldo* (1562), and two religious poems written in the last years of his life, *Monte Oliveto* and *Sette giornate del mondo creato*. His prose works—*Epistolario* and *Dialoghi*—were written in an interesting style no longer dominated only by classical models and not yet corrupted by baroque excesses. The *Epistolario* reflects the poet's conflicting aspirations.

13. The New Philosophy.—At the end of this chapter in the history of Italian literature, mention should be made of Giordano Bruno, the greatest Italian philosopher of the 16th century, who in his dialogues in Italian (publ. 1584–85) expounded his new cosmology and expressed his antihumanist ideas in an impressive personal style. The merit of having not only initiated modern physics but also of having created an Italian scientific prose was, however, to belong to Galileo Galilei (*see* below). (G. A.)

V. THE 17TH AND 18TH CENTURIES

The 17th century, no less than the first half of the 18th century in Italian literature, is usually described as a period of "decadence" in which writers who were devoid of sentiment resorted to exaggeration and aspired to cloak an utter poverty of matter beneath an exuberance of form. In this period, it is said, freedom of thought was fettered by the Accademia della Crusca (the aim of which was to maintain the purity of the Tuscan tongue), the Counter-Reformation, and the political supremacy of Spain. *Seicentismo*, however, in its various forms, was not simply an Italian phenomenon. It was at this time that "Gongorism" flourished in Spain and the poetry of the metaphysicals in England. Modern scholars have revalued favourably the works of such

artists and composers as Bernini, Caravaggio, Monteverdi, Corelli and Frescobaldi. It has been realized that it is fallacious to continue interpreting the culture of the 17th century on the basis of the negative presuppositions of the traditional literary and art historians. Far from being exhausted indeed, this was an extremely vital period. A new and more comprehensive understanding of the literature of the Italian baroque than that to be found in many literary histories is being formulated by scholars conversant with the changing attitude toward this phase of civilization in Germany, France and England.

1. Poetry and Prose.—The popularity of satire in the *Seicento* was a sign of reaction against prevailing conditions. Benedetto Menzini (1646–1704) was prominent in this *genre;* while Salvator Rosa attacked in seven satires the vices and shortcomings of the age. Alessandro Tassoni acquired great fame with *La secchia rapita* (1622), a mock-heroic poem which is both an epic (partly based on historical fact) and a personal satire. Other notable satiric writers were Francesco Bracciolini (*Lo scherno degli dei,* 1618) and Lorenzo Lippi (*Il Malmantile racquistato,* publ. posthumously 1676). The greatest poet of the period however was Tommaso Campanella, a Dominican friar who is less well known for his rough-hewn, philosophical verses than for the *Città del sole* (1602), a vision of a political utopia in which he advocated the uniting of humanity under a theocracy based on natural religion.

The principal representative of Italian *secentismo* was Giambattista Marino, the author of a large collection of lyric verse (*La lira,* 1602, 1608–14; *La sampogna,* 1620); and an extremely long mythological poem called *Adone* (1623). Marino derived much of his inspiration from the poetry of the late 16th century. But his aim—typical of his age—was to excite wonder by novelty. His work is characterized by "conceits" of fantastic ingenuity, metaphor, sensuality, extreme facility and a superb technical skill. His imitators were innumerable. And in general it may be said that most 17th-century Italian poets were influenced—for better or worse—by the phenomenon of *marinismo.*

Gabriello Chiabrera, more sober in style than Marino, made successful experiments in imitating the metres of classical poetry (especially Pindar), and he excelled in the composition of musical *canzonette.* Toward the end of the century Vincenzo da Filicaia and Alessandro Guidi were hailed as major poets, while the naturalist Francesco Redi was the author of the sprightly dithyramb *Bacco in Toscana* (1685).

Among prose writers Traiano Boccalini stands out with his *Ragguagli di parnaso* (1612) as a standard-bearer in the fight against Spanish domination. The history of the Council of Trent was written by Paolo Sarpi—the advocate of the liberty of the Venetian state against papal interference—and the history of the rising of the Low Countries against Spain by Guido Bentivoglio. All the restless energy of this period reached its climax in the work of Galileo Galilei, a scientist who, following in the footsteps of Copernicus and Tycho Brahe, laid the foundations of mathematical philosophy and earned a prominent place in the history of Italian literature through the example his writings provide of a robust, scientific prose style that goes straight to the point.

Tragedy on biblical and historical themes flourished in the *Seicento* with Federico della Valle and Carlo de' Dottori. The prose romances of Giovanni Ambrogio Marini—*e.g., Calloandro* (1640–41)—were extremely popular; and Girolamo Brusoni's Venetian trilogy (*La gondola a tre remi,* 1657; *Il carrozzino alla moda,* 1658; and *La peota smarrita,* 1662) is still of interest. Any survey of this period should also mention the *Viaggi* of Pietro della Valle and *Lo cunto de li cunti,* a collection of 50 fairy tales written in Neapolitan dialect by Giambattista Basile.

2. The Music-Drama; Arcadia; Comedy.—With the rise of the music-drama and the sacred opera (*see* OPERA) Italian authors worked to an ever-increasing extent in conjunction with the lyric stage. The libretti written by poets such as Ottavio Rinuccini at the beginning of this period were planned with dramatic and musical artistry. During the 17th century however a popular spirit entered the public opera houses. *Intermezzi* were required between the acts. This practice undermined the dramatic unity of the performance as a whole, and toward the end of the century every vestige of theatrical propriety was abandoned. The spread of *marinismo* moreover was felt by many as an abuse. In 1690 the Academy of Arcadia was founded in Rome for the express purpose of exterminating "bad taste." Foremost among the founders were Giovan Mario Crescimbeni (1663–1728) and Gian Vincenzo Gravina (1664–1718). The purpose of Arcadia—which first met under the auspices of Queen Christina (*q.v.*) of Sweden—was in tune with a genuinely felt need. Many of its members were Cartesian rationalists endowed with a severe classical erudition. Their reaction however (at least on a superficial level) consisted in imitating the simplicity of the nymphs and shepherds who were supposed to have lived in the Golden Age. Thus a new artifice replaced an old one: extreme sophistication and a flight from reality took the place of bombast and rhetoric.

Giambattista Zappi and Carlo Innocenzo Frugoni were among the most typical members of this school of poetry. Its greatest exponents however were Paolo Rolli and Pietro Metastasio, two poets of improvisatory talent who deserve praise not only for the freshness of their lyrics but especially as librettists for one of the greatest cultural manifestations of the 18th century, the *opera seria.*

Metastasio's reform of the operatic libretto was paralleled in the mid-18th century by Carlo Goldoni's reform of comedy. Throughout the 17th century the *commedia dell'arte* (*q.v.*)—a colourful pantomime of singing, mime and acrobatics, often performed by actors of incredible virtuosity—had gradually replaced the regular comedy. In the early years of the 18th century however the *commedia dell'arte* had degenerated into mere buffoonery and obscenity. The characters were stock types with mannerisms that had long become fixed. Some of them, such as Arlecchino and Pantalone (Pantaloon), always wore masks on the stage. The dialogue was for the most part improvised, and the plot—a complicated series of stage directions, known as the *scenario*—dealt mainly with the themes of forced marriages, star-crossed lovers and the intrigues of servants and their masters. Between 1750 and 1760 however Carlo Goldoni succeeded in replacing this traditional type of improvised farce with comedies whose composition was preserved in a written script. His characters are acutely, even optimistically, described: he studied "nature" but, unlike Molière, did not plunge into psychological depths. He portrayed the Venetian scene especially in a masterly way, writing many of his best comedies in Venetian dialect.

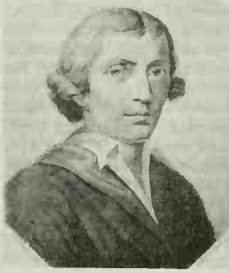
The novelist Pietro Chiari and Carlo Gozzi also stand out in their different ways among 18th-century Italian playwrights. Two of the many adventurers of the period, Lorenzo da Ponte and Giambattista Casti, wrote libretti for Mozart and the Austrian imperial court.

3. The World of Learning.—Giambattista Vico was a sign of the awakening of historical consciousness in Italy. In his *Scienza nuova* (1725–44) he applied himself to the investigation of the laws governing the progress of the human race and ruling over the course of events. From the psychological study of man he endeavoured to infer the *comune natura delle nazioni,* or the laws by which civilizations rise, flourish and fall. From the same spirit there was born a different kind of investigation, that of the sources of Italian civil and literary history. Lodovico Antonio Muratori, after collecting in one body (*Rerum italicarum scriptores,* 1723–51) the chronicles, biographies, letters and diaries of Italian history from 500 to 1500 and after discussing the most obscure historical questions in the *Antiquitates italicae medii aevi* (1738–43), wrote the *Annali d'Italia* (1744–49) minutely narrating facts drawn from primary sources. Muratori's associates in historical research were Apostolo Zeno and Francesco Scipione Maffei. Giovanni Maria Mazzuchelli and Girolamo Tiraboschi devoted themselves to literary history. Literary criticism also attracted attention; Vico, Gravina, Maffei, Muratori and several others, while advocating the imitation of the classics, realized that such admiration should be cautious, and thus anticipated critical standpoints that were later to come into favour.

4. The Enlightenment in Italy.—With the end of the Spanish domination and especially with the spread of the Enlighten-

ment reforms were gradually introduced in various parts of the Italian peninsula. The new spirit of the times led men—mainly young men of the upper middle-class and a sprinkling of the nobility—to enquire into the mechanism of economic and social laws. Pietro Giannone supported the civil power in its conflict with the Roman Catholic Church in his *Istoria civile del regno di Napoli* (1723); Gaetano Filangieri wrote *La scienza della legislazione*. The famous *Dei delitti e delle pene* (1764) of Cesare Beccaria played an important part in the reform of the penal system in Europe; while Giovanni Maria Ortes and Ferdinando Galiani made original contributions in the field of economics. Francesco Algarotti, the Italian *philosophe par excellence*, wrote important essays on the opera, painting and architecture, and popularized the optical theories of Isaac Newton. The ideas and aspirations of the Enlightenment as a whole were effectively voiced in such organs of the new journalism as Pietro Verri's periodical *Il caffè* (1764–66).

More than anyone else, however, Giuseppe Parini seems to embody the literary revival of the 18th century. In his day the life of the upper classes was characterized by a love of display and the usual intrigues of a society founded on patronage. It was against the irresponsibility and shamelessness of such people in Milan that Parini's muse was directed. In the *Odi* Parini's positive values are clearly apparent. The satirical note however is strong in the poem *Il giorno*, in which he pretends that he is teaching a young Milanese patrician the habits and ways of the gallant life; in the course of his exposition he reveals its essential frivolity and with delicate irony unmasks the futility and corruption of a whole social class.



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GIUSEPPE PARINI

The satire in the *Sermoni* (1763) of Gasparo Gozzi is less pungent, though directed at similar ends. And in his two periodicals—the *Gazzetta Veneta* (1760–61) and the *Osservatore* (1761–62)—Gozzi presents a lively chronicle of Venetian life and indicates a practical moral with much good sense. Another well-known writer of this period was Giuseppe Baretti, an extremely controversial figure who published a critical journal called *La frusta letteraria* (1763–65) in which he castigated "bad authors." Baretti learned much through a lengthy sojourn in England, where his friendship with Doctor Johnson helped to give independence and vigour, if not always accuracy, to his judgments.

The most all-embracing satire however written in Italy during the 18th century was the *Viaggi di Enrico Wanton* (1749–64)—a philosophical novel in the form of an imaginary voyage by Zaccaria Angelo Seriman, a Venetian author of Armenian descent.

In the second half of the 18th century a number of lengthy didactic poems were produced which reveal the new interest in agriculture, commerce and the natural sciences. Notable among these were *La coltivazione del riso* (1758) by Giambattista Spolverini, *La coltivazione dei monti* (1778) by Bartolomeo Lorenzi and the *Invito a Lesbia Cidonia* (1793) in which the science departments at Pavia university are described by Lorenzo Mascheroni, the professor of mathematics.

5. Tragedy.—At the beginning of the 18th century Pier Jacopo Martello wrote tragedies in the French style. And in 1713 Francesco Scipione Maffei, the antiquary of Verona, produced *Merope*—a tragedy which met with astonishing success and pointed the way toward reform of the Italian tragic theatre. Between 1726 and 1747 Antonio Conti—an admirer of Shakespeare—wrote four Roman tragedies in blank verse. It was not until 1782 however, with the writing of *Saul*, that an important Italian tragedian finally emerged in the person of Vittorio Alfieri. In strong contrast with Metastasio's mellifluous *melodrammi*, Alfieri's tragedies are harsh, bitter and unmelodious. He chose classical and biblical themes;

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VITTORIO ALFIERI

and through his hatred of tyranny and love of liberty, he aspired to infuse into his audience magnanimous sentiments and a patriotic fervour. Alfieri's influence on Italians in the Romantic period and throughout the Risorgimento was immense.

Like Goldoni, Alfieri wrote an important autobiography which gives a most revealing account of his struggles to provide Italy with a corpus of drama comparable, he hoped, with that of the other European nations. (D. M. We.)

VI. THE 19TH CENTURY

The 19th century in Italy was a period of political ferment and aspiration, and many of the most outstanding writers were, inevitably, concerned with politics and involved in public affairs. Their work reflects the mood of the time and sometimes achieved success more for its expression of popular feeling than for intrinsic value.

MANSELL—ALINARI

DETAIL FROM PAINTING OF UGO FOSCOLO BY FRANÇOIS XAVIER FABRE. IN GALLERY OF MODERN ART, FLORENCE

Nevertheless, much of the literature written with a political aim has become part of Italy's national heritage, and has proved an inspiration not only to those for whom it was written, but to all who value freedom.

1. Foscolo and Monti.—Foremost among the writers who inspired, and were inspired by, the early struggles of his country to achieve unity and freedom from foreign domination was Ugo Foscolo, a patriot who was able to reconcile in his art his passionate feeling with a formal perfection inspired by classical models. His *Ultime lettere di Jacopo Ortis* (1798) is the story, told in letters, of a young man forced to suicide by frustrated love both

for a woman and for his fatherland. Many of its pages are moving and inspiring and it was extremely popular. His poem *I sepolcri* (1807) also had a great and well-deserved success. In fewer than 300 lines Foscolo succeeded in giving lyrical expression to variations on the theme of the inspiration to be found at the tombs of the great. He extols past glories as incentives to the future and exhorts the Italians to be worthy of their heritage. This poem had great influence on the Italian Risorgimento, and the passage in which Florence is praised because it keeps in Santa Croce the ashes of Michelangelo, Machiavelli and Galileo is still familiar to all educated Italians. Two odes celebrating the divine quality of beauty, 12 sonnets ranking with the best of Petrarch's and Tasso's, and the unfinished poem *Le Grazie,* which contains passages of great beauty, also testify to Foscolo's outstanding poetic merit. As an exile in England from 1816 until his death (1827) he wrote for English readers essays on Italian literature which are remarkable pieces of criticism.

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VINCENZO MONTI

In Foscolo patriotism and classicism united to form almost one passion, but Vincenzo Monti, who ranks with him as one of the great writers of the early 19th century, was ruled by no one emotion; it is rather the mobility of his feelings which is outstanding. He saw danger to his country in the French Revolution, and wrote the *Pellegrino apostolico* (1782) and the *Basvilliana* (1793); Napoleon's victories caused him to write the *Prometeo,* the *Bardo della Selva Nera* and the *Spada di Federico II* (1806) in his praise; in his *Fanatismo* and his *Superstizione* (1797) he attacked the papacy; later he extolled the Austrians. Thus every great event made him change his mind, with a readiness due to his lack of political conviction. Yet some of his poems achieve greatness, notably *La bellezza dell'universo* (1781) and some lyrics inspired by his domestic affections. Knowing little Greek, he succeeded in making a translation of the *Iliad* which is remarkable for its neoclassical beauty and is his true masterpiece.

2. Foreign Influences.—Another translation produced at this time, that of the *Odyssey* (1809–22) by Ippolito Pindemonte, was once greatly admired. But Pindemonte is more remarkable for the preromantic qualities of his poems, which were deeply influenced by 18th-century English literature. Among the many writers who drew inspiration from English models (particularly Thomas Gray and Edward Young) the most notable was Alessandro Verri (*Le notti romane*; 1792–1804). Filippo Pananti, who spent some years in England, must be remembered for his *Poeta di teatro* (1808), a poetic novel written in a lighthearted style.

A wider and more lasting appeal was exercised by *Le poesie di Ossian* (1763–72), a verse translation by Melchiorre Cesarotti of the so-called Ossianic poems (*see* MACPHERSON, JAMES). Preromantic and even later poets such as Foscolo and Giacomo Leopardi were greatly influenced by these lyrical and epic, mysterious and gloomy fantasies, so alien from classical inspiration.

3. The Purists.—Cesarotti had also occupied a prominent position in the world of learning at the end of the 18th century; his *Saggio sulla filosofia delle lingue* (1785) was an important pronouncement in the dispute on the Italian language. It was not surprising that at a time of great political agitation the question of the Italian language should be heatedly discussed, for it had raged during the 16th century (*see* above) and it was to occupy the minds of Alessandro Manzoni (*see* below) and his friends. The trend was toward a pedantic classicism in the choice of words and expressions as a reaction against the excessive Gallicism favoured by some of the 18th-century innovators, such as Verri and Beccaria. Among the purists may be mentioned Antonio Cesari, of Verona, who republished works by the great writers of the past and brought out a new edition, with additions, of the *Vocabolario della Crusca.* He wrote a dissertation *Sopra lo stato presente della lingua italiana* and endeavoured to establish the supremacy of Tuscan and of Dante, Petrarch and Boccaccio as models. But patriotism in Italy has always had something municipal in it, and a Lombard school opposed this Tuscan supremacy. At the head of it were Vincenzo Monti and his son-in-law Count Giulio Perticari. Monti issued a *Proposta di alcune correzioni ed aggiunte al vocabolario della Crusca,* in which he attacked the Tuscanism of the *Crusca.* The dispute about language was ranked with the literary and political disputes, and all Italy took part.

A patriot, a classicist and a purist at one and the same time was Pietro Giordani (1774–1848); he was almost a compendium of the literary movements of the time. His works were few and comparatively unimportant but his position among his contemporaries was such as to single him out as the last great exponent of *purismo.*

4. The Romantic Movement.—The French domination in Italy had a twofold effect: it caused people to realize that the traditional and often purely sentimental aspirations toward political unity and independence were within the range of possibility, for the separate states and their rulers had been swept away by Napoleon; and it convinced Italians that no reliance could be placed on foreign help if such an aim was to be attained, for the French themselves, who had entered Italy as liberators, had proved oppressive masters. An artificial form of classicism was associated with the Napoleonic domination so that when Napoleon fell, forces antagonistic to classicism were released. The 18th-century critics had already denounced some of the exaggerations of the classicists; literary romanticism had won favour in France, and the French romantics erroneously thought themselves akin to the German romantics. Between 1816 and 1818 a battle was fought for romanticism, particularly in Milan where a romantic periodical, *Il Conciliatore,* was published. G. Berchet (the patriotic poet and author of *La lettera semiseria di Grisostomo,* the manifesto of romanticism), the dramatist Silvio Pellico, L. di Breme, Giovita Scalvini and E. Visconti were among its principal contributors. Their efforts were silenced in 1820 when several of their group were arrested by the Austrian police because of their liberal opinions; among them was Pellico, who was later to write a famous account of his experiences, *Le mie prigioni* (1832). It appears from the articles in the *Conciliatore* and from other essays that the new school, though advocating the study of modern works in different languages, a certain independence from classical imitation and the discarding of classical conventions, was on the whole consistent with Italian tradition, a point made even clearer in the works of Manzoni, who was hailed as the chief exponent of Italian romanticism.

5. Manzoni.—*I promessi sposi* (1825–27) is the work that has made Alessandro Manzoni immortal. This novel tells the story of two peasant lovers whose marriage is opposed by a wicked nobleman and who are finally reunited. Their many adventures lead them through war, revolution and plague. This is the great masterpiece of modern Italian fiction and ranks with the greatest novels of any literature. The 17th-century background is vividly described and skilfully integrated with the complications of the plot; at the same time the novel is concerned with the presentation of its author's views on life, morality and religion. A keen though kindly sense of humour pervades the whole work, which is written in fluent and elegant style. As a poet, Manzoni had gleams of genius, especially in the ode *Il cinque maggio,* written on the death of Napoleon, in another ode, *Marzo 1821,* and in those passages of the *Inni sacri* (five poems in celebration of church festivals), where he described human affections. His tragedies,

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ALESSANDRO MANZONI

Il conte di Carmagnola (1820) and *Adelchi* (1822) marked the victory of romanticism over the classicist school; they lack strong dramatic power but contain some passages of great lyrical beauty.

Apart from Pellico, Giovan Battista Niccolini (1782–1861) was the only other notable dramatist of the romantic period, but his work, which gradually evolved from the classical to the romantic in style, was not based on historical research and never achieved more than topical significance. Eloquence was his strong point, and this he used to stir his compatriots to love of liberty.

6. Leopardi.—The greatest Italian poet of the age was Giacomo Leopardi. He was an outstanding scholar and philosopher, and his philological works together with his writings on philosophy (notably the dialogues collected in *Operette morali*), would alone place him among the great writers of the 19th century.

His short life was embittered by solitude, sickness and near penury. From the age of 20 he realized the vanity of his youthful hopes and proclaimed that life held no attraction for him. Later he developed a doctrine of universal pessimism, seeing life as evil and death as the only comfort. Yet the poetry based on these bitter, despairing premises, is far from being depressing in itself, and can give great consolation.

FEDERICO ARBORIO MELLA

GIACOMO LEOPARDI

Leopardi's poems are all contained in one book (*I canti*) first published in Florence in 1831. Some of them are patriotic and were once very popular in Italy; but the best come from a deeper lyrical inspiration. Among them are "L'infinito," a moving meditation on infinity, "A Silvia," on the memory of a girl who died when the poet was 20; "Le ricordanze," an evocation of his childhood; "Il passero solitario," a comparison between the lonely poet and a sparrow that sings by itself; and "La quiete dopo la tempesta" and "Il sabato del villaggio," two pictures of village life in the calm after a storm and on the eve of a festive holiday. Their greatness depends on a balance between depth of meaning and formal beauty, on their simplicity of diction, their intensity and their verbal music.

7. Historiography.—The political preoccupations prevailing at the end of the 18th century had their effect on historical studies: Vincenzo Cuoco, the historian of the Neapolitan revolution of 1799, not only related the facts of that significant political event which opened the Risorgimento, but also examined and discussed the principles that inspired it. Another Neapolitan, Pietro Colletta, in his *Storia del reame di Napoli dal 1734 al 1825*, openly called his countrymen to take up the struggle for the independence and liberty of Italy. He had a rapid and nervous style which made his book extremely readable. A moral and political purpose is also present in the works of the Piedmontese Carlo Botta, who continued Guicciardini's *Storia* to 1814 and wrote an account of the *Guerra d'indipendenza degli stati uniti d'America.*

Later, when realism began to dominate literature, its influence was also seen in the development of the positive method in criticism. From the manner of Botta and Colletta history returned to its role of learned research, as is shown in the *Archivio storico italiano*, established at Florence by Gianpietro Vieusseux, and in such works as Gino Capponi's *Storia della repubblica fiorentina*, Manzoni's own remarkable treatise *Sopra alcuni punti della storia longobardica in Italia*, Carlo Troya's *Storia d'Italia nel medioevo* and Michele Amari's fine histories of the *Vespro siciliano* and of the *Musulmani di Sicilia.*

8. The Risorgimento.—After 1821 the literature of Italy was mainly concerned with political events. The names of romantics and classicists survived, but the representatives of both were actuated by patriotism. Manzoni's novel created so deep an impression that several writers followed his example. Tommaso Grossi, Manzoni's friend, composed a historical novel, *Marco Visconti*, lacking in vigour of characterization and conventional in its description of the middle ages, which enjoyed, however, considerable popularity. Massimo Taparelli d'Azeglio, a painter and a statesman as well as an author, had a political object in view in writing *Ettore Fieramosca*, on a heroic episode of the Renaissance, and *Nicolò de' Lapi*, on the private life of a middle-class Florentine family during the siege of 1530. Though overcrowded with incidents, the first of these novels is full of zest. Later D'Azeglio entered politics and was several times prime minister; during a period of leisure he composed an excellent book of memoirs, *I miei ricordi.* D'Azeglio was a Piedmontese and a monarchist. Francesco Guerrazzi, also author of several historical novels, was born at Leghorn and was a republican and a follower of Mazzini. Writing was, to him, a means of fighting oppression; he led the Tuscan revolution of 1848 and wrote his novels, of which the *Assedio di Firenze* is the most notable, in the intervals of his political activity. His style is rhetorical and his historical accuracy is open to criticism; nevertheless, the vigour of his writing impressed his readers. Garibaldi knew Foscolo's *Sepolcri* by heart and his followers called each other by the names of Guerrazzi's characters. It is among Garibaldians that one finds the last historical novelists. G. C. Abba wrote *Da Quarto al Volturno*, a moving account of Garibaldi's campaign in 1860; and the Friulian Ippolito Nievo, who also was one of the Thousand, wrote *Le confessioni di un italiano* (1858), a cyclic novel that just falls short of being a masterpiece through lack of revision, Nievo having been drowned in 1861 in his 29th year. Giovanni Ruffini, an exile and a friend of Mazzini, originally wrote his two novels, *Lorenzo Benoni* (1853) and *Il Dottor Antonio* (1855), in English.

The pressure of political events inspired many works, most of which were of ephemeral value, though some are of lasting importance. Giuseppe Mazzini (1805–72) wrote profusely on art, literature and music; at first he championed romanticism, later he opposed it as laying too great a stress on the individual, but at all periods his style was as vigorous as his convictions were sincere; among his political works may be mentioned *Fede ed avvenire* (1835), *Doveri degli uomini* (1844) and *Ai giovani d'Italia* (1860). Cesare Balbo, a historian, should be mentioned here as the author of the essay *Le speranze d'Italia* (1843), but more important was Vincenzo Gioberti, a Piedmontese priest, a philosopher and a man of wide vision, who left his country and the priesthood because of his love of liberty. In 1843 he published his *Primato morale e civile degli italiani* in which he advocated the moral and historical right of the Italians to independence and the creation of an Italian confederation under the presidency of the pope. This book formed the basis of the political creed of those Italians, other than the followers of Mazzini, who took part in the events of 1848–49. The failure of the revolution caused him to revise his opinions and to advocate the institution of a monarchy under the house of Savoy in his *Rinnovamento civile d'Italia* (1851). A Neapolitan patriot should be included with these authors: Luigi Settembrini, whose memoirs, *Ricordanze della mia vita*, are one of the best examples of popular Italian patriotic literature.

Patriotic themes were common in the poetry of the period. Besides Manzoni, Leopardi, Berchet and Niccolini, an exile to England, Gabriele Rossetti, the father of Dante Gabriel and Christina Rossetti, should be mentioned here. The lyrics of Goffredo Mameli, Alessandro Poerio, Luigi Mercantini, once very popular, are little more than facile and impromptu verse. The work of Giuseppe Giusti had greater literary merit, and his satires were avidly read. The wit of this satirical verse, as well as the farce of situation and character, can still be enjoyed.

Satire was also the province of two great poets of this period who wrote in dialect and for that reason are little known outside Italy. The Milanese Carlo Porta made the French and then the Austrians the target of his invective; the Roman Giuseppe Gioacchino Belli used his extraordinary gifts of realistic observation to depict, in 2,000 sonnets, the way of life of the people in papal Rome.

Francesco Dall'Ongaro, Aleardo Aleardi and Giovanni Prati were sentimental romantics and patriots. Prati was, indeed, the standard-bearer of the so-called "second romanticism," a move-

ment that had its heyday between 1850 and 1870 and was characterized by its sentimentality and mannerism. Prati's *Ermengarda* (1841) was acclaimed as a novel and original work of art, and Aleardi was held in high repute; but they and the mediocre imitators of Manzoni brought romanticism into disrepute and prepared the way for Carducci's reaction. Niccolò Tommaseo was also a patriot and a romantic, after Manzoni the greatest Roman Catholic poet and essayist of his age. His personality and his work have many conflicting characteristics, combining modern tendencies with others belonging to the past, but some of his poems are outstanding. Two playwrights should also be mentioned here: Pietro Cossa, whose tragedies on Roman subjects were generally acclaimed, and Paolo Ferrari, who showed an early interest in social problems.

9. Carducci and Pascoli.—The outstanding figure of the age was Giosue Carducci, whose enthusiastic support for the national cause during the struggle of 1859–61 was changed to disillusionment by experience of the difficulties in which the new kingdom was involved. The bitterness of language of some of his poetry thus takes on a Jacobin character, revealing his frustration and rebelliousness. The *Rime nuove* and the *Odi barbare*, which both appeared in the 1880s, contain the best of his poetry: touching memories of childhood, fine evocations of Maremma landscape, sad laments for domestic sorrows, the inspired representation of great historical events, the ambitious effort to resuscitate the glory of Roman history and the anachronistic but sincere cult of pagan civilization. His strenuous effort to adapt Latin prosody to Italian verse was much admired and sometimes produced good poems. However, his determined opposition to romanticism and his professorial inclination for rhetorical tirades were soon to provoke a strong reaction, and his metrical reform was short-lived. Carducci was also a polished writer of prose and a scholarly historian of literature; his literary essays have a permanent value, although philosophical criticism such as that of De Sanctis was distasteful to him.

Francesco De Sanctis, who was exiled by the Bourbons of Naples, considered literature the expression of social and moral conditions, and on the basis of a sound philosophical training in the works of such masters as Vico and Hegel he inaugurated aesthetic criticism. His *Saggi critici* and particularly his masterly *Storia della letteratura italiana* were not fully or generally appreciated in his day, but later received recognition and formed the starting point of the philosophical revival of the later 19th century.

While Carducci was still alive, Giovanni Pascoli acquired a great reputation and succeeded him in the chair of Italian literature at Bologna. His art was often impressionistic and fragmentary, his language occasionally childish and laborious; but his lyricism, at first timid and tender and rustic and domestic in inspiration (*Myricae*, 1891) rose gradually to fuller tones, when he attempted the loftier themes of antiquity, Roman heritage and greater Italy. His original vein still found a touching expression in the best among the *Canti di Castelvecchio* (1903); and the classicism of the *Poemi conviviali* (1904), much subtler and more temperate than literary or political neoclassicism usually is, was rather imbued with melancholy nostalgia than swollen with celebration. In later years he produced—both in rich humanistic Latin and in self-consciously elaborate Italian—heroic hymns in honour of the two sacred cities of Italy, eternal and modern, Rome and Turin. But what Pascoli wrote in imitation of Carducci and D'Annunzio was inferior to the poems derived from his humbler inspirations.

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GIOSUE CARDUCCI

At the turn of the century Carducci's popularity was so great and overwhelming that all other poets, however deserving, were left in the shade: even poets as honest and highminded as the Piedmontese Giuseppe Giacosa, author of two greatly applauded plays (*Partita a scacchi*, 1871; *Come le foglie*, 1900), or as gifted as Arturo Graf, Giovanni Marradi and Guido Mazzoni. Giacomo Zanella, a classicist, wrote poetry full of inspiration, though lacking in depth. Cesare Pascarella wrote in the Roman dialect poems full of verve, wit and human feeling.

In the realm of prose, the forceful style and rugged personality of Alfredo Oriani, a novelist, essayist and historian (*La lotta politica in Italia*, 1892) received less notice than was their due. S. Farina and G. Rovetta were minor if popular novelists.

10. The Realist Novel.—Giovanni Verga stands out as by far the greatest Italian novelist of his time and as probably one of the greatest Italian novelists of all times; he was a realist, indeed, the master of Italian realism, and his two best novels (*I malavoglia*, 1881; and *Mastro Don Gesualdo*, 1889), which describe the dismal conditions prevailing in Sicily during the first part of the 19th century, often achieve a poignant intensity. Verga was also an exceptionally gifted writer of short stories (*Novelle rusticane*, etc.). Although his success was not immediate, it proved lasting and his influence on the development of Italian literature was paramount. A friend and follower of his was Luigi Capuana; and the much younger Federico de Roberto, who wrote a masterly novel (*I Vicere*, 1894), must also be considered as belonging to the same group.

FEDERICO ARBORIO MELLA

GIOVANNI VERGA

In order to secure a realistic reproduction of life, all these writers drew their subjects almost invariably from the life of their town or district, thus creating a tradition of "regionalist" novels. The same is true of the Neapolitan Matilde Serao and of the Tuscan Renato Fucini. To some extent it could be said of Antonio Fogazzaro, too, although his characters move in a wider circle. Fogazzaro was a deeply religious man and was much influenced by Manzoni and the German romantics. His later tales (*Il santo*, 1906, well known because of the criticism which it provoked from the ecclesiastical authorities; *Leila*, 1911) did not equal the mellowness and sentimental seductiveness of previous works (*Piccolo mondo antico*, 1895, generally acknowledged as his masterpiece; *Piccolo mondo moderno*, 1900). This was due partly to the growing disagreement between the writer's unchanging moods and the needs and tastes of a changing time, partly to the stiffening of the church's attitude toward modernism. Fogazzaro tried to contrast, in his novels, the prevalent *verismo* (realism) of his times with a personal idealism, and was more interested than the *veristi* in psychological problems. Yet he never rose to the power of Verga.

11. Other 19th-Century Authors.—A lasting, though less resounding, fame was won by Emilio de Marchi, whose literary allegiance can be traced back directly to Manzoni; his novels (particularly *Demetrio Pianelli*, 1890) reveal the thoughtful and kind-hearted nature of their author and are not devoid of a sense of humour. A very different writer was Edmondo de Amicis, whose *Cuore* (1886) became a classic of children's literature and whose short stories and travel books are mainly remarkable, not indeed for vigour of thought, but because they are truly representative of the mood of the masses in his time.

Finally the writers of the *Scapigliatura milanese* deserve mention. This movement, which had Milan as its centre, was strongly imbued with real romanticism—not the "second romanticism" (against which it waged war). It affected an attitude of rebellion and a dislike for bourgeois orderly life, taking its cue from the French *Bohémiens*. The novelist Giuseppe Rovani (*I Cento Anni*, 1859–60), Emilio Praga and the poet and musician Arrigo Boito

(Verdi's librettist) were the foremost among the *Scapigliati*.

In literary criticism the historical method prevailed. Under the inspiration of such teachers as Alessandro D'Ancona, A. Bartoli, C. de Leva, Pasquale Villari, D. Comparetti and G. I. Ascoli much scholarly research was carried out and expounded in learned monographs, which aimed at establishing facts and clearing up obscure points in political and literary history.

VII. THE 20TH CENTURY

1. D'Annunzio.—The literature of the 20th century was marked at its inception by the rising influence of Gabriele D'Annunzio. Nietzsche's theory of the superman and the influence of many of the literary trends of that time (from Dostoevsky to Maeterlinck and Barrès) converged in D'Annunzio's maturity and in the immature imitations of his followers. His literary quality somewhat deteriorated after the culmination of his art had been reached in the first years of the century. The plays that followed the tragic pastoral *La figlia di Jorio* (1904) never reached its colour and melody, the poems following *Alcyone* (1904) marked a steady decline, and none of the many novels after *Il piacere* (1889) and *L'innocente* (1892) showed progress from that rather unconvincing beginning. D'Annunzio's fame as a playwright and novelist was certainly much greater than he merited, but the poet of *Alcyone* has not suffered from the passing of time. His greatest gift as a poet was in his sensuous, joyful feeling of communion and even identification with nature; the abundance and intensity of his sensations are rendered in a musical, modern, original form.

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GABRIELE D'ANNUNZIO BY HENRY G. BROOKS. IN MUSÉE DU LUXEMBOURG, PARIS

D'Annunzio's extraordinary vitality led him to take part in the historical events of his time. He struck the keynote to Italy's intervention in World War I and throughout the war continued to inspire his countrymen. In Sept. 1919, at the head of a small army of irregulars, he occupied Fiume, where he reigned like a prince of the Renaissance until the end of 1920. The seed he had sown bore fruit in the Fascist march on Rome and in Mussolini's conquest of Italy in Oct. 1922.

2. Croce and Gentile.—More aloof from current events and from popular feeling was Benedetto Croce. He had a high reputation as a philosopher but his main significance is in the history of letters. His treatise on ethics (*Filosofia della pratica*, 1909) is perhaps his greatest achievement as a philosophical study, but none of his works equals in effectiveness the *Estetica*. Published in 1902, it inaugurated the new century like a clarion call to youth. Many of its readers overstressed or perverted outright whatever indications in favour of boundless individualistic expressionism and of ultimate dissociation of aesthetic from moral values the book contained. Croce's doctrine was a reaction against the positivism of the previous generation and seemed at first to be an expression of the affected aestheticism of decadent literature. Croce, however, never approved either the so-called "pure poetry" of Mallarmé or D'Annunzio's cult of the superman, and remained all his life a staunch admirer of the classics. Warned by the growing difficulties in applying his aesthetic doctrine to the actual matter of literary criticism, by the objections of some of his pupils and opponents and, last but not least, by his own innate tendency to moderation, he tried repeatedly to correct his theory without discarding its primal tenets. Various stages of such alterations were contained in books or collected essays like *Problemi di estetica* (1910), *Breviario di estetica* (1913), *Nuovi saggi di estetica* (2nd ed., 1926) and *La poesia* (1936). They made his aesthetic theories more comprehensive, but also more vague.

In literary criticism, especially successful when exercised on Italian contemporary literature and on the writers of the past most congenial to him (*La letteratura della nuova Italia; Saggi sulla letteratura italiana del Seicento*) as well as in historiography (especially notable are *Storia del regno di Napoli*, *Storia d'Italia dal 1871 al 1915* and *Storia d'Europa nel secolo XIX*), Croce's tireless diligence provided Italy with a monumental corpus of which the outstanding characteristics are common sense blended with humour, which delights the reader even when the argument itself is unconvincing, and the neatness of an almost unlimited humanist scholarship. His prose is polished, spontaneous and appropriate, never inhibited or stilted: qualities valued the more for their rarity in Italian literature.

P. C. COMPIX

BENEDETTO CROCE

The closest friend of Croce's youth, Giovanni Gentile, whose remarkable contributions to literary criticism can be seen in such books as *Dante e Manzoni* (1923) and *Filosofia dell' arte* (1931), deduced rigorously from certain principles of neo-idealistic philosophy which he had held in common with his elder associate, a theory of "absolute idealism" which in its political implications openly justified the "absolute state." Fascism found a philosophical justification in this derivative of Hegelianism, and Gentile became the accredited philosopher of the Fascist "ethical state." Croce avoided this dead end and reaffirmed steadfastly his allegiance to the liberal faith, never satisfactorily defined in his work either from a philosophical or from a social and economic standpoint, but unquestionably alive with moral fervour. Direct participation or even expression in politics was obviously forbidden to a nonconformist in the era of Mussolini; Croce's opposition, however, is testified—even if, as a rule, by implication and innuendo—in the issues of his bimonthly review *La Critica* (founded 1903). After World War II Croce played an important part in the definition and re-establishment of democracy in Italy. Gentile was killed by anti-Fascist partisans in 1944.

3. Poetry from 1900 to 1920.—With the close of the great cycle of lyric poetry which ran from Parini to D'Annunzio, particular trends become more and more difficult to discern. Many poets, such as A. S. Novaro, Francesco Pastonchi, Angiolo Orvieto, still clung to traditional patterns, and the poems of Salvatore Di Giacomo (collected *Poesie*, 1907) were Grecian in their gracefulness. In Rome, Trilussa (Carlo Alberto Salustri) carried on the tradition of Belli and Cesare Pascarella, expressing his skeptical wisdom and easygoing maliciousness, sometimes with a political sting, in fables and sonnets in Roman dialect. In Milan, Ada Negri wrote verses revealing spontaneity and feminine warmth of heart. Another Neapolitan, Francesco Gaeta, is less easy to define: in some ways he was akin to the *Crepuscolari*, although with a stronger and more classical personality than most of them.

The *Crepuscolari* (so-called because they seemed poets of a disenchanted twilight after the dazzling D'Annunzian day) heralded the break with poetic tradition which became a marked feature of 20th-century poetry. Their innovation was double: on the one hand, tired by Carducci's classical prosody and D'Annunzio's overornamented style, they favoured a much simpler diction; on the other they rebelled against the heroic outlook and rhetoric of their predecessors, and cultivated an attitude of indolent melancholy and complacent resignation. Influenced by the French and Flemish decadents, they groped for an ideal, failed to find it and were left with the emptiness of life as their main theme. Sergio Corazzini (*Piccolo libro inutile*, 1906), Fausto Maria Martini, Marino Moretti and Aldo Palazzeschi were the best representatives of this mood. Guido Gozzano won more permanent fame than any other of the *Crepuscolari;* he blended an attitude of disenchanted naïveté (*La via del rifugio*, 1907; *I colloqui*, 1911) with a capacity for cynical introspection, using a style often described as poetically colloquial.

A more acute stage in the spiritual crisis of Italian culture was marked by Futurism, the literary and artistic movement heralded in 1909 by Filippo Tommaso Marinetti. The Futurists set out to proclaim the subversion of all aesthetic and intellectual standards, to abolish every intermediary between word and expression (by the use of *"parole in liberta"*) and to create an art appropriate to an era of scientific and industrial dynamism; in their view, the inspiration of poetry and the urge of physical violence should be one and the same. As a whole, Futurism (although it can now be seen as the starting point of a feeling of revulsion against the traditional language of Italian poetry) was a somewhat farcical movement, sometimes amusing. Its greatest influence was on the fine arts where it achieved some good results (Boccioni, Severini, De Chirico, Carrà). Dino Campana, a poet who developed in the Futurist atmosphere but was also influenced by the French Symbolists, stands out as a minor Rimbaud (*Canti orfici*, 1914).

4. Journalism, Criticism and Historiography.—Among the periodicals which attempted to interpret scholarship and philosophy to a wider public *La Critica* long preserved an undisputed primacy, but a long lineage of smart reviews stretched from the *Leonardo* (Florence, 1903) of Giovanni Papini to the *Voce* (Florence, 1908) of his friend Giuseppe Prezzolini, and from the Roman neoclassicist *Ronda* of V. Cardarelli, A. Gargiulo and Riccardo Bacchelli to the *Convegno* in Milan and other more eclectic or more exclusive journals in the 1920s and 1930s. Among many who achieved reputation mainly through such journals, Renato Serra, Emilio Cecchi and Francesco Flora can be singled out as the most remarkable.

Historiography, in all its branches, flourished; both the work of specialized scholars such as Ettore Pais; *Storia di Roma nei primi cinque secoli*); Gaetano De Sanctis (*Storia dei Romani*); Luigi Salvatorelli, Ernesto Buonaiuti, Piero Martinetti (*Gesù Cristo e il Cristianesimo*), or in the vivid interpretations of Guglielmo Ferrero (*Grandezza e decadenza di Roma*, 1902–07). In literary history the guidance of Francesco De Sanctis was acknowledged by nearly all. Of those who contributed best to its progress, P. Rajna, E. G. Parodi, A. Gargiulo, G. De Robertis, G. A. Cesareo, Guido Mazzoni, V. Rossi, M. Barbi, C. De Lollis, Arturo Farinelli, G. Bertoni, L. Russo, G. Toffanin, A. Galletti and especially Attilio Momigliano won a following also among laymen.

5. The Fascist Era.—The Fascist regime (1922–43) on the whole affected literature unfavourably. Conditions under a dictatorship thwarted the free expression of ideas. In the theatre, the works of such well-established playwrights as Luigi Antonelli, Sem Benelli (*La cena della befe*, 1909), Roberto Bracco, Luigi Chiarelli (*La maschera e il volto*, 1916), E. L. Morselli (*Glauco*, 1919), Dario Niccodemi and Rosso di San Secondo continued to hold the eye of the public. The main interest, however, remained focused on Luigi Pirandello. His dramas (*Così è se vi pare*, 1918; *Sei personaggi in cerca d'autore*, 1921; *Enrico IV*, 1922; *Questa sera si recita a soggetto*, 1930; etc.) gained international success by the original, dry geometric method of their treatment and by an often paradoxical technique: their characters move on the stage like puppets lacking human flesh and blood and responsive to a strange string-pulling from behind the scene; yet they are torn by powerfully felt, though unresolved, conflicts—the conflicts among the different beings that live together in one mind. Drama was the ultimate and most congenial form for the expression of Pirandello's belief in the irrational nature of life and in the incoherence of human personality. But before turning to drama, he had tried his hand at, and perfected his style, on fiction.

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LUIGI PIRANDELLO

Here his roots lay in the common terrain of the Sicilian realistic school of which Verga, Capuana and De Roberto had been the main exponents; but his numerous short stories (*Novelle per un anno*, 1922–ff.) were admirable for the uncompromising pessimism of the background from which their sketchy characters emerged rather than for the pity and hope that had inspired his predecessors. Already in his early novel, *Il fu Mattia Pascal* (1904), the basic theme of his work—an implacable attack against the hypocrisy of social conventions—is almost fully developed.

PUBLIFOTO, MILANO / MELLA

ITALO SVEVO

In the narrative genre some of the masters continued to hold their own. Grazia Deledda portrayed her native Sardinia in an uninterrupted flow of novels in which nobility, beauty of style and sentiment were not obscured by some monotony. Her masterpiece was *Elias Portolu* (1903). Alfredo Panzini wrote novels and short stories in which an exquisite literary irony seasoned the bitter taste of a reality rather contemplated as puzzling than apprehended as dreadful.

Literature for a wider public was provided by Virgilio Brocchi and Salvator Gotta, while Bruno Cicognani, Enrico Pea and two former *Crepuscolari* poets turned novelist, Marino Moretti and Aldo Palazzeschi, wrote novels and stories of less popularity but greater distinction. Some of the best prose-authors of the time, however, were not novelists: Antonio Baldini, Emilio Cecchi, and on a different, more journalistic level, Ugo Ojetti wrote essays and portraits of permanent value. Massimo Bontempelli exercised his talents in surrealistic writings. Giuseppe Antonio Borgese gained greater fame for his works of literary criticism and aesthetics than for his novel, *Rubè* (1921). The output of Giovanni Papini was concerned with philosophy and literary criticism, autobiography (*Un uomo finito*, 1912) and religion, and was as plentiful as it was uneven, though his earlier works stand out for their polemical brilliance and zest. A *Crepuscolare* turned Futurist, he later became the leading Catholic writer in Italy. His *Storia di Cristo* (1921) was translated into many languages.

A writer from the older generation, Italo Svevo (pseudonym of Ettore Schmitz) who won recognition late in life with *La coscienza di Zeno* (1923) was perhaps the most impressive Italian novelist since Verga. Though his name is usually linked with those of James Joyce and Proust or with German romanticism, his own brand of searching psychological analysis defies classification. Of the younger generation, Riccardo Bacchelli, a poet and later a playwright as well as a successful novelist, owes his renown to *Il diavolo al Pontelungo* (1927) and, even more, to *Il mulino del Po* (1938–40); both these powerful and well-contrived novels follow the best Italian narrative tradition. Corrado Alvaro did for Calabria what Verga had done for Sicily and Deledda for Sardinia. His short novel, *Gente in Aspromonte* (1930) is outstanding and many of his stories rank with the best of the century. Ignazio Silone (pseudonym of Secondo Tranquilli) had acquired a wide international repute before his best novels (*Fontamara*, 1933; *Pane e vino*, 1937) were known to his compatriots; for Silone was a political exile, and his books handled convincingly the theme of the anti-Fascist struggle. When they appeared in Italy after World War II, however, the public was out of tune with their style and mood.

6. The "Hermetic" Movement.—Poetry in the Fascist period underwent an interesting process of involution which extended the break from a centuries-old tradition, partly under the stress of political conditions in Italy, but even more under the influence

of French symbolism. This process amounted to a new and indeed revolutionary use of words and to an attempt at isolating, so to speak, their "lyric potentiality" and at discarding all accessory or decorative elements. Obscurity inevitably resulted, so that the new manner came to be called *ermetismo*, because the meaning of the words was hermetically sealed and because the poet aimed at isolating himself, with uncompromising integrity, within the solitary sphere of his inner self. Fragmentariness, aridity and an attitude of indifference were the main features of this movement, which disregarded the appeal of popularity. Its herald was Arturo Onofri, and its best exponents were Giuseppe Ungaretti (*Allegria di naufragi*, 1919; *Sentimento del tempo*, 1933), in whose brief sketches each word is charged with an extraordinary significance and intensity of emotions, and Eugenio Montale (*Ossi di Seppia*, 1925, *Le occasioni*, 1939), who took the visible aspects of the external world as "occasions" for a corrosive and cynical symbolizing of his sorrowful outlook on life. Salvatore Quasimodo, winner of the Nobel prize for literature in 1959, and Leonardo Sinisgalli also deserve mention among "hermetic" poets. Umberto Saba preserved a more immediate human appeal and a greater touch with everyday realities.

7. World War II and Its Aftermath.—"Hermetic" poetry lingered on during World War II, in the work of Mario Luzi and Alfonso Gatto, for example, but with the subsequent violent changes in the political climate it evolved so much in the direction of articulacy as to become unrecognizable, the first steps in this direction being taken by Ungaretti himself (*Il dolore*, 1947).

Italian poetry after the war, while still in the throes of the spiritual crisis that characterized most of the first half of the century, and still groping for new ways of expression, seemed likely to exchange the gloomy mood of the Fascist period for a brighter and more vigorous attitude.

In narrative literature Italy displayed remarkable vitality and maturity during the 1940s. Having felt earlier and more intensely than many other nations the crisis that led to war, Italy was prepared at its end for the task of expressing artistically its painful experiences in the previous eventful years, its feeling of rebirth and its new mood of alertness and of undefined but marked expectation. Already in 1941 two novels, Cesare Pavese's *Paesi tuoi* and Elio Vittorini's *Conversazione in Sicilia*, were promising a new stage in literary development.

From these two works and from certain aspects of American narrative literature (as exemplified by William Faulkner, Ernest Hemingway and John Steinbeck) Italian postwar neorealism took its cue. This neorealism had its roots in the Italian realistic tradition of the late 19th century; but it differed from the latter in that the reality that was its theme was not a historical reality, but a lyrically interpreted one, evoked at once with lucidity and with the detachment of dreams and given an almost magic hue. The treatment, moreover, was strongly analytic, or rather psychoanalytic, and the style was colloquial and unpretentious, thus carrying on in prose the reaction to a classical and rhetorical tradition already noticed in regard to poetry. While poetry, however, remained exclusive, prose affected a simplicity of style which gave it a wider appeal. Trends parallel to literary neorealism were also apparent in painting and in the cinema.

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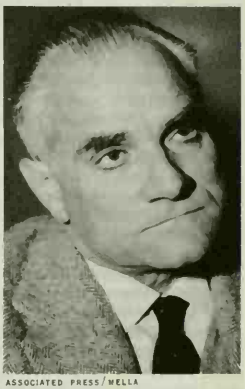
ELIO VITTORINI

Elio Vittorini, a restless artist forever experimenting in new techniques, was perhaps the most promising of the younger writers (*Uomini e no*, 1945; *Le donne di Messina*, 1947; *La Garibaldina*, 1956), the early death of Cesare Pavese robbed Italy of a novelist who had already proved his exceptional gifts in such novels as *Prima che il gallo canti* (1949) and *La Luna e i falò* (1950) where balance and control were coupled with a clear insight into the conscience of man. Next to these two masters of neorealism, Vasco Pratolini proved himself to be in the forefront of postwar narrative literature; his *Cronache di poveri amanti* (1947) was full of vitality and described with gusto the teeming life of the Florentine working classes. Many drew their material from war experiences, as Giuseppe Berto (*Il Cielo è rosso*, 1947), or from a re-elaboration of prewar experiences, as Carlo Levi, whose *Cristo si è fermato a Eboli* (1945) shows a moving sincerity and also sketches a social, moral and, above all, poetical portrait of a people and of a district. Of the older generation, Aldo Palazzeschi eclipsed the fame of his earlier novel, *Le sorelle Materassi* (1934), with the uneven but more pleasing *I fratelli Cuccoli* (1948), which seems to spring from the same source that produced the genial short stories of his *Il palio dei buffi* (1937). Ignazio Silone added to his series of novels dealing with peasant life in the Abruzzi (*Una manciata di more*, 1952; *Il segreto di Luca*, 1957). Alberto Moravia (Alberto Pincherle) achieved an international reputation as a storyteller; his gifts, already apparent in his first novel (*Gli indifferenti*, 1929), were refined by experience in his later works, which show an eager curiosity about the processes of the human mind. His power to excite indignation, while pretending to refrain from passing judgment, masks the occasional weakness of his plots. In *Agostino* (1946), *La Romana* (1947), *La disubbidienza* (1948) and *Amore coniugale* (1949) his psychological analysis was convincing but limited to certain problems or situations; in *Il conformista* (1951), *Racconti romani* (1956) and *La ciociara* (1957) he seemed to have deepened and widened his field of observation.



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ALBERTO MORAVIA

In the postwar period Naples became an active centre of neorealism. It was the Neapolitan writers (Carlo Bernari, Giuseppe Marotta, Anna Maria Ortese, G. Patroni-Griffi, Michele Prisco, Domenico Rea and Fortunato Seminara) who did most to replace the literature of the *bourgeoisie* with the literature of the people and to focus national and international attention on the problems of the Italian south. Rocco Scotellaro's *Contadini del Sud* (1954) was the outstanding book on this subject.

A consequence of the recovery of freedom after the Fascist domination, and one characteristic of the postwar Italian writers, was a closer contact with European and American writing. Some short stories and a novel (*Quer pasticciaccio*, 1957) by Carlo Emilio Gadda resemble James Joyce's work both in language and conception; Dino Buzzati's tales are strongly reminiscent of

Kafka; and Tommaso Landolfi's surrealistic stories sometimes have a Russian flavour, while the American style introduced by Vittorini and Pavese has been followed by many young writers. Pier Paolo Pasolini, Giovanni Testori and Goffredo Parise should be mentioned as the most promising exponents of the neo-realistic novel. Italo Calvino stands apart as a master of the fantastic tale.

ITALO CALVINO

The dramatist Ugo Betti, a judge by profession, in several successful plays (*Frana allo Scalo Nord*, 1937; *Corruzione al Palazzo di Giustizia*, 1944; *Delitto all'isola delle capre*, 1946; etc.) dealt with the problems of moral justice and responsibility. A postwar tendency toward religious drama appeared with Diego Fabbri (*Processo a Gesù*, 1955), while the tradition of the dialect theatre was carried on by the Neapolitan E. De Filippo. (U. L.; F. Di.)

See also articles on Academies; Autobiography; Biography; Drama; Novel; Romance; Theatre; etc., and on such specialized articles as Commedia Dell'Arte; Canzona; Chansons de Geste; Charlemagne Legends; Macaronics; Ottava Rima; Pastoral; Terza Rima; etc. *See* also biographies of all the major and many of the minor writers mentioned; and references under "Italian Literature" in the Index.

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ITALIC DIALECTS comprise a well-defined subdivision of the Indo-European languages spoken in Italy in ancient times, of which only one, Latin, survived, as Italian, through postclassical and medieval times into modern. In addition to the non-Indo-European Etruscan, there were also spoken in ancient Italy other Indo-European languages, *e.g.*, Messapic, to which the term Italic is not applied; this distinction must be borne in mind. By Italic, then, is understood that subdivision of the western group of Indo-European languages spoken in ancient Italy, which, as tested by the accepted criteria of agreement and of regular, but not uniform, development in vocabulary, syntax, accidence, word formation, and treatment of a common stock of speech sounds, makes a coherent group of dialects. This group is distinguished, by the same criteria, from other western Indo-European subdivisions.

This Italic subdivision, however, falls into two smaller classes: Osco-Umbrian and Latin-Faliscan. The agreements between these two classes are so numerous and so striking that it is necessary to regard them as together forming a single group. The argument that they are separate Indo-European subdivisions need not be pressed further than to say that the speakers of the two classes entered Italy in successive waves. The argument that Osco-Umbrian is in some features closer to Greek than to Latin is unconvincing.

Italic as a whole shows remarkable agreements with Celtic and,

in less degree, with Germanic. Perhaps the most striking features that separate Osco-Umbrian from Latin are the substitution of *p* for Indo-European q^u where Latin has *qu* or *c* (before *u* or a consonant) and *u* (initial and intervocalic), and the substitution of *b* for Indo-European g^u where Latin has *gu* (after *n*), *g* (before *u* or a consonant) (*c* by assimilation); *e.g.*, Osc. *púd*, *pod*, Umb. *pur-e*, Lat. *quod*, Indo-Eur. $*q^uod$; Osc. *kumbened*, *conuēnit*, Umb. *benust*, *uenerit*, Lat. *uenio*, Gothic *qiman* "come." Sans. *gácchati* "he goes," Indo-Eur. $*g^uem$; Umb. *umen* (older **omben*), Lat. *unguen*, Indo-Eur. $*ong^uen$. (The asterisk denotes a derived form.)

Celtic also falls into two subdivisions, similarly distinguished by their treatment of q^u; thus Irish *cia* "why," Welsh *pwy* "who" (cognate with Osc. *pod*, Lat. *quod* above). There are also other important points of agreement between Celtic and Italic. (*See* CELTIC LANGUAGES.)

Of all the ancient languages of Italy, only one, namely Latin, is fully documented and therefore fully known. It remains here only to say something about the geographical distribution of the dialects, the dates between which they are recorded, the nature of the documents in which they are preserved and the varieties of alphabet in which those documents are recorded. Apart from Latin, which also has epigraphic as well as literary evidence, the other dialects are known only in inscriptions, some from a certain number of glosses, *i.e.*, definitions of dialect words, preserved in ancient writers. The evidence of ancient names, local, divine and personal, is by comparison unimportant, but (like the glosses) usually confirms the other evidence (or is confirmed by it) and occasionally, especially in the more scantily recorded dialects, contributes a few items of information that would otherwise be totally unknown.

Latin was originally the language only of Rome and its immediate vicinity. Its neighbour and congener Faliscan was properly the dialect of Falerii in southern Etruria and of a tract of surrounding territory as far south as Capena. It is probable that these dialects were introduced into Italy by an early wave (not later than the beginnings of the Early Iron Age) of Indo-European speaking tribes, who, coming down from the north, crossed the eastern Alps and then the Apennines to reach the west coast of Italy, where they were subsequently isolated by the Etruscans. In fact, traces of kindred speech have been detected among Alpine dialects, of which Venetic shows some features curiously reminiscent of Latin, *e.g.*, medial *b* and *d* from Indo-European *bh*, *dh*; *ks* and *kt* preserved; genitive singular *i* or *o* stems; dative-ablative plural *-os* [*-bos*].

A group of Raetic inscriptions discovered in 1936 and 1937 in the Val Camonica (north of the Lago d'Iseo) reveals striking similarities with Faliscan, *e.g.*, *sanquos*, genitive singular of a *u* stem; *cf.* Faliscan *zenatuo(s)*; *tito*, dative singular, as in Faliscan *titoi*, *tito*. (*See* J. Whatmough, *Classical Philology*, vol. xxxv, pp. 186–188, 1940.)

The Osco-Umbrian dialects are believed to have entered Italy at a later date. Umbrian is wedged between Etruscan and Picene, and the southernmost extension of Oscan to the toe of Italy and across the Strait of Messina dates from *c.* 300 B.C. The following may be distinguished: (1) southern Oscan, represented chiefly by the Tabula Bantina (Apulia), but also by fragmentary remains in Lucania and in the country of the Bruttii; (2) central Oscan in Campania and among the Samnite tribes (Hirpini, Samnium, Frentani), which is the main source of information about Oscan, especially as it appears in the numerous inscriptions of Campania, so that "Oscan" unqualified usually means the central Oscan of Campania, though the language of the Tabula Bantina is not essentially different and contributes much to knowledge of the dialects; (3) northern Oscan, represented by inscriptions of the Paeligni, Marrucini and Vestini, which, because of their peculiar features and limited sources, are usually spoken of specifically.

A pair of Volscian inscriptions (Velitrae, Antium) represent the dialect of the Volsci who lived in southern Latium. Records of a number of minor dialects (of the Marsi, Acqui, Hernici, Praenestini and Sabini) in central Italy are commonly grouped together as Latinian, though actually they all belong (except Praenestine) with the Osco-Umbrian group. Volscian shows strong similarities of development to those of Umbrian. All the pre-Latin dialects of regions of Italy other than those here enumerated belong to other linguistic Indo-European groupings (Greek, Celtic, Illyrian and Ligurian), the non-Indo-European Etruscan of the west coast alone excepted.

Knowledge of a dialect cannot be claimed without primary records of that dialect; in the case of ancient dialects, this is tantamount to saying without written records of it. All varieties of writing in articulate documents of ancient Italy (a few Phoenician and late Semitic inscriptions excepted, and of course the non-native texts on exotic objects brought in by trade) stem from some variety of Greek alphabet. So far as the dialects described in this article are concerned, the alphabets in which they are preserved stem without exception (not even Latin) from a proto-Etruscan or Chalcid-Etruscan alphabet, which is a variety of western Greek alphabet (like the old Attic alphabet). This form of writing cannot have been introduced into Italy much before *c.* 800 B.C. The oldest dialect or Latin inscription (that of the Praenestine fibula) is dated *c.* 600 B.C. But neither dialect nor Latin inscriptions are numerous before the middle of the 3rd century B.C. There are no Oscan inscriptions of later date than the Pompeian graffiti which were written shortly before the eruption of Vesuvius overwhelmed Pompeii in A.D. 79. Since, however, Oscan has left some clear marks of its influence on southern Italian dialects, it probably was not extinct at so early a date. Official documents in Oscan cease at dates which vary with the advance of Roman control (at Capua in 211 B.C., for example; at Pompeii in 90 B.C., when Sulla captured the city; and indeed everywhere after the Social War of 90–89 B.C.).

With the help of such fixed points as these, the relative chronological order of inscriptions may be determined, within broad limits, on epigraphic grounds.

Both the Oscan and the Umbrian, like the Etruscan and the oldest Latin, alphabets have the letters facing to the left (ꟻ *b*) and also have a right-to-left direction of writing. The Latin alphabet is in use in the later inscriptions, and in some of the southern Oscan inscriptions the Tarentine-Ionic variety of Greek alphabet is used.

See also ETRUSCAN LANGUAGE; LATIN LANGUAGE; OSCAN; UMBRIAN LANGUAGE.

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ITALO-ETHIOPIAN WAR (1935–36). The motives of Fascist Italy in attacking and annexing the ancient, independent Christian state of Ethiopia (Abyssinia) were complex but easily intelligible. They included the desire for national greatness and empire; the personal megalomania of Benito Mussolini and glorification of his regime; the need for new resources for crowded and impoverished Italy; vengeance for the humiliating defeat of Aduwa (1896); and the ambition to substitute Italian civilization for the black barbarism alleged to be dominant in Ethiopia. Ethiopia was, in fact, still an extraordinarily backward and unorganized state. The accession of the emperor Haile Selassie to sole power (1930), his suppression of disloyal rases (feudal princes), attempted suppression of slavery, efforts in cautious modernization and the granting of a constitution (1931) had done little to discipline the mixture of primitive peoples; and the lax or nonexistent frontier administration failed to prevent frequent border clashes with the Italians in Eritrea and Somalia, as also with the French in Djibouti or the British in Kenya and the Sudan. Nevertheless, Ethiopia had become a unanimously accepted member of the League of Nations in 1923, had concluded a pact of friendship with

Italy in 1928 and had exchanged ambassadors with it in 1929.

The Coming of War.—The final and fateful frontier incident was a clash of Italian and Ethiopian troops at the wells of Walwal in the undemarcated no man's land between Somalia and the Ethiopian Ogaden on Dec. 5, 1934. Italy immediately demanded an apology and damages; the Ethiopians refused until full inquiries should have been made and, when these were refused, appealed to the League of Nations. The League slowly set up a four-member conciliation commission, which failed to agree; a fifth member was co-opted, and the commission finally reported in the vaguest terms. Italy meanwhile began military preparations both at home and in the colonies, appointed Gen. Emilio de Bono high commissioner for the colonies, rejected proposals made by the British and French ambassadors in Paris (Aug. 1935) and showed increasing signs of planned and resolute aggression. Regular and "blackshirt" units were sent to the colonies, stocks were built up and communications were improved. At the League council meeting in July and August the Italians, under Baron Pompeo Aloisi, blocked every attempt at conciliation and demanded the exclusion of the Ethiopians from all negotiations. At the assembly in September the British representative, Sir Samuel Hoare (the foreign secretary), urged the full upholding of League ideals and procedures. He was generally supported, though in fact neither France nor Germany (no longer a member of the League) was anxious to take a line critical of Italy. The latter replied by declaring its continued conviction of Ethiopian hostility and the indignity of negotiating with barbarians, while Mussolini was speaking already of military measures and the achievement of the Fascist empire. Proposals highly favourable to Italy were submitted to the council by an *ad hoc* committee of five but were refused at sight by the Italian representative, who belatedly produced a vast dossier of Ethiopian malpractices. War was now certain, with Italy diplomatically isolated and its opponent enjoying almost universal sympathy.

Italian Victories.—After further border clashes between Italian and Ethiopian elements during 1935 and a great intensification of the former's military preparations, the invasion of Ethiopia began, without declaration of war, on Oct. 3, 1935. Gen. Rodolfo Graziani was in command of Italian forces on the southern (Somalia) front, De Bono (succeeded on Nov. 28 by Gen. Pietro Badoglio) on the Eritrean, while the emperor was in supreme command of all Ethiopian forces. The disparity in military power between the two sides was extreme; the scarcely trained and illarmed Ethiopian forces, even with advantages of territory and mobility, were no match for the aircraft, mustard gas, guns, armoured vehicles and full modern equipment of the Italians. The Ethiopians, moreover, were led with little military skill. Before the end of 1935 the Italians had, after a deeper but temporary advance, consolidated a line from Aksum to Aduwa and Makale in the north and held positions around Dolo in the south. Early in 1936 Badoglio, who had been reinforced, advanced to defeat an Ethiopian force, won the battles of Enderta (Feb. 11), the plains of Shire (Feb. 29) and Tembien (March 3), defeating the units or levies under the rases Kassa, Seyum, Mulugueta and Imru. The emperor again concentrated his forces by early April, though his best policy would have been to scatter and avoid engagement. The Ethiopians were beaten near Lake Ashianghi (April 9), with the consequent loss of Gondar, the Lake Tana area and Dase (April 14). The Italian victory was widely credited to the use of poison gas. Meanwhile Graziani advanced and occupied Sassabaneh and Dagabur late in April and finally took Jigjiga on May 5. The emperor, to save further hopeless bloodshed, left the capital with his family on May 1 by way of Djibouti.

Addis Ababa, already looted by its inhabitants, was entered by the Italian forces on May 5, 1936. The main operations of the unequal war were over; there remained the long-continued mopping-up operations, acceptance of the surrenders of chiefs and villages and visits of armoured columns to outlying areas. These hostilities ended in the spring of 1937, after every province and district had been visited and almost the last ras had laid down his arms. Meanwhile the victory and the foundation of the new empire had been proclaimed by Mussolini in Rome on May 5, 1936. King Victor Emmanuel III became emperor of Ethiopia four days later and the empire, divided into five provinces (of which the old colonies, enlarged, formed two), was placed under Badoglio, shortly afterward succeeded by Graziani, as viceroy. Provincial governors were, initially, all generals, and countryside guerrilla operations continued for several months. A large Italian population subsequently settled in Ethiopia.

Diplomatic Activities.—Throughout the war great diplomatic activity had continued in Europe, with Germany standing aside, the United States benevolent but commercially neutral, the papacy unhappily silent and opinion of small nations—notably in Africa, where the invasion was a profound shock and warning—highly favourable to the invaded. The League declared Italy an aggressor in Oct. 1935 and voted sanctions in arms supply, finance and export-import restrictions. These were reported to be satisfactorily implemented by the member states, but never included the vital withholding of oil supplies. Proposals highly favourable to the aggressor—involving indeed the dismemberment of Ethiopia—were formulated at a meeting between Hoare and the French premier and foreign minister Pierre Laval (Dec. 13, 1935). These, leaked to the world, were strongly rejected by European and British opinion. Hoare was replaced as foreign secretary by Anthony Eden, who tried to organize the Mediterranean nations (France, Yugoslavia, Greece and Turkey) for common action in the event that Italy again threatened the peace in protest against the sanctions. Oil sanctions were again discussed, but inconclusively. The League Committee of 13—in effect the council without Italy—in March 1936 appealed to both sides for a cease-fire. Both accepted, but the Italians only on conditions excluding Ethiopian participation, and with a refusal to suspend military operations in progress. The conversations between Aloisi and Salvador de Madariaga, chairman of the Committee of 13, accordingly led to nothing, and the council could do no more than to appeal to Italy for a more conciliatory attitude. At this unhappy point came the fall of Addis Ababa and proclamation of the Italian empire.

The Italians thereafter refused to sit in Geneva with Ethiopian spokesmen and on May 12, 1936, withdrew from the Palais des Nations. Sanctions were continued with decreasing resolution until they were dropped on July 15. Great Britain, France and Germany appointed consuls general, instead of ministers, to Addis Ababa under its new masters, and interpower relations rapidly became normal with general recognition of the conquest. But Italy left the League in protest at Ethiopia's continued representation.

The emperor, after a short rest in Palestine, arrived in England and prepared his case for the League, insisting, in particular, that the war was still in progress. On June 30, 1936, he presented his country's plea in person, in terms of great dignity and conviction, but in vain. He retired to spend four years in Bath, Eng.

The preliminaries, course and aftermath of the Italo-Ethiopian War represent a sadly instructive episode of 20th-century international activity. If the Ethiopian state, under an outstanding ruler, was primitive, feeble and militarily powerless, the Italian aggression was shamelessly selfish, morally and legally unjustified, yet aided temporarily by international conditions and personalities. The feebleness of the League as an effective restrainer of aggression was made manifest. The alignment of the nations preparatory to World War II took shape, and few illusions could thereafter be retained as to the strength of international morality when national fears or interest were aroused.

See also ETHIOPIA: *History;* ITALY: *History;* LEAGUE OF NATIONS.

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ITALO-TURKISH WAR (1911–12). Ever since the completion of Italian unification Italian statesmen had considered the possibility of expansion in north Africa. The entry of Italy into the Austro-German alliance on May 20, 1882, had been occasioned by Italian hostility to the establishment of a French protectorate over Tunisia by the convention of Bardo (May 12, 1881). Though Italy remained a nominal member of the triple alliance until

1914–15, relations with France began to improve toward the end of the 19th century, when the French ambition of dominating Morocco demanded an understanding with Italy with regard to the central Mediterranean. There was a relaxation of tension when France granted Italian settlers in Tunisia certain privileges on Sept. 26, 1896, in return for which Italy gave France a virtual recognition of its protectorate over the country. Italy therefore began to think that it might make use of French plans in order to extend its own control over the remaining north African dominions of Turkey: Tripolitania and Cyrenaica. The French foreign minister, Théophile Delcassé, came to an understanding with Italy in Dec. 1900; and in an exchange of letters between the French ambassador in Rome, Camille Barrère, and the Italian foreign minister, Emilio Visconti-Venosta, France offered Tripolitania to Italy in return for Italian recognition of France's position in Morocco. Though Italy renewed its alliance with Germany and Austria-Hungary on June 28, 1902, the foreign minister, Giulio Prinetti, in an exchange of letters with Barrère in November, gave France the assurance that Italy was not committed against it. Austro-Italian relations worsened when Austria-Hungary annexed Bosnia-Hercegovina in Oct. 1908, because under the terms of the triple alliance Italy was entitled to compensation in the event of the enlargement of Austria-Hungary. During a visit of the Russian emperor Nicholas II to Italy in Oct. 1909, Italy strengthened its diplomatic position in the Mediterranean by an accord with Russia, the so-called Racconigi agreement, by which the Russian foreign minister, A. P. Izvolski, and the Italian foreign minister, Tommaso Tittoni, undertook that Italy and Russia should "engage themselves to regard with benevolence, the one Russia's interests in the question of the Straits, the other Italian interests in Tripoli and Cyrenaica." The general international result of Italian ambitions in north Africa therefore was to weaken Italy's ties with the Central European powers and bring it into association with the entente powers, France and Great Britain.

The vital question, however, was the situation in Morocco, which had brought into existence the initial exchange of letters in Dec. 1900. With the prospect of a peaceful settlement of the Agadir crisis of 1911 and the withdrawal of the German challenge to French domination of Morocco, it seemed likely that Italy's usefulness to France in north Africa would be much diminished. The Italian government therefore decided to strike while the opportunity presented itself and before the entente powers could withdraw their support. Italy delivered a 24-hour ultimatum to Turkey on Sept. 28, 1911, concerning the infringement of its interests in the vilayets (provinces) of Tripolitania and Cyrenaica and demanding the admission of Italian troops. Though the Italians proclaimed the annexation of the vilayets on Nov. 5 their forces, under Gen. Carlo Caneva, made slow progress against the Turkish troops and had some difficulty with indigenous resistance also. In the meantime Italian warships appeared at the Dardanelles in April 1912, which led to an Austro-Hungarian protest; and Rhodes and the group of islands subsequently known as the Dodecanese were occupied by Italian troops in May. In the summer of 1912 the Italian army was able to make some progress against the Turkish forces in Cyrenaica under Enver Bey and peace talks were opened in August. Under the terms of the treaty of Ouchy of Oct. 15, 1912, the Porte ceded sovereignty over Tripolitania and Cyrenaica to Italy and undertook to withdraw its troops from Libya. Italy was to hold the Dodecanese and Rhodes until the evacuation was complete; in fact Italy remained in possession of the islands until 1946, when as a result of its defeat in World War II, they were united to Greece. The importance of the Italo-Turkish War is that it revealed to the small Balkan powers the weak position of Turkey and therefore to some extent set in motion the train of events that brought about the Balkan Wars of 1912–13. *See* also ITALY: *History*.

See L. Albertini, *The Origins of the War of 1914*, vol. 1 (1952); W. C. Askew, *Europe and Italy's Acquisition of Libya, 1911–12* (1942). (R. F. LE.)

ITALUS, JOHN (fl. 11th century A.D.), Byzantine scholar and philosopher, who succeeded Michael Psellus as professor of philosophy in the University of Constantinople and left a number of writings on Christian metaphysics. As a young man he came from southern Italy to Constantinople, and he may have been of Norman origin. He was patronized by the Ducas family and played some part in politics during Michael VII's reign (1071–78). He was suspected of heresy, and figured in a trial under Alexius Comnenus (1082), though this may have been due to his association with the opposition Ducas family. He dramatically abjured his errors from the pulpit of Hagia Sophia.

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ITALY (ITALIA, officially REPUBBLICA ITALIANA), a republic in southern Europe and the name applied in ancient and modern times to the great peninsula projecting from central Europe southward into the Mediterranean sea, where the island of Sicily continues the continental promontory. That part of the Mediterranean called the Tyrrhenian sea is enclosed by Italy, Corsica, Sardinia and Sicily; and that part called the Ionian sea separates Italy from Greece. On the east Italy is bounded by the Adriatic (*q.v.*) sea, while to the north it is separated from the rest of Europe by the semicircular barrier of the Alps. Besides Sicily and Sardinia, Italy includes numerous smaller islands, mostly near the Tyrrhenian coast. It has an area of 116,303 sq.mi. Within the geographic boundaries of Italy are the sovereign republic of San Marino (area 24 sq.mi.) and the sovereign state of Vatican City (108.7 ac.). The capital of Italy is Rome.

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I. PHYSICAL GEOGRAPHY

From the Vetta d'Italia in the Alto Adige to the Isola delle Correnti in Sicily the country stretches from latitude 47° 5′ N. to 36° 38′ N. Rome, the capital, is almost exactly halfway between these extremes and also lies only slightly west of the country's median meridian. The peninsular extension of the country, together with the major islands, give it a coast line long in relation to its size and about four times the length of the land frontiers. Italy's location and shape have not only given it easy access to the sea but make it a transit land between Europe and Africa and the Levant. It looks to both the western and the eastern Mediterranean and is a link between that sea and the Germanic and Slav lands to the north.

1. Physical Regions.—More than one-third of Italy is mountainous and more than two-fifths consists of uplands, leaving less than one-quarter of the area to the plains. The country forms part of the great Eurasian belt of Tertiary mountain building.

The Alps.—The Italian Alps sweep north and west of the Northern or Padanovenetian plain from the Venetian provinces to Piedmont and Liguria (*qq.v.*); thence the folds of the Apennines bend southeastward through the peninsula to sweep westward again in northern Sicily, thus uniting continental, peninsular and insular Italy in a great S-bend. While the terrain has limited the agricultural productivity of much of the country and involved arduous engineering works to overcome difficulties of transportation, the contrasts of landscape between rugged mountains, wooded or vine-covered slopes and exuberantly fertile plains have played a great part in the traditional fascination of Italy and in the growth of its tourist industry.

The western Alps comprise the highest mountain masses including Gran Paradiso (13,323 ft.), the culminating point of the Graian Alps and the highest mountain entirely within Italy. The central Alps are lower and more easily accessible by transverse routes opened up by the great glacially-deepened Prealpine lakes of Lombardy: Maggiore, Lugano, Como, Iseo and Garda (*qq.v.*). Italy has little of the crystalline zone of the eastern Alps, but the calcareous belt broadens; the valley of the Adige (*q.v.*) opens out in the Merano and Bolzano basins, rich in fruit and vines. Eastward the Dolomites (*q.v.*) rise to heights of about 10,000 ft. in fantastic pinnacles contrasting with the forested or grassy slopes below and form one of Italy's greatest scenic attractions. (*See* ALPS for detailed geology and structure.)

The Northern Plain.—The late Tertiary and early Quaternary emergence of Italy was subsequently completed by the filling-in with river alluvium of the arms of the sea, gulfs and intermontane lakes that still penetrated the land surface. The greatest of these was the Pliocene gulf of the Adriatic that was to become the Padanovenetian plain (16,000 sq.mi.) accounting for three-fifths of Italy's lowland area. The plain is bounded on its Alpine edge by subalpine hills of morainic origin.

The upper plain is formed by: (1) the remains of the oldest conoids, which have been decalcified and oxidized to form an impermeable clay (*ferretto*) and in which the streams are incised; (2) a permeable zone of fluvio-glacial outwash, consisting of the coarser gravels. The water percolating through this upper plain comes to the surface on the lower ground where it meets the finer and more impermeable material in a zone of springs (*fontanili*) from which the lower plain derives much of its irrigation water. Moreover, on the lower plain the rivers are more easily tapped by irrigation canals and it is from this lower plain, made increasingly fertile by millenniums of human effort, that Italy's greatest agricultural production is derived. In the western section of the plain the Po (*q.v.*) river runs nearer to the Apennines than to the Alps, largely because of the greater volume of alluvium brought down by the Alpine tributaries.

Peninsular Italy.—Peninsular Italy arose from the sea in the late Tertiary and Quaternary periods with the folding of the Apennine chains in a wide semicircle from Liguria to Sicily, with a great outburst of volcanic activity from Tuscany to Campania and with the uplift of the limestone plateaus in Apulia (Puglia).

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On the whole the altitudes are not great but in the Abruzzi, where massive limestone has been more resistant to erosion, the Gran Sasso d'Italia rises to 9,560 ft. The Apennines (*q.v.*) are generally steeper on the inner or Tyrrhenian side of their curve than on the Adriatic slopes. They are not continuous but consist rather of bundles of short overlapping chains, separated (especially in the west) by longitudinal valleys that widen into many intermontane basins connected also by fairly easy transversal passages. There are numerous passes below 3,000 ft. The mountain and hill belt widens toward the centre and south. In the peninsula as a whole the plains take up only about 15% of the total area. Settlement has been largely on the hilltops, the frequently broad summits being more stable than the more easily eroded lower slopes and providing protection against both malaria and human enemies. Sandstones, marls and clays predominate in the northern section, which has gentle relief and rarely rises above 6,500 ft. On the Tyrrhenian side, between the valley of the Arno (*q.v.*) and the sea, the sandy and clayey Pliocene of the Monti del Chianti has been eroded into open valleys on whose slopes Italy's principal export wine is grown.

The central Apennines consist of complex masses rather than chains. On the higher limestone areas water is scarce and there is at best only thin grazing for sheep and goats. Population is concentrated in the basins, where springs outcrop at the base of the limestone. Fucino (*q.v.*), once the largest lake of the peninsula, is of tectonic and karstic origin. Between the central Apennines and the Tyrrhenian sea, from the southern border of Tuscany to the Agro Pontino south of Rome, lies a series of Quaternary volcanic structures. Between the Tiber (*q.v.*) and the sea the Volsini, Cimini and Sabatini mountains and, south of the Tiber, the Alban hills (*q.v.*) present highly eroded craters, some containing lakes (Bolsena, Bracciano, Albano, Nemi [*qq.v.*] and Vico), and large areas of much eroded stratified tuffs, sometimes forming terraces that were sites of Etruscan cities, sometimes groups of small hills like the seven hills of Rome. Monte Soratte (Soracte, 2,267 ft.), visible northward from Rome, is a limestone outlier.

In the southern Apennines limestones and clays again predominate. The Sorrentine peninsula (Punta di Sorrento) and its continuation in Capri are an offshoot of the Campanian Apennines. The steep valleys on its rugged southern face, terraced for vines and olives and forming the background to the Amalfi coast, and the broad terraces on which Sorrento stands amid its citrus groves make this one of the greatest tourist attractions of Italy. Above the Bay of Naples rises the cone of Vesuvius (*q.v.*), whose first recorded eruption buried Pompeii under ash and Herculaneum under lava. Farther south, between Calabria and Sicily, Stromboli and Vulcano in the Lipari Islands (*q.v.*) are still active volcanoes. In the far south the plateaulike, largely granitic La Sila, older than the Apennines, and the Aspromonte range, rising to 6,417 ft. at the tip of the peninsula, have retained much of their forest cover.

Sicily.—The Apennine folds are continued on the island of Sicily and the broad summer-dry streams (*fiumare*) are like those of Calabria (*q.v.*). In the centre settlement keeps to the calcareous heights and is found up to 3,000 ft.; much of the lower ground is instable and infertile. The gypsum-sulfur formation of the Upper Miocene stretches across the island from the Sicilian channel to the plain of Catania, above which the great cone of Mt. Etna (*q.v.*; 10,705 ft.), Europe's largest active volcano, rises above the gardens of citrus fruit that flourish where the Arabs once brought irrigation from the springs at the base of the lavas. (*See* SICILY: *Physical Geography.*)

Sardinia.—This island is a fragment of the ancient Tyrrhenian land mass. Granitic formations occupy most of the east and much of the southwest. The wide ditch of the Campidano that separates the larger upland of the east from the smaller upland of the southwest is the island's main granary. (*See* SARDINIA: *Physical Features.*)

2. Climate.—Stretching through more than ten degrees of latitude between the Alps and Africa, with contrasts of continental mainland, peninsula and islands, mountain, hill and lowland, Italy has a great range of climates even within very short distances. The Alps have abundant precipitation, with a summer maximum and a winter minimum; their range of temperature, annual and daily, is high; snow cover is thicker and more lasting toward the east, where Italy's highest precipitation occurs. The Po plain has generally less than 40 in. of precipitation annually but has two maxima, spring and autumn; it has a high annual range of temperatures, much snow and winter fog. In contrast the Riviera (*q.v.*), sheltered by the mountains and warmed by the sea, has relatively high winter temperatures. Southward in the peninsula total precipitation diminishes and a winter maximum becomes more marked; the Calabrian and Sicilian coasts have the mildest winters. In Sardinia precipitation is mainly in autumn and spring; the island suffers both from rainfall variability and from a hot south wind (*scirocco*).

(C. J. Ro.)

3. Vegetation.—The flora and vegetation of the Alps, the northern or Padane plain, and the Apennines belong botanically to the continental European region, while those of the coasts, Sicily and Sardinia belong to the Mediterranean region. The highest limit of the holm or holly oak (*Quercus ilex*) plant communities is taken as the dividing line. The continental European region of Italy is divided into two provinces, the Alpine-Padane and the Apenninic; the Mediterranean region is divided into the Italo-Sicilian and the Sardo-Corsican provinces.

In the Alpine-Padane province the northern plain consists of grassland, orchards, and fields of cereals, rice, sugar beet and vines, with poplars. Almost all the original oakwoods have been destroyed. Though within this province, the Insubria (the region of the Alpine lakes) and the Colli Euganei near Padua have a relict Mediterranean vegetation with scattered parks and gardens bordered by cypress trees. The submontane belt carries woods of pubescent, sessile and pedunculate oaks (*Quercus pubescens, Q. petraea* and *Q. robur*) and woods of sweet chestnut with broom, ling and bracken, interspersed with fields and areas of *brughiera* (heathland dominated by ling). The montane belt consists of a lower zone of beechwoods where the climate is more maritime, and coniferous woods (Scots pine and some Austrian pine) where the climate is more continental; and a higher zone characterized by woods of Norway spruce, European larch (*Larix decidua*) and, toward the upper limit, Swiss stone pine (*Pinus cembra*). Above this the subalpine belt contains shrub communities of mountain pine (*P. mugo*) and green alder, communities of alpine rose (*Rhododendron ferrugineum* and *R. hirsutum*) and dwarf juniper, and undershrub associations of Mediterranean heath (*Erica carnea*) and bilberry. Scattered woods and isolated trees of European larch and Swiss stone pine extend to the alpine belt which begins above the tree line and is characterized by alpine meadows. This belt passes gradually through rock and boulder vegetation to the snow line.

The submontane belt of the Apenninic province is characterized by woods of pubescent oak in the lower slopes and of Turkey oak (*Quercus cerris*) higher up. In the northern Apennines the pubescent oak is accompanied or replaced by the sessile oak and in the southern Apennines by the Hungarian oak (*Q. farnetto*). In these oakwoods hop hornbeam (*Ostrya carpinifolia*), hornbeam (*Carpinus betulus*), manna or flowering ash (*Fraxinus ornus*), elm, hazel and small-leaved linden or lime (*Tilia cordata*) are frequently found. Other submontane woods are of sweet chestnut with an undergrowth of broom and ling, while cultivated fields have replaced parts of the original cover. The montane belt consists of two typical wood formations: beech and silver fir, the latter being far less common and always in specially preserved homogenous stands. This belt in the southern Apennines is characterized by woods of Corsican pine (*Pinus Laricio*) which cover extensive areas of the La Sila and Aspromonte mountains. Only on a few scattered summits of the Apennines is there alpine vegetation. Mountain pine, two junipers (*Juniperus nana* and *J. hemispherica*), bilberry and crowberry (*Empetrum nigrum*) are found on the higher slopes, but more typical of this belt are the pseudalpine grasslands, so-called because they are caused by windy and dry climate rather than by altitude.

The belt of Mediterranean vegetation along the coasts is narrow in the north becoming gradually wider in the south where it pene-

trates deeply inland. Behind the halophilous (salt-loving) formations of the sandy shores and cliffs the vegetation consists of: (1) three types of littoral pinewoods where the chief trees are, respectively, stone pine, maritime pine and Aleppo pine (*Pinus pinea*, *P. pinaster* and *P. halepensis*); (2) maquis with arbutus, lentiscus, holm oak, wild olive, alatern (*Rhamnus alaternus*), myrtle, the Italian juniper (*Juniperus oxycedrus*) and *Euphorbia dendroides;* and (3) garigue with scarlet oak, dwarf palm (*Chamaerops humilis*), rosemary and *Cistus monspeliensis*. In southern Italy these are replaced by plantations of carobs and olives. Other types of the Mediterranean vegetation, reaching a higher level and spreading farther inland, are represented by woods of holm oak, common in all parts of the Mediterranean belt, and of cork oak, particularly abundant in Sardinia but present also in southern and central Italy. Everywhere in this belt olives, carobs, vines and other annual and perennial plants are cultivated. The ancient Mediterranean montane vegetation is represented by a few relicts in localized areas of the southern Apennines. (R. E. G. P.-S.)

4. Animal Life.—The fauna in Italy has suffered from unrestricted killing. In the past some of the big landowners protected some of the animals and in the early 1960s there were four national parks, two in the Italian Alps and two in central Italy. In addition, near Turin is La Mandria reserve used especially for protecting the red deer, the commonest deer being the much smaller roe deer. Brown bears are found only in the Abruzzi National park, and wolves are there as well as in other mountainous parts of southern Italy. Other large animals are the chamois, ibex and wild boar; the last-named being the most numerous large animal. The ibex is found only in the Gran Paradiso National park, in the western Alps. The chamois is restricted to the Abruzzi National park.

Of the smaller mammals, the following occur throughout Italy: fox, badger, otter, polecat, marten and weasel, hedgehog, red squirrel, dormouse, brown hare and rabbit. The common porcupine lives in the west and south and the wildcat in the mountain forests. There are three kinds of mole: the common mole in the north; the blind mole in the north and northwest; and the Roman mole in the east and southeast. Mountain or blue hares live on the slopes of the Alps.

Hunters sallying forth on bicycles with their guns feel rewarded if they return with a blackbird or two. Consequently, although Italy is one of the main routes for birds migrating between Europe and Africa, birds are scarce and there are few resident songbirds. Even migrating birds, such as thrushes, larks and quails are shot and snared in large numbers for food; though waterfowl resting on the marshes while on migration may escape.

Birds of prey are not killed for food and therefore are molested less than other birds. They include the usual small hawks and falcons, the red kite and black kite, buzzard and goshawk. Mainly in the Alps are the golden eagle, Bonelli's eagle and the Egyptian and griffon vultures. There, too, are game birds, including the capercaillie, ptarmigan and black grouse, the hazel hen, rock partridge and red-legged partridge. Many of the birds are similar to those found in Britain but there are some that are shared with central Europe and a few with eastern Europe, such as the middle spotted woodpecker and the penduline tit.

Lizards are common; they include the green lizard and wall lizard. The only poisonous snake is the viper, but nonpoisonous snakes include the grass snake and the tessellated, smooth and angry snakes. There are pike and perch in the rivers, numerous eels, and some salmon, with trout in the mountain streams, but the better-known fisheries are in the sea where anchovies and sardines are caught on a large scale and the tunny fishing is famous. Marine animals generally are typical of the warmer seas. They include corals, especially the red and black precious corals. Commercial sponges are not abundant in Italian seas. Cuttlefish are important as a source of food.

The invertebrate fauna, both on land and in the sea, shows its subtropical character by the presence of species recalling those living nearer the equator. On land there are poisonous centipedes, tarantula spiders and fireflies. The rich marine fauna includes colourful species, among which are a variety of squids.

(MA. BU.)

II. ECONOMIC REGIONS

1. The Northwest.—The northwest and particularly the triangle between Milan, Turin and Genoa is the core of the Italian economy. This area, inhabited by one-quarter of the population in 1951, had by the early 1960s two-fifths of the national income and an average income per head more than 60% above the national figure. Its total purchasing power exceeded that of the larger populations in either of the two other major regions. It possesses both the richest agricultural land and half Italy's industry, whether measured by employed population or by net product. The area inherited good commercial connections with the transalpine countries, strengthened in modern times by the construction of the Alpine tunnels; it was near abundant hydroelectric resources; it had a plentiful supply of labour and a long tradition of skill; while many centuries of intensive cultivation and a great development of irrigation on the plain ensured abundant food supplies.

Milan (*q.v.*), the greatest node of transportation, became not only the chief centre of trade and population but thereby a great assembly point for raw materials and a market for manufactures. The Milan district is the greatest centre for the engineering industries, including machine tools and electrical engineering, and for the metallurgical industries supplying their needs; as well as for the production of textiles, cement, glass, rubber, dyestuffs and pharmaceuticals. Turin (*q.v.*) became the centre of the Italian automobile industry. Genoa (*q.v.*) and its neighbours along the Ligurian coast developed a great shipbuilding industry as well as a considerable production of locomotives and rolling stock, linked now with the large integrated iron and steel plant at Cornigliano Ligure.

Not only inside the "industrial triangle" itself, as at Pavia and Novara (*qq.v.*), but outside it are numerous smaller centres where skilled labour formed a basis of growth for many smaller engineering firms. In the Alpine valleys the relatively cheap hydroelectric energy was turned to account in the electrochemical and electrometallurgical industries. In contrast with old cities like Pavia and Novara is Sesto San Giovanni, a wholly modern development with the most rapid urban growth in Italy.

The different specialized sections of the area from the Alpine valleys of Piedmont, the Valle d'Aosta and Lombardy to the Ligurian seaboard have an industrial interdependence strengthened by Milan's position as Italy's greatest traffic node by road and rail, by the electric transmission lines bringing energy from the Alps and by the pipelines bringing methane from Emilia-Romagna and imported oil from Genoa and Vado Ligure. Also, the Lombard section of the Po plain has an agriculture into which livestock are more highly integrated (thanks to irrigation and climate) than in any other part of Italy.

2. The Northeast and Centre.—This area covers nearly two-fifths of the country, stretching from the Venetian provinces in the northeast to Rome in the southwest, possessing greatest variety but close to the national average. At its heart lies Tuscany (*q.v.*), transitional in landscape and in the balance of agriculture and industry. Between the northern plain and the southern Apennines, Tuscany is the part of Italy that leaves the strongest impressions on many visitors. Like the northwest the area possesses many small centres of industry: in the Venetian foothills; along the Via Aemilia; and in the basins of Tuscany. But in the north the *Tre Venezie* (Trentino-Alto Adige, Veneto and Friuli-Venezia Giulia; *see* VENETIA) were late in industrial development and did not overtake the already highly organized industries of Lombardy and Liguria. They suffered from political hindrances, their railways were late in development, their sources of energy fewer and their location in the unified Italy was peripheral. But with the construction of Porto Marghera on the mainland, Venice (*q.v.*) has become the third port of Italy both for passengers and freight. Its world renown nevertheless remains that of its art treasures and of the *lidi* that make it a great bathing resort. Beyond the Po delta and Ravenna, too, from Fano southward, the Adriatic coast provides long stretches of fine beaches.

The problems of land reclamation in the lower sections of the plain were more formidable than in the west. Emilia-Romagna (*q.v.*) had large areas of prosperous agriculture. Nevertheless the

area has been notable for its great social contrasts; only seasonal or casual employment is available for the large surplus of landless agricultural labour. Hence it was selected as one of the areas for agrarian reform. Among the towns along the Via Aemilia the foremost is Bologna (*q.v.*), where the main trans-Apennine route to Florence and Rome begins. Renowned both for its medieval university and for its good living, it is the centre of a highly productive agricultural area and important for its engineering industries.

In Tuscany the middle Arno basin became a focus of valley routes across the Apennines or to the south. Around the broad intermontane valley that forms the heart of Umbria (*q.v.*) stand Perugia, Assisi and Spoleto (*qq.v.*). Farther southwest are the basins of Terni and Rieti (*qq.v.*), important respectively for their industry and agriculture. The population of Rome grew rapidly during and after World War II and by the early 1960s it was exceeded among European cities only by London, Moscow, Berlin, Leningrad and Paris. Its location in Italy resembles that of Washington, D.C., in the U.S., in that it stands on an important dividing line between the south and the rest of the country. This, together with the growth of government services, has been one of the main factors in its rapid development. It has still relatively little industry apart from the immense scale of its tourism. The fact that it contains the Vatican (*q.v.*), the centre of the Roman Catholic religion, contributes greatly to the flow of visitors. (*See* ROME.)

3. The South.—The south, which includes Lazio south of the province of Rome, Abruzzi e Molise, Campania, Puglia, Basilicata, Calabria and the two large islands, Sicily and Sardinia (*qq.v.*), comprises more than two-fifths of the country's area and about two-fifths of its population. More than half the occupied population is engaged in agriculture and less than a quarter in industry. Partly as a result of this, occupational structure income per head is low, little more than one-third of that in the northwest.

Although it depends so largely on agriculture much of the area is rugged or consists of infertile clays, unstable and subject to landslides (*frane*). For much of the year the area suffers from drought and frequently from scorching winds, while in the rainy season the rain is frequently torrential, aggravating the loss of soil from erosion. Yields of wheat are only half the Italian average. Local transportation and communications are poor and both the southern part of the peninsula and the islands are far from the great markets of the northwest. Under these conditions the characteristic system of agriculture, which may be either capitalistic or peasant, is one in which thin cereal crops alternate with pasture. The larger landowners, who had made very little capital investment in the land, traditionally relied on balancing their income from cereals by that from wool and cheese. The flocks of sheep moved from the hills in summer to winter grazing on the coastlands, using drove roads established centuries ago. The poor crops of wheat depend on the winter rains; demographic pressure causes much to be grown on land more suitable for grazing. This is especially to be seen on the peasant holdings, largely in the hands of small tenants or of sharecroppers, but also partly in those of small owners.

While less than one-fifth of the area in the south is plain, some of these districts, both on the coast and in the basins and valleys of the interior such as the long-renowned Terra di Lavoro north of Naples and the circum-Vesuvian plain, produce large and varied crops of vegetables, or like the coastal fringe of Bari are rich in vines and olives, while the terraced slopes of the Sorrentine peninsula and the Calabrian riviera are citrus covered. Small holdings in such areas absorb much labour and provide good family incomes. There are also the coastal plains of recent reclamation, like those of Latina (*q.v.*; the former Pontine marshes), the Volturno, the Sele and the Mesima.

Before and immediately after World War I the pressure of population in the south was partly relieved by emigration, and southerners also had a share in the migration to underpopulated rural areas in France. After World War II migration to the large industrial centres of the northwest was very considerable. All these movements were the source of remittances to relatives and have in the past played an important part in the Italian balance of

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payments. Industry is practically limited to the periphery of the south, at the ports of Naples, Bari, Palermo and Catania (*qq.v.*), and much of it is concerned with processing local food crops, with some mineral smelting, oil refining and ship repairs.

In 1950 the *Cassa per il Mezzogiorno* ("fund for the south") was established to alleviate the agricultural depression and provide conditions conducive to private industrialization. It was later empowered to raise loans abroad (it is the channel for loans from the International Bank for Reconstruction and Development) and to finance not only the infrastructure but industry itself.

By 1960 more than 2,000,000,000,000 lire (about $3,250,000,000) had been allocated for spending over the period 1950–65. Investment was to be 55% in agriculture, 30% in aqueducts, drainage, roads and schools, 15% in industry, including tourism, and was in addition to ordinary expenditure by the appropriate ministries. But few firms were induced to come south and these principally established branches near Naples. Indeed, in the 1950s the southern share of the national income was unchanged and the gap in income per head between the south and the other regions actually increased. Neither agriculture nor industry in the south seemed able to absorb the surplus labour. (C. J. Ro.)

III. THE PEOPLE

For pre-Roman and post-Roman settlement see *History* below; for Roman settlement *see* ROMAN HISTORY. As the Italian people are strongly homogeneous and generally of Mediterranean type, no purpose would be served by discussing them from the standpoint of constituent ethnic strains. The chief variations are anthropometric differences.

1. Anthropometry.—The physical characteristics of the Italians were investigated by an anthropometric inquiry on military recruits born in the years 1859–63, of which the results were extended by later Italian scholars. The distribution tables of anthropological characteristics show that, proceeding from north to south, the proportion of individuals with short, broad skulls generally diminishes, particularly in the mountain regions and in the interior. In the Apennines and in some isolated coastal stretches the narrow, long skull is well represented. The highest cephalic indices are found in the western Alps and in Alto Adige, decreasing from west to east. In the regions with numerous wide-skulled people it is found that the zones with better communications are those with a lower cephalic index. Such a zone stretches from central Liguria across the Apennines into Piedmont and Lombardy and extends eastward until it enters the Trentino. People with a wide and low skull conformation are concentrated in the highest and most isolated lateral valleys of the western as well as the eastern Alps. High indices also occur in the central plain of the Po, with ramifications in lower Veneto and in Romagna and reaching into the lower valleys of the Arno and Tiber. All the mountain districts of the Apennines have lower cephalic indices. Groups with a high cephalic index and a flat occiput are found in southern Veneto, in Romagna, in the Adriatic littoral and in several islands of the southern Tyrrhenian. Thus in Italy the modern geographical distribution of wide cephalic forms appears to differ from that of prehistory and protohistory and probably has no connection with medieval invasions.

The height of contemporary Italian men (general averages from conscripts born in 1918) is 5 ft. 5½ in., as against 5 ft. 4½ in. for conscripts born in 1874. Above-average stature is found in Piedmont, Veneto and in some parts of Abruzzi and Puglia. The medium tall and those of middle height are not found in continuous belts but occur in Alto Adige and Venezia Giulia. Less favourable averages are found in the plain of the Po, in peninsular Italy and particularly in the Italian islands; the larger islands have the country's lowest averages (5 ft. 2¼ in. to 5 ft. 4 in.). These can also be found in some districts of the interior in the Romagna Apennines. The average statures in the smaller Mediterranean islands off the coast of Sicily and in the island of San Pietro off Sardinia are not so low.

The pure blond type is rare in Italy, though conspicuous in the Valle d'Aosta, Gorizia province and Alto Adige. The mixed blond is also scarce but is found in Piedmont, Lombardy, the eastern Prealps, the plain of the Po, eastern Liguria, northern Tuscany, north Lazio and one or two valleys in Sannio and Irpinia. The people of the peninsular coastal zones and the islands are darker than those of the interior; this also applies to Sicily and the central Apennines. In the region at the foot of the mountains in Piedmont and in lower Venezia chestnut tones predominate; but many northern areas—in particular Lucchesia, Garfagnana, Romagna, southern Piedmont and Modena province—contain a good percentage of individuals with dark hair. Red hair is seldom found in Italy; there are exiguous traces of it in the blond areas, such as Tuscany.

The shape of the nose is of some interest. A somewhat short and broad nose is found in some Alpine districts and in those of the interior in the Tuscan Apennines as well as in the islands. Slender noses are characteristic of the plain of the Po, Romagna, Liguria and western Tuscany. In Italy the shape of the nasal profile is straight (65%) in general; 25% of noses are concave, 15% convex, even aquiline. The convex shape is found mostly in lower Piedmont, Veneto and in some parts of Tuscany, Lazio, Molise and Campania and is often associated with fair hair and a flat occiput.

Of modern European types the Mediterranean is the commonest in Italy, with regional variations; one of these is the shorter type with a rather broad nose, found in Sardinia (*paleosard Maxia* type). Also in Sardinia but more commonly in upper Tuscany, Lazio and Abruzzi is found the *apenninic* variety, of medium height, long head and moderate pigmentation. The *apuana* (Lucchesia) type around Lucca is taller but still has the long head, narrow face and thin nose. In Puglia is the *pugliese* type with a low-swung face, prominent cheekbones and dark pigmentation. Pure Mediterranean groups are found in Piedmont, upper Lombardy and in the Trentino up to Merano. In the latter localities the presence of the Nordic type, with a long head, tall and blond, is revealed, but the percentage of these is small (2%). Other individuals with narrow head, medium height and blond hair are found in Liguria and Tuscany, where, however, are also types with wide skull and flat occiput. The Alpine type is easily distinguished by the wide, low head and sturdy build; its members are taller in Lombardy and Alto Adige than in Piedmont. In Romagna, the Marches and Tuscany is the *padana* variety of the Dinaric type, with a wide head and a flat occiput; not tall, not excessively depigmentated and with an aquiline nose. Other people with wide head and flat occiput, generally of medium height, with long torso, aquiline nose, eyes not deep set and in colour not intense, are frequently found in southern Italy and in the islands. This is the *campano* type long settled in these localities and possibly of eneolithic origin, like some human remains at Paestum (*q.v.*). Traces of the Baltic type, though rare, are found on the northeastern borders.

The distribution of blood groups A, B, AB and O among Italians is similar to that for Europeans generally: a large proportion of individuals of O and A, a number of B and very few of AB. The western Sardinians differ in that B is very scarce, but they have a larger percentage of AB. For blood groups M, N and MN Italians are again within the framework of the European populations, for there is a greater frequency of M than of N, while about 50% are MN. But the western Sardinians differ, disclosing a very large prevalence M over N, and a very small percentage of MN.

2. Languages.—The language of Italian protohistory does not appear to have been homogeneous. People with an Aryan linguistic structure were the Italics (Indo-Europeans of the Italic group) living in the lower central part of the peninsula (Sabini, Volsci [*qq.v.*], Umbri, Osci). The Veneti (*q.v.*) and the Iapygii lived respectively east of the Adige and in Puglia; they also were Indo-European but resembled Illyrians. Latin, spoken by a small tribe in the lower reaches of the Tiber, and the idiom of the Siculi (*q.v.*) of east-central Sicily were Indo-European languages but of an earlier date. But the Ligurians, many central Alpine people, the Corsicans, Sardinians and western Sicilians (Sicani, Elymi) were not Aryans. The Etruscans (*q.v.*) were probably Aryan (10th to 4th centuries B.C.), well spread between the Tiber and the Rubicon, and with settlements more to the north (Venezia Tridentina) and to the south (Campania). While the Greeks were then found-

ing their colonies in southern Italy and in Sicily, Rome also was beginning its transforming influence in Italy and beyond, so that the modern Italian dialects must all be considered as neo-Latin. Depending on the ethnic substratum in which they came to be deposited, they can be split up into northern dialects (Ligurian, Piedmontese, Lombardic, Emilian-Romagnoli, Veneziano and Istrian) and Italian south-central dialects (Marchigiano, Umbro-Romanesque, Abruzzese, southern Pugliese, Campano-Lucano, Salentino and Calabro-Siculo). (*See* also ETRUSCAN LANGUAGE; ITALIC DIALECTS; LATIN LANGUAGE; OSCAN; SABELLIC; UMBRIAN LANGUAGE; VENETIC LANGUAGE.)

Tuscan, whose background is not Italian but Etruscan, has a Florentine section derived from pure Latin with an Etruscan basis, which constitutes the literary Italian language. There is a western Tuscan and a southern or Sienese dialect. On the borders of the area where it is spoken Tuscan gradually blends into south-central speech. Sardinian, originally Aryan, underwent modifications inclining toward neo-Latin (Logudoro) before the continental neo-Latin was formed, and this applies to Ladin in the north. But 99% of Italians are autochthonous and unilingual. (*See* ITALIAN LANGUAGE.)

There are colonies of foreigners (*alloglotti*), a few bilingual, some neo-Latin and others not. Thus in northern Italy there are nuclei of neo-Latin *alloglotti:* French and Franco-Provençal (Valle di Susa, Stura di Lanzo, Aosta [where Valdostano is spoken], Valle Varaita, Valle Pellice, etc.). In northwestern Sardinia, at Alghero, where more than 20,000 inhabitants speak a mixed language, there exists a Catalan colony speaking a Provençal dialect. Ladin (archaic neo-Latin, with more than 12,000 speakers in Italy) is spoken in Val di Sole, Val di Non, Val di Fiemme, Val di Fassa, Val Cordevole and in Alto Cadore. Farther east the Friuli dialect (spoken by 500,000 individuals), the dialects of the Tagliamento and Fella valleys and of the Torre basin are also considered as Ladin. (*See* RAETO-ROMANCE DIALECTS.) The Germans of Val Sesia, Val d'Ossola and Macugnaga are not neo-Latin peoples of Italy but are of late medieval formation. Other pockets of German-speaking people, also recently formed, are in Carnia, the valleys of the Alto Adige (more than 200,000 people), western Veneto, the 13 Verona and 7 Vicenza communes (speaking the Cimbric dialect), all of which are now shrinking.

In the east, toward the Isonzo basin, Slovene also is spoken, as in the provinces of Udine and Gorizia, Trieste, the Iudrio valley and Postumia. In south-central Italy there are *alloglotti* colonies which are not neo-Latin and are sometimes bilingual, including the Albanian colonies of Molise, Otranto, Calabria, Basilicata, Bari and Sicily, speaking a south Albanian dialect of 15th to 18th-century origin and constituting about 100 rural centres with 80,000 inhabitants. Some very old Greek-speaking colonies, not connected with those of Magna Graecia, are in the Otranto district (eight villages) and Calabria (six villages); they number about 20,000 persons. Communities speaking Slavonic dialects are found in Molisano (about 4,500 people). Neo-Latin *alloglotti* patches are found in the province of Foggia (Faeto, 2,700 people; Celle San Vito, 700 people) with a Provençal dialect; the people of Montaguto, Monteleone, Volturara Appula, etc., speak Franco-Provençal.

(C. V. MA.)

3. Religion.—At the census of 1931, 99.6% of the population described themselves as Roman Catholics, although only about one-third of them attended Mass regularly and only about one-tenth received the sacraments at Easter. The position of Catholics in Italy, a country which in 1861 had been unified in the name of anti-Christian liberalism, was in 1929 restored by the Lateran treaty which recognized Roman Catholicism as "the sole religion of the state"; the treaty was confirmed by the constitution that came into force in 1948.

The treaty recognized the Vatican (*q.v.*) City state as an independent city-state, and the concordat attached to the treaty regulates the position of the Catholic Church, upholding the special character of the city of Rome as the "centre of the Catholic world and place of pilgrimage." The names of those chosen by the Holy See for episcopal appointments in Italy (except Rome and its suburbican dioceses) are submitted to the government to ensure that there is no political objection, and similar notice is given of parochial appointments. Bishops take an oath of loyalty to the Italian state. Priests and religious under vows are generally exempt from military and jury service, and clerical stipends may be subsidized by the state. The concordat further restored to ecclesiastical institutions their legal personality and their power to own immovable property, and moreover pledged the state not to impose special taxes on church property. Other articles secure the seal of the confessional, recognize the major feasts of the church and the activities of Azione Cattolica Italiana or Catholic Action (*q.v.*) and govern the position of priests under civil law. Priests may not belong to any political party nor (without episcopal permission) be employed by the state. The state recognizes the validity of Catholic marriage and its subjection to the provisions of canon law; nullity cases are therefore reserved to the ecclesiastical courts and there can be no divorce. But marriages may be celebrated before a registrar or the recognized minister of another religion and are not then subject to canon law. By the concordat the state agrees to religious instruction in the public primary and secondary schools being given on Catholic principles by teachers appointed by the bishops.

Besides being the head on earth of the Roman Catholic Church everywhere, the pope is primate of the church in Italy and archbishop and metropolitan of the Roman province and bishop of Rome. By custom the archbishops of Bologna, Florence, Genoa, Milan, Naples, Palermo, Turin and Venice (the last-named titled patriarch) are members of the College of Cardinals. The dioceses were reduced in number in 1818 but remain much more numerous than in any other country; they are grouped into 18 regions and administer more than 25,000 parishes.

Religious minorities include in Calabria and in Sicily Catholic populations following the Greek or Byzantine rite but in communion with the see of Rome; they are known as Italo-Albanesi because they are partly descended from Albanian refugees of the 15th and 16th centuries. In 1931 there were 83,618 Protestants, about one-third of whom were Waldenses (*q.v.*) living to the southwest of Turin; and 6,801 Greek Orthodox in Italy. Other minorities include Baptists, Methodists, a small Lutheran community in Lombardy, and Seventh-Day Adventist and Salvation Army groups. Jews, estimated in the 1950s at about 30,000, live mainly in Rome and in the industrial cities of the north.

All religions are constitutionally free before the law, and their relations with the state are governed by agreements made with their respective representatives. Non-Catholic denominations and their members may make free profession of their convictions, advocate their doctrines and practise private or public worship provided that the rites do not offend public morality. (X.)

4. Customs and Culture.—Although modern conditions tend to level out the characteristic features of Italian ethnography, there continue to survive ancient fashions and customs such as habitations, popular arts, celebrations and, in some cases, dances. One-room houses with thatched roofs (huts occasionally used by shepherds), and those of one story, built of stone with a conical roof, are rare, but the masonry rectangular house of several rooms, each with its own roof, and consisting of stones built up in the shape of a cone (Puglia) or a truncated cone (Capri) is still to be seen.

The large Veneto houses in the Po valley are single-story dwellings, with pyramidal thatched roofs and walls of unbaked clay bricks. Other habitations of the same type but with tiled roofs are found in southern Italy. The ordinary rural dwelling and the modern residential villa are masonry structures of one or more stories, rectangular in shape, the tiled roof sloping slightly in two directions or flat (in the south). In some cases there is a veranda on the ground floor or on the one above, often accessible by an external stairway, sometimes covered. Farmhouses may have several dwelling units and annexes surrounding a central courtyard, sometimes with balconies overlooking the yard; this type is seen in the northern plain, Piedmont and Lombardy, the Roman hamlets and in the south. Some buildings have towers for pigeon cotes, with or without an open gallery, possibly formerly used for defense. The houses of the Alpine region are mainly built of masonry, with

two stories, the roof consisting of small wooden boards (*scandole*) with two eaves sloping very steeply and projecting far enough to cover any stairs, balconies or wooden verandas along the front of the house. Italian furniture benefits from centuries of experienced craftsmanship and varies according to the region. Attractive are the inlaid furniture, implements and wood and bone utensils, china, glass and ornaments, often with ornate traditional or religious motifs, and there is much beautiful pottery, ceramics, leatherwork, carpets, lace, metalwork and jewelry.

Italian home cooking is not elaborate nor is the usual menu extensive. A frequent constituent of the diet is pasta (a paste based on wheat flour worked into various shapes, including macaroni, vermicelli and spaghetti), or, in the poorer homes of the south, polenta (a sort of porridge made from maize). The main meal, usually at midday, often begins with soup which may contain rice, pasta or greens; followed by meat (chicken, veal, beef) or fish garnished with cheese and fruit. There are numerous regional gastronomic specialties, although Italians in general tend to be abstemious.

Survivals of national costume for women are skirts, pleated or with coloured flounces; the low bodice with shoulder straps, always of attractive colour (red, blue or black) with tassels and embroidered patterns; the apron (made of cotton, silk, wool, velvet or leather) ornamented with brightly coloured designs or with gold or silver filigree. Black cloaks are now scarce in Sicily, but handkerchiefs and scarves made of silk, wool or lace (the colour showing whether the wearer is married or not) still persist to some extent in most regions. The Piedmontese and Alto Adige bonnet, the straw hats of Siena, the mitres of Lazio are infrequently worn. The black cap is still worn in Sicily and in Sardinia by the men, who also wear a type of velvet waistcoat and trousers (long or short) with brightly coloured silk sashes. Partial covering of the body and legs with animal skins sewn together is used for work in harsh climates.

Civil and religious festivals derive from established regional customs and include the March ceremonies in Trentino; the spring fairs of Piedmont and Lombardy; the May songs in Tuscany and the special games at Florence, Pisa, Siena and Arezzo; the flower shows of Lazio; the feast of the candles at Gubbio; processions in Abruzzi; the feast of the lilies at Nola and of the giants at Messina; and the ceremonies at the feast of St. Rosalia at Palermo. All are closely connected with religious, seasonal, historic and sometimes even archaic topics. The regional dances of modern times disclose ancient features, as do the songs, legends, proverbs and old rhymes, which usually reflect the gaiety and joy of the traditional Italian way of life.

See also ITALIAN LITERATURE; for Italian art and architecture *see* PAINTING; RENAISSANCE ARCHITECTURE; RENAISSANCE ART; BAROQUE ART; BAROQUE AND POST-BAROQUE ARCHITECTURE; ROMANESQUE ARCHITECTURE, etc. (C. V. MA.)

IV. ARCHAEOLOGY

The preclassical archaeology of Italy is largely determined by its geographical position between the two principal routes used by the cultures of the ancient east in their westward spread into central and western Europe, the land route through the Balkans and the Mediterranean sea route. The influence of the former was felt chiefly in northern Italy and along the Adriatic coast, that of the latter in southern Italy, Sicily and Sardinia and up the western coast. But there was inevitably a great deal of overlapping, and the archaeological picture is correspondingly complex. The sort of reasoning which could equate the Terramara Bronze Age people of the Modena district with the ancestors of the historical Latins is now seen (quite apart from the errors of fact on which it was founded) to be a grotesque oversimplification of a continuously developing and shifting situation. Here and there indigenous or quasi-indigenous peoples, such as the Ligurians in the western part of north Italy, did succeed in preserving their identity. But over most of the peninsula the ethnic, linguistic and cultural balance was constantly changing, and the most that archaeologists can hope to do is to identify stages in the formation of the later peoples and cultures of historic Italy. Of the many regional cultures that have been so identified the most important for the subsequent history of the peninsula are the Bronze Age Apennine culture and the early Iron Age Villanovan culture on the mainland, and that of the Sicels in Sicily.

Fresh peoples were continuing to enter Italy from the north as late as the Celtic invasion of the 4th century B.C., and the process was to be resumed the moment that Roman power declined. But from the middle of the 2nd millennium B.C. it was increasingly by the sea route that the influence of the more advanced civilizations of the eastern Mediterranean came to be felt in Italy. At first Mycenaean and Phoenician traders and then, from the 8th century B.C., Greek, Carthaginian and possibly Etruscan colonists established themselves in the south and up the western coast as far as the mouth of the Arno river. Thereafter, until the unification of Italy by Rome in the 4th–1st centuries B.C., the archaeology of the peninsula is that of its constituent peoples: in the north the Ligurians, Veneti, Gauls and various Alpine tribes; in the centre the independent tribesmen of the mountains and Adriatic coastlands, among them the Umbrians, Picenes, Samnites, Lucanians and numerous lesser peoples; in Tuscany and spreading thence into northern and central Italy the Etruscans; in Latium the evergrowing power of Rome and the Latin peoples; around the south coast from Campania to Apulia and in eastern Sicily the Greeks; and in western Sicily and Sardinia the Carthaginians.

After the unification of Italy by Rome, although regional differences persisted, they diminished in importance. The archaeology of Italy is that of Rome itself and of the urban civilization which it established throughout the peninsula. Important excavated sites of this period include: Aosta (*see* VALLE D'AOSTA), Aquileia, Brescia (*qq.v.*), Sirmione on Lake Garda and Velleia near Parma in northern Italy; Ardea, Alba Fucens, Cosa, Lucus Feroniae, Ostia, Praeneste (*qq.v.*), Carsulae and Hadrian's Villa near Tivoli in central Italy; Baiae, Herculaneum, Pompeii, Stabiae (*qq.v.*) and Egnatia and Piazza Armerina in south Italy and Sicily. The archaeology of Italy is also discussed in articles on ancient regions and peoples of Italy. *See*, for example, APULIA; CAMPANIA; LATIUM; LUCANIA; PICENES; UMBRIA; *see* articles on individual tribes listed in *History* section of this article (AEQUI, etc.); ETRUSCANS, SICULI and VILLANOVANS (where individual sites are listed); *see* also CELT; GAUL, CISALPINE; GOLASECCA; TERRAMARA and the archaeology sections of SICILY and SARDINIA. (J. B. W.-P.)

V. HISTORY

From the fall of the Roman empire until modern times the Italians had no political unity, no independence, no organized existence as a nation. Their history was that of a group of cognate populations, enjoying various types of constitutional development. The early history of Italy is chiefly that of the Romans. The following discussion is therefore mainly concerned with events after A.D. 476. First, however, some account must be given of pre-Roman Italy, the organization of the country by Augustus and the road system.

A. ANCIENT AND CLASSICAL ITALY

Pre-Roman Population.—The name *Italia* is probably a grecized form of an Italic *Vitelia* ("calf land"), which originally belonged to the southern part of the "toe." It was gradually widened to include Bruttium (by 450 B.C.), Lucania (*q.v.*; by 400) and Campania (*q.v.*; after 325). By 241 it included all south of Liguria and Cisalpine Gaul. Although Cisalpine Gaul was not fully incorporated until 42 B.C., from the mid-2nd century B.C. the word Italia was loosely applied to the whole country south of the Alps.

Knowledge of the population of early Italy derives partly from what is recorded by surviving ancient writers, partly from archaeological and partly from linguistic evidence, but it is not always easy to fit the various pieces of evidence into a unified and consistent pattern. The linguistic evidence is discussed in the article ITALIC DIALECTS. Here brief reference is made to the general picture.

Italy supported life during Paleolithic times, and traces of Neanderthal man have been found. Evidence of Neolithic settlement of "Mediterranean" people is found in both the south and north. Chalcolithic culture developed from *c.* 2500 B.C. under Aegean in-

fluence in the south. In the north it is seen, in a later phase, in the Remedello culture of the Po valley, which was reinforced by "warrior" elements from central Europe and by bearers of the bell beaker culture from Spain. Bronzeworking soon developed, both among the Alpine lake dwellers and the Ligurian cave dwellers, while in central Italy Neolithic culture developed into the Bronze Age "Apennine" culture. In the north more invaders arrived, including the founders of the Terramara culture which was confined to the Po valley (*c.* 1500 B.C.). These people spoke dialects of Indo-European (*q.v.*) and practised cremation. To what extent the main movement of Indo-European peoples was over the Alps from north to south, or, as many now think, over the Adriatic from east to west, is a controversial question. The Iron Age in Italy, after 1000 B.C., was marked by the influence of Villanovan culture (*see* VILLANOVANS) in north and central Italy as far south as Latium. Other Iron Age cremating groups were the Comacine-Golaseccan near Lakes Como and Maggiore and the Atestine in Venetia (*see* GOLASECCA; ESTE). The inhuming Apennine culture in the south continued into the Iron Age, influenced by Illyrians who crossed the Adriatic to dominate Picenum (*see* PICENES) and Apulia (*i.e.*, Iapygian tribes, the Messapii, Daunii and Peucetii). Tentatively, the southern Villanovans may be equated with the speakers of Latin and Faliscan (though others would attribute to them a non-Indo-European tongue), the later Apennine culture with the Osco-Umbrian dialects and the Illyrian sphere with the so-called east Italic dialects (*see* SABELLIC). Three other peoples are found in Italy: Etruscans, Greeks and Celts. Etruria was dominated by Greco-oriental influences which the chief ancient tradition assigned to invading Etruscans (*q.v.*) from the eastern Mediterranean. From Etruria Etruscan power spread northward to the Po valley and southward to Campania, but it was later restricted to Etruria itself. Meanwhile, from the 8th century, Greeks had established numerous colonies in the south, on the coast of Italy and Sicily (*see* MAGNA GRAECIA). North Italy again received invaders from central Europe when the Celts (*see* CELT) brought with them *c.* 400 B.C. the La Tène culture (*see* LA TÈNE) and occupied the northern plain (Cisalpine Gaul; *q.v.*). This complex pattern of settlement was completed by numbers of smaller tribal units: *see* AEQUI; AURUNCI; BOII; BRUTTII; CENOMANI; FALISCI; HERNICI; HIRPINI; LIGURIANS; MARRUCINI; MARSI; PAELIGNI; RUTULI; SABINI; SAMNITES; VENETI; VESTINI; VOLSCI.

Where the Etruscans had failed, the Romans gradually succeeded in the task of unifying these various peoples into a political whole (*see* ROMAN HISTORY). By 264 B.C. all Italy south of Cisalpine Gaul was united under the leadership of Rome in a confederacy; its members were either incorporated in or allied with the Roman state. The status of the allies gradually changed until after the Italian or Social War (*i.e.*, the war of the *socii* or allies) of 90 B.C. Roman citizenship was extended to all Italy. But political unification was achieved more quickly than sentimental unity: Romans and Italici did not immediately coalesce into a nation. Cicero might talk of *tota Italia*, but Italy was not finally united in spirit until the time of Augustus, and romanization was still slower in superseding local differences. In the meantime Cisalpine Gaul, which had received Roman citizenship in stages, was incorporated in Italy in 42 B.C.

Augustan Districts.—For administrative purposes the emperor Augustus divided Italy into 11 regions; (1) Latium and Campania, including the Volsci, Hernici, Aurunci and Picentini, from the mouth of the Tiber to that of the Silarus (Sele) river; (2) Apulia and Calabria, including the Hirpini (the "heel" of Italy); (3) Lucania and Bruttium, bounded on the west coast by the Silarus, on the east by the Bradanus (Bradano) river (the "toe" of Italy); (4) Samnium, including the Samnites, Frentani, Marrucini, Marsi, Paeligni, Aequiculi, Vestini and Sabini, bounded on the south by the Tifernus (Biferno), on the north probably by the Matrinus (Piomba) river; (5) Picenum, between the Aesis (Esino) and Matrinus rivers; (6) Umbria, including the *ager Gallicus*, bounded by the upper Tiber, Crustumius (Conca) and Aesis rivers; (7) Etruria, bounded by the Macra (Magra) and Tiber rivers; (8) Gallia Cispadana, limited by the Po, from Placentia (Piacenza) to its mouth, and by the Crustumius which was substituted for the Rubicon; (9) Liguria, bounded by the Varus (Var), Po and Macra; (10) Venetia and Istria, including the Cenomani round Lake Garda in the west; (11) Gallia Transpadana, bounded by the Alps, the Po and the Addua (Adda) river. This arrangement was retained almost unchanged until Diocletian's reorganization (*c.* A.D. 290–300), when the diocese of Italy included the islands of Sicily, Corsica and Sardinia, and Raetia and part of Pannonia to the north. In practice this diocese was divided into two areas, each under a *vicarius:* that of Italy with the four northern regions and that of Rome with the seven southern areas and the islands.

Road System.—Rome's control of Italy in the early days was largely gained and maintained through the splendid system of roads; each fresh advance was consolidated by establishing roads and colonies. Thus cart tracks were developed into a network of permanent highways which bound Italy together. From Rome roads radiated in all directions. The main trunk roads may be considered in a clockwise direction, starting toward the northwest.

The *Via Aurelia*, 170 mi. long, went from Rome to Alsium (Palo) and thence along the Etruscan coast to Vada Volaterrana (Vada). It was built before 109 B.C., when it was continued by the *Via Aemilia Scauri* which ran by way of Pisae (Pisa) and Genua (Genoa) to Vada Sabatia (Vado Ligure), where it turned inland to Dertona (Tortona); this last stretch was also called the *Via Aurelia* in the Antonine Itinerary (*see* ITINERARIUM). From Vada Sabatia the *Via Julia Augusta* (built by Augustus) continued along the coast to Albintimilium (Ventimiglia) and beyond.

At the 11th mile from Rome the *Via Clodia* diverged to the north-northwest from the *Cassia*. The latter led to Sutrium (Sutri), Clusium (Chiusi), Florentia (Florence) and perhaps to Luca (Lucca) and Luna (Luni). It may be slightly earlier than the *Via Flaminia*. The *Via Clodia*, which in part followed older Etruscan roads, went to Tuscana (Tuscania) and Saturnia, thence perhaps northward or to the coast at Cosa.

The *Via Flaminia*, the great north road from Rome to Ariminum (Rimini), was built by Gaius Flaminius in 220 B.C. It ran by way of Narnia (Narni) to the Adriatic at Fanum (Fano) and thence to Pisaurum (Pesaro) and Ariminum, about 209 mi. An alternative section between Narnia and Nuceria (Nocera Umbra) was built after A.D. 69. It was much used and often repaired; *e.g.*, by Augustus, Vespasian, Trajan and Hadrian. Several of its bridges are partially preserved. It was continued by the *Via Aemilia*, built by the consul of 187 B.C., which ran from Ariminum 176 mi. in an almost straight line northwestward to Placentia. It was repaired by Augustus and Trajan, and some original bridges are preserved. The *Via Aemilia* helped to romanize Cisalpine Gaul quickly, and the district is still called Emilia. Later extensions to Augusta Praetoria (Aosta), to Segusio (Susa) and to Aquileia were also known as the *Via Aemilia;* a stretch from Ariminum to Hatria (Adria) was due to P. Popilius, consul in 132 B.C., and that from Tergeste (Trieste) to Pola (Pula) was begun by Vespasian.

Via Salaria, an old highway, ran northeastward by Reate (Rieti) and Asculum (Ascoli Piceno) to Castrum Truentinum on the Adriatic, a distance of 151 mi. At the 35th mile from Rome the *Via Caecilia* diverged from the *Via Salaria* and ran about 148 mi. from Rome by Amiternum (San Vittorino, near L'Aquila) to Interamnia Praetuttiorum (Teramo) and Castrum Novum (Giulianova) on the Adriatic.

Via Valeria, the main route across Italy to Aternum (Pescara) on the Adriatic, in its first 15 mi. consisted of the ancient *Via Tiburtina*. This was continued, perhaps *c.* 300 B.C., to Carsioli (Carsoli), Alba Fucens (Albe) and Cerfennia (Collarmele); it was paved perhaps in 154 B.C., and was the *Via Valeria* proper. It was continued by the emperor Claudius as the *Via Claudia Valeria* from Cerfennia to the Adriatic. A *Via Claudia Nova* linked the *Claudia Valeria* to the *Via Caecilia* near Amiternum, thereby connecting the road systems of north and south Italy.

Via Latina, perhaps the oldest of the roads to the southeast, had probably been built as far as Cales (Calvi Vecchia) by 334 B.C. It skirted the Alban hills at Algidus and was joined near Anagnia (Anagni) by the alternative route of the *Via Labicana* from Rome; it followed the valley of the Trerus (Sacco) river, crossed the Liris

(Liri) at Fregellae and then passed Aquinum (Aquino), Casinum (Cassino), Venafrum (Venafro), Teanum (Teano) and Cales; finally at Casilinum (modern Capua), 135 mi. from Rome, it joined the *Via Appia*.

The *Via Appia* is called by Statius the "queen of roads." The first 132 mi. to Capua (Santa Maria Capua Vetere) were built by Appius Claudius in 312 B.C.; the road was continued, probably by 244 B.C., another 234 mi. to Beneventum (Benevento), Venusia (Venosa), Tarentum (Taranto) and Brundisium (Brindisi). Originally a graveled road, it was paved with stone between 295 and 123 B.C. On the stretch to Beneventum are remains of tombs, embankments, bridges, milestones, a rock-cutting (at Terracina) and of the ancient paving (*e.g.*, outside Rome and at Itri; *see* APPIAN WAY).

Via Traiana, an alternative route to the Appian way, was developed between Beneventum and Brundisium (part of it was used by the poet Horace on his journey to Brundisium); it ran by way of Canusium (Canossa) and was made into a main road by Trajan. The road from Brundisium to Tarentum around the heel of Italy may also be Trajanic.

Via Popilia, the main road down the west coast from Capua to Rhegium (Reggio di Calabria), was 321 mi. and a continuation of the *Via Appia*. It was built in 132 B.C.

There were of course numerous other roads, such as that between Rome and Ostia, or that linking Capua, Cumae, Puteoli (Pozzuoli) and Neapolis (Naples). In the north the *Via Postumia*, built in 148 B.C., ran from Genua through Dertona to Placentia and Cremona, and on to Verona and Aquileia. Cremona, its central point, was an important meeting point of roads in Cisalpine Gaul, as also were Hostilia (Ostiglia), Patavium (Padua) and Aquileia. From Aquileia roads leading out of Italy diverged northward to Raetia, eastward to Noricum and Pannonia and southward to the Istrian and Dalmatian coasts. Farther west, roads led over the higher Alpine passes: the Brenner from Verona, the Septimer and the Splügen from Clavenna (Chiavenna), the Great and Little St. Bernard from Augusta Praetoria, and the Montgenèvre from Augusta Taurinorum (Turin). (H. H. Sd.)

B. Medieval Italy, 476–1454

Goths and Lombards.—The deposition of the Western Roman emperor Romulus Augustulus by Odoacer in 476 opened a new period in Italian history. The revolution had been caused by the refusal of the Western government to settle its barbarian army on Italian soil. The soldiers, who wanted to follow the example of Germanic peoples in other provinces of the empire, elected Odoacer (*q.v.*) their king, and after the deposition of the puppet emperor they were settled in Italy, Roman landowners ceding one-third of their lands. This settlement of a barbarian army was a turning point: Italy now shared the fate of other imperial provinces. Theoretically, the government of the country passed in 476—or at least after the death in Dalmatia of the last legitimate emperor of the west, Julius Nepos (480)—to the Eastern emperor at Constantinople. In fact, Odoacer was the master of Italy. He wanted not to detach it from the empire but to govern the Roman population as viceroy, while ruling his barbarian soldiers as king; and the emperor Zeno acknowledged his authority by accepting him as patrician.

In 488 Zeno sent the Ostrogoths under their king Theodoric (*q.v.*; Theoderic or Dietrich) to Italy to attack Odoacer, with whom relations had become increasingly strained. In 493 Odoacer, having surrendered Ravenna, was killed by Theodoric. The dual government of Italy was continued. King of the Goths, who were settled like Odoacer's people before them, Theodoric ruled over the Roman population as imperial viceroy; and the Roman administration was left intact, civil offices being usually filled with Romans, military offices with Goths.

Theodoric having died in 526, his daughter and successor, Amalasuntha, was in 535 imprisoned and killed by her cousin Theodahad; this was the signal for Byzantine intervention. Justinian had recently recovered north Africa from the Vandals; the conquest of Italy was the next step. Belisarius, the victor over the Vandals, was sent to Italy, and the fall of Ravenna in 540 seemed practically to conclude the campaign. But Gothic resistance revived, and it took the Eastern emperor more than 12 years to break it. The decisive battle of Taginae (near Gubbio) was won by his general Narses, commanding a new imperial army in 552; the last Gothic stronghold fell in 555. Italy came under Byzantine government. The country had been devastated by the wars, and Byzantine taxation lay heavily on it. Although the frontier defenses were reorganized, internal conditions must have assisted the Lombards when they invaded Italy under Alboin in 568.

The Lombard conquest (*see* LOMBARDS) led to the permanent settlement of a Germanic people in Italy and thus showed the failure of Justinian's policy of imperial recovery. But the Lombards were unable to conquer the whole of the peninsula, and the division of Italy into a large Lombard and a smaller Byzantine part was to have far-reaching effects. Alboin died in 572, having conquered nearly the whole of the Po valley and Piedmont. From 574 to 584 the monarchy was suspended. About 30 dukes ruled over the conquered territories. But the conquest continued after Alboin's death, and was extended to central and to southern Italy. After the restoration of the monarchy by Authari in 584, the duchies remained the basis of Lombard government but were subordinated, in varying degree, to the king; the great southern duchies of Spoleto and Benevento were virtually autonomous. The Lombards did not recognize Byzantine sovereignty, and the dual government of the Germanic and Roman population was abandoned. The methods of settlement were infinitely harsher than under Odoacer and Theodoric, for the Romans were treated as a conquered nation. Large numbers of the Roman nobility appear to have been killed and their lands confiscated.

The Roman *coloni* had already lost most of their freedom; they then became assimilated to the Lombard half-free. But a free Roman population survived in the towns. From the end of the 7th century the condition of the Romans seems to have improved; the peace with the Byzantines *c.* 680 probably contributed to this. In the course of time the Lombards assimilated much of the relics of Roman civilization, thanks largely to the adoption of Catholicism by the formerly Arian Lombards in the second half of the 7th century. The decline of the Lombard idiom and the increasing use of the language of the conquered by the conquerors was a striking symptom of it.

The Roman city territories survived as administrative districts in the duchies, the dukes usually residing in their chief towns. A number of towns were under royal officials (*gastaldi*). The towns thus retained some importance as administrative centres of the Lombard kingdom; they were moreover seats of bishops and served as market places for the surrounding countryside, urban trade and crafts fulfilling at least some local functions.

Byzantine Italy was mainly confined to stretches of the coast with their hinterland. By the middle of the 7th century, it included Istria; the islands of the Venetian lagoon which had been settled by refugees from the mainland; the territories of the exarchate of Ravenna proper and of the Pentapolis (roughly from Rimini to Ancona); Perugia; the "heel" and the "toe" of Italy, separated by the duchy of Benevento; and the small territory of Naples and the fairly extensive one of Rome, including part of southern Tuscany. (*See* RAVENNA, EXARCHATE OF.) Moreover, Sicily, Sardinia and Corsica remained under the empire. In the imperial territories of Italy, the framework of the earlier Roman administration survived.

As in other Byzantine provinces, the combination of civil and military power became characteristic of Byzantine administration. The exarch at Ravenna was the governor of imperial Italy; under him dukes commanded new military districts; below them were tribunes as governors of towns. Byzantine officials and local landowners, often identical, came to form a new ruling class; this development contributed to bring about decentralization, which was also fostered by the difficulties of central government over the widely dispersed territories. Thus in Naples the dukes had acquired a semi-independent position by the 8th century; in Rome, the pope increased his secular authority (already considerable during the pontificate of Gregory I, 590–604), upheld by vast estates in Italy and Sicily. To a minor extent, the position of bishops

in other towns tended to develop on similar lines. The revolution that swept Byzantine Italy in 726, although primarily provoked by the emperor Leo III the Isaurian's iconoclastic policy, revealed these separatist tendencies. The papacy, which had taken a leading part in the revolution, suffered a setback after its suppression; but by 754 it had become virtually supreme in the Roman duchy.

Under the Lombard king Liutprand (712–744), the peace between Greeks and Lombards came to an end. The revival of Lombard expansion reflected the internal strengthening of the monarchy from the end of the 7th century. Liutprand seized territories around Ravenna; he threatened both Ravenna (captured for the first time *c.* 732–733) and Rome. King Aistulf (749–756) pressed this new attack with vigour; in 751 Ravenna was lost by the Byzantines. The next move was against Rome; and in 753 Pope Stephen III (II) crossed the Alps to appeal for help to the Frankish ruler Pepin the Short. Pepin invaded Italy twice between 754 and 756, and both campaigns led to Lombard defeats. Aistulf was forced to return the recently conquered territories; but Pepin, instead of restoring them to Byzantium, gave them to Pope Stephen, to whom the promise of an extensive donation had been made. Thus he became one of the founders of the papal states. The next Frankish intervention, under Charlemagne (*q.v.*), was caused by Lombard attacks on Pope Adrian I and ended in the annexation of the Lombard kingdom by Charlemagne, who assumed the title of king of the Lombards (774). He confirmed, and perhaps increased, his father's promise of donation to the papacy; but the establishment of Frankish rule created a new situation in which the wider territorial aspirations of the popes were not fulfilled. The latter remained in the possession of the Roman duchy, the small duchy of Perugia, the exarchate of Ravenna and the Pentapolis; but Charlemagne could make his authority felt within the new papal states. He now began to use the title of Roman patrician conferred already on Pepin by Stephen III. The imperial coronation in 800 was not only a recognition of his European power; it also confirmed and strengthened the position of the Frankish ruler in Rome and the papal states.

Carolingian Italy.—Frankish Italy had become a province of the new Western empire. Its special place was recognized by the conferment of the royal title on its governor; but the centre of the empire lay north of the Alps. Charlemagne took over the Lombard administration with few major changes, the dukes and *gastaldi* being, as a rule, replaced by counts. But the counts were more strictly subordinated to the monarchy than the Lombard dukes had been; at the same time collaboration of counts and bishops was encouraged, as in the rest of the empire. Frankish noblemen were not only entrusted with leading offices but were also granted lands and privileges in Italy; the new immigration strengthened the Germanic element in Italian society, into which feudalism now began to penetrate.

The partitions of the Carolingian empire during the 9th century changed the status of the Italian kingdom several times. Louis I the Pious, by his *Ordinatio imperii* of 817, decided that it should go to his son and coemperor Lothair I; and the treaty of Verdun (843) extended Lothair's territory as far as the North sea. Within this new dominion, between the French and the German kingdoms, Italy came once more under a separate administration and was given by Lothair to his son Louis, who retained it after his father's death. He had previously been crowned emperor as Louis II, but his position remained that of a king of Italy. He was the only Carolingian ruler after Charlemagne who made real—although futile—efforts to improve the internal conditions of the kingdom, which had suffered from the weakening of public authority. He also helped, with considerable success, to defend Italy against the Arabs. The Arabs had begun the conquest of Sicily in 827 and had taken Palermo (831) and Messina (843), an invaluable base for incursions into southern Italy. Conflicts and rivalries in that region assisted their attempts, for instance a civil war that broke out in 839 between two claimants to the duchy of Benevento. Seizing Bari and other places, the Arabs began to settle on the mainland. Their attacks along the Tyrrhenian coast threatened the maritime towns as well as Rome, which was partly sacked in 846. Naples, Amalfi and Gaeta put up a determined resistance, and Louis succeeded, after several campaigns, in taking Bari from the Arabs. The years after his death (875) were the epilogue of Carolingian rule in Italy. In 887 Charles the Fat, who had reunited the whole empire for a short time, was deposed by the East Franks. A section of the Italian nobility followed suit by electing Berengar of Friuli king of Italy (888).

The Italian Kings.—The following decades were marked by intermittent struggles for the Italian crown, in which the main contestants were powerful local magnates—margraves or dukes of Friuli, of Spoleto, of Ivrea—the kings of Provence and the kings of Burgundy. Even the most successful of the Italian kings never succeeded in controlling the whole kingdom; and the possession of the imperial crown was not more than the possession of an additional title implying the right to protect the pope. Nor were they able permanently to defend the country against the Hungarians, who after 898 periodically ravaged northern Italy, thus adding new dangers to the Arab incursions. The growth of feudal powers provided the background to the political struggles; already before 888 the margraves of Friuli, Tuscany and Spoleto had ruled over large dominions; they were followed by others, such as margraves of Ivrea and the counts of Turin. But also at a lower level, feudalism spread during the 9th and 10th centuries. As elsewhere in Europe, this went hand in hand with the disintegration of royal authority.

The Italian kings, in their need for support and also in order to provide for the better defense of the towns against the incursions, granted public rights in the towns to bishops whose secular authority—which had undoubtedly grown during these times of trouble—was thus strengthened. In Rome the house of Theophylact rose from the beginning of the 10th century to princely power at the head of the nobility. The papacy came to depend on it; and after the death of Theophylact's grandson Alberic, Alberic's son was elected pope as John XII (955). By that time the secular authority of the papacy was practically limited to Rome and the territory around it; but there Alberic pursued, in the pope's stead, a vigorous administrative policy. In southern Italy the Byzantines much improved their position toward the end of the 9th century. In successful struggles against the Arabs, they recovered the territories that had been conquered by them on the mainland; they reorganized their administration in the two new "themes" of Calabria and Longobardia; and they temporarily wielded considerable influence among the southern principalities and towns, to which they gave valuable protection against the Arabs.

The Saxon and Franconian Emperors.—The German king Otto I came to Italy in 951 and forced the king of Italy, Berengar of Ivrea, to do homage to him (952). But in 960 Pope John XII appealed for help against Berengar's and his son Adalbert's aggression. Otto crossed the Alps again and was crowned emperor in Rome in 962, while Berengar's power collapsed. A new chapter in the history of Italy began.

Otto I laid the foundations on which German rule in Italy was to rest until the 12th century. Determined to assert his sovereignty over the feudal magnates, he accepted and fostered them as long as they were loyal to him. As the Italian kings had done, he made or confirmed grants of jurisdiction to Lombard bishops in their towns. (Bishops probably did not become counts until the 11th century; and even then the privileges were with very few exceptions confined to the towns and land around them. In Tuscany, moreover, jurisdiction was granted only in few relatively late cases; and even in Lombardy not all bishops received such grants.) In Rome he tried to revive the authority of Charlemagne but met with the resistance of the Romans; and although he made and deposed popes at will, there was strong opposition against his nominees, culminating in risings. In southern Italy Byzantine recovery had been only temporary; and the princes there soon regained their full liberty of action. They did homage to Otto, who thus extended his influence to the south. Pandulf of Capua was made margrave of Spoleto and Camerino and became Otto's most powerful supporter in that region. Western imperial designs on southern Italy led to war with Constantinople; peace was concluded and Otto II betrothed to the Byzantine princess Theophano in 972.

Once again Italy had become part of an empire whose centre was north of the Alps. This was a source of both strength and weakness. It had helped Otto to succeed where the Italian kings had failed; on the other hand, government from Germany and occasional expeditions were to prove doubtful substitutes for continuous presence. Of all Otto's successors before Frederick II, only his grandson Otto III may have contemplated a change in this policy by taking up his residence in Rome. Inspired by the ideas of Roman renewal, he may have thought of making the city the imperial capital. But he was probably far less prepared to abandon earlier traditions of German rule than might appear.

Italian opposition to the emperors was not lacking. After Otto III's death, the margrave Arduin of Ivrea was elected king of Italy by his supporters (1002); but his brief reign remained confined to northern Italy and met with much resistance from the episcopate. There were risings against the emperor in Pavia in 1004 and in 1024 (on Henry II's death) and in Ravenna in 1026. At the same time social tensions between nobility and episcopate and between higher and lower nobility began to foreshadow later conflicts in the communes. Thus in 1036 the Milanese lower nobility of the *valvassori* rose against the powerful archbishop of Milan, Heribert (Aribert); after their expulsion from Milan, the revolt spread over Lombardy. Conrad II's feudal law of 1037 aimed at satisfying their claims by making all fiefs hereditary and consequently granting equal rights to the *valvassori* and to the higher nobility of the *capitani*.

The feudal law was issued during the unsuccessful siege of Milan, Heribert having rebelled against the emperor. This showed that a powerful episcopate was not always an asset and that there were limitations to the loyalty of the Lombard bishops—even before the Investiture conflict. Heribert strikingly personified the power that the Italian bishops could wield. Although not count of Milan, he was the actual ruler of the town and of a considerable territory outside it, and lord over a large number of vassals. Soon after, however, the power of the archbishops of Milan was broken during the civil and religious strife which began in 1056 with the Milanese reform movement of the Patarini.

Rome continued to be a major problem for the emperors. In 1046 Henry III intervened to decide who should be pope: Benedict IX, Silvester III and Gregory VI were all declared deposed and a German bishop elected in their place as Clement II. Eager to foster ecclesiastical reform, Henry III helped decisively, by his interventions in the papal elections, to assure its victory at the *Curia;* Clement II and his successors were not only Germans but also supporters of the reform movement. But the reformed papacy soon turned against the time-honoured relationship between church and state and thus threatened one of the pillars of imperial government in Lombardy; while the Lateran decree of 1059 practically eliminated the influence of both the Roman nobility and the emperors on papal elections.

The Investiture conflict between pope and emperor began in 1076. It weakened ecclesiastical loyalties and made Matilda of Tuscany, the most powerful of the Italian rulers, Henry IV's enemy. Yet, despite the Norman alliance (*see* below) and the help of Matilda, Gregory VII could not prevent Henry's capture of Rome in 1084. Norman help, when it came, was a double-edged weapon. Although it forced Henry to withdraw, the devastation of Rome by the Norman army ruined Gregory's position there; he died at Salerno in 1085. The conflict continued under his successors. In 1115 Matilda died without heirs, and the succession to her vast properties, which she had bequeathed first to the papacy but probably later to Henry V, became a new source of conflict between empire and papacy. (*See* also INVESTITURE CONTROVERSY.)

The Normans in the South.—Pope Nicholas II, meanwhile, in Aug. 1059 at Melfi, had invested the Norman adventurer Robert Guiscard with all conquests in Apulia and Calabria and with all future conquests in Sicily; on the same occasion he invested another Norman, Richard of Aversa, with the principality of Capua. This was a landmark in the momentous events that had been taking place in southern Italy from the time when Norman mercenaries arrived in 1017 and served in a revolt against the Byzantines. From that time the Normans had taken part, in increasing numbers, in the conflicts between the principalities of southern Italy. Their permanent settlement began *c.* 1029 when Rainulf was granted Aversa. In 1041 they began their conquest of Apulia; a few years later Robert Guiscard was entrusted with that of Calabria. He pressed successfully the conquest of Calabria and Apulia and, with his brother Roger, began that of Sicily in 1060. The fall of Bari (1071) marked the final collapse of Byzantine power in Italy. In Sicily, Palermo was captured in 1072; but it was not until 1091 that the whole island was won from the Arabs. At first Roger governed Sicily as a separate county; but his son, the second Roger, united it with the duchy of Apulia after the death of Duke William (1127). In 1130 this Roger became king of Sicily, having obtained the investiture from the antipope Anacletus II; and in 1139 this was confirmed by Innocent II. In his powerful state (which included all Norman conquests in southern Italy and Sicily) Greek, Arabic and Norman institutions were welded into a new and singularly efficient structure, in which the feudal nobility and the towns were strictly subordinated to the monarchy. (*See* SICILY.)

The Age of the Communes.—By the 11th century, several Italian towns had reached considerable prosperity. They were mostly in Byzantine territory or had maintained contact with Constantinople and could thus take full advantage of the revival of eastern trade.

Foremost were Venice and Amalfi, the latter reaching the height of its commercial power about the middle of the century; others included Bari, Otranto and Salerno. Amalfi, for a short time a serious rival of Venice, declined after having submitted to the Normans in 1073. Then Venice received, with the privilege of 1082, exemption from all customs duties within the Byzantine empire. In the 11th century Pisa, the natural port of Tuscany, began to rise amid struggles with the Arabs, whom it defeated repeatedly; and Genoa, which was to be its rival for centuries, was following suit. Among the inland towns—as yet less conspicuous—Pavia, which had owed much of its early prosperity to its role as capital of the Lombard kingdom, was rapidly outdistanced by Milan; Lucca, on the Via Francigena from Lombardy to Rome and for a long time the residence of the margraves of Tuscany, was the most important Tuscan inland town.

The importance of fortified centres during the Hungarian and Arab incursions contributed to the development of towns. Town walls were rebuilt or repaired, providing security both to citizens and to people from the country; and the latter found further places of refuge in the many fortified *castelli* with which the countryside began to be covered.

Simultaneously, local self-government developed. The movement began first in the Byzantine territories; thus Venice elected its doges (dukes) from the early 8th century onward, Amalfi its annual magistrates from the 9th century. In the Italian kingdom, on the other hand, the authority exercised by bishops or counts gave scant scope for urban liberties. Assemblies in front of the church, known since Lombard times, as well as the introduction of the Carolingian jury, were humble beginnings. The citizens helped to defend their towns against Hungarians and Arabs; and the notables (*boni homines*) took some part in local administration by assisting the bishop or count.

The communal movement (*see* COMMUNE [MEDIEVAL]) created a new situation in northern and central Italy from *c.* 1080, while the Norman conquest of southern Italy put an end to the progress of municipal autonomy in that region. Whether it took the form of a conflict with the established authorities or of peaceful transition, the ultimate result of the communal movement was full self-government. Originally the communes were, as a rule, associations of the leading sections of the town population; but they soon became identical with the new city-state. Their first opponents were often, but by no means always, the bishops; in Tuscany, where margravial authority was strong, Henry IV encouraged rebellion against Matilda by granting extensive privileges to Pisa and to Lucca in 1081; and Matilda's death made it possible for Florence to achieve independence. The Investiture conflict, which was liable to undermine episcopal authority, often

encouraged the citizens to assume a bolder attitude in urban politics. But even before the contest, the Patarini in Milan showed, after 1056, how dangerous to episcopal authority religious conflict could become.

The first organs of the commune were the general assembly of all its members (*parlamento, concio, arengo*) and the magistracy of the consuls. At an early date a council began to replace the unwieldy assembly for ordinary political and legislative business; and with the growing complexity of the constitution, further councils emerged, conditions varying considerably from town to town. Communal law constituted a blend, under the influence of the revived Roman law, of urban customs and the new communal legislation. During the 12th century, the consular office was usually monopolized by the class that had taken the initiative in the establishment of the commune. This class was usually composed of small feudal or nonfeudal landowners and the wealthier merchants. In Pisa and Genoa the commercial element was predominant, while in parts of Piedmont the commune derived from the associations of the local nobility. Thus the early commune was predominantly aristocratic. The fortified towers of the leading families, resembling the feudal castles of the countryside, were characteristic of these conditions. In Italy there had in fact never been the same separation between town and countryside as, for instance, in northern France and in Germany; feudal society had penetrated into the towns, while nonnoble citizens were often landowners outside their walls. This link between town and country was to become progressively stronger and more complex in the course of communal history.

From the beginning the conquest of the countryside (*contado*) became one of the main objectives of communal policy. The small fortified townships (*castelli*) and the lesser rural places, which had also been widely affected by the communal movement, were now absorbed by the city-states. The divisions and subdivisions of feudal property, partly the result of the Lombard law of inheritance, weakened many feudal houses and thus facilitated the conquest, while the bishops could not prevent the extension of communal control to their lands. The members of the rural nobility were subjected one by one and often forced to become citizens; others did so voluntarily. Only a small number of more powerful families, such as the house of Este, the Malaspina, the Guidi and the Aldobrandeschi (*qq.v.*), succeeded in maintaining their independence, and that not without frequent losses and concessions. Soon, however, it became evident that the territorial conquests, as well as the growth of urban liberties, must lead to conflict with the empire.

The Hohenstaufen Emperors.—That conflict began soon after Frederick I Barbarossa, the second German king of the Hohenstaufen dynasty, had been crowned emperor (1155). The decrees of Roncaglia (1158), issued at the beginning of his second Italian expedition, with the assistance of members of the new Bolognese law school, placed imperial policy on a new basis. Frederick's predecessors Lothair II (or III) the Saxon and Conrad III had only rarely intervened in the affairs of northern and central Italy. Conrad III never came to Italy at all. By the time of Frederick Barbarossa's first expedition (1154–55) the communes had greatly increased their power, and no organized attempt had been made to check them. Frederick tried to strike at the core of the problem by claiming for the empire the royal rights (*regalia*) which had in so many cases been usurped by the communes.

The victims of this usurpation, however, had been far less the emperor himself than the bishops and the nobility, who for a long time had been in possession of most of the *regalia*. The innumerable grants of royal rights had formed an integral part of the traditional system of imperial government. Frederick intended to replace it, to a wide extent, by one of direct control. Imperial officials were to administer town and countryside; and if the communes were to be left some of their liberties, they were to owe them entirely to the emperor. In fact the emperor began soon to differentiate between the communes; those which took his side were granted considerable concessions, such as free elections of the consuls. The violent resistance of Milan and other towns was largely responsible for this turn of Frederick's policy. It was significant that Milan's enemies, such as Lodi and Cremona, vigorously assisted in the siege of that town and shared in its destruction in 1162.

On the other hand the revival of the struggle between empire and papacy provided the anti-imperial towns with a powerful ally. The double papal election of 1159 led to a schism; and while Frederick recognized Victor IV, Alexander III was prepared to support any communal reaction against the emperor. After the fall of Milan, Venice, threatened by the extension of imperial power, had taken the initiative in founding the Veronese league (1164); and in 1167 a second league was formed between several Lombard towns. In the same year the two leagues joined and entered into close contact with Alexander. (*See* LOMBARD LEAGUE.) In the meantime Frederick had taken Rome; but an epidemic had decimated his army (1167), and his return route to Germany was almost cut by the Lombard revolt (1168). As a result, imperial authority practically collapsed in Lombardy and was much weakened in Tuscany.

After his return to Italy, Frederick was prepared to give up the execution of the Roncaglian decrees, as was shown in the negotiations of Montebello (1175); but these negotiations were ineffective, and in 1176 Frederick was defeated by Milan near Legnano. In 1177 Frederick concluded the separate peace of Venice with Alexander III; and an armistice with the Lombard league was culminated after six years by the peace of Constance (1183). The Lombard communes were left the *regalia* inside the towns and, on certain conditions, in the territory, and they retained nearly all their liberties; but the consuls were to be invested by the emperor (a right of which he seems to have hardly ever made use). The peace concerned, however, only Lombardy. In Tuscany, Spoleto and the Marches, the imperial position had been greatly strengthened during the previous years, and the administrative reorganization that had failed in Lombardy was carried out with considerable success in that region. Moreover, Frederick was preparing the extension of German rule to the kingdom of Sicily.

The emperors had made repeated attempts at conquering the Norman kingdom. In 1137 Lothair II had achieved a short-lived success in Apulia; in 1166–67 Frederick had planned an attack on the kingdom. In 1184 the Sicilian heiress Constance, King Roger's daughter, was betrothed to Frederick's son and successor Henry, an event of far-reaching importance for Italy and the empire.

At Frederick's death in 1190, Henry VI had already begun to assert his and his wife's claims to Sicily, King Roger's grandson William II having died in 1189. But resistance led by Tancred, an illegitimate grandson of King Roger, was strong. The kingdom had to be conquered, and it was not until 1194 that Henry succeeded in doing so. He left the Norman regime unchanged; the highly centralized Sicilian state was an invaluable addition to the resources of the empire in Italy. Henry's unsuccessful plan to make the empire hereditary would have led to permanent union, since the Sicilian crown was hereditary. Placing imperial rule on a stronger basis than it had ever possessed, it would have been fraught with dangers for the political independence of the papacy. Thus the papacy made a determined effort, after Henry's death in 1197, to destroy the union of Sicily and the empire.

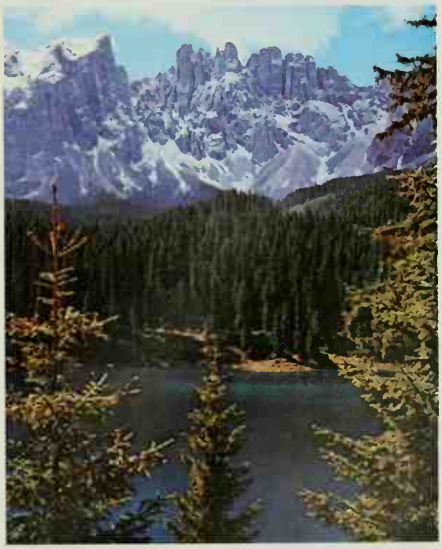
Henry's death was followed by a double imperial election; in Italy imperial administration disintegrated rapidly, the communes recovering everywhere what they had lost. Innocent III (1198–1216) took full advantage of this reaction and substituted papal government for imperial administration in the duchy of Spoleto and in the march of Ancona, thus once more extending the papal states to the Adriatic sea. Constance of Sicily renounced the imperial crown on behalf of her son Frederick, the new king of Sicily, and appointed Innocent III to be his guardian after her death (1198). The next step in the separation of Sicily from the empire was the renunciation of that kingdom by the German king Otto IV (1201), a Welf who had been recognized by Innocent against the Hohenstaufen Philip of Swabia. But after his imperial coronation in 1209, Otto turned to its conquest, the continuity of imperial policy proving stronger than promises and a change in dynasty.

The fishing and yacht harbour of Naples

The Piazza S. Marco, Venice. The Basilica of St. Mark is in the background with its campanile and the Doges' Palace. The piazza itself is shown while flooded by exceptionally high tidal waters

The Piazza della Rotonda in Rome. The fountain was erected during the reign of Pope Gregory XIII in 1575. Part of the Pantheon is seen in the right background

The Ponte Vecchio, oldest and most famous bridge in Florence



Lake Carezza in the Dolomites, a mountain group in the eastern section of the Italian Alps

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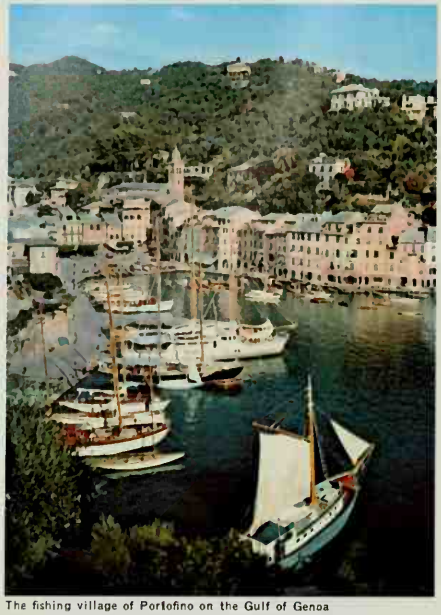
ITALY



The fishing village of Portofino on the Gulf of Genoa

The town of San Gimignano in Tuscany

Sheep grazing on the shore of the Adriatic, near Barletta in southeastern Italy

A view of Marina Grande, landing place on the north shore of Capri

The harbour and breakwater of Sciacca, a town and episcopal see of Sicily

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In Sicily, the preceding years had been marked by internal disorders which threatened to destroy the work of the Norman monarchy. In 1211 Innocent decided to play off the young king Frederick against Otto by supporting his new election as future emperor in Otto's stead. Crowned as German king at Mainz (1212), Frederick II grew rapidly more powerful; and the battle of Bouvines (1214) sealed Otto's fate. But the success of papal policy was only temporary, for Frederick too did not keep his promise to separate Sicily from the empire.

Between 1220 and 1250 Frederick continued with great vigour and much success the policy of his German and Norman ancestors in Italy and Sicily. The years after his imperial coronation in 1220 were mainly devoted to rebuilding and consolidating the structure of the Norman monarchy. Further reforms took place in later years, and the constitutions of Melfi of 1231 admirably reflected the spirit and working of the highly centralized and bureaucratic Sicilian state. In northern Italy, active intervention began in 1226 and immediately led to the revival of communal resistance; and when in 1227 the new pope Gregory IX excommunicated Frederick after his failure to keep the date appointed for the crusade, the pattern of the reign of Frederick I was reproduced, the papacy allying itself with the Lombard towns against the emperor.

The peace of San Germano (1230) between pope and emperor was of short duration. Open war with the Lombards broke out again in 1236; the great defeat of the league at Cortenuova (1237) was not fully exploited by Frederick; and in 1239 Gregory once more excommunicated the emperor. The capture of Rome then became a major objective; Frederick may have been on the eve of attaining it at the time of Gregory's death (1241). Peace negotiations with Innocent IV and the league broke down in 1244; and Innocent deposed the emperor at the council of Lyons (1245). In the following years the struggle continued with unprecedented violence. Despite numerous setbacks, the imperial cause seemed to be in the ascendant when Frederick suddenly died in 1250.

After 1237 he had reorganized imperial administration in northern and central Italy, introducing and adapting Sicilian methods of government. Vicars-general with wide authority governed new provinces, while under them local officials administered towns and countryside. The preponderance of natives of the Sicilian kingdom in the Italian administration significantly contrasted with the leading role played by Germans under Frederick I and Henry VI. Sicily had become the main pillar of imperial rule in Italy, and its great resources held out a substantial promise of success. At the same time Frederick tried to preserve the support of the German princes by far-reaching concessions (1232).

Frederick's death was a turning point in the history of Italy; it marked the end of the Hohenstaufen policy of placing the country under a centralized monarchical government. The conflicts between Frederick's successors and the papacy continued until 1268. In 1265 Pope Clement IV invested Charles of Anjou with the Sicilian kingdom, where King Manfred, Frederick's illegitimate son, had been consolidating his power. In 1266 Manfred was defeated and killed in the battle of Benevento. Two years later Frederick's young grandson Conradin made a supreme effort to save the fortunes of his house; after a triumphant entry into Rome he was beaten by Charles at Tagliacozzo (1268) and executed at Naples.

During the struggles between papacy and empire Italy had become divided into two parties, papalist and imperialist, which in the course of the 13th century assumed the names of Guelph and Ghibelline. This had not only affected relations between states but had also divided the population of the towns, thus giving fresh impetus to local factions. The names remained a tragic legacy of the Hohenstaufen period to the political life of Italy. (*See* GUELPHS AND GHIBELLINES.)

Monarchies and Communes in the 13th Century.—By the end of the 12th century, the communes had triumphed in Lombardy and Tuscany; but although the communal movement extended also to other parts of the country, it did not prevail everywhere. Large regions of Italy retained or developed monarchical institutions: foremost the Sicilian kingdom, but also the papal states, Piedmont and Sardinia. Feudalism formed an important element of monarchical Italy, which represented also in this respect a contrast to the antifeudal policy of the communes. With other European countries, monarchical Italy had in common the development of assemblies of estates (*parlamenti*), in which the towns were represented. Originating primarily from the earlier feudal assemblies, the parliaments of the 13th and 14th centuries reflected the attempt to give the towns together with the feudal classes an influential place in the political structure of the monarchical states. They thus constituted also a new development in the position of the towns, which often enjoyed considerable local autonomy under monarchical control. Conditions varied considerably, however, both with regard to the functions of the parliaments and the rights of the towns. Thus the papal states, comprising many communes which had been only recently acquired, contrasted with the Sicilian kingdom where the towns had remained strictly subjected to the monarchy from the time of the Norman conquest, whatever the privileges that had been granted to them.

In communal Italy, the internal conflicts that began to disrupt the communes in the 12th century created new and far-reaching problems. Caused by rivalries and feuds within the ruling oligarchies and already, sometimes, by social conflicts, they led toward the end of the 12th century to the institution of a single executive magistrate (*podestà*). This innovation did not, however, put an end to internal strife. While the consular government disappeared at the beginning of the 13th century, it became the general rule for the *podestà* to be a citizen of another town, so that the executive could no longer be the object of family rivalry. The struggles between the municipal parties, led by powerful families from which they often took their names, became a permanent feature of communal politics, and strife was intensified by the custom of the blood feud (vendetta) and by the expulsions of the defeated party. The growth of Guelphism and Ghibellinism gave the local parties endless possibilities of outside support and added fresh violence to their struggles. But they were no longer alone in their desire for political control.

The increase of economic prosperity and the growth of the town populations led to a challenge of the virtual rule of the aristocracy in the communes. The prosperity was primarily the result of the expansion of Italian trade and the development of Italian banking and industry. The crusades (*q.v.*) provided Venice, Pisa and Genoa and, indirectly, other towns with new trading centres on the fringe of Asia; the fourth crusade, which established the Latin empire at Constantinople in 1204, gave Venice a colonial dominion in the Levant, the economic value of which was immeasurably great. The restoration of the Byzantine empire under Michael VIII Palaeologus in 1261 was not a serious blow to Venice's new dominion; but it gave Genoa vast commercial opportunities at Venice's expense. The Sicilian policy of the papacy after 1250—the offers of the kingdom first to Edmund, son of Henry III of England, and then to Charles of Anjou—provided Italian bankers and merchants with new fields of action. Hand in hand with increasing prosperity went immigration into the towns, the new citizens being recruited from all classes.

The rise of the merchant and craft guilds was closely related to these developments, another form of organization of the *popolo* being military companies. The *popolo* roughly corresponded to the middle classes, and the final stage of its political formation was reached when it was organized like a commune, with executive, councils and statutes of its own. Conflicts between the aristocracy and the *popolo* began early but generally did not reach full strength until the 13th century. A first attempt to settle them led in Milan and other Lombard towns to the government's being shared between the two classes. Later in the 13th century the organized *popolo* sometimes succeeded in establishing control of the commune, as in Florence in 1250 and 1282.

Instability and civic strife were generally traits of the 13th-century communes. The fate of the vanquished was bitter, the political exile becoming a typical figure; and the victor's desire for permanent power was determined not only by ambition but also by the fear of the consequences of defeat. To grant special

powers to the leader of one's party or of the *popolo* might appear the easiest method to achieve this end; but the breaking down of constitutional limitations opened the road for the establishment of despotic government.

Interstate conflicts, which had existed even before the rise of the communes, were a constant feature of Italian politics from the 12th century onward. Caused by quarrels over boundaries, by commercial and political rivalry or by Guelph and Ghibelline loyalties, they present a bewildering picture, which nevertheless reveals some patterns. Thus the conflicts between Pisa and Genoa, the principal rivals on the Tyrrhenian coast, both aiming at control of Sardinia, continued intermittently throughout the 12th and 13th centuries and culminated in Pisa's decisive naval defeat off Meloria in 1284, which sealed its decline as a great maritime power. In the meantime, the struggle between Genoa and Venice over the eastern trade, beginning in the 12th century, had been intensified by the establishment of Venice's Levantine dominion in 1204 and the restoration of the Byzantine empire in 1261. Commercial rivalry must have been largely responsible for Milan's traditional enmity with Pavia and Cremona. In Tuscany the struggles between Pisa and Lucca began in the 11th century. Lucca, once the most powerful Tuscan town, had been overtaken by Pisa, the chief Tuscan port. Florentine expansion led to mortal enmity between Florence and Siena from the 12th century onward, while Florence's growing economic and political power brought about struggles with Pisa from the beginning of the 13th. One effect of these conflicts was that the emperors always succeeded in enlisting the services of communes against other communes. Another result of the conflicts and of the territorial policy of the communes in general could be the acquisition of city-states by more powerful neighbours. But in this respect too the rise of the *signorie* (seigniories) proved a new departure.

Rise of the Signorie.—Frederick II's administrative reforms, as well as the temporary establishment of autocratic rule over several north Italian towns by the Ghibelline Ezzelino da Romano (d. 1259) and then by Frederick's former official, the margrave Oberto Pelavicino (d. 1269), were important elements in the rise of despotism in Italy; while Piedmontese feudalism helped the margrave William of Montferrat to extend his control over many communes of Piedmont between 1260 and 1290. But the broad stream of despotism sprang from internal developments in the communes, in particular from the struggle for political power, from the frequent internal crises and also from the desire for peace at any price. The offices of *podestà* and *capitano del popolo* served as starting points; the new rulers, usually influential citizens and sometimes feudal lords, were given special powers and longer terms of office, notwithstanding constitutional limitations. They had reached their goal when *parlamenti* and councils elected them *signori* (lords) for life with unlimited powers and when hereditary succession was assured. The new regime preserved the framework but not the spirit of the communal constitutions; under the absolute rule of the *signore* magistracies, councils and elections were left in existence. The *signori* owed their power originally to a measure of consent; and even when they had consolidated it they still had reason to care for popular support. But republican resistance was not lacking, and family rivalries could also lead to sudden changes of fortune.

The new regime began in Lombardy and the Romagna; it was not until the early 14th century that it seriously affected Tuscany. By that time, a number of leading northern *signorie* had reached a strong position: the Visconti (*q.v.*) in Milan, the Della Scala at Verona, the house of Este (*q.v.*) at Ferrara. The Carrara established their *signoria* at Padua first in 1318 and finally, after an interlude of Della Scala rule, in 1337; the Bonacolsi of Mantua were replaced by the Gonzaga in 1328.

Meanwhile Florence and Venice were carrying out constitutional reforms which were doubtless responsible to a large extent for their survival as republics. In Florence the reforms of 1282–93 based the government on the 21 guilds, with the predominance of the greater guilds; and the Ordinances of Justice (1293–95) consolidated the rule of the *popolo* by excluding the magnates, who were largely identical with the nobility, from nearly all important offices. Similar measures against the magnates had been taken shortly before in Bologna (1282) and were subsequently taken in other towns. In Venice, on the other hand, the aristocracy decisively consolidated the regime which it had been building up from the 11th century onward by the so-called "closing" of the great council through a series of laws making membership of it practically hereditary (1297–1323). After further reforms during the 14th century, the aristocratic constitution remained almost unchanged until Napoleon overthrew the Venetian republic in 1797.

The First Angevins in the South.—The Angevin conquest of the Sicilian kingdom opened a new chapter in the history of southern Italy. Charles I retained much of the existing administration as reorganized by Frederick II; but the conquest was followed by a strengthening of feudalism, largely a result of the immigration of French noblemen. Relations between natives of the kingdom and French were at first often hostile. In Sicily they deteriorated to such an extent that the tension culminated in 1282 in the great revolt of the Sicilian Vespers (*q.v.*) which led to a new separation of Sicily from the mainland. The Sicilians offered the crown to Peter III of Aragon, and the Angevins were unable to wrest Sicily from him or his successors. Although the War of the Vespers was ended by the treaty of Caltabellotta in 1302, hostilities began again soon after. For the Angevins at Naples the reconquest of Sicily from the Aragonese dynasty seemed essential not only for their prestige but also for their security.

Charles I of Naples had at first acquired control of nearly all Tuscany and part of Lombardy, but his influence in those regions depended on the papacy and the Guelphs and was therefore necessarily weakened when their need to seek his protection against the empire disappeared after 1268. His power outside the kingdom was thus only temporary; but his Italian policy was resumed by later Angevins. Relations between the Sicilian kingdom and the Tuscan merchants remained very close. Charles's conquest of the kingdom could hardly have succeeded without their loans; and the commercial advantages that they derived from his victory were correspondingly great.

Guelphs and Ghibellines in the 14th Century.—The virtual absence of imperial authority between 1268 and 1310 constituted a momentous change in the political situation. The papacy profited from it in several respects. While in the Guelph towns of Tuscany its influence became considerable, its territorial power was, at least potentially, strengthened by the German king Rudolf I's final renunciation of imperial rights over the Romagna in 1278. In Florence the Guelph party split into Blacks and Whites at the end of the 13th century. Boniface VIII (1294–1303) asserted his influence there by intervening, while nearer Rome he pursued with great success ambitious territorial plans for his family, the Gaetani, at the expense of the Colonna and Aldobrandeschi. Clement V's setting up of the papal residence at Avignon in 1309 proved a setback for the Italian policy of the papacy from which it did not recover until the 15th century. Republics and *signorie* freely asserted their independence, conditions being particularly favourable to the growth of small *signorie* such as those of the Ordelaffi at Forlì, of the Manfredi at Faenza, of the Malatesta at Rimini, of the Da Polenta at Ravenna, of the Pepoli at Bologna and of the Montefeltro at Urbino. Rome was the stage of constant struggles between the baronial families, the Colonna, the Orsini, etc.; and the remarkable successes of Cola di Rienzio in 1347 illustrated the weakness of the papacy.

In 1310 Henry of Luxembourg arrived in Italy, the first German king for many decades to undertake an Italian expedition; in 1312 he was crowned emperor as Henry VII. The expedition led to a revival of Ghibellinism and strengthened the position of the Lombard *signori* who sided with Henry. Matteo Visconti recovered the rule of Milan, and the title of imperial vicar granted to him and to the lords of Verona and Mantua tied them to the imperial cause by improving their legal status. The imperial vicariate, however empty a title it became after Henry's death, continued to be sought after by the *signori*. For the time being, the greatest obstacle to Henry was Guelph Florence. A siege (in the autumn of 1312) had to be raised. Henry died in 1313, on his

way to attack King Robert of Naples, the other great Guelph power.

The expedition remained an episode, but the Ghibelline revival retained its importance for some time to come. During the emperor Louis IV's struggles with Pope John XXII it became connected with antipapalist heresies, and prosecutions for heresy played an important role in papal warfare against the Ghibelline *signori*. In Tuscany the rise of Uguccione della Faggiuola as lord of Pisa (1313) and Lucca (1314) and then that of Castruccio Castracani, who ousted Uguccione from Lucca in 1316, was a heavy blow for Guelphism. The Florentines suffered crushing defeats at Montecatini in 1315 and at Altopascio in 1325. After the latter defeat they made Charles of Calabria (son of Robert of Naples) *signore* of Florence (d. 1328). Castruccio acquired Pistoia and Pisa (1325, 1328) and threatened Florence with encirclement; but he died in Sept. 1328, and his dominions broke up immediately. The Italian expedition (1327–30) of the emperor Louis IV was a fresh stimulus for Ghibellinism; its final decline resulted primarily from the scant role of the empire in Italian politics after this time; the two expeditions of Charles IV (1354–55, 1368–69) were of little consequence and vividly illustrated the eclipse of imperial authority.

The papacy had once more fought the Ghibellines vigorously; at the same time, John XXII had made a determined bid to recover control of the papal states. Bertrand du Pouget, papal legate in Italy from 1319 to 1334, achieved only temporary successes; but the house of Este came to terms with the pope and were created papal vicars of Ferrara, a title copied from the imperial vicariate and soon to be generally used by the papacy to assert at least a minimum of sovereignty over the despots of the papal states.

Expansion of the Signorie.—One of the outstanding developments of Italy in the 14th century was the territorial expansion of a number of city-states. Expansion beyond the boundaries of the *contado* had occurred before the rise of the *signorie;* but the *signorie* were in a singularly favourable condition to carry it forward, since one man could be elected *signore* of more than one town. Thus Matteo Visconti of Milan (d. 1322) and Cangrande I della Scala of Verona (d. 1329) laid the foundations of great territorial states in northern Italy. The brief intervention of King John of Bohemia in that region (1330–33) proved ultimately an advantage to the Lombard *signori,* who extended their territories when John's power collapsed. In the race for territorial acquisitions—that is to say, acquisitions of other city-states—the Visconti were momentarily outpaced by the Della Scala, whose power stretched in 1336 from the march of Treviso to Lucca. It was rumoured that Mastino II was aiming at the Lombard crown. The leagues of 1336–37 against them brought about their fall. After the peace of Venice in 1339, the Della Scala dominions were practically reduced to Verona and Vicenza (Parma and Lucca being lost in 1341).

These events were characteristic of the instability of the *signorie.* Towns were often as easily lost as gained, and at home also the position of the *signori* was not always secure. On the other hand, republicanism continued to suffer reverses. Thus in Padua communal government came to an end in 1328, and in Tuscany the *signoria* gained much ground after Henry's expedition, Florence itself being not immune from it.

The war against the Della Scala had an aftermath in the war over Lucca. Sold by Mastino della Scala to Florence, Lucca was attacked and then taken by Pisa (1341–42). The result of this setback and of internal discontent was the *signoria* of the duke of Athens, Walter II (Walter VI of Brienne), in Florence from 1342 to 1343. It was followed by antidespotic reaction and by a period of increased political influence of the lesser guilds. These were also years of economic crisis for Florence. The difficulties and final bankruptcy in the 1340s of the great houses of Peruzzi and Bardi ruined many other companies and shook the economic life of the town. The Black Death of 1348, which decimated the population, caused further disaster.

In 1343 Robert of Naples died; during his long reign Naples had once again played a leading role in Italian politics as protector and leader of the Guelphs. But several years before his death Robert had practically withdrawn from these wider fields of action, and under his granddaughter heiress, Joan I, a period of internal troubles began for the kingdom.

A new Italian problem had meanwhile arisen in the shape of the companies of mercenaries. Nearly all under foreign commanders, they had spread over Italy from the early 14th century. The troubles of the kingdom of Naples after Robert's death provided them with fresh opportunities, while the Anglo-French peace of Brétigny and Calais (1360) released many soldiers for service in Italy. Their ravages and disloyalties caused infinite hardships. But the Italian powers themselves were largely to blame as they made constant use of the companies. It was not surprising that the frequent leagues against the latter had little success.

Italy From 1350 to 1454.—Giovanni Visconti acquired Bologna, the gateway to Tuscany, in 1350 and Genoa in 1353. The former event led to war with Florence, the first in a long series of conflicts between Milan and Florence. Genoa was lost in 1356 and Bologna in 1360, but both remained prominent objectives of Visconti policy. At that time a new political factor of lasting importance was emerging in northwestern Italy. The count of Savoy, Amadeus VI, subdued the Piedmontese branch of his house (1360–68) and established a powerful dominion which combined French and Vaudois with Italian territories. It was not surprising that he clashed with the Visconti (1372–75), equally aiming at predominance in western Lombardy. While the Visconti state was temporarily divided after Giovanni's death in 1354 into three and then into two parts, Florence was recovering from the earlier crises and was once more extending its territory, being well on the way to complete hegemony in Tuscany. The Guelph party was virtually in control of the state from 1354; resistance against its dictatorial methods flared up in 1378 and developed into a revolt of the poorest section of the population, the *popolo minuto,* against the traditional preponderance of the rich *popolo grasso* (the revolt of the *ciompi*). But by 1382 the *popolo grasso* had not only recovered but permanently strengthened its position.

In the papal states a fresh attempt was made from 1353 onward to restore papal authority. The great successes of the new legate, the cardinal de Albornoz (Gil Alvarez Carrillo), led to a complete change in the political situation. He forced the Malatesta and the Ordelaffi to submit and reorganized papal administration. The Aegidian constitutions of 1357 (Aegidius being the Latin form of his Christian name) remained its basis until the early 19th century. These achievements paved the way for the return of the papacy to Rome. Urban V was in Rome from 1367, Gregory XI from 1377 during the War of the Eight Saints (1375–78) between the papacy and Florence—a state now alarmed about the effects of the papal recovery. Gregory's death in 1378 was followed by the outbreak of the Great Schism.

The last two decades of the 14th century form, in more than one respect, a landmark. The War of Chioggia between Genoa and Venice ended with the failure of Genoa's supreme bid to destroy the power of its rival (1381) and thus decided the long struggle between the two powers. The Great Schism ruined the work of Albornoz in the papal states. In Naples, it led to civil war. Joan I having adhered to the antipope Clement VII, Urban VI called her second cousin Charles of Durazzo (Charles III of Naples) to Italy against her; Joan made Louis I, the Valois duke of Anjou, her heir. It was not until 1399 that Ladislas, Charles III's son, finally prevailed against Louis II of Anjou, as his father had done against Louis I (d. 1384). In Lombardy and Tuscany, the last 15 years of the century were marked by the rise of Gian Galeazzo Visconti. Having in 1378 succeeded his father, Galeazzo, in his parts of the Visconti dominions, Gian Galeazzo in 1385 took Milan from his uncle Bernabò and thus reunited the Visconti state, giving it a stronger and more centralized administration. He attacked the Della Scala of Verona in 1387 and the Carrara of Padua in 1388 and annexed all the territory of the former and most of that of the latter. Florence feared that expansion into Tuscany would follow; war between Florence and Gian Galeazzo broke out in 1390 and again in 1397. In the meantime, the emperor Wences-

las raised the lord of Milan to ducal rank, the first *signore* to reach princely dignity (1395). Gian Galeazzo acquired Pisa, Siena and Perugia in 1399–1400 and Bologna in 1402. He seemed on the eve of attacking Florence when he suddenly died in 1402.

Gian Galeazzo had divided his state between his sons Giovanni Maria, who became duke, and Filippo Maria; but it rapidly broke up at the hands of his former captains, of local *signori* and of neighbouring states. The tide seemed indeed to have turned in favour of Venice and Florence. The Florentines conquered Pisa in 1406, thus gaining at last direct access to the sea. Venice seized most of Gian Galeazzo's conquests in eastern Lombardy. In 1405 it destroyed the Carrara, who had recovered Padua in 1390 and taken Verona after Gian Galeazzo's death.

These events were a landmark in the history of Venice, the beginnings of an active policy of territorial expansion on the Italian mainland where it had previously been primarily interested in commercial control. In 1416 war with the Turks began, the first of the wars during which Venice was to lose its Levantine colonies. In 1419–20 it finally conquered Friuli; by 1420 it had recovered Dalmatia (lost to Hungary in 1358). Complete control of the Adriatic sea, a fundamental objective of Venetian policy, appeared to be near realization at a time when Venice had become one of the great mainland powers.

At the beginning of the 15th century, Naples re-emerged under King Ladislas for a short period of Italian power. Reviving the policy of earlier Angevins and taking advantage of the troubles of the papacy, Ladislas occupied Rome and Latium and advanced into Tuscany in 1408–09; after a withdrawal, he again seized Rome and advanced north in 1413–14. He clashed with the Florentines, faced by another invasion of Tuscany. But at the height of his power Ladislas died (1414). Under his sister Joan II the kingdom was once more plunged into a war of succession. In the meantime another and more lasting political revival had begun in northern Italy. Filippo Maria Visconti succeeded Giovanni Maria after his assassination in 1412; by 1421 he had reconstructed the Visconti state roughly within the boundaries of 1385, thus reawakening the fears not only of Florence but also of Venice, which owed so much to the breakup of the Visconti dominions. The submission of Genoa in 1421 and intervention in the Romagna (1422–23) recalled earlier Visconti objectives. War broke out with Florence in 1423 and with Venice in 1426; and wars continued intermittently until the middle of the century. Venice pushed its frontiers farther west by acquiring Brescia, Bergamo and Crema; it concluded final peace with Milan at Lodi in 1454. Florence had already changed alliances earlier.

In 1447 Filippo Maria died, and the Milanese republic was restored—after nearly two centuries of despotic rule; but in 1450 his son-in-law, the former *condottiere* Francesco Sforza, took Milan and restored despotism under a new dynasty. A friend and ally of Cosimo de' Medici, he put an end by his victory to the long struggle between Florence and Milan.

The rebuilding of the territorial power of the papacy, which began after the accession of Martin V (1417), was a slow process; after promising beginnings under Martin, the situation deteriorated again under Eugenius IV (1431–47). But by the middle of the century the tide had turned; the council of Basel had been dissolved and Francesco Sforza had in 1447 lost the march of Ancona (which he had acquired in 1433). Nicholas V pursued a policy of pacification, and it was not until Sixtus IV that a fresh advance in territorial policy began.

In Naples the succession crisis lasted intermittently until 1442, when the army of Alfonso V of Aragon, who was already king of Sicily, took Naples. Joan II, who had at first adopted him as heir, had gone over in 1423 to Louis III of Anjou, Martin V's candidate. At her death in 1435 she left the kingdom to Louis's heir, René of Anjou; and now Alfonso made a fresh bid for the kingdom. After his victory he was invested with it as Alfonso I by Eugenius IV (1443); but René of Anjou did not abandon his claim, which in 1494 was to form the juridical basis for the French king Charles VIII's Italian expedition.

In Florence the government underwent a momentous change in 1434. From 1382 Florence was ruled by a group of leading families, headed from 1393 by Maso degli Albizzi and, after his death in 1417, by his son Rinaldo. In a difficult position because of an unsuccessful war against Lucca (1429–33), Rinaldo struck against his chief rival, Cosimo de' Medici, whose family had been rising in political importance from the end of the 14th century (*see* MEDICI). Cosimo was banished in 1433; but in 1434 Rinaldo fell from power and Cosimo was recalled while the Albizzi were exiled. A new epoch in Florentine history began. At first Cosimo followed largely the traditions of the oligarchical government and only cautiously extended his power beyond that enjoyed by the Albizzi. His position was greatly strengthened by the successes of his diplomacy. By making Francesco Sforza an ally of Florence, he established a new policy of friendship with Milan.

The peace of Lodi between Milan and Venice (1454) and the ensuing conclusion of an Italian league (*see* below) marked the end of a period of wars. The conflicts of the first half of the 15th century had helped to bring the new Italian art of war to maturity. Its founder had been, toward the end of the 14th century, Alberico da Barbiano; and mercenary warfare in Italy had subsequently passed into the hands of Italians. Muzio Attendolo Sforza and Braccio da Montone, who had both served under Alberico, gave rise to two different schools of warfare; at the beginning of the Neopolitan struggles under Joan II they fought in opposite camps, adding military rivalry to the political issues. The rise of the Italian *condottieri* also led to new political developments. While minor *signori*, eager to increase their revenues, often served as *condottieri*, *condottieri* would sometimes become *signori*—an ambition more natural to Italian than to foreign captains. Shifting loyalties remained, however, a characteristic feature of the *condottieri*. The governments often suspected their generals and sometimes acted against them, the most spectacular example being the execution of Francesco da Carmagnola by Venice in 1432.

The new alignment of forces in Italy after 1450 was to determine much of the history of the following decades. The political map of the country had been simplified by the territorial expansion of Milan, Venice and Florence; five great powers now completely overshadowed the remaining smaller states, and the idea of a balance between them was beginning to take shape. After 1454, the Italian league and the triple alliances between Milan, Florence and Naples, although not permanent, pointed in this direction and held out at least some promise of peace. (N. R.)

C. Italy and the Great Powers, 15th–18th Centuries

The Italian League.—The second half of the 15th century witnessed a movement toward confederation among the Italian states. A common language and a common culture fostered the sense of nationality. This found expression in the league of 1455, the members of which were pledged to preserve peace among themselves and to resist foreign intervention. An alliance between Milan, Florence and Venice following the peace of Lodi (1454) had brought the league into being. Nicholas V, eager to turn the forces of Italy against the Turk after the fall of Constantinople, ratified it in the name of the papacy and used his influence to bring Naples in. Almost all the lesser states were enrolled as adherents of one or the other of the five leading powers.

The aim of the league was to maintain the balance of power by resisting acts of aggression on the part of any member state and to keep the foreigner out. It was instrumental in defeating René of Anjou's attempt to win the crown of Naples on the death of Alfonso V of Aragon (1458) and in securing the succession for the latter's illegitimate son Ferdinand I (Ferrante); in so doing it gained for Italy a respite from foreign intervention. When Pope Sixtus IV and Venice made a combined attack on Ferrara in 1482 the intervention of Milan, Florence and Naples saved the city for the house of Este. Thus the league became a guarantee of the independence of the smaller states, enabling each to make its individual contribution to the civilization of the Renaissance. Freed from the burden of major wars, Italy enjoyed a period of prosperity in which all the arts flourished and the separate states were drawn closer together in pursuit of their common interests.

During these years political institutions tended everywhere to-

ward despotism. The Medici became more indispensable to Florence and the Bentivoglio more autocratic in Bologna. Perugia submitted to the dictatorship of the Baglioni and Siena to that of the Petrucci. The head of each family was recognized as the leading citizen of his republic, being a despot in fact but not in law. Other rulers, who had been given the lordship of their city by popular decree, strengthened their title by obtaining investiture from pope or emperor. Thus the Gonzaga lords of Mantua became imperial margraves, the Este were invested with Modena by the emperor and with Ferrara by the pope. Imperial investiture as duke of Milan, for which Francesco Sforza had negotiated in vain, was granted to his son Ludovico.

The interests of the popes approximated more and more to those of Italian secular rulers. Their aim was to establish their direct authority throughout the states of the church, and their means was the bestowal of lands and offices upon their relatives. Sixtus IV (1471–84) controlled the Sacred College through his Della Rovere and Riario nephews and established another nephew, Girolamo Riario, as lord of Imola and Forlì as a step toward the subjugation of Romagna. Thanks to the work of architects and painters brought thither by successive popes, Rome became a splendid Renaissance capital.

The despots made life fuller and gayer within their cities and added to their prestige abroad. Nevertheless their position was precarious. Citizens nurtured in the republican tradition acquiesced in despotic rule only so long as they felt its advantages. The murder of Francesco's son Galeazzo Maria Sforza in Milan (1476) and the attempt on the part of members of the Pazzi family against the Medici in Florence (1478) are typical of an age in which no ruler could rely upon the continued loyalty of his subjects. In Naples the Angevin baronage was ever ready to revolt against Ferdinand of Aragon. Even Venice, the most stable of Italian states, was unpopular with the nobles in its subject cities. Conscious of insecurity at home and fearful of attack from neighbouring powers, each state thought more of securing some temporary advantage for itself than of the preservation of Italian unity. Lorenzo de' Medici (Cosimo's grandson, Lorenzo I il Magnifico) almost alone worked consistently for peace, using his tact and skill to minimize occasions for quarreling. His death (1492) was the prelude to foreign invasion.

The French Invasions, 1494–1592.—A new age opened for Italy when Charles VIII of France turned his mind toward the pursuit of his claims to Naples, as the heir of René of Anjou. At this time a serious quarrel had broken out between Naples and Milan. Galeazzo Maria Sforza was succeeded as duke of Milan by his infant son Gian Galeazzo, the boy's uncle Ludovico (il Moro) acting as regent. When Gian Galeazzo grew up and married (1489) Isabella of Aragon, daughter of Alfonso, duke of Calabria (who was to be king of Naples as Alfonso II from 1494 to 1495), Ludovico retained the government in his hands. He and his brilliant wife, Beatrice d'Este, usurped the place of the rightful duke and duchess, thereby arousing the indignation of the Aragonese of Naples.

Piero de' Medici, who succeeded to his father Lorenzo's supremacy in Florence, was incapable of healing the breach between his allies, while the election of Rodrigo Borgia to the papacy as Alexander VI increased the tension between the Italian powers. Ludovico, feeling himself isolated and expecting an attack from Naples, threw himself on the side of Charles VIII, who entered Italy as his ally (1494). Hardly had Charles passed through Lombardy on his unhindered march southward before Gian Galeazzo died. Ludovico, who incurred grave suspicion of having poisoned him, became duke of Milan.

In Florence, Charles VIII's coming resulted in the expulsion of Piero de' Medici and the establishment of a republican government allied with France and drawing its inspiration from Fra Girolamo Savonarola. Savonarola's preaching brought about an astonishing religious revival in the city; but opinion turned against him as the first enthusiasm faded and as neither the new constitution nor the French alliance achieved the good results that he had foretold. In 1498 he was tried and executed on the charge of heresy. Meanwhile Charles VIII had won the throne of Naples and lost it again. In 1495 he was back in France, having narrowly escaped defeat at the hands of Italian forces at Fornovo as he crossed the Apennines; Spanish arms reinstated Alfonso II's son in Naples as Ferdinand II (he died, however, in 1496).

Charles had gained nothing, but his expedition paved the way for more formidable invaders. His cousin the duc d'Orléans, who succeeded him as Louis XII in 1498, at once prepared to enforce his claims on Milan, inherited from his grandmother Valentina Visconti. Ludovico Sforza fled to the imperial court and on his return to Milan with an army in 1500 found the *castello* in French hands. At the battle of Novara his Swiss mercenaries refused to fight against their compatriots in French service. Ludovico was captured and taken to France (he died at Loches in 1508). Louis XII, now duke of Milan, in 1500 concluded the treaty of Granada with Ferdinand II, king of Aragon, whereby France and Spain agreed to divide Naples between them. The conquest was easy and Frederick, the last ruler of the illegitimate line of Aragon, who had succeeded his nephew Ferdinand II of Naples in 1496, retired to France. The king of Aragon, however, soon picked a quarrel with his ally. The French were driven out by the beginning of 1504 and the two Sicilies were reunited under the Spanish crown. An important step toward Spanish domination of Italy had been taken.

Meanwhile the Italian powers made use of foreign invaders for their own ends. Louis XII had found it politic to ally himself with Alexander VI before coming to Italy; thus the pope's son Cesare Borgia embarked on his campaign of conquest in Romagna supported by French troops. Cesare seemed to be upon the point of creating a powerful Borgia state, embracing not only Romagna but Tuscany, when Alexander's death (1503) brought about his own fall. Most of his acquisitions in Romagna reverted to the Holy See, but Venice added to the cities that it already held there. The Venetian republic had gained ports in Apulia when helping to defeat Charles VIII and towns in Lombardy as the price of its alliance with Louis XII. Its territorial gains had been made at the expense of its neighbours, and these now included the pope and the kings of France and Spain. Thus Pope Julius II was able to unite France, Spain and also the emperor Maximilian against the republic in the league of Cambrai (1508).

Julius II's aim was to restore power and prestige to the church and, first of all, to bring all papal lands in Italy under his direct rule. He had already conquered Bologna and forced the Baglioni in Perugia to submit to his authority when he joined in the attack on Venice. The defeat of Venice at the battle of Agnadello (1509) was followed by the dissolution of its mainland dominion. It was forced to accept the pope's terms, renouncing its claims to independence in ecclesiastical matters and ceding the cities which it held in Romagna. Julius was now undisputed master of the states of the church, with the sole exception of Ferrara, where the duke, Alfonso I d'Este, sheltering under the protection of France, refused obedience to his suzerain. Thereupon the pope proclaimed his intention to free Italy from the barbarians and formed the Holy League (1511) to drive out the French. In 1512 the battle of Ravenna was fought between Spanish, papal and Venetian forces on one side and French and Ferrarese on the other. Gaston de Foix, the brilliant French commander, bought victory dearly with his death. Before his leaderless forces had time to recover from the shock the Swiss, as members of the Holy League, invaded Lombardy, drove out the French and set up Massimiliano Sforza as duke of Milan. In the same year the armies of the league restored the Medici to power in Florence. Only the death of Julius II in 1513 saved Ferrara for the house of Este.

The Emperor Charles V and the Spanish Ascendancy.—The expulsion of the French brought Italy hope of freedom from foreign rule and moved Niccolò Machiavelli to write his *Principe*. He dedicated it to Lorenzo de' Medici, duke of Urbino, who, because of the return of his family to Florence and the election of his uncle Giovanni to the papacy as Leo X, had, in Machiavelli's eyes, only to follow the advice laid down for him in order to become the saviour of Italy. Such hopes were illusory. The Italians had neither the will nor the power for united resistance to the foreigner, and France had been expelled at the cost of increasing the

predominance of Spain. By the victory of Marignano (1515) Francis I of France broke the power of the Swiss and regained the duchy of Milan. Then Charles of Austria, already ruler of the Spanish kingdoms, was elected Holy Roman emperor, as Charles V, in 1519. This was the prelude to the struggle between Habsburg and Valois which vexed Italy for the next 40 years.

Charles began by driving Francis from Milan and investing Francesco Maria Sforza with the duchy (1522). In 1525 Francis' attempt to regain it ended in his defeat and capture at the battle of Pavia. Alarmed at the growth of imperial power in Italy, Pope Clement VII (Giulio de' Medici) deserted Charles for Francis and engineered the league of Cognac (1526) with France, Florence, Venice and Milan to drive his former ally from Italy. Charles determined to make Clement see reason by force of arms, and in 1527 fresh troops from Germany joined the Spaniards in Italy. A mutinous and starving army led by Charles, duc de Bourbon, who had deserted the French for the imperial service, appeared before Rome. Bourbon was killed in the first attack, and the sack of Rome followed. The horrors of the outrage reverberated through Europe, and though Charles was not directly responsible his hold upon Italy was in jeopardy. Within three years, however, Habsburg domination of Italy was an accomplished fact. Andrea Doria brought Genoa and its fleet into Charles's service. Clement VII came to see that his interests both as Medici and as pope would be best served by alliance with Charles. When he was a prisoner in Castel Sant'Angelo the Medici had again been expelled from Florence, and the price of his forgiveness of Charles was the loan of imperial forces to overthrow the last Florentine republic. Florence fell after a heroic defense (1529–30) and Alessandro de' Medici became duke of Florence. By the treaty of Cambrai (1529) Francis I renounced his claims on Milan and Naples, and when Charles was crowned emperor by Clement VII at Bologna (Feb. 1530) he had become the arbiter of Italy.

Charles V's settlement of Italy was based on the principle of favouring the interests of the native rulers in order to secure their support against France. He used his influence to reconcile Alfonso of Ferrara with the papacy. He restored Francesco Maria Sforza to Milan and married him to his niece Christina of Denmark, despite Francesco Maria's treachery in having joined the league of Cognac. He raised Federigo Gonzaga of Mantua to the rank of duke and in 1536 confirmed his succession to Montferrat. Cosimo, of the younger line of Medici, who in 1537 succeeded Alessandro as duke of Florence, was invested with Siena in recognition of his aid in suppressing the last Sienese republic. The duchy of Parma and Piacenza, which the Farnese pope Paul III had created in 1545 for his son Pierluigi, came eventually into the Habsburg orbit through the marriage of Ottavio Farnese with Charles V's natural daughter Margaret.

Throughout the Spanish supremacy Italian princes continued to preside over their courts, to cultivate the arts and to adorn their cities with sumptuous buildings. Nevertheless the great days of Italy were over, and the country as a whole suffered steady decline in wealth, prestige and freedom. In its later stages the war with France was fought for the most part outside Italy, but Francis I and Henry II in turn pressed their claims to Milan and Naples and never let slip an opportunity of fomenting Italian opposition to Habsburg rule. The death of Francesco Maria Sforza without heirs in 1535 was followed by fresh outbreaks of war and fruitless negotiations with France, until Charles settled the fate of Milan by investing his son, the future Spanish king Philip II, with the duchy (1540), at the same time transferring all imperial rights in Italy to Spain.

In 1559, after Charles had ceased to rule, the treaty of Cateau-Cambrésis between Philip II of Spain and Henry II of France marked the final renunciation of Valois claims to Italian territory and added further to the Spanish dominions by assigning to Philip the Tuscan ports known as the Presidii. With Spanish viceroys in Milan and Naples, Italy had ceased to be independent. The title of grand duke of Tuscany, granted to the Medici of Florence by Pope Pius V in 1569, was not recognized by the emperor Maximilian II until 1575.

The power of the papacy, however, had increased rather than diminished during the Franco-Spanish wars. It had gained new life from the Counter-Reformation, the work of baroque architects added yearly to the splendours of Rome, and the authority of the popes in the states of the church was undisputed. When, in 1597, Alfonso II d'Este died childless, Clement VIII refused to invest his cousin Cesare with Ferrara, which was at long last incorporated in the papal states. The house of Este, however, continued to reign in Modena. In 1631 Urbino, which had been renowned as a centre of the Renaissance under its Montefeltro rulers, also fell to the papacy, the last duke, Francesco Maria II della Rovere, having arranged for the devolution of his state to Urban VIII.

Individual popes might pursue a policy of opposition to Spain, but papal government was as repressive in character as that of the Spaniards. In 1542 the Inquisition (*q.v.*), already a recognized feature of Spanish rule, was established in Rome. Henceforth printing was controlled throughout Italy, heretics were sought out and burned, the least symptom of political unrest called forth punitive measures. Spain and the Counter-Reformation destroyed the free spirit of an earlier age.

Among the Italian secular states Venice retained the greatest measure of independence. By 1517 it had recovered the bulk of its Lombard territories, which were to enjoy relative prosperity under its rule until the coming of Napoleon; and in spite of the submission forced from it by Julius II, the church in its dominions remained to a large extent under state control (Venice gave asylum to fugitives from the Inquisition for many years before it yielded to papal pressure and expelled heretics). This policy brought on Venice the enmity of both the papacy and Spain and led in 1606 to the contest with Paul V in which Paolo Sarpi acted as the champion of the republic. Venice was strong enough to ignore the interdict imposed and to secure its removal by a compromise that involved no surrender of principle.

Nevertheless Venice had ceased to be a great power. The discovery of the Cape route to India robbed the city of its monopoly of the spice trade and thus struck a mortal blow at its commercial prosperity. Already in the 15th century its carrying trade had become less profitable through rivalry with the Turks. Now the trading system that it had built up declined in value because of the advantages of the sea route to western Europe enjoyed by the Portuguese. Meanwhile the city fought a losing battle for its dominion in the Levant. It shared in the triumphant victory over the Turks at Lepanto (1571), but in the peace that followed failed to recover Cyprus. When Candia fell to the Turks in 1669, all Crete save three ports was lost after a 20-year struggle; and by the peace of Passarowitz (1718), only the Ionian Islands remained to Venice of a once great Levantine empire beyond the Adriatic.

Italy as a whole declined in prosperity through the shifting of trade paths consequent on the discovery of the new world. The Florentine cloth trade had long passed its zenith, and the preeminence of Florence in banking passed to new centres of exchange such as Antwerp. In Genoa the noble families who had laid the foundations of Genoese maritime and colonial power were rich enough to build fine palaces, but their overseas empire was dwindling and the sale of Corsica to France in 1768 marked its end. Of the Spanish territories the duchy of Milan in particular suffered from the presence of large military forces, taxation was everywhere excessive and government officials were corrupt. An occasional rising took place, as for instance that of Masaniello in Naples (1647) and the rebellion of Messina (1674–78), which was first aided and then deserted by a French fleet. For the most part the people acquiesced apathetically in a regime which, while it cared little for their welfare, based itself on the principle of noninterference.

It was during the years of Spanish domination that the dukes of Savoy turned to building up their position as a power in Italy rather than north of the Alps. Charles III of Savoy had supported the emperor Charles V in his struggle with France until, in 1536, Francis I occupied his dominions. Thus Emmanuel Philibert, when he succeeded his father in 1553, was a duke without a duchy. He distinguished himself in the service of Philip II of Spain, notably at the battle of St. Quentin (1557), and the treaty of Cateau-Cambrésis restored him to his possessions. When he

had recovered Turin, which with certain other Piedmontese fortresses remained in French hands for a few years after his restoration, he transferred his capital to Turin from Chambéry. From that time Italian Piedmont took the place of French Savoy as the centre of interest for its dukes. In 1601 Charles Emmanuel I acquired Saluzzo, but had to cede Bresse, Bugey, Gex and Valromey to Henry IV of France. On the outbreak of the War of the Mantuan Succession in 1628 he hoped to secure the duchy of Montferrat. French aid, however, set up the Nevers branch of the house of Gonzaga in both Mantua and Montferrat, although the peace of Cherasco (1631), nine months after Charles Emmanuel's death, assigned territories in the latter duchy to Savoy.

The death of the last Habsburg king of Spain, Charles II, in 1700 provoked the War of the Spanish Succession, in which the conflict between Austrian Habsburg and French Bourbon claimants necessarily involved Italy. Savoy held the key to the passes of the Alps between France and Lombardy, and Victor Amadeus II, with a good army and a united people, was courted by both sides. He was encouraged in resistance to France by his second cousin, Prince Eugene, the leading general in the Austrian army, who in 1706 relieved Turin and drove the French from Italy. The part played by Savoy in the war won for its duke a voice in the peace negotiations and a share in the spoils.

Austrian Ascendancy in the 18th Century.—The terms of the peace of Utrecht (1713) recognized the duc d'Anjou as Philip V of Spain but assigned Milan, Naples and Sardinia together with Mantua (from which the last Gonzaga duke had been ejected during the war) to his rival the archduke Charles. Thus Austria replaced Spain as the dominant power in Italy. Victor Amadeus, who aimed at securing Milan, received instead only Montferrat and the island of Sicily, with the title of king. Italy was sacrificed to the balance of power in Europe and its territories were assigned to new rulers without regard to their history or traditions. The division of Sicily and Naples and their separation from Spain provoked great discontent, and this was exploited by Isabella Farnese, the Parmesan wife of Philip V of Spain, in the interests of her own family. She was aided by the king's minister Giulio Alberoni, like herself a native of Parma, who engineered abortive invasions of Sardinia and Sicily (1717–18). Thereupon Austria took possession of the latter island, forcing Savoy to accept Sardinia in exchange (1720). From that time until they became kings of Italy, the dukes of Savoy bore the title of king of Sardinia.

On the outbreak of fresh fighting between Habsburg and Bourbon in the War of the Polish Succession, Charles (eventually Charles III of Spain), the eldest son of Philip V's marriage with Isabella Farnese, led an expedition to Italy and won the crown of Naples and Sicily in 1734. He failed however to gain the succession to Parma, where he had been proclaimed duke on the extinction of the Farnese line, or to Tuscany, where Medici rule ended with the death of the grand duke Gian Gastone in 1737. Instead, Tuscany went to Francis Stephen of Lorraine (the future Holy Roman emperor Francis I) in compensation for the loss of his original duchy; and Parma was added to the Lombard dominions of Austria.

Yet another European conflict, the War of the Austrian Succession, had its repercussions in Italy. When the emperor Charles VI died in 1740, the Bourbon kings of France, Spain and Naples joined in the attempt to despoil his daughter Maria Theresa of her heritage. The failure of their efforts and the re-establishment of Austrian power in Italy was largely the result of the rivalry between Charles Emmanuel III of Savoy and Charles of Naples. During the War of the Polish Succession these two had fought together against Austria, and Charles Emmanuel had occupied Milan for three years. Isabella Farnese, however, was anxious to secure Milan for one of her sons, and Charles Emmanuel, seeing that the prize he coveted would not be won in alliance with the Bourbon powers, now went over to the Habsburg side. Under the treaty of Aix-la-Chapelle (1748) he failed to obtain either Milan or Genoa but received territories in Lombardy, which brought the eastern frontiers of his kingdom to the Ticino. The principal gain for the Bourbons was the establishment of Isabella's second son, Philip, as duke of Parma, Piacenza and Guastalla.

Italy settled down to a period of peace under an Austrian family system presided over by Maria Theresa and her husband, the emperor Francis I. On her death in 1780 her eldest son, the emperor Joseph II, ruled in Lombardy; her second son, Leopold, was grand duke of Tuscany; her daughters Maria Carolina and Maria Amalia were married to the Bourbon cousins Ferdinand of Naples and Sicily and Ferdinand of Parma; a third son, Ferdinand, ruled in Modena as husband of the heiress, Maria Beatrice d'Este. Genoa retained independence under French protection. Venice had entered upon the last stage of political decay and was famous chiefly for its theatre, pageants and gay luxurious life. The republic of Lucca was in the hands of a close oligarchy. In the Apennines the little republic of San Marino preserved the constitutional forms of a medieval city-state.

The Enlightenment in Italy.—The years 1748–92 were marked by reforming movements on the part of the principal rulers of Italy. Among the evils which cried out for remedy were the prevalence of crimes of violence, the appalling poverty of all but a fraction of the population, the excessive wealth and numbers of the clergy and, more especially in the south, the abuses arising from seigniorial privilege. In Lombardy a fixed tax on land known as the *censimento*, together with the abolition of privileges, did much to distribute the financial burden more evenly and to develop agriculture through its encouragement of the small proprietor. Under the terms of a concordat extorted from the papacy, many ecclesiastical possessions were subjected to taxation, about 100 monasteries were suppressed and their property diverted to charitable and educational purposes. Cesare Beccaria's pamphlet *Dei delitti e delle pene* (1764) inspired judicial reforms by which torture was abolished and the criminal law made more humane.

In Tuscany, where the despotism retained something of the paternal and popular character given to it by the Medici, the grand duke Leopold I (later Holy Roman emperor as Leopold II) earned for himself a place among the leading *illuminés* of the age. Free trade, equality of taxation, prison reform, reduction of the armed forces and limitation of the power and wealth of the church were among the many salutary changes introduced by him and his ministers. The Spanish Bourbon Charles of Naples and his great minister Bernardo Tanucci, who remained in power after Charles had transferred Naples to his son Ferdinand IV (1759), did their best to improve the peasants' lot by abolishing a number of personal services, admitting the right of appeal from seigniorial to royal courts and allowing peasants to sell their produce in the open market.

They also made it their policy to assert the rights of the crown against the church in matters of justice, finance and clerical appointments. The expulsion of the Jesuits from the Neapolitan kingdom (1767) and the discontinuation of the yearly tribute of a white palfrey in recognition of papal suzerainty were among the signs of that emancipation of secular rulers from papal control which distinguished the period. By 1773 opposition to the Jesuits and their political influence had grown so strong that Pope Clement XIV dissolved the society. The Savoyard kings, Charles Emmanuel III and Victor Amadeus III who succeeded him in 1773, pursued a similar policy, striving to improve social conditions in semibarbarous Sardinia and to increase the authority of the crown at the expense of both church and feudatories.

Everywhere, however, reforms were made in the interests of the despot, imposed on the people without consultation and, for the most part, carried out by alien rulers. Even members of the house of Savoy were foreigners in Sardinia, and although they enjoyed in full measure the loyalty and support of the people of Piedmont, their rule there was rigidly authoritarian. Nevertheless the greater prosperity and awakened interest in the problems of government which followed on the reforming movement encouraged Italians to think and act for themselves. Vittorio Alfieri's tragedies which denounced tyranny and exalted liberty; the popularity among the growing middle classes of the Masonic lodges as a means of association; and the works of historians, economists, philosophers and scientists, who found in periodicals such as the Milanese *Il Caffé* a platform for the discussion of their ideas: all these were among

the signs of new activity in Italy on the eve of the French Revolution. (C. M. Av.; X.)

D. Revolution, Restoration and Risorgimento

The French Revolutionary Period.—In March 1796 Napoleon Bonaparte was appointed by the Directory in France to command the army of Italy (*see* France: *History;* French Revolutionary Wars). He began the invasion of the peninsula almost at once. Most of the Italian states formed part of the anti-French system, but none was able to offer an effective resistance. The Sardinian monarchy had already been weakened severely by the loss of Savoy and Nice in the French campaign of 1792 (Victor Amadeus III having joined the coalition against France) and by internal revolutionary movements. An Austrian system existed, based on Austrian Lombardy and dependent on marriage and family alliances, but Tuscany, potentially its most useful component, was determinedly neutral. The kingdom of Naples, another important unit in the Habsburg connection, was crippled by an anti-Jacobin reaction, and a feudal social structure impoverished the peasant masses and stood in the way of all centralization. Parma and Piacenza and Modena, also within the Austrian orbit, were themselves occupied in undoing the effects of previous reform. The republics of Venice and Genoa, decaying under a narrowly oligarchical rule, preserved their stability with difficulty; Austrian designs on the Venetian hinterland were evident, while the Genoese had proved their own inability to govern both in Corsica and Liguria. The smaller republics, Lucca and San Marino, stagnated in an obscure municipal isolation. The papal statés had an administration perhaps even less adequate.

Bonaparte's campaign opened brilliantly with the defeat of the Piedmontese forces and the consequent defection of Sardinia from the Austrian alliance (armistice of Cherasco, April 28, 1796). The French army then crossed the Po, overran Parma and Modena, and on May 15 entered Milan, the capital of Austrian Lombardy. The remnants of the Austrian army were blockaded in Mantua. By June Ferdinand IV of Naples asked for, and obtained, an armistice. A part of the French army then invaded the papal territories of Bologna and Ferrara (the Legations) and forced Pius VI to seek terms. In Feb. 1797 the peace of Tolentino was signed by French and papal representatives. Meanwhile, Bonaparte defeated the Austrian counterattack in a campaign that carried him to within 50 mi. of Vienna by the end of March. The negotiation of the preliminaries of Leoben closed the fighting.

At the beginning of the invasion there already existed in Italy some revolutionary groups. These were enthusiastically pro-French. There had already been risings led by these groups against the authorities of Piedmont, Naples and the Legations. At this time the bulk of the population greeted the French invasion with indifference and rarely with hostility. But the character of the occupation, the systematic plundering and exaction that were necessary both to supply an army living on the country and to maintain a flow of money to the Directory, soon changed the indifference of the Italians into a sullen discontent. There were violent outbreaks against the French at Pavia, Genoa and Verona during 1796 and 1797 and others of less importance elsewhere. At the same time the hopes of the Italian Jacobins were dashed by the Directory's distrust of nationalist elements (which might favour the growth of a strong Italian state) and by the opportunism of Bonaparte's own policy.

The prestige and power which Bonaparte commanded at this time were such that he was able to reorder the peninsula almost at will. His conception of Italian policy was wholly different from that of the directors, who silently acquiesced in his actions so long as the stream of money continued to flow from Milan to Paris. The central feature of Bonaparte's conception was the establishment of a strong North Italian state.

In Oct. 1796 Reggio nell' Emilia, Modena and Bologna were associated to form the first of the revolutionary states founded in Italy, the Cispadane republic. Its constitution was based on revolutionary principles. In July 1797 the Cisalpine republic came into existence at Milan (it bore for a short time the name of the Transpadane republic). Within a month the Cispadane was merged in the Cisalpine, and the latter was soon enlarged by the addition of territory from the Venetian hinterland and from the Swiss cantons of the Valtellina. Like the Batavian republic, the Cisalpine had a constitution modeled on that of France. It possessed a nominally complete independence, maintaining its own embassy at Paris, but the presence of French forces, the continuous strain of a monthly subsidy to the French republic and the suspicion with which it was regarded by the rest of Europe prevented it from ever playing an effectively independent role.

Bonaparte's reorganization of northern Italy was completed by the remodeling of Genoa, henceforth called the Ligurian republic, and by the conclusion with Austria of the treaty of Campo Formio (Oct. 17–18, 1797). The preliminaries had agreed that the Venetian republic should bear the strain of the territorial compensations to be given to Austria for its losses in Lombardy. In the treaty of Campo Formio these compensations were extended to include the city of Venice itself, and the republic of St. Mark passed out of existence.

As had been their practice in Genoa and Venice, the French openly encouraged the democrats of the remaining independent Italian states to provoke the incidents which provided the formal excuse for invasion. It was in this way that Charles Emmanuel IV was forced to relinquish his Piedmontese possessions in Dec. 1798. He made vain attempts to control a revolutionary situation inflamed by "patriotic" insurgent expeditions from the supposedly friendly Cisalpine republic, but inevitably failed. He retired to Sardinia, leaving Piedmont to be annexed to France.

Joseph Bonaparte, French ambassador in Rome, similarly encouraged the Roman Jacobin minority in spite of the peaceful protestations of his government toward the papal states. The disturbances which arose soon furnished the excuse for invasion. In Dec. 1797 the French general Léonard Duphot was killed by papal security forces in a riot provoked by the Jacobin clique. In spite of the offer of redress and apology at once made by the papacy, Joseph Bonaparte withdrew to Florence, protesting that his safety was endangered, and Louis Alexandre Berthier (who had succeeded Bonaparte in command of the army of Italy) occupied Rome, deposed the papal government and installed a puppet administration under the name of the Roman republic (Feb. 15, 1798). The unpopularity of this government increased daily as its inability to stop French plundering became manifest. Pius VI was exiled, ultimately to France, where he died in 1799.

The kingdom of Naples brought about its own occupation by the decision of Ferdinand IV to re-enter the war against France. He was encouraged by the presence of a powerful British squadron under Horatio Nelson in the Mediterranean and by its great victory in the battle of the Nile on Aug. 1, 1798. At the same time it appeared that shortage of supplies, the absence of Bonaparte in Egypt and the activities of the Directory's political agents had greatly reduced the army of Italy's fighting capacity. Ferdinand's own designs on former papal territory were the deciding factor; and in November the Neapolitan army, newly rebuilt by Sir John Francis Edward Acton and led by the imperial general Karl von Mack, occupied Rome. At the same time a sea-borne expedition landed at Leghorn. The French had abandoned Rome, but after J. E. Championnet had shaken off the control of the political agents, he defeated Mack at Civita Castellana. The re-establishment of the Roman republic and the general retreat of the Neapolitan army followed. Championnet pursued closely, hampered by a guerrilla war which began to flare up on the flanks of his advance.

The evacuation of the Bourbon court to Palermo (Dec. 21, 1798) and the surrender of Mack gave the signal for a revolutionary outbreak at Naples against the pro-French democrats who wished to hand the city over to Championnet. Three days of the most bitter street fighting were necessary before the French restored order. On Jan. 23, 1799, the Parthenopean republic was proclaimed. The hatred of the populace of Naples and of the Calabrian peasantry for the supposedly atheist French and their Neapolitan allies almost completely stultified the reforms of the new administration. The inexperience of the democrats proved disastrous after the replacement of Championnet by J. E. J. A. Macdonald and the removal of the only restraint on the exploita-

tion of the new state. With the coasts surveyed by British warships it was inevitable that the countryside should slip almost at once out of control of the government at Naples.

The revolutionizing of the republic of Lucca at the same time as the creation of the Parthenopean republic was the last extension of French power in Italy before the onslaught of the second coalition.

The reconquest of Italy by the Austro-Russian army was accomplished even more quickly than the French campaign of 1796. The Russian field marshal A. V. Suvorov inflicted a severe defeat on the French army at Cassano (April 28), and J. V. Moreau ordered Macdonald's army to move north to prevent the division of the French into two isolated groups. After another defeat, the French under B. C. Joubert, who had assumed command, retired on Genoa, and only André Masséna, in Switzerland, was left as a protection to the southern frontier of France. The occupation of Lombardy by the Austrians necessarily resulted in the collapse of the Cisalpine republic, and the Roman and the Parthenopean survived scarcely longer. In the south, above all at Naples itself, a period of the most cruel reaction began.

Russia soon recognized the determination of the Austrians to exploit to the full the situation created by the successes of Suvorov. The defection of Russia from the coalition followed. Neither the Austrians nor any of the restored authorities paid any attention to Italian national aspirations, which were, for a brief period after the French collapse, at their strongest. It was the second disillusionment in five years for patriots of all parties.

The French Consulate and Italy.—On Oct. 9, 1799, Bonaparte returned to France from Egypt. A month later, by the *coup d'état* of Brumaire, he became first consul.

The reconquest of Italy did not begin until Bonaparte was completely sure of his security in France. In May 1800 he led a new army across the St. Bernard and marched straight on Milan. The city was re-entered (June 2), and the Cisalpine republic restored. On June 14 Bonaparte defeated the main Austrian army at Marengo, near Alessandria. During the truce that followed, Italy was once more at the disposal of the French army.

Better discipline and greater consideration for local opinion were shown by the army of the second French occupation. At the same time Bonaparte preserved a moderate limit to his diplomatic demands. Pius VII was allowed to continue in possession of the papal states. Tuscany, Piedmont and Liguria were put under provisional governments. When the final peace settlement was made (treaty of Lunéville, Feb. 8, 1801), the Cisalpine and Ligurian republics retained their independent existence and the settlement of Campo Formio was in general restored. The treaties of Aranjuez with Spain (March 21) and of Florence with Naples (March 28) completed the pacification of Italy. By the former, Louis, son of Ferdinand, duke of Parma, was enthroned in Tuscany as king of Etruria; and by the second, Ferdinand IV of Naples agreed to the closing of all Neapolitan ports to British shipping and to the admission of some French garrisons. Lastly, in Sept. 1802, Piedmont was incorporated into the French republic and given representation in the legislature.

This phase of territorial reorganization was completed by the consolidation of Bonaparte's control of the Cisalpine republic. A *consulta* was held at Lyons, at which Talleyrand and his assistants engineered the passing by the nominally independent Cisalpine delegates of various changes in the constitution and the election of Bonaparte as president. The state was now called the Italian republic and was ruled autocratically by Bonaparte through a local administration presided over by the Lombard patriot and moderate, Francesco Melzi d'Eril.

The Napoleonic Empire.—On May 18, 1804, the first French empire was proclaimed. Numerous Lombards hoped that the offer of the crown of Italy might persuade Napoleon to accord a more genuine degree of independence to the Italian republic; and his acceptance of the offer was followed by his coronation at Milan (May 26, 1805) with the old iron crown of the Lombard kings, the traditional formula *Dio me l'ha data, guai a chi la tocca* ("God has given it to me, woe to him who lays hands on it") being invoked. In the reorganization which followed this ceremony, Eugène de Beauharnais was appointed viceroy and Melzi d'Eril retired to take a less active part in the affairs of the North Italian state. The subordination of the interests of the new kingdom of Italy to those of France remained as marked as ever.

New territorial changes followed. Lucca was granted to Elisa Bonaparte as a principality, while Parma was annexed to the empire. In June 1805 the government of Genoa was forced to ask for incorporation in the empire, and the Ligurian republic came to an end. This disregard of the provisions of Lunéville, which had been intended to guarantee the independence of the new states, led to the formation of the third coalition, Great Britain, Austria and Russia, later joined by Naples. After a fresh series of defeats the Austrians quickly agreed to the treaty of Pressburg (Dec. 26, 1805), which imposed the recognition of the Napoleonic settlement in Italy, the surrender of Austrian Venetia to the kingdom of Italy and submission to the French occupation of Istria and Dalmatia.

On Feb. 15, 1806, Joseph Bonaparte entered Naples. The Bourbon court once more fled to Palermo under Anglo-Russian protection. A British landing and the prolonged resistance of Gaeta did something to inflame the peasant rebellion which almost immediately broke out against the French; but Calabria was brutally pacified by a policy of savage reprisal. Joseph was proclaimed king of Naples (March 30), and under his rule the beginnings of a long-needed campaign of reform did much to alter the feudal structure of society and the chaos of feudal law. Judicial and criminal procedure were reformed in accordance with the Code Napoléon. These reforms were continued by Joachim Murat, who succeeded Joseph as king in 1808. Their effects were important but limited by the economic imprisonment of the kingdom within the continental system and by the failure of the government to achieve any important redistribution of land.

The restrictions of the continental system were a subsidiary cause both of the occupation of Tuscany by Elisa in 1808 and of the deterioration of the empire's relations with the papacy. Napoleon had shown care to enlist the authority and advocacy of the church in his support whenever possible, and to this end the concordat of 1801 had been directed. In spite of this, a refusal to grant papal sanction for the divorce of Jérôme Bonaparte and the need to perfect the continental blockade led to the occupation of Rome (Feb. 2, 1808) and the overthrow of the papal government. In April 1808 the papal Marches were annexed to the kingdom of Italy; and after the occupation of Vienna in May 1809 Napoleon proclaimed from that capital the end of the temporal power. Pius VII, having prepared a bull of excommunication against those concerned in this transaction, was immediately arrested and exiled (July 5). Rome was annexed to the empire and declared its second city. Reforms were initiated and the Code Napoléon introduced—to the great resentment of a population strongly influenced by a numerous and newly dispossessed clergy.

There was at that time no part of the Italian mainland not dominated by Napoleon. Only Sardinia and Sicily remained under governments which had existed before the French invasions. The effects of this subjection on the economic life of the peninsula were disastrous, save in those areas where the blockade could be flouted with impunity. Those provinces annexed to France were the most rigorously controlled, but the kingdom of Italy was equally mercilessly exploited in French interests. Besides the local burden of the support of a large French garrison, the contingents for the Italian forces were a strain on the manpower resources of the peninsula. The drain of bullion was almost complete, and the liquidation of landed wealth did not go fast or far enough to offset this acute shortage. The commerce of the ports, so dependent on British Mediterranean trade, was ruined by the blockade. The natural markets of North Italian industry, Germany and Piedmont, were arbitrarily closed by the workings of the imperial customs system. The restraints thus imposed on industry and the lack of a strong *bourgeoisie* able to play an important national role were not unconnected.

By introducing the French commercial and banking codes, Napoleon contributed something valuable to Italian commerce. At the same time the improvement in communication brought about by the program of public works of the Napoleonic administrations

was to help later development. The most important Napoleonic contribution to the historical development of Italy, however, was probably not material but ideological. A diffused experience of a common system of administration, the beginnings of a system of public education, common obligations of military service for natives of all regions and the existence of a common legal code counted for much in the formation of the patriots of the early years of the nationalist Risorgimento movement for political unity. The unpopularity of the French itself strengthened the independence of those who, like Ugo Foscolo, having been disappointed in their early hopes of the French, had been driven to rely more on purely Italian resources. Ultimately the failure of the French seems the result rather of an inability to press reform far enough than of overzealous innovation. Above all, little or nothing was done to associate the masses with the new regime by reforming the distribution of landed property. Almost all the Italian Jacobin manifestos of 1796 had asked for this, but only the slightest beginnings were made by the Napoleonic reforms.

After the battle of Leipzig (Oct. 1813), the Austrian invasion of Italy began. In the face of superior enemy, Murat deserted Eugène de Beauharnais, who had refused his suggestion that they should seek a separate peace. At the same time, patriotic groups hampered Eugène's defense, hoping that Italian independence would follow a French collapse. The armistice of Schiarino Rizzino (April 23, 1814) recognized the kingdom of Italy, but too late to prevent the patriots associated with Federico Confalonieri from gaining control of Milan. Eugène retired to Bavaria, knowing a restoration of himself to be impossible, and the Austrians at once occupied Lombardy. There was no chance that they would surrender power to the once more disillusioned patriots. Murat's belated attempt during the Hundred Days to re-establish a Napoleonic state in the peninsula and his subsequent execution removed the last obstacles to the process of restoration. (*See* further NAPOLEONIC WARS.)

The Restoration.—The restoration in Italy could not be a complete return to the order of 1795. Austria retained possession of Venetia, and prudence dictated to the statesmen of the congress of Vienna that continued Austrian predominance in Italy should guarantee the peninsula against French influence. The combined territories of Venetia and Lombardy were to be ruled as a single province, by a not unduly harsh or unjust administration. But the remoteness of the imperial government at Vienna and an increasingly illiberal regime soon aroused discontent in the Austrian province. The Austrian archduchess Marie Louise, former empress of France, who was granted Parma, Piacenza and Guastalla for her lifetime, preserved some of the Napoleonic administrative and legal structure in the duchy. In Modena a complete reaction began under the rule of Francis IV, son of the previous duke, Maria Theresa's son Ferdinand. But Tuscany under Ferdinand III, the emperor Leopold II's son, was an oasis for Italian liberals during the years of persecution. But as Austrian princes, the rulers of Tuscany were always susceptible to pressure from Metternich on any major issue. Liberal hatred of Austria all over the peninsula sprang from the knowledge that Austrian intervention was the ultimate guarantee against constitutional reform anywhere in Italy.

Among the non-Austrian rulers restored in 1815, the king of Sardinia received some increase of territory by the addition of Liguria to Piedmont. Within Piedmont, the reaction against French innovations was violent but tempered by a jealousy of Austrian domination of northern Italy, which made some identification of the cause of Sardinia with that of Italy appear inevitable. In the papal states the reaction was catastrophic, the attempted reforms of Ercole Cardinal Consalvi collapsing under the incompetence of the central administration and the revived influence of the Jesuits. Almost from the first days of the restoration the provinces which had formerly belonged to the kingdom of Italy were in a state of revolutionary unrest. Ferdinand IV of Naples, who now took the title Ferdinand I of the Two Sicilies, was hampered in his efforts to restore the *ancien régime* by the intransigence of the island of Sicily (which had enjoyed some degree of liberty under a constitution imposed upon Ferdinand by the British forces of occupation) and by his dependence on many of the administrators and officers of the Murat epoch. Of the smaller states, Lucca passed to the Spanish infanta Maria Luisa (widow of Louis, king of Etruria, whose son Charles represented the Bourbons of Parma, temporarily excluded by the grant of Parma to the Austrian Marie Louise) and suffered some degree of clerical reaction. San Marino survived the process of restoration almost unchanged.

The Early Revolutionary Movements.—Some middle-class and patriotic groups soon began to regret the passing of the Napoleonic administration and its opportunities. Discontent first became vocal in the Italian secret societies. The period of the ascendancy of the Freemasons ended with their quasi-official patronage by the French, but a group of societies known as the Carbonari (*q.v.*) had replaced them. These societies had originally come into existence at Naples as an anti-Bourbon force under the French administration; after turning to opposition under the restoration they had acquired an almost regularized existence as the focus of discontent in the south. Always largely middle class, they soon lost all contact with the masses, who remained loyalist and clerical in their sympathies.

In 1814 and 1815 the Carbonari spread to the Romagna. A similar organization in Piedmont, the Federati, derived its inspiration directly from France and was patriotic and anti-Austrian in purpose. The revolutionary plots of 1820 and 1821 were the work of these and similar societies and seldom looked beyond the confines of single states.

A revolution at Naples in 1820 forced Ferdinand to grant a constitution (July 7), which was based on the democratic Spanish charter of 1812 (*see* SPAIN: *History*). A ministry of former Napoleonic officers and administrators was set up but had to face almost immediately a second insurrection at Palermo. This was wholly separatist in aim, a movement of all classes that cut across the constitutional revolution of the mainland. A local quarrel between Palermo and Messina further complicated the situation. No Sicilian deputies were present at the parliament which opened at Naples on Oct. 1. Then the congress of Troppau, followed by that of Laibach, made clear the determination of the Holy alliance (*q.v.*) to preserve the Vienna settlement in Italy. Ferdinand, in spite of his constitutional oaths, applied to the Holy alliance for help. An Austrian army overthrew the revolutionary government in March 1821 and reconquered Sicily for the crown soon after. It remained in occupation until 1827 and enforced a violent reaction under the king and his police chief, Antonio Capece Minutolo, principe di Canosa.

A similar movement, but localized to a greater degree in the officer corps and more specifically anti-Austrian, broke out in Piedmont. Charles Albert (*q.v.*), the heir presumptive to King Charles Felix of Sardinia, was cognizant of the plot and assumed the role of regent for a few days when the *pronunciamiento* took place in March 1821. His grant of a constitution was at once revoked by Charles Felix; he was arrested, and after a few weeks an Austrian army recaptured Turin for the king. The chief result of the plot was the disgrace of Charles Albert and a temporary weakening of the normally anti-Austrian trend in Piedmontese policy. Both the Neapolitan and the Piedmontese movements suffered from being the plots of small groups rather than true revolutionary movements; the same was true of the Lombard liberals, who suffered imprisonment after a series of trials (1821–23) and were almost all drawn from the ranks of the educated and noble classes. The investigation of the Piedmontese plot led to their discovery, and their contribution to the Risorgimento could consist only in the example of their courage and the legend of their martyrdom. The work of one, Silvio Pellico, was a notable contribution to the literature of the national movement.

Central Italy, especially the Legations, also suffered from disturbances. After the July revolution in Paris (1830) and the spread of the illusion that France would not permit Austrian intervention, the movement took a serious aspect in the papal Marches. The revolutionaries believed they had the support of Francis IV of Modena, who had toyed with the idea of a central Italian kingdom, and risings took place at Parma and Bologna, while that at Modena itself was forestalled by the arrest of the chief conspirators. But with Tuscany and Lombardy quiet and their hopes of

help from France disappointed, the revolutionary governments which were set up proved helpless.

The revolutionaries' own internal divisions left them to face the Austrian invasion singly. Louis Philippe, the new king of the French, ordered the occupation of Ancona by a French force as a counter to the extension of Austrian power which the new restorations brought with them, and this completed the disillusion of those who had looked to him for help (Feb. 1832). A five-power memorandum had been addressed to the papal government recommending internal reforms before the final occupations of Bologna and Ancona but was virtually ignored by the papal administration.

The failure of Carbonarism was one of the stimuli prompting Giuseppe Mazzini (*q.v.*) to seek a new outlet for Italian discontent. On the succession of Charles Albert to the throne of Sardinia (1831), Mazzini addressed to him an appeal to lead a nationalist movement. Alarmed by a recent incursion of Italian patriots into Savoy from France, the king did nothing, apparently as Mazzini had hoped. Mazzini therefore proposed to rely solely upon a national insurrectionary movement, aiming at unity in a free republic. He envisaged the creation of the new Italy in terms as much moral as political and looked to patriotism and example rather than to diplomacy and tactics as his methods. In 1831 he founded the revolutionary organization Giovine Italia, whose influence spread rapidly among Italian exiles and inside the peninsula. But though it was more broadly based and national in outlook than the Carbonari, its recruitment still drew on a relatively small class of young bourgeois and middle-class radicals and made no effective appeal to the masses. In addition, Mazzini's distrust of Piedmont and his rejection of foreign intervention stood in the way of any final success. But from 1833 to 1845 repeated raids and insurrections organized by Giovine Italia kept alive the unionist cause and the tradition of revolt. Only with the failure of the expedition of the Bandiera brothers to Calabria in 1844 was the bankruptcy of this method in the face of popular apathy at last fully realized.

Federalism and Reform in the 1840s.—In reaction against the waste of life and ill-success of Mazzini's program, moderate opinion tended to crystallize about federal conceptions of the solution of the Italian problem. In 1843 Vincenzo Gioberti published his *Del primato morale e civile degli italiani*, advocating a federal union of the existing states which would look to the papacy for leadership. A Piedmontese group, including Cesare Balbo and Massimo d'Azeglio, advocated a similar federation, but claimed its leadership rather for Piedmont as necessarily the main defender of the peninsula. Charles Albert's attitude toward Austria had stiffened in the years before 1846, and an unavowed toleration was given to the Turin moderates who emphasized the anti-Austrian rather than the constitutional aspects of the Italian problem.

The election of Pope Pius IX (June 16, 1846) in succession to the staunchly conservative Gregory XVI was the beginning of the crisis of the early Risorgimento. Pius was a man of liberal and patriotic views, influenced by Gioberti's conception of the role of the papacy and not clear, at the beginning of his reign, how far these views were incompatible with the European status of the papacy and the existence of the temporal power. His influence over the other Italian sovereigns and over the country clergy and nobility, none of whom would have been likely to adhere to the national movement without his example, was immense in 1846 and 1847.

Pius at once instituted a number of overdue reforms. An amnesty was granted, plans for railway development were drawn up, Rome received a municipal government, the laity were admitted to the civil administration, a council of state was set up, a new press law granted some degree of freedom of publication and a civil guard was formed. The democratic party, encouraged by these concessions, became more uncontrollable and Pius more disquieted as this process gathered momentum.

Alarmed by the reforms, Metternich permitted Josef Radetzky, the Austrian commander, to occupy the papal town of Ferrara on July 17, 1847, as a precautionary move and Parma and Modena later in the year. At the same time he approached France with a view to joint Austro-French intervention to stifle the reform movement. These measures identified Pius more firmly than ever with the growing national and liberal cause. Negotiations began for a customs union of Tuscany, Piedmont and the papal states, but were fatally hampered by the disparity between the essentially negative papal conception of such a union and the Piedmontese conception of it as a positive anti-Austrian force. More important was the response in the other states to Pius' example of internal reform. Lord Minto's ambiguous advisory mission from the British cabinet contributed to the same end. Leopold II of Tuscany granted a press law (May 6, 1847) which was immediately followed by a burst of reformist propaganda. Lucca was granted a civil guard on Sept. 1, Tuscany two days later. The growing violence of the democrats, above all at Leghorn, was already making settled government difficult in Tuscany.

Charles Albert had hoped to avoid constitutional reform but was constrained by moderate opinion to accept a more liberal ministry and to concede a press law. The wave of reformist agitation that followed prompted further reform in police and administration. By the end of 1847, Piedmont was also affected by the spread of democratic faction, notably at Genoa, and Charles Albert, like Pius, was already feeling compromised by his association with reform.

The War of 1848–49.—The situation was suddenly and radically transformed by the Sicilian revolution of Jan. 12, 1848, the first revolution of the year of revolutions. As in 1821, the local separatist movement of the island was complicated by a constitutional revolution on the mainland that soon followed the Palermo revolt. The islanders demanded independence or the Spanish constitution of 1812; and to preserve his grip on the mainland Ferdinand II (V of Naples) granted a constitution which went far beyond any previous reforms in any of the Italian states. But Sicily proclaimed its independence of the Bourbon monarchy on April 13.

Encouraged and frightened by the events at Naples, other sovereigns granted constitutions. Tuscany received one on Feb. 11, and Pius granted one on March 14. The only constitution that was to survive the revolutionary war was that of Piedmont (March 4), which became the constitution of united Italy.

The European situation was a favourable one for the reform parties. The February revolution in Paris and the March revolution in Vienna made any active intervention unlikely. Lombardy had been disturbed by riots and outbreaks in the early months of 1848. Finally, when news of the Vienna revolution reached Milan, that city rebelled in its turn and after the famous "five days" of battle forced Radetzky to withdraw (March 18–23). Simultaneously, a revolt at Venice restored the ancient republic under the leadership of Daniele Manin (March 22). Charles Albert saw that the moment for effective action against the Austrian army had come, declared war (March 24) and led his army across the Ticino to Milan.

The Piedmontese army was weakened by detachments to the French frontier and did not succeed in catching Radetzky before he took refuge in the fortress area of the Quadrilateral (Verona, Peschiera, Legnago and Mantua). Charles Albert pursued him, broke into the Quadrilateral and soon forced the Austrian army to depend upon Venetia for its communications; he was not able, however, to shake its tenure of the fortresses. Tuscany and Naples had by now declared war, and a papal force under Giovanni Durando crossed the Po with the aim of operating on the Austrian communications in Venetia.

The decay of this still favourable situation began with a papal allocution of April 29 in which Pius, obsessed by the danger of an Austrian and German schism, disavowed any intention of declaring war on any Christian nation. The internal divisions of the Italian movement at once assumed a much enhanced importance. The Lombard rebels were already bitterly divided into pro-Piedmontese and anti-Piedmontese factions. Charles Albert's motives were also deeply distrusted by the Tuscan democrats. He himself would not entertain the notion of seeking French support, fearing the accession of strength that the Piedmontese republicans would draw from it. In addition, the North Italian peasantry was almost everywhere indifferent or hostile to the Piedmontese army.

Charles Albert's failure to take Verona was the military turning point of the campaign. An army under Laval Nugent evaded in-

terception and reinforced Radetzky on May 25. Ferdinand II of the Two Sicilies had by this time recalled the Neapolitan troops (which had been moving northward) in order to deal with the revolution at Naples, now wholly out of hand. The annexation of Parma, Piacenza and Modena to Piedmont by plebiscite in June gave Charles Albert no military help, and the annexations of Lombardy and Venice (July) increased suspicion of his real motives.

At the end of July Radetzky turned on Charles Albert and defeated him in a succession of battles around Custoza. To save the Piedmontese army Charles Albert abandoned Milan, amid the hostility of the city which was enraged by his "treachery." On Aug. 9 he withdrew from further fighting by concluding an armistice at Vigevano.

In all the states the extremist democrats now tended to assume power, though they were in fact incapable of controlling their followers. A revolt in Bologna failed to force Pius into a declaration of war, but drove out the Austrian garrison. In Rome the moderates were wholly discredited, and Pellegrino Rossi, an able liberal, tried in vain to preserve order. His ministry was ended by his assassination (Nov. 15). Pius fled in disguise to Gaeta on Nov. 24 and refused to return. A constituent assembly voted the end of the temporal power and proclaimed a republic (Feb. 9, 1849), and Pius appealed for armed intervention to secure his restoration.

Similar deteriorations took place in Tuscany and in Naples. Leopold and Ferdinand abandoned the attempt to control the extremists and went to Gaeta. The Tuscan republic was proclaimed on Feb. 8, 1849. A few days earlier, a Roman invitation to Piedmont to nominate delegates to a constituent assembly for all Italy was rejected summarily by Gioberti's government. This government was soon replaced by another, under Urbano Rattazzi, which hoped to reopen the war. To redeem past promises to the Lombard patriots and to avoid the necessity of accepting an Austrian peace the armistice was denounced at its expiry (March 12), and war began on March 20. On March 28 Charles Albert abdicated after the decisive defeat of Novara. His successor, Victor Emmanuel II, hastened to make peace. (*See* ITALIAN INDEPENDENCE, WARS OF.)

Italy was now at the disposal of the Austrian army. Lucca and Florence were occupied, and Leopold II returned to his capital under Austrian protection (July 28); Ferdinand of the Two Sicilies had crushed the Sicilian rising on his return. Already in April, unwilling to allow Austria to act alone in the restoration of the papacy, the government of Louis Napoleon had sent a French force under Nicolas Oudinot to Civitavecchia. The French suffered an initial defeat at the hands of Giuseppe Garibaldi (*q.v.*), and the Roman republic, under Mazzini, defended itself heroically for a month; but Oudinot broke into Rome on June 29. The assembly was dissolved a few days later, and the keys of the city sent to Gaeta. Garibaldi, with some of the garrison, set out for Venice and reached San Marino before his small force fell completely to pieces. Venice itself, deprived of Piedmontese naval support, capitulated in August. A peace treaty between Austria and Piedmont, imposing a heavy indemnity on Piedmont and restoring the territorial settlement of 1815, completed the pacification of 1849.

This pacification marked, in general terms, the end of the revolutionary phase of the Risorgimento and the beginning of the diplomatic phase. The revolutionaries failed because of their internal dissensions, because of the distrust of Piedmont by the smaller states, because of the Piedmontese distrust of France and because of the confusion over the role which the papacy should play in the making of Italy. Moreover the mass of the population was unmoved by the revolutionary appeal. Only at Venice, Milan and Rome did genuine popular movements of all classes have any effect. The military superiority of Radetzky both in the quality of his troops and in generalship was the final factor assuring the Austrian restoration of 1849. (J. M. Rs.)

Piedmont in 1850.—The defeat of Piedmont, together with the failure of Mazzini's republic at Rome and Manin's at Venice, led to a second restoration of the old despotic regimes and to the virtual occupation of central Italy by Austrian troops. The war had shown how little feeling there was among Italians for unification. Thereafter Piedmont alone among Italian states retained any initiative or independence, and this was largely offset by defeatism and by a cleavage between moderates and revolutionaries which failure in battle had exacerbated. There was serious dissatisfaction with the government. A revolt in Genoa necessitated the blockade and bombardment of the city by royal troops. It was resented that the armistice had been arbitrarily signed by the king without the participation of his ministers; and because of a hostile left-wing majority in the chamber, the king had to appeal against parliament to the people in a personal proclamation from Moncalieri. Only after new elections was the treaty of Milan ratified, early in 1850.

Neither the armistice nor the proclamation of Moncalieri had shown much regard for constitutional proprieties. Unlike other Italian states, Piedmont preserved intact its new constitution of 1848, but this *statuto* was a conservative document, the handiwork of men of the right like Cesare Balbo and Ottavio di Revel. There was always a danger that Victor Emmanuel II might follow the example of Ferdinand of Naples and repudiate his constitutional oath. His mother and his wife were both Austrians, and he must have appreciated that representative institutions as yet evoked little esteem in the country. Massimo d'Azeglio, who was prime minister from 1849 to 1852, though a sincere liberal, had been disillusioned by the events of recent years into thinking that perhaps the *statuto* had gone too far and that a long time would be needed before Italians were ready for freedom and national unity. Most people would have agreed with him.

Gradually, however, and almost unintentionally there developed the habit of ministerial responsibility to parliament. The presence of exiles from other provinces helped to identify Piedmont as the nucleus of a future Italy and to mollify the provincialism and illiberalism of Turin. Administrative unification helped to fuse the royal dominions of Savoy, Piedmont, Sardinia and Liguria, and deputies self-consciously learned to speak Italian instead of French or dialect so as to make themselves understood. A railroad was built to link Turin with Genoa; the Siccardi law was passed to curtail ecclesiastical jurisdiction; and battle was joined to limit the aristocratic monopoly in the senate, the army and the bureaucracy.

Cavour.—In 1850 the ministry was strengthened by the inclusion of Camillo Benso di Cavour (*q.v.*), a financial expert who had recently entered parliament. Cavour soon set about breaking the hold of the house of Rothschild upon Piedmontese finances and defied the experts by imposing heavy taxes and changing the country's economy to one of almost complete free trade. This helped to destroy the restrictions of economic paternalism and municipalism and also won the favour of Great Britain as a new market for local goods. Conquering his own initial unpopularity, Cavour showed himself to be by far the ablest man in the coalition. He skilfully made a tacit alliance with Urbano Rattazzi of the centre left to supplant D'Azeglio and then resigned, early in 1852. D'Azeglio's cabinet soon foundered on the king's refusal to permit the passage of further anticlerical legislation. Cavour was the obvious successor, as he was more amenable on this point, and his *connubio* (union) with the left gave him effective control of the chamber. In November he duly became prime minister. During the next nine years he was to preside over the formation of a new kingdom of Italy.

The *connubio* of right centre and left centre prevented the emergence of a two-party system in Italy; but it also prevented the king's attempting a *coup d'état* such as that of Louis Napoleon in France (*see* NAPOLEON III). Cavour yielded to the king by withdrawing the civil marriage bill in 1853, but the radicals were strong enough in his cabinet to force through an attack on mortmain lands and ecclesiastical salaries. In 1855 Luigi Nazaridi Calabiana, bishop of Casale, led a clerical counterattack against Cavour, and the king tried to veto a bill to dissolve some of the monasteries; but when Cavour resigned Victor Emmanuel was forced to recognize that he was not strong enough to flout parliamentary wishes too openly and sensibly gave way.

By this time Cavour was becoming chiefly interested in foreign policy. He continued to deplore the activity of those who wanted to unify Italy. His government condemned Mazzini to death and

expelled hundreds of the extreme radicals, hounding their journals out of existence, revising the jury system when necessary and introducing harsher press laws. Nevertheless, nationalism was no longer a mere literary aspiration among the intellectuals, and Cavour was gradually being converted to the view that many of the visionary ideals of Mazzini were neither so dangerous nor so utopian as he had thought. In preparation for the future he made a deliberate attempt to show other European states that Piedmont not only could govern itself wisely and liberally but also was a force to reckon with abroad and could speak for Italians elsewhere in the peninsula. The army was reorganized by Gen. Alfonso Ferrero La Marmora. Austria was publicly reproached for its harsh rule in Lombardy and for its confiscation of the property of those Lombards who had fled into exile at Turin.

Cavour realistically perceived that Charles Albert and Mazzini had both been in error to think that foreign alliances were superfluous. French support was indispensable if Austria was to be withstood. It was thus the more disastrous when in 1854–55 the outbreak of the Crimean War temporarily healed the rivalry of France and Austria, and Piedmont's old game of playing one off against the other no longer worked. So as not to be completely isolated, Cavour subsequently joined in the war. He was forced into this step by the king, who was eager to retrieve the reputation of his army and had arranged if necessary to supplant a recalcitrant Cavour with a more warlike cabinet of the right. Cavour forestalled this by accepting the war, overruling the almost unanimous opposition of the other ministers and courageously committing his country without any guarantees or conditions to a war where no direct national interest was involved. So doing, he kept power at home and hung onto French sympathy until better times should allow him to exploit it. As a reward, Piedmont was later given a seat at the peace conference in Paris (1856), where a few hours were given to general discussions on the unfortunate state of Italy. This was not much, but it was more than Cavour had at one time expected. The Italian question was at last open. Austria was isolated again, and its occupation of central Italy was becoming recognized as a breach of the Vienna settlement.

At once Cavour began to prepare for a third war of independence against Austria. Railways were built with military strategy in mind; a naval base was constructed at La Spezia; fortifications were erected at Alessandria—by royal decree, in order to avoid a parliamentary debate. By these means a moral ascendancy was captured over the rival republican program of Mazzini. The two programs, opposite though they seemed, each stimulated the other and both proved to be necessary ingredients of the process of unification. But the failures of Francesco Bentivenga in Sicily (1856) and of Carlo Pisacane in Naples (1857) showed that the time for isolated republican conspiracies was over and that the need was rather for diplomatic action backed by a regular army and the organization of a state.

Another sign of the times was that, instead of dreading Piedmontese expansion, other Italians were beginning to welcome it. The Venetian Daniele Manin, the Tuscan Bettino Ricasoli, the Sicilian Giuseppe La Farina and Luigi Carlo Farini from the papal states were all turning to collaborate with Turin. The exiled Manin, founder of the National society, promised in a famous challenge to renounce his republicanism if only the house of Savoy would accept the doctrine of unity. Meanwhile about 30,000 exiles from other provinces had taken refuge in Piedmont—whereas hitherto men like Gabriele Rossetti, Anthony Panizzi and Pellegrino Rossi had rather taken foreign citizenship. As these later exiles were people of education for the most part, they came to have great influence on the press and on politics in Turin and largely contributed to the education of the Piedmontese in *italianità*. Cavour himself, though he refused the proffered alliance of Mazzini, accepted that of the National society and began to think that unity might not after all be the "nonsense" that he had lately called it.

The elections of Nov. 1857 came as a reverse to Cavour. Savoy, Sardinia and Liguria returned an opposition majority, and had he not been so self-confident he would have resigned. He also came near to a breach with the king over the latter's disreputable private life; and it weakened him still further when Rattazzi left the ministry early in 1858. Luckily for him, French support was now so firm that even Felice Orsini's attempted assassination of Napoleon III in Jan. 1858 could not shake it. Cavour cleverly divined that Napoleon's empire, though conservative at home, was revolutionary abroad and needed a policy of prestige and military victory. Furthermore, Piedmont was a necessary buffer which France could not allow to be defeated by Austria. It was rather a French interest to chase Austria altogether from Italy, especially as France could name as its price the provinces of Savoy and Nice.

The War of 1859.—In July 1858, unknown even to his colleagues, Cavour had secret talks with Napoleon III at Plombières, where together they hatched a plan to create a kingdom of north Italy including Lombardy, Venice and the central duchies. It then became Cavour's task to provoke a war by the following spring in such a way as to make Austria seem the aggressor. This might not have been so easy had not Austria also regarded the war as inevitable. After an alliance had been signed between France and Piedmont in Jan. 1859, Austria declared war in April. The French won the battle of Magenta in June, and the allies entered Milan. This was shortly followed by a second indecisive victory at Solferino. Napoleon, however, was disillusioned with the lack of support from other parts of Italy and knew that Cavour was working behind his back to annex Tuscany and Umbria as well as the other territories already agreed. This acquisition of part of the papal states would not only have scandalized Napoleon's Catholic subjects but also have created a stronger kingdom in Italy than he desired to see. Accordingly in July he unexpectedly arranged an armistice at Villafranca. The peace of Zürich in November eventually gave most of Lombardy to Piedmont, but not Venice, not the formidable Quadrilateral and not the duchies. Napoleon's plan was to leave Italy a relatively weak confederation of small states under the general presidency of the pope, and in this plan, for the moment, he almost seemed to have succeeded.

Cavour protested unavailingly against this desertion and reached the point of using most disrespectful language to the king at the latter's headquarters in Monzambano. Reluctantly, but realistically, the king accepted the accomplished fact, and Cavour resigned in July 1859. For six months he was out of office, while a stopgap Rattazzi-La Marmora ministry proved itself unequal to the situation.

During this time attention was first fixed on central Italy, where the outbreak of war against Austria had caused spontaneous risings against the old ruling houses and their Austrian garrisons. Napoleon was resolutely opposed to the annexation of the duchies by Piedmont; and though royal commissioners had been sent to Bologna, Florence, Modena and Parma, these forfeited their authority after the armistice of Villafranca. However, the local revolutionary governments refused to be dismayed. Elections were held to confirm the triumph of the nationalists; more or less open dictatorial powers were conferred on Farini and Ricasoli respectively; and Gen. Manfredo Fanti was seconded from Piedmont to organize an army of central Italy, with Garibaldi as his second in command.

Cavour, although out of office, had continued to give advice and encouragement to these revolutionaries in their effort to annex themselves to Piedmont. In Jan. 1860 he saw how to recapture the political initiative; and after ousting La Marmora he proceeded to upset Napoleon's original plans by offering to exchange Savoy and Nice for permission to carry out this new annexation. A treaty was signed in March to ratify his plan. Plebiscites were held in each several region to confirm the exchange (March–April), so successfully that their sanction in each case was almost unanimous. The parliament that met at Turin on April 2 thus included Lombards, Tuscans and Romagnols. In less than a year Piedmont had more than doubled its size, against the strong wishes of most of Europe. It now included nearly 10,000,000 people, almost half the population of the peninsula. Only the sacrifice of Savoy and Nice marred the general satisfaction.

Garibaldi's Conquest of Southern Italy.—The next stage in unification was the annexation of Sicily and Naples, and for this Italy had to thank the much-maligned radicals of the extreme left. In

May 1859 Ferdinand II of the Two Sicilies was succeeded by his son, Francis II, who continued the traditional policy of refusing a constitution or a friendly alliance with Piedmont. There was little evidence of much nationalist sentiment in the south, but the brutal persecution and crass unenlightenment of the Bourbons had generated a widespread desire for change. In Sicily this was supported by a bitter and age-old dislike of rule from Naples; and Francesco Crispi, with other friends of Mazzini, found it easy to prepare and begin an insurrection. Early in May 1860 Crispi persuaded Garibaldi to lead 1,000 men from Genoa to support this revolt. They reached the island just before order had been restored. Aided by a peasants' revolt against the landlords, which spread disorganization and terror, Garibaldi wrested Palermo from a strong garrison of troops; and by the beginning of June nearly all the island was cleared of Bourbon soldiery.

Cavour had given no help to the original expedition and indeed had done his best to persuade Garibaldi not to sail. Excited however by the amazing success of the revolution, he quickly made up for this and soon sent royal commissioners to arrange the annexation of Sicily. Garibaldi was nevertheless determined to hold onto his dictatorial powers. His intention was that the states of Europe might be confronted with the acquisition not only of Sicily but of Naples and Rome as well; and he knew that, were Cavour in charge of the revolution, the French could use their influence on him to stop his further progress. Crossing to the mainland, he occupied Naples in Sept. 1860. Francis II fled to Gaeta, but the Bourbon army at last held Garibaldi on the Liri (Garigliano) river.

Unification, 1861.—Cavour then decided on one of his boldest strokes and in September, on the flimsiest of excuses, invaded the papal states. Napoleon III would never have allowed this but for the plea that Garibaldi could otherwise have carried the revolution into the Holy City itself. Carefully leaving intact Rome and its surrounding countryside, the northern army captured Umbria and the Marches, defeating the papal troops at Castelfidardo and entering Neapolitan territory in the middle of September. This simultaneously put pressure on Garibaldi to yield his conquests, and plebiscites were held in October which purported to express the wish of the people of Sicily and Naples for annexation to Piedmont. Garibaldi reluctantly retired to his island home of Caprera; Farini was sent to organize an emergency government in the south; and Gen. Enrico Cialdini supervised the capture of the last Bourbon strongholds early in 1861. Umbria and the Marches were also annexed, and representatives of these provinces and of the south were present when parliament met at Turin and in March 1861 declared Victor Emmanuel to be king of Italy—his title remained Victor Emmanuel II, to show that it was no new state but a continuation of the old kingdom of Sardinia.

E. The Kingdom of Italy, to 1922

His lifework thus accomplished, Cavour died in June 1861, worn out with responsibility and with the strain of carrying virtually the whole burden of the country's administration. His achievements were the result of no preconceived plan, but of enlightened opportunism over means and ends. He had been an ambitious man, second to no one in unscrupulousness and Machiavellianism; but he remained faithful to the broad tenets of liberalism. Along with a remarkable power of grasp and penetration, he had courage and firmness of decision, a sense of proportion and a tact and skill in maneuver which in combination amounted to genius. It was a great misfortune for his country that he died so early and before the initial problems of the newly unified kingdom had been properly tackled. In his last days he attracted the applause of parliament by his proclamation that the capital of Italy had to be Rome. But how to proceed thither, how to reconcile the pope and Catholic opinion to a unified Italy, he did not yet know. Furthermore, he left behind him neither a properly stable parliamentary majority nor responsible and able leaders who could take over where he had left off.

Ricasoli, Rattazzi, Farini and Minghetti.—From June 1861 to March 1862 the prime minister was Bettino Ricasoli. Problems calling for his immediate attention included the "Roman question" and the desultory negotiations which Cavour had conducted with the Vatican. There was also the problem of administrative unification, the harmonizing of many diverse provincial systems of law and of varying levels of taxation; and a way had to be found to inject regional pride with a common national consciousness. The inadequate administrative staffs of the government departments in Turin had to be suddenly expanded and taught how to deal with an infinite variety of local difficulties. Armies which had lately been fighting each other had to be persuaded to fuse amicably, and promotion in both military and civil services had to be distributed regionally so as not to offend wounded susceptibilities. Much ill-feeling was caused among Garibaldi's volunteers by the preferential treatment accorded their defeated enemies in the former Bourbon army.

Serious opposition was also encountered from the many people in each province who would have liked to see many more concessions to local autonomy. Federalists like the Lombard Carlo Cattaneo refused to take their seats in a central parliament. Former capital cities such as Naples and Florence had to reconcile themselves to demotion. The Garibaldians and the yet more extreme Mazzinians were highly indignant that the Turin government had halted the revolution without marching into Rome. Adherents of the old regimes sometimes refused to take the oath required in favour of the new order and often were only biding their time against the day of a counterrevolution and the restoration of the old Bourbon and Habsburg rulers.

Ricasoli was a man of iron will and high ideals, and more ready to tolerate Mazzini than Cavour had been. He was also, as a Tuscan, a bulwark against the Piedmontization of the kingdom which many people so disliked. But he lacked alike the ability and the desire to win popularity, and he treated the king with tactless condescension. Victor Emmanuel therefore began to intrigue with Rattazzi to replace him, and the Piedmontese lawyer thus returned to power from March to Dec. 1862.

Rattazzi's great failure was in his incompetent handling of another attempt by Garibaldi to march on Rome. In June 1862 the volunteers began to reassemble in Sicily; and when no obstacle was put in the way of their landing in Calabria, Garibaldi assumed that the government, as in May 1860, was standing aside to see what his chances of success would be. Rattazzi tardily realized that, since a French garrison was still established in Rome, the expedition must be stopped; and in August Garibaldi was wounded and captured by the regulars at Aspromonte.

The next ministry, that of Farini, was quickly terminated on account of the premier's ill-health, and Marco Minghetti took office from March 1863 to Sept. 1864. A convention was signed with France in Sept. 1864, under which French troops were to be evacuated from Rome on the understanding that Italy would guarantee the inviolability of the Holy City. As an earnest of good will, the Italian capital was to be moved from Turin to Florence, with the implication that former designs on Rome had been renounced. The news of this pact at once provoked an insurrection at Turin, whereat the king simply dismissed Minghetti and summoned another Piedmontese, La Marmora, to succeed him. The September convention was duly honoured, and in 1865 the capital was transferred to Florence.

La Marmora and the War for Venice.—One of the chief problems in these years after 1860 was the endemic plague of brigandage in southern Italy. This was now organized for political purposes by the Bourbons from their exile in Rome, with the active support of the Vatican; and it had soon attached to itself a program which embodied most of the political and economic grievances of Naples. Southerners resented that they had been conquered and were treated almost as a defeated colony. Claims for local autonomy were not met after 1860; conscription was introduced; far larger taxes were imposed than southerners had known under the loose and ineffective rule of the Bourbons; and the abolition of the old protective system also left the industries of the south helpless before competition from the north. So widespread was the disaffection that D'Azeglio made a published statement to the effect that the Neapolitan plebiscite in favour of annexation must have given a false notion of popular wishes. Sixty battalions of soldiers were scarcely enough to control the situation, and civil

war continued off and on for four or five years, marked by great ferocity on both sides. More people were said to have died in this prolonged campaign than in all the other wars of the Risorgimento put together; and even when law and order were restored the fundamental social and political reasons for unrest continued. Only after 1900 was the southern question to be given adequate recognition by politicians and students of sociology. No completely satisfactory solution was ever to be found.

The new kingdom of Italy took its first steps in foreign policy by preparing a war against Austria for the acquisition of Venice. Cavour had begun intriguing in 1860–61 for an insurrection in Hungary, and Victor Emmanuel was so keen on war that he entered into a secret understanding with Mazzini, unknown even to his ministers. As a foreign alliance was indispensable and as France already thought Italy quite strong enough, negotiations were opened with Prussia, where Bismarck was scheming to upset the preponderance of Austria in Germany. Austria then took fright and sought to purchase Italian neutrality by offering the peaceful cession of Venice. This offer La Marmora almost surprisingly refused. A strong faction existed which desired a prestige victory and hoped to conquer the province of Trentino as well. War was assured from the moment when a treaty was signed with Prussia in April 1866. Hostilities began in June. (*See* further SEVEN WEEKS' WAR.)

The Italian army and fleet, though a good deal larger than those opposed to them, were sadly lacking in generalship, provisions and morale. La Marmora (resigning the premiership to Ricasoli) planned a direct attack on the Quadrilateral, ignoring the lessons of 1848 and 1859 and refusing to collaborate in the efficient Prussian plan which in a bare fortnight led to the crushing victory of Sadowa (Königgrätz). Instead the Italians were beaten at Custozza. The king had insisted on helping to direct operations; and this, together with the divided command and all the jealousies and incompetence of the general staff, led to a quite unnecessary retreat and prevented exploitation of the simultaneous Prussian success. Garibaldi was deliberately kept as much as possible in the background, though once again his volunteers came off better than the regulars. Worse still, the feckless Adm. Carlo Persano had to be repeatedly ordered out of harbour by the government and then led his superior fleet to defeat at Lissa (for which he was dismissed from the service).

Meanwhile Bismarck, who wanted Austria as a friend against France, made a separate armistice in July, and Italy was forced to follow suit. Peace was eventually concluded in October. Austria ceded Venetia to Napoleon as a mediator, and he allowed a plebiscite to be held to confirm its union with the rest of Italy. This was a considerable acquisition. But the hoped-for prestige victory had not been won, and the Trentino was to remain in Austrian hands until 1918. Italians had overestimated their strength and internal cohesion and were now disappointed and depressed.

Ricasoli and Rattazzi, Second Ministries.—Ricasoli's second ministry lasted from June 1866 to April 1867, hardly longer than the average length of life of a government in the unstable conditions of Italian parliamentarism. The Austrian war almost coincided with a rebellion in Sicily, which lost Ricasoli much support. Sicily had never been reconciled to conscription and had been indignant at the martial law and military occupation which Gen. Giuseppe Govone had been obliged to enforce for the preservation of order in 1863. In 1866 a provisional government was set up by insurgents at Palermo, and an expeditionary force had to be sent from northern Italy to subdue the island once more. In March 1867 Ricasoli dissolved the chamber to try and secure a larger majority; but the elections did not improve his position and he resigned in favour of Rattazzi.

One of the few good features of Rattazzi's governments of 1862 and 1867 was his appointment of Quintino Sella and Francesco Ferrara as finance ministers. These men were responsible for facing the very serious question of the annual budget deficit coming on top of the heavy expenditure incurred in the wars of the Risorgimento. In some years the deficit was 50% of the total revenue, and it made matters worse that the ruling classes in the state habitually refused to burden themselves with an efficient system of tax collection. The introduction of a forced paper currency in 1866 lowered the national credit still further. As a partial remedy, the large areas of land held in mortmain by the church were nationalized in 1867 and bought up (mostly by speculators on terms very favourable to themselves) to help stabilize the national finances. The tobacco monopoly was also farmed out by the exchequer to a private company, to the great gain of the latter. In Jan. 1869 the hated grist tax on the grinding of corn was reintroduced, and this provoked extensive rioting among the poor on whom it weighed heavily and disproportionately. These various measures, socially and even economically undesirable though they often were, partially bridged the gap between revenue and expenditure.

The Occupation of Rome.—The sale of ecclesiastical lands was only one among a number of anticlerical measures. The situation and status of Rome inevitably made the Risorgimento an anticlerical movement, and not until 1929 did the pope recognize the absorption of the centre and the south into a unified Italy. In the years immediately after 1860, former concordats were repudiated, prominent churchmen were prosecuted and refused permission to exercise their functions, a civil marriage ceremony was introduced and declared obligatory and many more monasteries were dissolved. From the other side, Pius IX in 1864 issued a *Syllabus* of errors wherein all the major principles of liberalism were condemned as inconsistent with the Catholic faith.

In 1867 Garibaldi led another march on Rome, hoping to prove that the Italian people themselves could carry out the work of unification without French or Prussian aid. Once again Rattazzi dithered, in the expectation perhaps that it would convince Napoleon that there would be no peace until Rome was Italian. Then he changed his mind and resigned in October, giving place to Gen. Luigi Menabrea. Meanwhile Garibaldi found to his dismay that the people of Rome were indifferent if not hostile to his invading army, and when Napoleon sent another expedition to defend the city, the volunteers were easily defeated at Mentana in November. The Italian government had again to decide against Garibaldi and sent its army to help his discomfiture. The delivery of Rome still awaited the aid of a powerful foreign ally.

The chance came in 1870 when the Franco-German War finally destroyed Napoleon III's empire, and the French garrison of Rome was again withdrawn. The way had been paved by the meeting of the Vatican council in 1869–70 and its proclamation in July 1870 of the infallibility of the pope. This symptom of the increasing centralization and clericalization of the church revived some of the old opposition to ultramontanism among Catholic states and made it easier for an Italian column to bombard the city of Rome with impunity. Victor Emmanuel, as a sincere Catholic if one of irregular life, was until the last moment reluctant to take this step. But the ministry under Giovanni Lanza and Quintino Sella, which took office in Dec. 1869, threatened him with a major constitutional crisis if he refused; and the Prussian victory left no obstacle except the paper undertakings of Minghetti's convention of Sept. 1864.

On Sept. 20, 1870, Gen. Raffaele Cadorna forced a breach in the Porta Pia; and after a token resistance Pius IX accepted what he had not the force to withstand. A plebiscite was held in October which—as usual—gave an overwhelming majority for union with Italy. At last the Risorgimento seemed to have achieved its purpose: apart from Trento, Trieste and other frontier rectifications (some Italians were soon to add the names of Dalmatia, Corsica, Malta and Tunis) unification appeared to be complete, and attention could be concentrated on constitutional and economic problems at home.

First in importance was now the problem of trying to reconcile the Vatican to the loss of temporal power and to the existence of a secular and even anticlerical government in the Holy City itself. Defying excommunication, the civil authorities requisitioned the Quirinal and other palaces. In 1871 they then passed what they hoped was the generous Law of Guarantees to regulate the position juridically, so far as possible implementing Cavour's doctrine of "a free church in a free state." The pope's position was to be sacred and his person inviolable. While free discussion

was allowable on religious matters, insults and outrages against the Catholic faith were punishable. The pope was allowed ownership of the Vatican and Lateran palaces and promised an annuity of more than 3,000,000 lire. He was to have diplomatic immunity for foreign representatives attached to his court. The state gave up its old jurisdictionalist rights over the church, and bishops no longer had to swear fealty to the king.

This law was thought by the left to give far too much liberty to the church. But Pius IX naturally thought it gave too little, and consequently he refused to accept it as valid, rejecting even the annuity. He and his successors remained voluntarily "imprisoned" in the Vatican, refusing even to recognize the existence of the kingdom of Italy, declaring in the *non expedit* that it was inexpedient for Catholics to vote in the national elections and that they could be "neither electors nor elected." For the most part this was a formal protest only. In practice, methods of co-operation were devised and legal fictions developed to allow religious organizations to hold property and to grow in number and authority. Nevertheless the *non expedit* had the unfortunate effect of helping to prevent the growth of a strong conservative party in parliament, and outbursts of clericalism and anticlericalism contributed to perpetuate a cleavage in society that was always unhealthy and often dangerous.

In 1871 parliament and the government offices were moved once again, this time from Florence to Rome, and an attempt was begun to turn Rome into a modern capital. In the next 30 years many of its old picturesque areas were to be pulled down to make way for new and not always tasteful construction.

Minghetti's Last Ministry.—The ministry of Giovanni Lanza lasted from 1869 to 1873. During this time Sella did much to bring national expenditure more into balance with the revenue, though this was purchased by keeping taxation high and inequitably assessed and by selling the capital asset of the ecclesiastical lands. When the next prime minister, Minghetti, was able to announce a budget surplus in 1876, at last the new Italian state seemed to be paying its way. Many thought the price had been too high, but no one could deny that it had been a considerable achievement.

By this time Cavour's carefully built-up parliamentary majority had undergone much change. Inside the so-called right there were many varying opinions and personal rivalries. Sella, for instance, could never sit in the same cabinet with Minghetti. The Piedmontese formed a regional group of their own in parliament to protest against the removal of the capital from Turin, and the Tuscans did the same when it was later moved again from Florence. Above all the south remained turbulent and voted increasingly for the left.

Rattazzi had died in 1873, but Agostino Depretis and Francesco Crispi were building up a composite left-wing group which stood for the concession of more democratic reforms and soon included a number of deserters from the right. After the elections of 1874, the opposition parties were nearly equal in strength to those of the government. Mazzini had died in 1872, and his extreme republicans were no longer a force to be reckoned with. Garibaldi was lending his name to the prophetic but unrealistic program of an incipient Socialist party; and yet, after going to fight for the French in 1870, he made only rare appearances on the political stage. Radicals like Crispi and Felice Cavallotti dutifully accepted the oath of loyalty to the king; and so, apart from the clericals on the right, there was only a handful of extremists on the left who remained outside the prescribed limits of the constitution.

A skilful tactician like Cavour might have known how to make another *connubio* with Depretis. Instead, the ministry of Minghetti became even more repressive and arbitrarily arrested some of its political opponents. When its plan to nationalize the railways antagonized a group of Tuscan and Lombard mercantile interests, a chance vote in March 1876 brought to an end the period of rule by the right. Their honest, courageous and thrifty conduct of government had set the country well on its way to power and prosperity; but they had at last lost the confidence of the people, and the need now was for younger men, with new ideas and more of a social conscience.

Depretis and the Parliamentary Left, 1876–87.—The year 1876 began a long period of government by the left. The first cabinet of Agostino Depretis was almost entirely composed of men new to office, most of them former radicals, many of them former republicans, but all of them now liberal monarchists. Their program comprised extension of the franchise, the decentralization of government, the abolition of the grist tax and other impositions which bore heavily on the poor, and a pervasive anticlericalism; but in other respects they were content to follow the policy of their predecessors, and people were able to say that government by the right and by the left was in practice much the same, except that the latter was perhaps not so good.

The new minister of the interior, who was the former radical agitator Giovanni Nicotera, immediately set about preparing for the elections with all the mixture of corrupt and legitimate influence which Italian practice allowed to the authorities in power. The results achieved in Nov. 1876 gave an overwhelming majority of 420 ministerialists against about 87 seats for the "opposition": over the whole of the south only 4 opposition deputies were returned. This eclipse of the conservative right proved very bad for political education in Italy, and conflict was soon transferred to inside the government coalition itself, with the result that successive ministries proved even more unstable than before.

Nicotera's electoral machine brought with it an increase in political corruption; and yet the lack of party discipline and of fixed party principles meant that there was an absence of clear conflict between alternative policies. The dissolution of parties dated back at least to Cavour's *connubio*, and the confusion of political principles had also been a feature of government by the right. By now they were regarded as deliberate methods of government, in the attempt to avoid extremes, to perpetuate a broad coalition of the centre and to provide no chance of a return of the old right to power. Successive prime ministers came to power just by a slight shift of emphasis inside the general framework of this coalition, usually for personal reasons and not because some great principle was at issue. It was a system of government that soon became known by the name of *trasformismo* or transformism and was to be claimed as a typical and even praiseworthy manifestation of Italian politics.

Depretis, who had severely censured the political morality of the *connubio* in 1852, thus effected a very similar parliamentary liaison when he was himself faced with the responsibility of office. Gradually he won over the more moderate members of the right, like Minghetti, for a policy of mild reforms. One example was Michele Coppino's act of 1877 intended to bring in compulsory elementary education. When Nicotera's authoritarian and unconstitutional actions endangered the continuance of the coalition, Depretis replaced him by Crispi (Dec. 1877); and Crispi, who had roundly condemned transformism when out of office, now welcomed it as the means of attaining power.

The succession of Humbert I (Umberto) to the throne on the death of his father, Victor Emmanuel II, in Jan. 1878 confirmed the almost universal acceptance of the monarchy. A month later Pius IX died, and the election of Leo XIII as pope served as an occasion to restate the cleavage between church and state. More than once Leo was to threaten that the papacy might remove itself from Italy if the claims of the church did not receive more respect.

Meanwhile one ministry followed another in quick succession. Depretis had to form a second cabinet in Dec. 1877; Benedetto Cairoli formed a ministry in March 1878; Depretis returned in December but fell in July 1879, after a vote in which Cairoli and Nicotera joined the conservative opposition; Cairoli succeeded once more but had to resign again in November and reconstruct his cabinet with the help of Depretis. The advent of the left in power was evidently not leading to a more stable and durable government despite such a huge majority; nor, it was noticed, was its rule notably much more liberal or enlightened than that of its predecessors.

Foreign Policy: Tunisia and the Triplé Alliance.—Not until after 1880 did Italy meet any severe test in the field of foreign policy. France, Prussia and Great Britain all had good reasons for wanting a moderately strong kingdom in Italy as an essential element in the balance of power, and Cavour had thus been able to run risks

in the confidence that he had everything to gain and not a great deal to lose. With the completion of unity, however, Italy was no longer content to acknowledge the patronage of foreign states and in return lost its status of a protected territory. In France, the republican Louis Adolphe Thiers reversed Napoleon III's pro-Italian sympathies. The appearance of a distinct and active Italian foreign policy, backed by eager participation in the armaments race, made other nations more chary of their support. Gen. Cesare Ricotti-Magnani was reorganizing the Italian army on the Prussian model; naval supremacy over Austria was declared to be essential; and the armaments industry was receiving heavy subsidies. The stronger Italy became, the more difficult it was to back down with honour from a position that was maintained only with a dangerously high expenditure of money and resources. Lacking iron and coal, Italy was at an inherent disadvantage here; and though in naval construction for instance it temporarily led the world, each new invention or process caused an increasingly disproportionate outlay of the national income. A vicious circle was soon set up: Italy's prestige became more and more involved; the state spent more and more money on interests that flourished on war scares and war production; and patriotism developed into nationalism and imperialism. The country became increasingly sensitive over real or imaginary affronts at the same time as it became ever more difficult to withdraw with dignity once any commitment had been made.

The same increase in strength helped to make Italy, in a moment of abandon, give up its valuable independence and enter the European system of alliances. Traditionally it had been able to play off Bourbon against Habsburg, France against Germany and vice versa, remaining free from commitments until it could intervene decisively. This had been the policy of the house of Savoy in the 17th and 18th centuries. But now, instead of limiting its ambitions to the preservation of the balance of power (in which it could act as an important makeweight), Italy was induced to side openly with Germany just when Germany had upset the balance by defeating France in 1870. The long-term result was to bring Crispi to a humiliating defeat.

There had been little sign of this in the period 1869–76 when Emilio Visconti-Venosta was foreign minister, although an exchange of visits between the rulers of Austria, Prussia and Italy in 1873–75 had marked the beginning of a reconciliation between the three conservative central monarchies. Then in 1877 Crispi paid a visit to Bismarck that convinced him Germany was the state of the future and that Italy should hurry up with its armaments and attach itself to this rising star. In his view it would have been unheroic just to try and restore the balance of power. As Victor Emmanuel II said, "Italy must not only be respected, she must make herself feared." This belligerent attitude was encouraged by Cairoli's failure to bargain successfully at the congress of Berlin in 1878 for a share in the disintegrating Turkish empire. The policy of "clean hands" provoked the indignant wrath of Crispi and his friends.

The final impetus to the German alliance came over the frustration of Italian colonial ambitions in Tunisia. For more than 40 years Italian explorers and missionaries had been penetrating into North Africa, sometimes with government encouragement. The Genoese chamber of commerce and, especially, the Genoese shipbuilder Raffaele Rubattino had spent much time and money in prospecting for colonies, and attempts had been made to purchase concessions as far away as the East and West Indies. The cutting of the Suez canal in the 1860s gave an additional incentive to colonization. In 1869 the government, working through Rubattino, made a settlement at Assab on the Red sea. Opponents pointed out the risk of war, the impossibility of maintaining a strong colonial movement without more resources and a larger army than Italy could afford and the lack of a financial or industrial surplus sufficient to exploit colonies once acquired. But although responsible statesmen expressed doubts about the course of events, appetite was now whetted, and prestige was thought to demand the extension of this settlement inland and the establishment of another colony in Tunisia.

There was indeed a substantial Italian population already living in Tunisia, and the acquisition of the country was considered necessary for the security of Sicily. But when Austria, Russia and Great Britain all suggested to Italy that it might compensate itself there for Austrian expansion into the Balkans, Visconti-Venosta and Cairoli agreed that Italy could afford only economic penetration. France also had claims to this region, and French hostility could not be lightly provoked. But Cairoli mismanaged the position and led on public opinion at home to look on Tunisia as a natural extension of the mother country at the same time as he knew that his government had neither the will nor the means to forestall the intervention of France. Then, in 1881, a French force entered the regency in pursuit of rebels from Algeria, and in May the bey signed the treaty of Bardo accepting French protection. In the following year Great Britain won a similar status in Egypt. Italy had to watch the last vacant stretches of North Africa being occupied by other countries and the balance of power in the Mediterranean turning against it. On grounds of security, and even more on those of prestige, this aroused the most bitter feelings.

It was partly in reaction to this setback that the government decided to make a formal alliance with Austria and Germany, and to sacrifice the advantage of not being bound to either of the big power groups of Europe. This was a breach with tradition. Austria had been the hereditary enemy for as long as people could remember, and its retention of Trento and Trieste, to say nothing of the presence of its fleet in the Adriatic and its ambitions along the Balkan coast, seemed to mark Austria out almost inevitably as Italy's opponent in any future war. From the Austrian point of view, moreover, Italy represented the principle of nationality which threatened the very existence of the Austro-Hungarian dual monarchy. Yet although the comparative weakness of Italy made it of little potential use as an ally, Austria wanted a guarantee for its southern frontier. Bismarck was likewise anxious to enlist Italian aid or benevolent neutrality against France should the latter contemplate a war of *revanche*.

Italy itself by now appreciated the case for ending its apparent isolation in Europe, in order to prevent further humiliation at the hands of France. The loss of Tunisia thus enticed the country away from its natural policy of "no commitments" and unadventurousness. An Austrian alliance would preclude the recapture of Venice in another war. It would also obtain formal acceptance by one of the leading Catholic powers of Italy's conquest of Rome, and this was important in that the pope was still hoping for foreign intervention to restore him his old authority. In domestic politics there was the further consideration that the treaty of Bardo had seriously shaken the parliamentary position of the left, and some success abroad was necessary to restore confidence.

For these reasons the foreign minister, Pasquale Mancini, opened negotiations for an Austrian alliance; and in May 1882 the triple alliance was signed. It was to last until May 1915. Germany, Austria and Italy undertook to support each other if ever attacked by other powers and to maintain a benevolent neutrality if one of the three states was forced to declare war. Austria and Italy in particular promised to maintain the *status quo* in the Balkans; but if ever this should become impossible, neither of the two powers was to occupy territories without previous agreement and adequate compensation. The Austrians tried to include in the treaty a clause which bound signatories to maintain a conservative policy at home, but Italy refused to accept this.

What Italy gained from this treaty was a comfortable feeling that it was no longer isolated. There was not much profit in a guarantee against the unlikely event of French invasion, and the offer of compensation in the Balkans was to prove illusory when the moment came for its application. In exchange for this, Italy had given up its freedom to negotiate with both sides. It had apparently reconciled itself to the Austrian possession of Trento and Trieste. Also, whether intentionally or not, it was committing itself to fight in some future war in which it might have little apparent interest and, in the meantime, to increase expenditure on military provision.

By article five of the constitution, the king had the right to make treaties of alliance on his own responsibility. He need only

inform parliament of the obligations that he had assumed for the country whenever he thought fit. The triple alliance was in fact kept secret, though the knowledge that the government had thrown in its lot with the former national enemy was not long in leaking out. It was noticed with some irritation that Humbert had even been seen in the uniform of an Austrian colonel at Vienna.

Meanwhile some of the nationalists were beginning to propagate the cult of irredentism, that is to say the extension of nationalist aspirations to Trieste, Trento and the other *terre irredente* or "unredeemed lands" still owned by Austria. In Sept. 1882 there was an incident when an "Italian" from Trieste, Guglielmo Oberdan, was arrested for attempting to assassinate the Austrian emperor Francis Joseph; and his subsequent execution made of him a martyr in the eyes of many Italian patriots.

It was an early sign of the fact that the apparent completion of Italian unity in 1870, far from making Italy a satisfied power as the Risorgimento leaders prophesied, had created an appetite for yet further expansion. Moreover, the larger Italy became, the greater was its strength to effect such expansion. The simultaneous pressure of Austria down into the Balkans and the remarkable growth of national consciousness among the Slavs who surrounded Trieste were alarming signs that the passage of years might weaken instead of strengthen the Italian case. If expansion did not come soon, it might never come.

Irredentism was as yet only on the fringe of Italian politics. Depretis had not been very happy about the triple alliance but was a realist and was determined to make the most of it. It was fortunate for Italy that, when the alliance came up for renewal in 1887, a heightening of tension between Germany and France and between Russia and Austria made friendship more desirable than it had been in 1882. As a result, Italy received larger concessions and more particular regard for Italian interests in the Mediterranean. Crispi then tried, for a time with success, to divert nationalist sentiment away from the debatable northern frontier to colonial expansion, from irredentism to imperialism.

Domestic Politics.—It is difficult to describe the balance of forces in parliament during these years 1880–87, because there were no exact parties, and political allegiance was to persons rather than to principles. After the elections of 1880, the centre groups of Depretis and Cairoli were confronted with an increase in representation for the extremists both right and left. The so-called "historic left" round Crispi and Nicotera could number more than 100 deputies whenever they could be induced to vote together. Minghetti and Sella on the right commanded even more. In this fluid position there was a new cabinet almost every year, and if it was usually led by Depretis, this was only because of his superior skill in avoiding the more controversial issues and in building up a personal majority by clever and not always scrupulous concessions to the local interests which dominated in each constituency.

In 1881–82 there was introduced a Franchise Reform bill which quadrupled the electorate to make a total of more than 2,000,000 voters. This had been part of the original "program of Stradella" with which Depretis had come to office in 1876. It had been generally recognized that the suffrage should be extended along with the gradual growth of education and economic prosperity. Even some of the conservatives agreed with this, in the hope that the middle and lower classes of society would prove a conservative influence (in which belief they were not far wrong). The age limit and the tax qualification being reduced, the vote was thenceforward possessed by all who had their education certificate or who paid at least 19 lire a year in taxes.

The same law also tried the experiment of abolishing the old single constituencies and introducing the *scrutin de liste* (single ballot) as a method of voting. It was intended thereby to secure a better representation for minorities; and enlargement of the electoral districts was expected to strike a blow at the local cliques which had simply managed to adapt the new techniques of democracy to perpetuate their control of municipal and village administration. The experiment failed, and the old methods were resumed in 1891. Another effect of the Franchise act in practice was to give more weight to the industrial north against the agricultural south and also to cities generally against the country districts. The results of this were not long in showing themselves during the severe agricultural crisis which set in after 1885.

The passage of this bill shows how Depretis was strictly adhering to the policy of moderate reform, defying the extremists on either side. His primary aim was to keep his amorphous centre majority intact and himself supported in power by a moderate consensus. Trimming his sails to the prevailing wind, he soon abandoned the radicals and made overtures to the centre right under Minghetti. By 1882–83 it became clear that a new government majority was in being and that *trasformismo* had effectively confused the old nomenclature of left and right.

Depretis thus remained in office more or less continuously until his death in 1887. The forced currency was abolished in 1883, when the treasury resumed payments in gold. Abolition of the grist tax came into effect in 1884, and a new cadastral survey was taken for a reform of the land tax. In 1885 a convention was made whereby the state railways were farmed out to three private companies for 20 years. Enlightened public health measures were passed, and a government commission of inquiry into the condition of agriculture at last brought to light some of the necessary facts upon which an agricultural policy waited.

This legislative program received the general support of parliament, for the various groups in opposition seemed to be incurably divided. On the right, Ruggero Bonghi and Silvio Spaventa tried to stop the disintegration of their party and to resist the dissolvent effects of transformism. On the extreme left there was likewise a small group of radicals, the *estrema*, round Agostino Bertani and Felice Cavallotti, which refused to be confounded in Depretis' policy of compromise and expediency. There was another right-wing group round Antonio di Rudinì and Sidney Sonnino which, despite occasional protests, gave conditional support to the government. Then there was the left-wing "pentarchy" formed of Crispi, Nicotera, Cairoli, Giuseppe Zanardelli, Alfredo Baccarini and their several clients, who vociferously claimed that Depretis had unscrupulously abandoned his former party but who then showed that they had nothing to learn from him when it came to tactical alliances in the struggle for power. When Depretis formed his last cabinet in 1887, Crispi and Zanardelli were among its members, despite their recent vilification of the irresponsible financial policy of their new colleague Agostino Magliani. The "wizard of Stradella" had so confused every issue that almost everyone had come to accept transformism. It appeared to be the only method of government which could transcend the bitter personal animosities and the almost anarchical individualism which typified the Italian parliament.

Crispi, to 1891.—The death of Depretis in July 1887 brought to the premiership the far more energetic and bellicose Francesco Crispi, who typically combined headship of the government with the two most important departmental posts, those of home and foreign affairs. Despite his former criticism, Crispi tried to continue with the transformist technique. But his uncompromising dogmatism, his personal churlishness and his impetuousness in action created opposition right and left. Where Depretis had been wont to "open his umbrella" at the first sign of a political storm (this had been his own description of his attitude), Crispi plunged headlong into any controversy; and his ability and enormous self-assurance usually carried him through to victory. Of all the pre-Fascist politicians, this was the man whom Mussolini most admired. He was at once the Jacobin reformer, the autocrat who concentrated all power in himself and rode roughshod over other ministers and even over the constitution itself, and the imperialist who believed fervently in the expansion of Italy and in its mission in Africa. It was unlikely with such a man that domestic politics would continue for long on the same even keel as with his predecessor.

Crispi was soon trying to patch up a reconciliation with the church. He knew the prestige that would accrue from healing the breach between Quirinal and Vatican, and he would have welcomed the aid of the church in his campaign against the Socialists at home and the heretic Ethiopians abroad. Here he met a reverse, for Vatican circles were still frightened that conciliation would

expose the pope to suspicion of being unduly subject to Italian political influence and were anxious to demonstrate that he was more Catholic than Italian. Crispi was personally something of a freethinker. After this rebuff he reverted to his former anticlericalism, and proceeded to nationalize most of the numerous charitable institutions owned by the church.

Crispi's ministry of 1887–91 was marked by a number of liberal reforms, especially the adoption of Zanardelli's new penal code which abolished the death penalty and made it easier for individuals to secure redress against the administration. A Municipal Franchise act widened the suffrage for local elections and gave greater responsibility to elected councils in local government. Crispi also introduced reforms in prisons and public health. Gradually, however, he became corrupted by power and began to think that Italians both needed and would appreciate something more dictatorial—or at least a chancellorship on the Bismarckian pattern. Faced with the problem of making parliament work without the aid of well-disciplined parties, he improved upon Depretis' methods, and while choosing his ministers from both right and left, often pushed through his reforms by arbitrary means or else acted on his own initiative before asking parliament for a retrospective bill of indemnity. Any opposition to himself was regarded as simply factious and irresponsible.

Crispi was his own foreign minister and a bad one. Italy's only hope of asserting influence in Europe was for France to be restored into a better balance with the Central Powers. Yet Crispi took animosity against France to absurd lengths and ostentatiously paid several obsequious visits to Bismarck in Germany, seeking to profit from any future German victories and so inciting his ally on to war.

Instead of opposing Austria as the old school of nationalists had done, Crispi went out of his way to earn its good opinion. He proclaimed the existence of Austria-Hungary to be a necessity for Italy and angrily dismissed his colleague Seismit Doda, the minister of finance, for having failed to protest against irredentist speeches delivered in his presence at Udine. Crispi had convinced himself that Italy was a powerful country which had nothing to fear from war and therefore did his best to pick a quarrel with France. Some of the wilder politicians had been advocating a "bath of blood" as a test of national virility; before long Crispi was to satisfy their wishes to overflowing in Ethiopia.

It was typical of the parliamentary situation that although Crispi, using every means of pressure, obtained a large majority in the elections of Nov. 1890, he was unexpectedly defeated by a vote in Jan. 1891. The slightest point served to reshuffle the many splinter groups in and out of the government, and on this occasion a tactless outburst about the supine foreign policy of his predecessors sufficed to upset him.

A man of such positive opinions could not but have made many personal enemies. He had divined and exploited the general wish in the country for prestige and national greatness and the desire for a government that would be not lax but active and forceful. At the same time he had underestimated the sensible caution of the governing classes, their alarm at his expenditure on military provision, their distrust of the promise of economic gain from colonial expansion, their irritation at his ruthless and dictatorial methods. People saw that he was dividing the country in two and provoking a dangerous restlessness among the poor. And his tariff war with France was proving to have been as unnecessary as it was disastrous.

The Economic Crisis After 1887.—Italy's repudiation of the French commercial treaty and its sudden conversion from free trade to protection were partly responsible for the severe economic depression of these years from 1887 to 1891—which in turn was to have serious political repercussions. The construction of railway routes through the Mont Cenis and Brenner passes and thence all over Italy had exposed Italian farmers and industrialists to increasing foreign competition and to the price fluctuation of a wider market. At the same time, the triumph of steam navigation was bringing much cheaper freight charges, and this favoured the large-scale import of grain from America and Russia, where it could be grown cheaply.

As a result there was a collapse of prices in the 1880s in response to which both industrialists and agriculturalists were loud in their demand for government protection. In particular the steel industry, always rickety because of the absence of fuel and raw materials in Italy, pressed the government to annul the commercial agreement with France and to make the country more independent of foreign supplies. This argument naturally appealed to a man like Crispi who wanted a strong domestic armaments industry and had a *parti pris* against France.

The results of this policy were not long in showing themselves. Complete self-sufficiency was of course unattainable, but any approach to it necessitated an increase in uneconomic and often inefficient production. By the imposition of heavy tariffs on imported metal, domestic consumers were made to subsidize the profits of a parasite industry. Moreover, political corruption became unbridled as the industry bribed deputies and newspapers to maintain this high level of protection.

Worse still, the increase in production from the new factories at Terni and the old workshops along the Ligurian coast had reached a point by 1890 when it exceeded any demand except on the hypothesis of war; and Crispi's belligerent foreign policy received all the more encouragement. The inefficiency of government protection can be judged from its both delaying the switch over in shipbuilding to the use of metal hulls and steam and keeping a wholly disproportionate area sown with cereal crops for which the land was unsuited and in which it gave only a minimal yield. Some protection was no doubt necessary, but the excess to which it was taken was damaging.

The political implications were as unfortunate as they were unforeseen. Instead of being forced to accept Italian conditions in negotiating a new commercial agreement, France easily turned to Algeria for wine and to the far east for silk, and these two staple Italian industries never recovered the ground thus lost. France had been Italy's best customer, taking about 40% of its exports; but these now came to a temporary stop. Southern agriculture received a crippling blow in order to pay for benefits reaped by northern industry, and the consequent increase in food prices took a great number of people below the starvation level, with disastrous political results. Ten years earlier the occurrence of the vine disease *Phylloxera* in France had led to a great expansion of viticulture in southern Italy; but now, just when the new vines were beginning to come into cultivation, most of southern Italy was turned into one vast depressed area, and before long rebellion was to break out openly.

This economic breach with France began in 1888, and though Crispi was obliged to climb down a little after 1890, the severance of relations had by then led to a heavy withdrawal of French capital. This was in part responsible for the collapse of certain important banks. There had latterly been much overspeculation in building and industrial ventures, and the banks had permitted far more credit than the law allowed. When signs of a financial crack began to appear in 1889, Crispi at first did nothing to halt this inflation of credit but rather encouraged its continuance, fearing the unemployment which would result from a contraction and giving undue weight to the advice of some of the financiers implicated. A secret report was written for the cabinet by an investigating committee under Senator Giacomo Alvisi. Though it was not published, it was later known to have revealed serious irregularities. The six banks of issue had abused their rights and by "favour loans" to politicians had come to wield considerable political influence. Bernardo Tanlongo, the director of the Banca Romana, had not only maintained an illegal circulation but had even printed false banknotes to the value of 40,000,000 lire. But for several years more all this remained concealed.

Rudinì, 1891.—When Crispi fell before a hostile vote in 1891, he was succeeded from Feb. 1891 to May 1892 by Antonio Starabba, marchese di Rudinì, who had led one group of the right ever since Minghetti's death in 1886. This signified the return to a milder and more conservative government, even though the state of parliament forced Rudinì into a transformist coalition with Nicotera's faction on the left. Crispi's megalomania now gave way to retrenchment both at home and abroad. Military expenditure was

decreased and the finances were thus reduced into better order. The new cabinet was also less anticlerical and more ready to consult parliament than its predecessor. Parallel with negotiations to renew the triple alliance in 1892, there was a noteworthy resumption of friendship with France and Russia; and the campaign for economic self-sufficiency was mitigated by the signature of commercial treaties to open up foreign trade. Despite all this, the parliament was still that elected under Crispi, and after a hostile vote Rudini resigned. His immediate successor was Giovanni Giolitti, a former colleague of Crispi, whose first ministry lasted from May 1892 until Nov. 1893.

Giolitti, to 1893.—Giolitti was a Piedmontese who had come to power by way of the civil service. Like Depretis he was first of all an administrator. His primary object was wherever possible to remain neutral in political differences, letting events take their natural course and so preserving tranquillity in the state at a difficult moment, while allowing new ideas and new ways of thinking to have free play and to usher in a period of progressive reform. Eventually, in the period from 1903 to 1914, Giolitti was to be the dominating figure in politics, and his skilful management of the elections of Nov. 1892 already gave a foretaste of his quality; but this time he came to grief over the question of the banks.

The Bank Scandals.—The scandals indicated in Alvisi's report (*see* above) were suddenly exposed when a copy of this secret document came to light in Dec. 1892. Giolitti was forced to arrest Tanlongo, whom he had just nominated to the supreme dignity of the senate. Crispi and Giolitti still tried to prevent a public inquiry, for this might damage Italian credit abroad as well as their own reputations. But the collapse of one bank after another made it impossible to conceal matters any further. A parliamentary committee of seven under Antonio Mordini had eventually to inquire into the condition of the banks of issue. Its report, read to the chamber in Nov. 1893, established that the two preceding cabinets had been aware of serious irregularities committed by Tanlongo and others; that Tanlongo had heavily subsidized the press; that a number of deputies, including several former ministers, had received from him "loans" of a considerable size. Crispi and Giolitti were both found to have had financial dealings with the bank and to have been guilty of grave errors of judgment if no worse. The air was cleared, the situation was shown to be not quite so bad as some had feared, and suitable reforms were introduced forthwith to make a recurrence of such irregularities unlikely; but the revelations forced the resignation of Giolitti, and he felt compelled to leave the country for a time.

The Sicilian Fasci, 1893.—Giolitti's first experiment in the management of parliament had broken down, for he had not yet learned Depretis' technique of how to keep many groups in common harness. The nationalists disliked his truckling to France when in Aug. 1893 some Italian workmen were killed in a riot at Aigues-mortes. The landowners resented his refusal to take arbitrary action against unrest in Sicily. The contraction of the French market for Sicilian produce, the devastation wrought in the vineyards by *Phylloxera* and a diminution in the sulfur trade had combined to produce in Sicily a discontent which led to the organization of the peasants into groups known as *fasci*. Giolitti had refused to dissolve these workers' unions. He had further annoyed the conservative landowners by his advocacy of higher taxation for the rich. They therefore chose to regard him as a dangerous revolutionary who was undermining their social position in collusion with the Socialists; and so they successfully worked for his supersession in office by Crispi, despite the latter's inculpation in the bank scandals.

The peasants who formed the vast majority of the Italian population had not yet become politically class conscious, although their social revolts had punctuated and sometimes contributed to the course of political development during and after the Risorgimento. Their poverty was extreme, and their condition of life became unendurable in years of bad harvest or trade depression. No politicians had bothered much about their lot. Mazzini and the old school of radicals had been more concerned with political than with social regeneration. The Socialist Carlo Pisacane (d. 1857) had been an isolated figure. Then, after the experience of Mikhail Bakunin's revolutionary anarchism, a workers' party had been formed in 1882, in which year Andrea Costa entered parliament as the first Socialist deputy. But the early Italian Socialists had been mostly intellectuals like Antonio Labriola and Filippo Turati. They had also thought of the peasants as a conservative rather than a revolutionary force and had concentrated their attention on the industrial artisans who were multiplying rapidly during the great industrial expansion of the 1880s.

Contrary to the belief of Crispi and his friends, the Sicilian outbreak of 1893 had had little connection with organized socialism. It was rather a hunger rebellion, a protest against the local octrois on food through which the poor paid more than their fair share of the expenses of local government. Once again, as so often in the course of the 19th and 20th centuries, the peasants marched to occupy the large estates or *latifondi*. The landlords were usually absentee and few of them had done much to improve these scantily cultivated lands; frequently they had usurped the communal lands and so deprived the peasants of the old rights of grazing which had been part of their livelihood. The clash between rebellious peasantry and the authorities in 1893 was in part the result of deliberate provocation by the landowners, who saw in agitation and agricultural strikes a threat to their own prosperity. Crispi recognized in the situation an ideal opportunity to accuse Giolitti of weakness and to rally conservative opinion by magnifying the danger into a major threat of Socialist revolution. This false scare incidentally was used to prevent a proper debate on Mordini's report about the bank scandals (to the great relief of many politicians) and allowed Crispi himself to appear in his favourite pose as the strong man who alone could restore order.

Crispi, 1893–96.—On Giolitti's resignation, the king had first asked Zanardelli to form a government; but, disliking Zanardelli's proposed cabinet, he then put this task into the eager hands of Crispi in Dec. 1893. The *fasci* were suppressed, and martial law and military tribunals were employed to restore order and send some of Crispi's opponents to the penal islands. Where parliament proved refractory, legislation was enacted by royal decree. The Socialist party was dissolved. An attempt to raise the question of Crispi's complicity in the bank scandals was then quashed by the sudden closure of parliament. Crispi ruled without parliament for almost half a year. After that, elections were held in May 1895 and suitably managed to give the administration a large majority. Crispi's policy of authoritarian government at home and imperial expansion abroad received a fillip which was shortly to prove disastrous both to Crispi and to Italy.

Defeat in Ethiopia.—In 1882 Depretis had declared Assab on the Red sea to be a crown colony; but he had then, against Crispi's advice, refused the offer of Great Britain to assist in the occupation of Egypt. The left-wing liberals agreed here with the irredentists and even some of the Milanese industrialists that colonies were an expensive luxury which Italy could not afford. Unfortunately, considerations of prestige and national dignity were thought by others to demand a forward colonial policy. Once the first settlement had been made, moreover, its defense required still further expansion into the interior, and chance conflicts with local tribesmen were soon followed by the dispatch of punitive expeditions. Pasquale Mancini hoped that "in the Red sea we shall find the key to the Mediterranean"; and in 1885 he occupied Massawa. As this was one of the trade outlets for Ethiopia, the move brought down on Italy the antagonism of the negus John IV and of Alula, ras of Tigré. Certain "frontier incidents" led to a clash in which Alula with greatly superior numbers overwhelmed a force of 500 Italians at Dogali (Jan. 1887). Crispi declared that this could not go unavenged, and preparations were accordingly made for a larger expedition.

From his original distrust of colonialism, Crispi had changed into an exaggerated imperialist. On the death of the negus John in 1889, he backed Menelik, king of Shoa, in a war of succession against John's son Mangasha. A treaty was signed with Menelik in May 1889 at Uccialli, the Italian text of which gave the Italians the illusion that they possessed an acknowledged protectorate over Ethiopia. It also agreed to an enlargement of the original Italian colony, which in Jan. 1890 was given by royal decree the new title

of Eritrea. In 1891–93 the governments of Rudinì and Giolitti had retreated a little from this aggressive attitude, but Crispi's resumption of office in 1893–96 witnessed a further penetration into Tigré. In July 1894 Gen. Oreste Baratieri captured Kassala from the dervishes. In Eritrea, the French Lazarist missionaries were expelled and replaced by Italian Franciscans. Aduwa was occupied in 1895.

Serious disagreements had existed in the cabinet and war office over this extended occupation. Financial stringency forced Crispi to stint supplies and to urge Baratieri to make the territories pay for their own conquest. Meanwhile the new negus was forced into a common opposition with the ras of Tigré and with the dervishes. In Dec. 1895 Menelik destroyed an Italian column at Amba-Alagi, and only then did the Rome government realize the incompetence of Baratieri and decide to replace him. Hearing of this, the unfortunate general precipitated a larger engagement to retrieve his reputation and, after gross tactical errors, was completely routed with 6,000 men at Aduwa in March 1896. To make matters worse, in a public communiqué he threw the blame for defeat upon his troops. His own subsequent court-martial rather showed up his personal responsibility and that of the government which had chosen him and directed the campaign.

The news of this defeat came as a cruel blow to a public opinion which had been indoctrinated by Crispi in an exaggerated view of national strength. This was the penalty for handing power over to a strong man who treated all criticism of himself as unpatriotic. It was also a commentary on the Italian parliamentary system for failing to produce a powerful party in opposition which could focus discontents and place an alternative policy before the country. The elections of 1895 might have been interpreted as showing that Italians were glad to have a strong man who knew his own mind and could cut through the interminable criticism of factious groups in parliament. If so, the electorate had its deserts. Crispi had taken too much on himself and had been able neither to stand back and see where his policy was leading nor to look after the executive details. He tried hard to put the blame on the military, so that the king would confirm him in office; but the king had more sense. Troops were withdrawn from Ethiopia, an indemnity was paid to the negus and Kassala ceded to Great Britain.

Rudinì, 1896–98.—A new cabinet was formed in March 1896 by Gen. Cesare Ricotti-Magnani, who, however, made over the premiership to Rudinì. This leader of the moderate right introduced his own brand of transformism once more, by making an alliance with the radical left of Cavallotti. An amnesty was accorded to those involved in the Sicilian outbreak. The liberal Zanardelli was brought in to strengthen the cabinet, and Visconti-Venosta was once more persuaded to take over the foreign office after an interval of 20 years. A *rapprochement* with France was the natural corollary of this latter appointment, and the recognition of the French position in Tunisia put an end to 15 years of tension. In Eritrea Ferdinando Martini inaugurated a period of relative quietude and prosperity. Crispi's policy was everywhere reversed.

But social unrest, far from abating, had rather grown as a result of Crispi's rule of martial law. It needed only another rise in the price of bread, and disturbances began to spread. The elections of May 1897 significantly strengthened the Socialists and the radical and republican groups that with them made up the parliamentary *estrema*. The Italian Socialist party had met for its first conference in 1892 and had laid down a program which refused all idea of co-operation with a nonsocialist government. Rudinì took alarm at this parallel growth of economic distress with political insubordination, especially after the outbreak of mob rioting during May 1898. Martial law was proclaimed in Milan, Florence, Livorno and Naples, and one military officer ordered the use of cannon in the streets of Milan. There was much loss of life. Military tribunals then imposed severe sentences. Universities were closed; thousands of Catholic and Socialist papers and associations were suppressed on the supposition that they were guilty of inciting to revolution.

Pelloux.—Indignation over these panic provisions led to Rudinì's defeat in parliament in June 1898, and the king summoned Gen. Luigi Pelloux to replace him. Measures were introduced to give the administration greater freedom to suspend the ordinary constitutional guarantees of popular liberties whenever it was thought necessary in the interests of order. As these met with opposition from the left, Pelloux proclaimed them to be law by simple royal decree. The Socialists met this by the method of parliamentary obstruction, the only possible rejoinder to which was a proposal to reform the standing orders of the chamber so as to make it permissible for the speaker to cut debate short. In June 1899 discussion on emendation of the standing orders was arbitrarily cut off and a vote called. When the Socialist deputies overturned the voting urns they were imprisoned, and parliament closed. The courts, however, declared Pelloux's decree law unconstitutional and void, and when parliament assembled again the opposition deputies walked out of the house in protest. Pelloux thought it better to appeal for a verdict to the country and when the elections turned against him in June 1900 he resigned.

This conflict had narrowly averted the danger of a modification of the constitution in an authoritarian sense. It had taught the various groups of the *estrema*, including the Socialists, to work together; and with them were now associated the so-called constitutional left of Zanardelli and Giolitti. Very rarely indeed in Italian history has it been possible for such a common alliance of groups to be formed at a critical moment with a common policy of opposition and to present the electorate with something like a clear choice. Yet the narrowness of the victory had exposed a dangerous weakness in the parliamentary system. The bank scandals had already weakened people's confidence in parliament; so had the practice of obstruction, the quick succession of insecure governments, the readiness of the house to abdicate before a parliamentary dictator who alone could "get things done," and the evident malpractices in the conduct of elections. Important doubts about the nature of parliament were being raised by responsible liberals like Ruggero Bonghi, Gaetano Mosca and Sidney Sonnino, and suggestions were made that the king's authority might be increased, so that the ministry in power should not be responsible to parliament. Pelloux's failure momentarily removed this possibility; but many people had had their faith shaken in liberal democracy, and when the opposition groups fell away again from their common front there was always the danger that another Crispi or Pelloux might find it all too easy to upset parliamentary government altogether.

Saracco.—Some of the responsibility for what had happened fell on King Humbert, who, although he had not played a very active part in the politics of this stormy decade, had not advanced his reputation as a constitutional monarch and had on occasion actively intervened on one side of the current political dispute. A few weeks after summoning the elderly senator Giuseppe Saracco to succeed Pelloux, the king was assassinated by an anarchist, Gaetano Bresci, at Monza in July 1900. The deed was stated to be in revenge for those who had lost their lives at the hands of the authorities at Milan in 1898. Humbert was succeeded by his only son, Victor Emmanuel III. The new king was less popular than his father; but he was not the sort of man to carry out Sonnino's plan to reinforce the royal prerogative and began his reign as a model constitutional monarch.

Giolitti, 1901–05.—Saracco had been chosen as premier, like many of his predecessors, without much regard for the balance of opinions in parliament or in the country. His defeat in Feb. 1901 gave Victor Emmanuel the chance to restore confidence and tranquility by bringing in the left-wing liberals under Zanardelli with a broad but essentially liberal cabinet. The strongest man in it was the minister of the interior, Giolitti, who in 1903 succeeded Zanardelli as premier.

The chief problem these men had to face was that of the growing labour unrest, which repression and martial law had failed to subdue. Giolitti and Zanardelli had strongly championed the rights of parliament against the "exceptional laws" which Pelloux had tried to pass. They also maintained that the conservative imperialists were far more a peril to social and political stability than were the insurgent poor or the Socialists. They believed that the country would only settle down if a new equilibrium was

achieved which gave the working classes a greater stake in the nation and a greater share in its prosperity. The rich had so abused their power, said Giolitti, that "we have a large number of taxes paid predominantly by the poor, but not a single tax that is exclusively on wealth as such." He therefore asked for more social justice, being confident that in the long run this would add greatly to the wealth of the community and that it would turn would-be rebels into defenders of social order. Henceforth labour unions were to be encouraged instead of prosecuted, and the government was to remain neutral in strikes so that wages as well as profits might find their own level.

It was a symptom of the advance in industrialization that the years after 1901 saw such a wave of strikes. Agricultural unrest still continued, as the peasants attempted to obtain better contracts with landlords or to resume former rights over enclosed common land. The drift of workers to the towns or overseas had a gradual effect in putting more bargaining power in the hands of the better-placed agricultural workers and in getting for them wages nearer to those current in the new centres of industry. Among the town artisans, however, strikes were even more common, so that Giolitti's theory was soon put to a severe test.

Naturally the Socialists exploited these grievances to the full and tried to organize labour leagues wherever possible. But from the first the Socialists were divided into a number of factions and so never constituted such a danger as their numbers and doctrines might have suggested. A revolutionary wing was led by Enrico Ferri, advocating uncompromising class warfare, while the moderate Riformisti represented by Leonida Bissolati-Bergamaschi were ready to ally with the democratic liberals. It was the aim of Filippo Turati to keep both these wings from open breach, and at the Socialist congress of 1900 in Rome he secured a compromise whereby the objectives of each were approved as a maximum and a minimum program for the party. As the minimum program included such aims as the amelioration of wages and conditions of work, Giolitti saw enough common ground there to try and attract the Riformisti away from their friends and into the government coalition. His concessions to the Riformisti were thus not just a sign of weakness (as his enemies said) but part of a larger plan to divide the party and to weaken the syndicalist, anarchist and revolutionary factions inside Italian socialism. The party congress of 1902 marked the temporary triumph of the Riformisti, and this gave him encouragement.

At the same time Giolitti remained firm with the extremists and he showed that he could break a strike wherever he thought it was irresponsible or merely political, or wherever it affected public servants. Early in 1902 the employees of the Mediterranean railway threatened to strike for the recognition of their union and for greater security in employment. As this might have paralyzed the whole economic life of the country, the government called out all the railwaymen who were army reservists. In 1903 the Socialists refused an invitation to join the cabinet, but the fact that Giolitti made them the offer was significant. In the same year Ferri became editor of the party paper *Avanti* and ousted the Riformisti from their position of leadership. Another alarming symptom was the appearance of the Syndicalists, who proclaimed themselves opposed to all legislative parliamentary action and who favoured only direct revolutionary propaganda. In Sept. 1904 a general strike was proclaimed which spread to nearly all the industrial centres.

Giolitti saw that it possessed a frankly revolutionary character and so would lack some of the popular support which the ordinary grievances of the working classes evoked. Accordingly he gave the strikers full play, putting them in the wrong by his moderation and showing how ineffective was the general strike as a method of revolution. The strike fizzled out, and the feeling of reaction thereby generated against socialism was such that Giolitti was able to force a general election in which the extreme left suffered a minor defeat.

This was a triumph of political skill, just as the elections themselves were a triumph of administrative ability. By now Giolitti had learned how to keep a broad coalition in being and how to keep controversial issues as far as possible below the surface. His cabinet included several men from the right: Tommaso Tittoni, the prefect of Naples, as foreign minister and Luigi Luzzatti at the treasury. No sooner had his offer of an alliance to the extreme left met with a rebuff than he turned perceptibly toward the other direction. Zanardelli's project for the introduction of divorce legislation was thrown over in a new effort to conciliate the Catholics; and as a result the elections of 1904 saw some of the latter at last participating openly in politics.

This alliance with the Catholics was in the end to be an important access of strength; but the delicate balance thus contrived was not immediately stable, and by March 1905 Giolitti felt the need of retrenchment while he cast about for some new formula of cohesion. The railway workers had been practising a system by which they could obstruct and delay traffic without leaving themselves open to prosecution, and Giolitti's handling of the situation had met with much criticism. In order to escape further unpopularity, he made way for one of his own friends, Alessandro Fortis, as the next prime minister.

Fortis and Sonnino, 1905–06.—Some of the old ministers continued in office under Fortis. It was a colourless administration. Its most important measure was a bill for the purchase of the railways by the state. Haphazard enterprise had built many lines that were proving uneconomic to run, and it was generally agreed that only the state could foot the bill and deal with the railway strikes which were becoming so familiar an event. Fortis met considerable opposition from southern agricultural interests over the commercial agreement with Spain, which allowed the import of Spanish wine on favourable terms. In Feb. 1906 he fell, and the succession devolved on Sidney Sonnino and the right centre.

Sonnino had been waiting for this a long time. By now he had given up his earlier proposal that Italy needed a less parliamentary type of government, and people looked to him for a restatement of liberal conservatism within the limits of the existing constitution. His ministers included Luzzatti and Antonio Salandra from the right and beside them—by an incongruity now familiarized by long usage—two militant radicals from the extreme left, Ettore Sacchi and Edoardo Pantano. As Giolitti had won over a number of leading politicians from the right, Sonnino was forced to look far afield in order to make up a majority different from Giolitti's, and so a typical transformist gesture landed him with this unholy compact of irreconcilables. Ferri also decided to vote for Sonnino when he had refused to support the more liberal Giolitti. With such a composite majority it was unlikely that the government would last long. After three months, when it became obvious that Sonnino was far less able than Giolitti to manage labour strikes, the latter returned to power with another cabinet (May 1906).

Giolitti, Sonnino and Luzzatti, 1906–11.—Giolitti's third ministry had the unusually long duration of three years (1906–09). As before, it was mainly built up from the left centre, but Tittoni returned to the foreign office. It began auspiciously with the conversion of the public debt to 3½%, on lines already prepared by Luzzatti. Subsequent changes in the personnel of the ministry brought Pietro Bertolini over from Sonnino's party as minister of public works, and this tore another hole in the opposition alliance. When Gen. Ettore Viganò was succeeded by the senator Severino Casana, this was the first time that a civilian had ever been war minister. (It had been customary for the king to retain a specially close control over the service ministries as over the department of foreign affairs and often to appoint "nonpolitical experts" to direct them. Army generals had taken a special oath of obedience to the throne, and therefore frequently acted as servants of the king inside the cabinet, continuing in office from one ministry to the next. Indeed, Casana was quickly succeeded by another senior officer.)

This was a period of prosperity for Italy. For almost the only time in modern history, the annual budgets showed a favourable balance between 1900 and 1910, until another African war started the deficit again. Foreign trade doubled in this decade, wages rose, the general standard of life improved. Recognition of the southern question at last allowed the passing of remedial legislation for the betterment of backward areas. The surplus agricultural labour which had depressed standards in rural districts

was now taking to emigration overseas at the rate of 500,000 a year. This helped to raise wages at home, and the flow of remittances sent home by prosperous emigrants became an important item in the balance of payments. Meanwhile the development of hydroelectric power opened up new possibilities for Italian transport and industry, which had hitherto been crippled by the high cost of imported fuel. The Fiat company was formed in 1899 as a pioneer in automobile construction. By the concluding years of World War I it had become a great complex of highly modernized factories.

Meanwhile the relations between church and state began to show signs of change. Pope Leo XIII (1878–1903), although intransigent in word, showed much more political aptitude than his predecessor. His successor, Pius X (1903–14), was distinctly less insistent in his claims to temporal power, and his own political conservatism made him anxious that clerical influence should be felt in parliament to offset the advance of socialism. At the same time many prominent Catholics were trying to reconcile the church to the ideals of liberal democracy and even to vie with socialism in advocating social reform. From either angle it was now apparent that the refusal to recognize the loss of Rome had damaged both church and state; and since outside Rome the relations between clergy and local authorities had remained quite cordial and co-operative, many people on both sides argued that greater formal reconciliation was possible than the ultras had hitherto believed.

In local elections Catholics had always been allowed to vote, and it seemed only a natural extension when in June 1905 an encyclical practically abolished the *non expedit* and allowed more active participation by Catholics in national politics. The simultaneous breach between the Vatican and the French republic also made it more desirable to find a new lay ally and not to place every Italian in the dilemma of being either a good Italian or a good Catholic when the majority wished to be both. A number of religious institutions in the near east, formerly under a protectorate of the French government, were now placed under Italian protection. Giolitti also tried to make a compromise on the subject of religious education in such a way as to offend neither the Catholics nor the Freemasons and other anticlericals. At the elections of March 1909 more than a score of clerical deputies were returned, who seemed to have forgotten about the temporal power and were ready to accept the lately anathematized monarchy.

In Dec. 1909 Giolitti's administration was defeated over a point of procedure, and Sonnino returned to office for a few months. In March 1910 Luzzatti succeeded with yet another hotchpotch ministry. Each of these short governments tried to outdo the other in reforms, hoping thereby to gain support enough to form a coalition that was durable and coherent. But neither had the strength to carry them through, and it soon became obvious that they were only holding office on sufferance until Giolitti saw fit to return.

It was a current belief that Giolitti had resigned merely in order to run away from temporary unpopularity and was biding his time to watch political developments and intending to resume office at the first opportune moment. Those who had criticized his apparently weak handling of the strikes now had occasion to see that such men of the right as Sonnino and Luzzatti were equally powerless and that Giolitti's tactics might actually be taking the sting out of the *estrema*. In March 1911 Giolitti was summoned to form his fourth cabinet, which he made up for the most part of men who had served under Luzzatti. Once again he offered posts to the Socialists if only they would give up their maximum program and their tactic of non-co-operation with all bourgeois government. But in 1911 the extremists were recovering the control of the Socialist party which they had lost in 1908, and Turati decided that acceptance of Giolitti's offer might split the party beyond hope of recovery.

Foreign Policy, 1896–1911.—In the field of foreign affairs, the post-Crispi generation began to appreciate that the triple alliance had given Italy a false illusion of strength (which indirectly had led to Aduwa) with little compensating support and assistance. Between 1896 and 1901 Visconti-Venosta therefore moved the country back into a middle position where it was courted by both Germany and France and where its influence was consequently the greater. The triple alliance was renewed in 1902; but public opinion was no longer so favourably disposed toward it, and it was partially neutralized by written undertakings toward France. Victor Emmanuel III in Oct. 1903 visited Paris, and in April 1904 Pres. Émile Loubet returned the compliment in Rome. Meanwhile, the final rupture between France and the Vatican was also welcomed in Italy. French rights in Morocco were officially recognized, in return for recognition of an Italian sphere of interest in Tripolitania. An Italian note sent in Nov. 1902 gave a guarantee that the triple alliance was no longer directed against France. Another sign that the alliance was wearing thin was the independent understanding reached with Great Britain about interests in the Mediterranean.

Giolitti favoured this policy of good-neighbourliness and non-commitment. The triple alliance was again renewed in 1907 and 1912; but it was no longer an exclusive pact and, whatever it said on paper, was in practice to bind Italy hardly at all. On the contrary, Austria's petty persecutions of its Italian subjects in the *irredente* provinces, support of the anti-Italian Slav elements on the Adriatic littoral and active propaganda incompatible with Italian interests in the Balkans as well as the anti-Italian war talk of Austrian military circles imperilled the relations of the two allies. A typical clash occurred in Oct. 1902 when the German students at Innsbruck rioted against the Italians at the university. In reply to this there was a renewed campaign of irredentism. Italian schools and commercial agencies were encouraged from Rome to form outposts of Italian culture and influence in Trieste and the Alto Adige (as South Tirol now came to be called).

Such was the position of growing tension when the Austrian annexation of Bosnia in Oct. 1908 upset the balance of power in the Balkans. Tittoni failed, moreover, to obtain the compensation explicitly allowed under the provisions of the triple alliance, apart from a tacit understanding that Italy could retort by the "pacific penetration" of Montenegro. The episode was a warning to Italy of what to expect from its ally, and led to the granting of greater credits for the army and navy. In 1909 an agreement was made with Russia at Racconigi to keep a wary eye on Austrian expansion in eastern Europe. In 1910 a new Nationalist party held its inaugural meeting in Florence, and its leaders Enrico Corradini and Luigi Federzoni began to reassert the old doctrine of expansion, antidemocracy and totalitarianism. These men were to link the period of Crispi with that of Mussolini. They welcomed war as an end in itself, as a test of national power and an example of virility; in domestic politics they were to ally themselves with those who wanted more discipline and fewer concessions in labour disputes. There was no lack of money to aid such a combination of causes, and their dramatic appeal to public opinion evoked a surprising amount of enthusiasm.

Conquest of Libya.—The nationalist movement soon concentrated its forces in advocating the occupation of the Turkish dependency in Tripolitania. Since the disaster of Aduwa there had been little that was spectacular to show in the colonial field—only an abortive expedition to China in 1898 and steady commercial exploitation in Eritrea and Somaliland. It was now argued once more that national self-confidence could only be restored by a successful venture in north Africa. No regard was paid to the even greater need for spending any available capital in the impoverished provinces of southern Italy and Sicily. Sentiment and prestige were held to outweigh all other considerations. Some people even deluded themselves into thinking that Tripoli was an area that Italians could settle and fructify.

Before long, Turkey became alarmed at Italian intentions and hence unwilling to allow further commercial concessions in North Africa without a guarantee of good conduct, which Italy was not able to supply. When the French took Morocco in 1911 and when Germany, foiled at Agadir, began to look farther east, it became apparent that Italy would have to intervene politically or else run the risk of losing its claims by default. Even Giolitti, anxious as he was to avoid foreign complications and expensive new responsibilities, could not afford to disregard the feeling concentrated behind the proposal to invade Tripoli. His majority in the house was imperiled. So without thinking twice or stopping even to

make the preliminary diplomatic and military preparations that caution might have counseled, he provoked the necessary incidents and declared war in Sept. 1911 (*see* ITALO-TURKISH WAR).

The extreme left (including the Socialist Benito Mussolini) disapproved of this imperial venture; but otherwise public opinion was favourable enough. In Nov. 1911 Italian sovereignty was declared to extend over Tripolitania and Cyrenaica. The course of hostilities proved more difficult than had been expected. The rest of Europe was unfriendly and, while Austria placed a veto on the extension of fighting to the Adriatic and the Balkans, a serious diplomatic incident arose with France over the right to search vessels suspected of carrying contraband.

Peace preliminaries were finally signed at Ouchy in Oct. 1912, the sultan retaining only spiritual authority over the inhabitants of the annexed territories while Italy was given possession in north Africa and occupation of the Dodecanese Islands. But although Turkey thus acknowledged defeat, the indigenous Berbers carried on the war vigorously. Before long the Senussi had limited effective Italian control to a narrow coastal strip. Libya was yet to cost Italy dear. The expense of the war had again unbalanced the budget. In return for this, there was little increase in trade with north Africa or in settlement there. At home it had marked a significant victory for the parties that believed in violence, imperialism and authoritarianism. War had been declared and annexation proclaimed without the sanction of parliament, and the whole episode represented a decline in the standards upon which Giolitti had built his system of liberal government.

Giolitti's Domestic Policy, 1911–14.—Giolitti's last great reforms had been carried through in this period 1911–12. Luzzatti had introduced a plan for extending the franchise, but Giolitti had defeated him by unexpectedly announcing his conversion to a much wider plan which in the end raised the electorate from 3,000,000 to 8,000,000 voters. Even the bulk of Catholics and conservatives welcomed this, because they hoped that enfranchisement of the illiterate southern peasants would aid them rather than the radical left. In practice it was to help the transference of power from the old liberal ruling classes to new mass parties, whether Socialist, Catholic or Fascist.

Other reforms at this time included the payment of deputies, the government monopoly of life insurance and a new education act. The Coppino law of 1877 had nominally introduced compulsory elementary education; but the simplicity of avoiding laws and regulations in Italy had rendered it a dead letter, and almost half the people of Italy were still given as illiterate in the census of 1911. Luigi Credaro's act of 1911 was to meet with the same opposition of inertia; and though loans were offered at easy rates to local authorities for educational improvements, the communes were too poor and too lethargic to take them up.

One of the results of the Libyan war was to divide the Riformisti on the issue of pacifism, and this opened the way for the revolutionary faction to capture the Socialist party in the 1912 congress. Leonida Bissolati-Bergamaschi and Ivanoe Bonomi were expelled from the party for their approval of the government's African policy and formed a new group prepared to collaborate with the other constitutional parties in parliament. Turati stayed behind in the Official Socialist party; but he was now in a minority, and Benito Mussolini became editor of *Avanti* with an antidemocratic, intransigent "maximalist" program.

This split among the Socialists, together with the growing strength of the Nationalists and the entry of the Catholics into politics, made Giolitti turn slightly more toward the right. In Oct. 1913 the first elections were held under the wider franchise, and for these Giolitti made a compact which included Sonnino and the clericals. Since the extreme left would not join his majority, he had to strengthen himself in the other direction. The pact arranged by Vincenzo Ottorino Gentiloni earned him the support of the church, especially valuable in the rural constituencies; and although both the Radicals and the Socialists increased the number of their deputies to more than 70 each, the government did not at first seem to be in any danger. But the anticlericals, whether on the right or the left, took fright at this betrayal of the liberal position; and many others were offended at the scandalous methods by which votes were purchased or forged by the election managers. The defection of the Radical ministers from the cabinet early in 1914 then convinced Giolitti that he had better retire once again and wait for a more favourable moment to resume office.

Without realizing the fact, however, he had come almost to the end of his political career, and he was never quite able to reconstitute his majority. For more than a decade he had appeared to be a virtual parliamentary dictator. During this time the country had advanced notably in wealth and renown. Although Giolitti was to go down in history as a great corrupter of politics, in all probability the damage was done before he came on the scene, and his methods were not significantly worse than those of his predecessors. What he contributed was a competence in administration and a realism that saw the trends of the time and fell in with them. Many people were to look back on this as a golden age and to forget the premonitory signs of breakdown already beginning to appear.

World War I.—The events leading up to World War I found Italy in 1914 still officially allied to Germany and Austria. When in 1912 the triple alliance came up again for renewal, Italy had not dared to renounce it lest the act be taken as a positive affront to its former allies. Giolitti's government knew of Austrian intentions against Serbia in the Balkans, but did little to prepare the country for war and was no doubt hoping to invoke the clause in the alliance that gave Italy the expectation of compensations for any Austrian advance. Under the right-wing government of Antonio Salandra after March 1914, the marchese di San Giuliano (Antonino Paterno-Castelli) continued as foreign minister with the moderately germanophile policy that he had maintained under Giolitti.

In June 1914 riots broke out at Ancona against this conservative government; a general strike was called, the peasants rose against the landowners and the revolutionary Socialists Mussolini and Pietro Nenni tried to turn the rising into an organized revolution all over Romagna and Emilia. Many towns were captured and run by the revolutionaries as autonomous republics, and only with difficulty did the troops and police restore order. One political motive behind the revolt had been a protest against conscription and against the bellicose nationalism that threatened to involve Italy in a greater and more costly war than that in North Africa. Acceptance of the implications of the triple alliance was likely to cause grave division at home.

It brought general relief when the Austrian declaration of war against Serbia was met by an Italian declaration of neutrality. Italy claimed that it was not bound by the alliance to take part in an aggressive policy or to fight against England; moreover it had not been consulted over the actions that precipitated the outbreak of hostilities. There was no thought at first of intervening with Great Britain and France; it was simply intended that independence of action should be reserved, and care was taken not to denounce the triple alliance in case future policy should dictate a claim for compensation from Austria in the Balkans as the alliance itself prescribed. The decision for neutrality was accordingly not left to parliament but was taken by an executive act that allowed Italy greater freedom of movement.

On San Giuliano's death in October, Salandra appointed Sonnino to the foreign office. One of his first actions was the occupation of the town and harbour of Valona on the Dalmatian coast. Peaceful penetration by Italy had been continuing for some while in this area, and there was thought to be a danger that Austria and Greece between them might spoil everything if Italy did not quickly stake out a territorial foothold. Occupation was also a countermove against the advance of the Slavs, which had lately been causing considerable preoccupation in Italy; it was also a pledge to hold against the possibility of victory by Austria.

At the same time, negotiations proceeded with Vienna over the compensations in the *terre irredente* which Austria might be prepared to surrender in payment for Italian benevolent neutrality. The "triplicists" were fairly numerous in conservative and diplomatic circles and in the army. The Catholics were firmly in favour of neutrality, because they disliked "atheist" France and Orthodox Russia, and their natural sympathies lay with Catholic Austria.

Many people in Vienna were quite certain that Italian finances would not stand a war and thus thought that they could play for time in these negotiations. For them, the cession of territory to Italy was feared as a possible signal for the breakup of the whole Austrian empire; and Trieste in particular was indispensable as a port in the Mediterranean. Only too late, in March 1915, was some move made to meet Italian wishes, so as to prevent Rome from intervening on the other side.

By this time, feeling in many quarters was hardening in favour of intervention on the side of the Allies. The irredentists and the Nationalists saw that this was perhaps the last chance for completing Italian unity and affirming Italy's position as a great power. The democrats, Freemasons, republicans and Reformist Socialists were in favour of intervention out of sympathy with France against militarist and authoritarian Germany. As for Mussolini and the revolutionary Socialists, they abruptly changed from pacificism to the other extreme of bellicosity when they perceived how war might generate a revolutionary situation from which they stood to profit. Accordingly, Mussolini broke off from the Official Socialist party, resigned the editorship of *Avanti* and founded a new paper, *Il Popolo d'Italia*, which supported intervention.

Sonnino and Salandra were determined not to let the war end without trying to acquire at least a part of the Italian districts in Austrian possession and to secure a rectification of the frontiers of 1866 (which left Italy open to invasion). They had first demanded from Austria the Trentino, the Isonzo valley and a free hand in Albania. At the same time as negotiations were proceeding on these lines, the Entente was approached to know what price would be offered by the other side for Italian aid. There was a danger that if it did not choose its partner quickly, the war might end soon without Italy's obtaining any advantage. On April 26, 1915, the treaty of London was concluded between Italy, Great Britain, France and Russia. In return for intervention, Italy was to receive the Trentino and all the Tirol up to the Brenner pass, Trieste, Gorizia, Istria and Dalmatia down to Cape Planka. Fiume (Rijeka) was, however, not included. A week later, the triple alliance was at last denounced. All this had been done without reference to parliament or to public opinion and probably even without debate in the cabinet. There is little doubt that the majority of the deputies agreed with Giolitti in advocating the continuance of a neutral policy as that from which Italy had most to gain. Giolitti knew at first hand the weakness of the armed forces and also believed that something could be obtained in the end from Austria in return for a simple and easy promise of nonintervention. But he dared not be too open in advocating these opinions for fear of weakening the government in its negotiations with Vienna. It came as a complete surprise to him and everyone that the king had dissolved a 30-year-old alliance and committed the country to war on his own executive authority.

Salandra was thus faced with a potentially hostile parliamentary majority as soon as the news of his act leaked out. So he put off the summoning of parliament and allowed free rein to interventionist demonstrations, bringing back Gabriele d'Annunzio from his exile in France for the purpose. Austria made a last-minute effort to offer some of the *terre irredente*. But Giolitti had done nothing to organize the opposition deputies to make criticism effective and was not himself in Rome. The king was also committed, and the king's influence on parliamentary votes was considerable. Mobilization proceeded, and the king refused to accept Salandra's resignation. When it finally met on May 20, 1915, parliament had only to ratify a *fait accompli*. Giolitti called off the struggle in order to save the national honour. Three days later Italy declared war on Austria-Hungary, and Salandra justified his action against the ally of yesterday by invoking what in a celebrated phrase he called *sacro egoismo*.

Once it had voted full powers to the government, parliament played very little part during the rest of the war. The military leaders upon whom responsibility fell for planning the successive campaigns were severely handicapped by the lack of munitions and industrial capacity. The army had not yet recovered from the Libyan war. When expectations of an early victory began to recede, it also became clear that there were serious weaknesses in generalship and organization. On the Isonzo front the Italians had a decisive superiority in numbers, but the difficulty of the terrain, coupled with the fact that no strategic plans were ready for such a war against a recent ally, made progress almost negligible for the first year. Then in May 1916 the Austrian victories in the Trentino and on the Asiago plateau shook the cabinet, and in June the almost 80-year-old Paolo Boselli became prime minister. The new ministry was notable for little except that it included representatives of the Catholics and the Reformist Socialists. In Aug. 1916 Gorizia was captured by the Italians, and Italy also at last declared war on Germany, thus removing a source of friction with its other allies. In April 1917 an agreement was concluded with the French and British at Saint Jean-de-Maurienne whereby in any future partition of Turkish territory the Smyrna area was to be assigned to Italy.

The strain of protracted war, the collapse of Russia and the grave privations at home had accentuated the feeling of depression in Italy. Enemy and neutralist propaganda contributed to this. The Socialist Claudio Treves coined a widely publicized phrase, "Next winter not a man in the trenches": and this, together with Pope Benedict XV's allusion to "the useless carnage" of the war, began to affect public opinion and the war-weary troops. On top of everything, Gen. Luigi Cadorna and his subordinate officers made certain serious military errors, and an Austro-German penetration at Caporetto in Oct. 1917 thrust the Italians right back into the plain of Lombardy on the Piave river.

The front was at last stabilized, British and French troops being hurried in to help. Cadorna was replaced by Gen. Armando Diaz. Boselli resigned in favour of Vittorio Emanuele Orlando, under whom Sonnino still retained the foreign office; and the radical Francesco Nitti was brought into the treasury. In the effort to repair the defeat, a magnificent response came from all sides now that the country was so obviously in danger.

In Jan. 1918 the U.S. president, Woodrow Wilson, published his fourteen points, and the Italians began to see how war aims to give autonomy to the peoples of Austria-Hungary and to rectify the northern frontier "along clearly recognized lines of nationality" would affect them adversely. But for the moment no protest was made, and potential differences between Italians and Slavs were buried in the effort to win the war. A Conference of the Subject Races of Austria-Hungary was held at Rome in April 1918, and it presented to Orlando the so-called pact of Rome, which bore the promise of hopeful collaboration between both peoples. But this pact never received official sanction; and although Slav units fought on the Italian front, Italian ambitions were still directed to domination of the Adriatic and so meant inevitable conflict sooner or later with the Dalmatian populations.

In June 1918 another Austrian offensive was successfully halted on the Piave, and a final counteroffensive began. While one Italian contingent was helping the Allies in Macedonia, Diaz won the victory of Vittorio Veneto at the end of October, after which an armistice was signed with Austria at the Villa Giusti near Padua on Nov. 3. In the whole course of the war Italy had lost between 400,000 and 600,000 men killed. It had been invaded and had suffered enormous damage and privations. It was not a strong nation, either physically or psychologically, which had to stand up to the strains of the postwar period.

The Peace Settlement, 1919.—In Feb. 1919 the Italian government presented a memorandum to the peace conference embodying and justifying its territorial claims. These for the most part corresponded to those agreed upon in the treaty of London of 1915, except that Fiume was also included. This represented a victory for the Nationalists, whose spokesman was the foreign minister, Sonnino. On the other hand, the so-called *rinunciatori* or renouncers were ready to give up Dalmatia, part of Istria and the Trieste hinterland, because they wanted at all costs to conciliate the Yugoslavs; while they claimed Fiume as Italian, some of them were even prepared to renounce the Alto Adige because of its German-speaking population; and Bissolati had resigned from the cabinet in 1917 when Sonnino had unexpectedly and arbitrarily declared the existence of an Italian protectorate over Albania. This division was fundamental and irreconcilable among Italian

politicians and was even present inside the peace delegation. Bissolati resigned once again, and he was followed by Nitti in Jan. 1919. Sonnino, however, stuck to the treaty of London and was unmoved by the implications of the fourteen points or by the Yugoslav counterclaims up to the old Italo-Austrian frontier.

In Feb. 1919 the Adriatic question came up before the Paris conference, and these differences were brought out into the open. As no progress was made, Wilson published in April his famous appeal to the Italian people over the head of their government, setting forth his reasons for opposing the Nationalist claims. This appeal aroused considerable indignation, and the Italian delegation withdrew in protest from Paris for a fortnight. In Rome Orlando received an overwhelming vote of confidence and found adherents even among the Socialists. But he then had to return to Paris for fear that his allies might conclude a separate peace. There he failed to make any advantage out of the fact that the other powers wanted Italy to sign the German treaty and accept the League covenant. Meanwhile he had allowed D'Annunzio and the Nationalists to stir up popular feeling for the acquisition of both Fiume and Dalmatia. He had hoped that this would act as a pressure on the Allies to make them yield; but in fact it only aroused in Italians a sense of frustration at his own inability to get results, and in June a defeat in the chamber forced him to resign in favour of Nitti.

The settlement finally achieved for Italy gave the nation a great deal, if not all, of what it had fought for. Wilson agreed to allow strategic considerations to outweigh "clearly recognized lines of nationality" in many places. Italy got the Brenner frontier, although this meant the inclusion of many German-speaking people in the two new provinces of Trentino and Alto Adige; also the great port of Trieste and a compromise settlement in Venezia Giulia and the Istrian peninsula which brought 250,000 Slavs under Italian rule. In Sept. 1919 the peace treaty with Austria was signed at Saint Germain-en-Laye, leaving the question of Fiume and Dalmatia still open. This was both more and less than what the treaty of London had promised. The other Allies had been enabled to disregard this treaty on the grounds that the United States had not signed and did not recognize it, just as the agreement of St. Jean-de-Maurienne was given up on the plea that it had not been officially ratified. Italy thus did not obtain a footing in Asia Minor; nor did it acquire any material compensation in Africa for the German colonies which passed to other nations as mandated territory. Italy's chief gain—and it was very considerable—was that its old hereditary enemy, Austria-Hungary, was no more and that the principal *terre irredente* had at last been redeemed.

There was, nevertheless, general dissatisfaction at these results, and the Nationalists were able to manufacture a legend that Italy had won the war but lost the peace. The fact was that once again, as before in 1870, the balance of power in Europe had been upset, so that Italy, which was still essentially a weak country, found it impossible to make its influence felt by holding the scales. The situation was rendered worse by the fact that Orlando and Sonnino proved unyielding and unrealistic in negotiation and refused to face the fact that Yugoslavia was also one of the victorious powers which had claims that could not be disregarded. The aim of security defeated its own ends when it made an enemy of such a neighbour.

Internal Politics, 1919.—The governments of Orlando and Nitti had many internal difficulties with which to contend. Demobilization brought with it the dismal prospect of unemployment. The financial situation was serious, and the budget statement presented in Nov. 1918 showed a deficit of 6,271,000,000 lire. The bread subsidy involved a huge expenditure and could not easily be abolished because of the steeply rising prices and their effect on the cost of living. Doles to the unemployed and subsidies to the farmers and to the industrialists added to this burden. The working classes were now well organized for political action, and politicians did not dare to risk their popularity by a deflationary policy. In Jan. 1919 the Partito Popolare Italiano was formed by some of the Catholics, with a more definite program and a more complete organization than the elder Catholic group. Its leader was Don Luigi Sturzo, a Sicilian priest, who advocated reforms of a Christian-Socialist character, including the expropriation of some of the larger landed estates for the benefit of the peasantry, with compensation to the landlords. His party also had a large trade-union following and went far toward winning the rural workers from the Socialist labour leagues. But the church itself, though trying at first to have nothing officially to do with this new party, could not avoid using indirect influence to make it more and more conservative; and especially when Pius XI succeeded Benedict XV in 1922 the Popolari found themselves progressively divided and undermined. Although they obtained 100 deputies in the elections of 1919, they never had the strength that their numbers warranted.

The Official Socialists, with 156 deputies after those elections, were the largest compact party in parliament, if not in the whole previous history of the Italian parliament. They also controlled the local government in more than one-third of the provinces. But they, like the Popolari, were frightened at formulating a definite program with which to confront the difficulties of the times, because any such program would threaten some vested interest and lose electoral support, and any precise wording of a policy threatened to split the party into two or more fragments. Playing for safety, they continually refused to take responsibility for positive action, preferring just to oppose every government in turn and rejecting every suggestion of a progressive alliance against the forces of conservative reaction. Yet they also continued to frighten middle-class opinion with threats of revolution, which apparently they had little intention of carrying out. The Socialist congress in 1919, against Turati's advice, voted for the expropriation of the capitalists, if necessary by violence, and for the institution of a soviet republic in imitation of Russia. As an earnest of their supposed intentions, a series of avowedly revolutionary strikes broke out in every trade and even in the public services. Small wonder that propertied men began to fear for their livelihood and looked about for someone to lead a counterrevolution. It was not appreciated that the Socialist movement was far too irresolute and divided to be dangerous. Ever since Mussolini and the Syndicalists had left the party before the war, it had adopted a pacifist and defeatist mentality.

The man who was eventually to be engaged by the counterrevolution was of course this same Mussolini. But in 1919, the year in which the Fascist party was inaugurated, he had not yet completed his *volte-face* from revolutionary, republican socialism to being the spokesman of conservatism and monarchy. His party program included such demagogic measures as the imposition of a capital levy, the confiscation of ecclesiastical property and an unusually large tax on war profits. In the elections of November, the Fascists obtained not a single seat. This failure helped convince Mussolini that there was little hope of power if he continued to follow the radicals in his party instead of the trimmers and the opportunists.

The strength of socialism and the existence of these two new parties, the Popolari and the Fascists, made the task of forming the customary government coalition exceptionally hard. There had been little previous history of highly organized, dogmatic parties in Italy; and in this new situation the necessary compromises inherent in Giolitti's system were difficult to achieve. The electoral law of Sept. 1919 had adopted the proportional system, whereby the voter voted not for a candidate but for a list. Sonnino and Giolitti had opposed this change, because the gainers would clearly be the Popolari and the Socialists, both of them being well organized and based on mass appeal. In the subsequent elections, Giolitti, Nitti and Salandra had gone on with their small, bickering groups instead of sinking their differences and rivalries in the interests of a liberal bloc with a common list in order to counter the unconstitutional objectives of the extreme left and right. This was to invite failure. Subsequently, in the new parliament, each of them in turn was to foil the others' attempts to form a government of the centre.

Fiume and the Treaty of Rapallo.—Meanwhile, fresh troubles had broken out at Fiume, which, as an Italian island in a Slav sea, was a natural danger spot, one moreover where D'Annunzio's propaganda had dangerously involved the national honour. Clashes between Italians and French troops induced an inter-Allied

commission to recommend the importation of British police to the town, and this was the signal for D'Annunzio to lead some mutinous soldiers in a piratical raid on the city. Public opinion had been led to believe that Fiume was naturally Italian, unreasonably snatched away from Italy by jealous allies at the peace conference. It was also feared that the trade of Trieste would languish if Fiume remained independent under some rival power, because they were rival ports for the commerce of central Europe. D'Annunzio captured the city in Sept. 1919 and ruled it for more than a year to the accompaniment of much posing and speechifying.

Nitti's government officially deplored this adventure; but with such an uncertain majority in parliament, Nitti did not dare use forceful measures to restore the authority of the state. Indirectly, if not also directly, he helped to keep the Reggenza del Carnaro in existence and used it as a bargaining counter to convince Europe that Italy had been badly treated and must be appeased if war was to be averted. Apart from antagonizing the Slavs, the result was to set an example of successful, unpunished illegality and to fan the flames of nationalist ardour still further. The men of Fiume and the techniques they had employed there were later to be of great assistance to Mussolini.

Nitti's policy was just to let the spirit of unrest wear itself out, regardless of the immediate danger to the country. Yet at the same time he annoyed the Nationalists by granting an amnesty to deserters and by advising army officers to go about in mufti and disarmed when off duty. When he created a force of royal guards to preserve order against a new outcrop of strikes and riots, this was strongly resented by the Fascists and Socialists, against whom it had been directed. Such was the combination of forces against him that in June 1920 he resigned.

This brought back Giolitti to power for his last and least effective term of office. His foreign minister, Carlo Sforza, had to meet certain troubles in Albania, where Salandra had established an Italian protectorate. The cost of this occupation had been considerable, and it had still not won over much enthusiasm in Albania itself. Armed conflicts were frequent, and the unpopularity of the whole venture now led to another mutiny among the Italian troops. Giolitti gave in to this, surrendered the protectorate and withdrew the Italian army. This infuriated the Nationalists. At the Spa conference in July 1920 Italy succeeded in getting its share of the German indemnity raised to 10% and that of the Austrian, Hungarian and Bulgarian indemnities to 25%. An interim settlement was made with Turkey in the treaty of Sèvres, signed in August. Then in November the outstanding differences with Yugoslavia were settled in a conference at Rapallo. Italy at last waived its claims to Dalmatia, except for the town of Zara. A frontier was agreed which allowed Italy possession of the islands of Lagosta and Pelagosa. Both powers recognized the independence of Fiume. The Italian-speaking inhabitants of the territories assigned to Yugoslavia were entitled to opt for Italian citizenship; and full freedom of language, culture and religion was promised to Yugoslavs in Italian territory.

This settlement brought considerable gains to Italy, although the fact that any concessions at all were made to the other party rankled with D'Annunzio and his friends. By a secret clause, which soon became public property although Sforza denied its existence, Port Baros adjacent to Fiume was promised to Yugoslavia. D'Annunzio, the self-styled regent of Fiume, refused to recognize this treaty, and Giolitti was at last bold enough to send Gen. Enrico Caviglia to oust him. He surrendered at the first show of force. It was then agreed to withdraw Italian troops from Dalmatia and Fiume, although they remained in Fiume during 1921 since the town elections were considered to demand their presence. Not long afterward, Mussolini decided to upset this arrangement and recover Fiume for Italy.

Giolitti's Last Government.—The temporary settlement of Fiume and the agreement of Rapallo showed that Giolitti had a clearer idea than most others of the path that Italy should follow. In domestic affairs he aimed once more at a compromise policy in order to secure as broad an agreement as possible. But the war of class against class was by now too strong for him. Internal troubles were reaching their worst in the autumn of 1920, and there were industrial, agricultural and railway strikes in various parts of the country.

In September a serious agitation broke out in the metallurgical industries. The factory owners, most of whom had made large profits in the war, were alarmed at the signs of a slump and decided that they could not afford to yield to the demands of their employees. Strikes at the Romeo works in Milan were thus countered by a lockout. In reply to this, the Federation of Metallurgical Workers called on all the metalworkers in Milan to remain permanently at the factories without working. The Federation of Mechanical Industries then extended the lockout to the whole of Italy. The workmen responded by seizing a number of factories and trying to manage them on their own without the owners or managers.

This was the famous "occupation of the factories," which some held to be the supreme justification of the Fascist revolution. In fact it was a haphazard affair, not desired or planned by the Socialist party. Giolitti skilfully avoided using force, for this might have united the several factions of socialism and also would have played into the hands of those counterrevolutionaries who were stirring up social and industrial conflict in the hope of precipitating a showdown. By simply letting matters take their own course, he successfully showed at once the weakness of the extreme left and the hollowness of the alarm shown by interested reactionaries on the right. Unfortunately he went too far in his pacifism and did not always take action to repress actual hooliganism and the more and more frequent breaches of the peace. The Fascists and the red guards outdid one another in armed disorder; and private justice grew up to supplement the evident deficiencies of public justice. Mussolini publicly welcomed the occupation of the factories; but before long he saw that his best hopes of achieving power were to throw his lot in entirely with the reactionaries, instead of trying to curry favour simultaneously on all sides.

For the moment, in Sept. 1920, Giolitti intervened with an acceptable compromise by which the workers evacuated the factories in return for some concessions—their effort to manage the factories on their own had proved a hopeless failure. The centre of interest shifted to the country districts where the *braccianti* or landless labourers had always been on the verge of starvation and were now being driven by postwar conditions into a state where they had almost nothing to lose and apparently almost everything to gain by insurrection. Nitti had already been forced, in a decree sponsored by Achille Visocchi, minister of agriculture, to allow retrospective sanction to some of the forcible land occupation effected by the peasants in fulfilment of promises made during the war. Over large areas in Emilia and the Romagna the labour leagues had acquired great authority in local government and were sometimes beginning to dictate terms of employment to the landlords. The latter replied that, if these wage demands were conceded, they would not have enough income remaining to pay their taxes; and to show their temper they set about organizing armed resistance. The Agrarian Association of Bologna was particularly effective in the organization of armed squads, and the Fascists soon emulated the technique.

Property owners everywhere began to rally in defense of their way of life. For them Giolitti came to be feared as a man who desired higher income tax and death duties and allowed strikes to continue with impunity and an eight-hour day to be enforced in industry. At the same time his fixed idea of letting social forces find their own level unimpeded played incidentally into their hands; for when they really set their minds to it they could muster far more massed power than the Reds, especially when aided by the organizing genius and ruthlessness of a Mussolini. It was perhaps natural for the middle classes after the Russian Revolution of 1917 to fear revolution only on the left and not from the right. Giolitti himself had little idea that fascism was to be feared and rather hoped to make use of it as he had made use of Catholicism or socialism to suit his own purposes—in this instance to bring socialist ambition within bounds.

His policy of domestic nonintervention was soon bearing fruit. At Bologna the Red leaders had to fly for their lives where lately their word had been law. The town council was forcibly dissolved

and the Fascists wrecked or burned down various buildings owned by the Socialists. Throughout the Po valley the Fascists proceeded to break the domination of the "Red baronies"; the revolutionary leagues which had controlled labour in that area were dispersed; and one Socialist town council after another resigned in fear or was dissolved.

Parallel with this there was a disintegration at Socialist party headquarters. A demand arrived from Russia that the Italian party should carry out its old "maximum" policy and expel all those tainted with the Reformist heresy. The reason given was that only by violent revolution and absolute submission to the orders of Moscow could socialism succeed. At the general congress of the party at Leghorn in Jan. 1921 a compromise resolution was adopted. Turati, Treves and the main trade-union body grouped in the Confederazione Generale del Lavoro (C.G.L.) showed that they were still prepared to collaborate in the parliamentary system and still wanted at all costs to keep the comprehensiveness of the party intact. The Communists (represented by 18 deputies) thereupon broke away, formed a party of their own and tried to assert themselves in what amounted to almost open civil war against fascism. The vicious circle of assassination and reprisal thereby received a new stimulus.

In this atmosphere Giolitti's policy of social neutrality did not work. The need to repair the great financial deficit was already forcing him to commit himself on many points where it might have suited him to keep silent. At the end of 1920 he had brought in legislation about the registration of bearer bonds, which was designed to diminish some of the general tax avoidance then so prevalent; and this had seriously shaken the adherence to his majority of share-capital owners. It was furthermore the final cause of alienating the church and the Popolari, for bearer bonds had been a common method of evading the law against ownership of property by the church. Another much-criticized move was the abolition of the bread subsidy in Feb. 1921, for this made enemies of many Radicals and Reformist Socialists. Financially such a measure was inescapable; but socially it seemed inequitable, and the consequent rise in food prices added fuel to the growing class war.

Because of the insecurity of his parliamentary position, Giolitti dissolved the chamber in April 1921 and held elections in May. Altogether misreading the situation, he made an electoral alliance with the Fascists and Nationalists, hoping that this would give him a majority, but such a one as would leave him master of his allies instead of their slave. Out of 535 seats, the Popolari increased their representation to about 108; there were about 123 Official Socialists, 34 Reformists and 15 Communists; there were 64 Radicals, 10 Nationalists and 35 Fascists; and the remainder was made up of nondescript liberals. The fact that there were now 35 Fascists in parliament where the 1919 elections had returned none must be in part attributed to Giolitti's error. Incidentally, he had permitted the use not only of the usual government influence on elections by corruption and intimidation but also of violence and even a reign of terror in many areas where police were told to maintain the fiction of "nonintervention." To crown all, Mussolini and the Nationalist Federzoni at once passed over to the opposition in parliament. They attacked Giolitti for his support of the League of Nations, for the occasional radicalism of his domestic policy and for his continued belief in the methods of parliamentary democracy. As he had not obtained the requisite majority, in June Giolitti resigned.

Bonomi and Facta.—From June 1921 to Feb. 1922 the prime minister was Ivanoe Bonomi, with a cabinet in which the Popolari were at first the preponderating influence. Bonomi, although a Reformist Socialist in origin, had never altogether exculpated himself from the accusation that as war minister under Giolitti he had connived at military stores' passing into possession of the Fascists. Under his government fascism continued its gradual process of building up a nationwide party organization, comprising a mixture of every extreme, idealists and undesirables, republicans and monarchists, agrarians and former syndicalists, reactionaries and Sorelian or Blanquist revolutionaries. There was nothing new in such a mixture for Italy, except that it included few but extremists of one shape or another. What was new and bewildering was the competitive armed violence of Fascist and Socialist squads—in which the Fascists nearly always proved to have better resources, more arms, much more money and greater cruelty and ruthlessness.

In many areas the Socialists soon dared not show themselves and had to allow their houses, printing presses and party headquarters to be pillaged at will, being forced in the end to advocate nonresistance and invoke government aid for the preservation of law and order. Local Socialist administrations were expelled in one place after another, the popular vote being simply set aside as irrelevant. The trade-union organization was crushed piecemeal, and rival Fascist syndicates erected in the unions' place. Still the government stood aside, perhaps secretly glad that the largest opposition group was thus neutralized and expecting that fascism with its small group of deputies could be easily tamed when its work of destruction was complete.

Meanwhile Mussolini was playing his own game of transformism. Although he held some powerful cards, his position in parliament was still very weak. The Fascist party was by no means united on policy, and he was only one leader among many. It was necessary to trim his sails to each favourable wind and to maneuver both with other parties and inside his own party. Thus in Aug. 1921 he signed a pact with the Socialists (which later on he preferred to forget). It was intended as a test of strength, to see if his other colleagues would follow him, and perhaps in the hope that the two avowed revolutionary parties might make up their differences and overthrow the parliamentary form of government which both affected to despise. But the local leaders—Dino Grandi, Roberto Farinacci, Italo Balbo and others—dug in their toes at this sudden and illogical change of front; and when the agrarian backers of fascism brought Mussolini to book he changed back again and tried to cover up his tactical error. The threatened split in fascism was healed before the liberals and Socialists could think of joining forces against him.

Attacked on all sides, the Bonomi cabinet resigned in Feb. 1922. A ministerial crisis lasted for almost a month, during which each parliamentary leader in turn declined to form a cabinet, believing that he could achieve nothing with parliament so divided and factious and would only lose his reputation in a useless cause. At last a nonentity was found—as in so many similar moments in the past—who was sufficiently colourless and pusillanimous to avoid any definite commitment and who thus obtained a bare majority. This was Luigi Facta, the last prime minister before Mussolini. In the next few months some achievement was registered in the reconquest of Tripolitania from the Senussi and in the international economic conference which opened at Genoa in April; but at home there was a continuance of industrial troubles, and another unpredictable shift among the parliamentary groups in July put Facta in a minority.

Once again, the country had no government at all for several weeks and the Fascist squads pursued their old course unmolested and unpunished. Nitti, Filippo Meda, Giolitti, Bonomi, Sturzo, Turati, Orlando: none of these was prepared to sink mutual differences and personal dislikes to give the country a strong government which was also liberal and constitutional. Each was waiting for a "more favourable moment" in which to resume office; each faction, moreover, was beginning to suspect that no cabinet would succeed in which Mussolini was not a partner—such was the impressiveness of Mussolini's character, the force of his propaganda and the evident weakness of the state authorities. Accordingly, a number of groups entered into unofficial relations with him, to prepare the way for receiving office in a future coalition. Meanwhile Facta returned to his position as premier, because, although defeated, there was manifestly no other combination which would yet work at all.

On July 31 a general strike was called throughout all Italy by an unofficial committee of certain labour unions, proclaimed to be a "legalist" strike by Turati because its professed object was to affirm the authority of the state against the Fascists. This was thought to be the last weapon yet remaining to the left, and it was a futile one. It upset the general public and its ridiculous failure proved to be the ultimate confession of Socialist bank-

ruptcy. Not even at this moment were the Socialists anything like united over aim or tactics. Mussolini, on the other hand, saw in this strike his great chance to show himself the defender of law and order, the only element of authority and power when the state itself was apparently powerless.

The Fascists and Nationalists therefore ordered a general mobilization and issued a manifesto calling on public servants and the workers "to shake off the yoke of the politicians by whom they were led" and giving the government 48 hours in which to prove its power and break the strike—"after which fascism will assume full freedom to supplant the state." This was an admirable opportunity for the Fascists to seize control of the administration of such major towns as Milan, Genoa, Livorno and Ancona where the Socialists were still entrenched, and so to open the road for the final march on Rome.

The Socialists had for years dominated the town council of Milan, which was the industrial capital of the country and its wealthiest and most populous city. The commercial classes there were naturally pleased when Fascists took the place of the strikers and restored the train services on which they were so dependent. Much pleasure was also given in the same quarters when on Aug. 3 a veritable invasion of the town ended in the burning down of the building where the Socialist paper *Avanti* was printed and when finally the town hall was occupied and the Socialist administration forcibly ejected. At Genoa the Fascists led a similar and equally successful operation against the port consortium which was largely under the influence of the Red dockers' union.

Instead of arousing violent indignation, these illegal actions almost seemed to put the state authorities in the wrong and the Fascists in the right, for public opinion was probably against the strike. They also discredited the Socialist movement and its leaders and caused further divisions and loss of morale inside the party. Above all they discredited the government, which had shown itself unable to deal either with the strike or with the criminal actions of the strikebreakers. The continuance of the widespread anarchy was a primary aim of Mussolini's, because the economy of Italy was beginning to recover after the immediate postwar years. Strikes were diminishing, the cost of living was evening out and trade was reviving. But it was imperative for Mussolini to keep up the appearance that economic breakdown was round the corner. All this had been achieved for him by Socialist incompetence and intransigence.

The new coalition which Facta formed in Aug. 1922 contained some well-intentioned liberals but also some people who, if not actual traitors, were at least disloyal. Once again the weakness of the Italian system of government was revealed. In the first place it had no room for an organized opposition ready to focus discontent and ready to take office with a clearly expounded opposition policy for the country's choice. In the second place it represented a series of imprecise coalitions, all of which lacked a common denominator, none of which dared risk discussion or action on the most burning questions of the day. The problem of whether or not to crush fascism while there was still time would have split this particular cabinet and so was never squarely faced. Yet the liberal ministers did not resign from it, for the principle of collective responsibility had never been precisely established.

The strength of fascism at this moment is difficult to assess. The full support of the government election agents had not enabled the Fascists to win more than 35 seats in parliament; and although they were becoming strongly entrenched in local administration, this was usually by intimidation and terror. In southern Italy there was said to be very little fascism until after Mussolini's forcible conquest of power. It had some influence at court through the queen mother Margherita and in virtue of the threat that the popular Emanuele Filiberto, duke of Aosta, would be put up as a Fascist pretender to the throne if the king proved unyielding. The agrarians and industrialists were naturally in sympathy with a movement which came to stand for strikebreaking, lower wages and substantial economic protection; demobilized officers and the educated unemployed were especially open to Fascist propaganda; many among the Nationalists and the Catholics fell for its more specious attractions; and disorderly elements at every level of society welcomed the violence, the plunder and the chance to work private grudges off with impunity.

Whether or not all this amounted to a strong numerical body of opinion, it affected many among the so-called governing classes. The fact remains that many of the self-styled liberal newspapers were coming to approve the punitive raids of the Fascist squads and gave moral support to the Fascist demand for political power. Salandra, Giolitti, Nitti, Bonomi, Benedetto Croce and Luigi Albertini (editor of the *Corriere della Sera*) either actively or passively assisted the momentary alignment of public opinion which made possible the final *coup d'état*—although they all later regretted the fact.

Rather than positive strength, it was the weakness of its enemies that made this coup possible. At the Socialist congress held early in Oct. 1922 the party split into two further groups: the Unitari or collaborationists round Turati, Treves and Giacomo Matteotti; and the uncompromising Massimalisti who remained to dominate the official body. The Bonomi Reformists, the Syndicalists and the Communists round Antonio Gramsci had already formed separate groups. As a result of this split, the C.G.L. broke off its alliance with the Socialist party and declared itself a nonpolitical body. Likewise the Partito Popolare was divided by conflicting tendencies, and the Catholic party was seriously weakened when Pope Pius XI enjoined the bishops and clergy to abstain from partisan political activity.

Not the least part of Mussolini's skill lay in the way in which he managed to retain the more or less grudging support of so many liberals at the same time as he openly advocated revolution and the supersession of parliament. At a gathering at Udine on Sept. 29, 1922, he made an important declaration in favour of the monarchy, thereby winning the favour of many nonfascists. The ostentatious abandonment of his earlier anticlericalism and republicanism was typical of the man; but instead of being read as evidence of his fundamental opportunism, it was taken as a conversion to orthodoxy which rendered him "safe." Paolino Taddei, the minister of the interior, advocated the taking of firm steps to stop illegalism in the provinces, but he was again and again overruled by his colleagues. Most of the ministers were now convinced that the ministry would soon fall and were eager not to offend Mussolini, so that they might be included with him in the coalition that would follow.

The "March on Rome," 1922.—On Oct. 24 another Fascist congress was opened at Naples, when the statements of Mussolini and his friends left no doubt that, if not allowed peaceably into the government, they would resort to force. A Fascist quadrumvirate was formed of Michele Bianchi, the former syndicalist who was secretary of the party, Italo Balbo, the commander of the armed *squadre*, Gen. Emilio de Bono and Cesare de Vecchi, while Mussolini retired to await events near the Swiss frontier. As mobilization of the *squadre* continued, all depended on whether Taddei would have his way and whether there would be any clash between the *squadre* and the troops. Gen. Pietro Badoglio, as well as Gen. Emanuele Pugliese who commanded the army units in Rome, guaranteed that at a word from the government they could restore order and crush the threatened insurrection. But Facta, probably from cowardice and incompetence more than from premeditated malice, refused to give precise orders and chose to make Fascist victory almost certain by proffering the cabinet's resignation.

The king did not immediately accept this resignation, and the ministry continued in office several days longer. The various liberal leaders were only just beginning to see from Mussolini's remarks at Naples that he would now be content with nothing less than the lion's share in any new coalition. Early on Oct. 28 Bianchi sent the government a virtual ultimatum, calling for its effective resignation, and this at last provoked Facta to resist. Proclaiming a state of siege, he ordered the military to use force wherever necessary. As the king had only the night before promised to support this policy if ever Facta thought it advisable, the proclamation was published soon after daybreak, and some observers thought that all would now be plain sailing. But the king had taken counsel during the night with Nationalist and Fascist sympathizers, and

the suspicion had been implanted in his mind that the army might refuse to obey orders and that the duke of Aosta would be able to force him to abdicate. Accordingly, in a moment of aberration, he refused to sign the decree.

For the constitutional impropriety of this act there can be no excuse. The king was making a political decision in defiance of his ministers. He had decided to appoint a new government based upon a coalition of the extreme right, although this was composed of less than one-fifth of the elected chamber—there was Salandra who led a group of about 30 conservative deputies, and there were also the 35 Fascists and 10 Nationalists under Federzoni. A great number of precedents existed for choosing a premier from a minority group. But in handing power over to people who gloried in murder and openly proclaimed their contempt of parliamentary institutions, the king was making a gigantic political error which cost his country dear.

For a time the king did not understand the implications of his action, and he asked Salandra to form a ministry. But Mussolini now knew that the king was an accomplice who had committed himself so far that he would not dare to gainsay fascism in anything. As a result, Mussolini, who had long since won Salandra's collaboration by secret hopes of support, now put his veto on a Salandra ministry, knowing that he himself was the only alternative. On Oct. 30 a sleeping car brought Mussolini to Rome from Milan at the king's invitation, and the so-called "march on Rome" was over. The next day some of the Black Shirts were brought in from surrounding villages to give the illusion of an armed occupation of the city. It did not suit the future dictator to let people think that he had risen to power by almost normal constitutional methods.

F. The Kingdom and Fascism

First Years of Fascist Government.—With a sure revolutionary instinct the new cabinet was chosen to give the appearance of one of the old familiar coalitions. Apart from Fascists, it included two war "heroes," General Diaz and Adm. Paolo Thaon di Revel; a Giolittian, Teofilo Rossi; a Social Democrat, G. A. Colonna di Cesarò; two liberals, Giovanni Gentile and Giuseppe de Capitani; two Popolari, Vincenzo Tangorra and Stefano Cavazzoni. At long last stringent orders were given for the cessation of all acts of violence. Yet the Duce chose to remind the deputies how he might have simply abolished parliament: he was determined to make it quite clear that it existed on sufferance and could not expect his government to feel responsible to it.

From what one can see, contemporary newspapers reflected a general consensus in their expressions of relief that the long reign of anarchy was over. Indubitably parliament had shown itself incompetent to produce efficient and liberal government. Even the deputies themselves were relieved to sense that there was to be an end to their bickerings, and only about 100 voted against the new government—probably these were just the Socialists. When Mussolini demanded full powers for a year to carry out what reforms he thought necessary, they approved by a vote of three to one what they had always refused to Giolitti and others.

For several years there was no overt establishment of dictatorship. Numerous precedents existed for government by decree and for the executive's replacing elected councils by nominated government officials in the towns. Only gradually were old methods and institutions changed, at the same time as each of the opposition parties was weakened and divided still further. It was a primary object that there should be no move which could provoke a combination to join in opposition and nothing which should alarm people unduly or make them think that a revolution had taken place or was taking place.

This incidentally gave time to consider the *raison d'être* of fascism, to decide whether it was primarily revolutionary or conservative. Hitherto it had been a movement, not a doctrine, and evidently the objects of its struggle for power were not apparent even to its own members. An economic policy of economy and retrenchment was therefore borrowed from the old liberal school of economists. The right to strike was curtailed, and a longer working week was restored. Nitti's royal guards were disbanded because they had dared to take action against Fascist illegality. To replace them, the Fascist squads were institutionalized into a security militia in Jan. 1923, ostensibly to assist in the maintenance of order. Gentile's educational theories were harnessed to make an education act in 1923. From D'Annunzio was taken much of the choreography and verbal claptrap which had become familiar at Fiume. A form of guild socialism was lifted from the early Syndicalists. Meanwhile the wealthy were courted by repeal of Giolitti's new taxes, by abrogation of the law on the registration of bonds, by winding up the commission considering wartime profits and by the reduction of the sum spent on social welfare. For the moment the finance minister, Alberto de Stefani, pursued a policy of abolishing controls. Only after 1925 was increasing government intervention to become typical of fascism.

Almost at once a fusion was effected with the Nationalist party, and it was the ideas of Federzoni and Corradini which provided the substance of Fascist foreign policy. Mussolini in his earlier years had gone to prison for his pacifist views and had once fled to Switzerland to avoid doing military service. But he now easily renounced his former anti-imperialism and became a bellicose nationalist. In Aug. 1923, when an Italian was killed by bandits in the Balkans, Mussolini presented an immediate ultimatum to Greece and asked for an indemnity of 50,000,000 lire, following this up by the bombardment and temporary occupation of Corfu. He then turned his attention to making a settlement with Yugoslavia which could compare favourably with that concluded at Rapallo by Giolitti. In Jan. 1924 the pact of Rome finally gave Fiume to Italy in return for recognition of Yugoslav claims to Susak and Port Baros. This began his attempt to revise the treaties of 1919 and was yet another blow aimed at the prestige of the League of Nations. To help the further progress of revision he also made his peace with Germany and the U.S.S.R., the two chief "have-not" powers of Europe.

In the summer of 1923 a bill was prepared to alter the representative system, so that the electoral list which obtained the largest number of votes should be entitled to two-thirds of the seats in the chamber, while the remaining third was divided among the other lists on a proportional basis. Though the last elections had returned only 35 Fascist deputies, both houses gave large majorities to this measure which threatened to make impossible any future alternation of parties in government. The deputies were simply agreeing to give a permanent majority to an avowedly antiparliamentary group. After this success, Mussolini could afford to renounce the full powers accorded him and proceed to the election of a new house that could be guaranteed to give him a yet easier passage to dictatorial power.

The one hope for the constitutional parties was to club together and oppose a single list to that of the Fascists. But in fact, when the elections were held in April 1924, there were six opposition lists; and as the Fascists had all the aid of prefects and police and their terrorist militia, they obtained 65% of the recorded votes, so that they had two-thirds of the seats quite independently of the new law. There were to be more than 400 ministerial deputies in the new house. All the other parties together polled nearly 3,000,000 votes out of 7,500,000. There were 39 Popolari deputies, 25 Reformist Socialists, 22 Maximalists and 19 Communists. Salandra, Orlando and Enrico de Nicola had been included inside the Fascist list, and Giolitti's group had fought in alliance with the Fascists.

The Murder of Matteotti.—Despite this overwhelming victory, the Fascists—or certain more ruffianly elements among them—in June 1924 brutally assassinated Giacomo Matteotti, a Socialist deputy who had dared to impugn the regime before parliament. Mussolini was forced to disown the murderers and to arrest four leading Fascists as accomplices. The country was scandalized and the government shaken; but although criticism came more into the open and fascism was deserted by many who had joined it only when it had appeared invincible, the opposition did not press their attack but withdrew from the chamber in passive protest.

This "Aventine secession" was intended to render parliamentary procedure impossible; but it was a futile measure against a man who already claimed to hold power by right of force and not in

virtue of responsibility to parliament. Thus the Socialists, the Popolari and some of the radical liberals under Giovanni Amendola cut themselves off from the one place where Mussolini might have been publicly accused. When the king was confronted with evidence of Fascist criminality he was able to reply that lack of opposition in parliament gave him no chance to intervene.

Even after Matteotti's murder the liberals in the senate gave Mussolini a convincing vote of confidence, and the Liberal party itself agreed to continue its general support of the government. Several liberals remained in the cabinet until the end of 1924. But in the second half of this year there were some notable defections from the government majority among those who had once welcomed fascism as an auxiliary but now feared it as a master. Orlando and Giolitti ranged themselves against the regime, without withdrawing from the chamber. The philosopher Croce had excused the unconstitutional methods of fascism and its bludgeoning tactics during the elections but now began to see the implications of what had happened for the liberalism which he had preached all his life. In December even Salandra changed his mind. The ex-servicemen's association also assumed an attitude of hostility to the government, at which Mussolini dissolved its directorate and replaced it with his own nominees.

This was a sign that the Duce had tested the weakness of his opponents and their reluctance either to combine against him or even to make direct accusations which he would have to answer. He now felt able to take another step in the establishment of a personal dictatorship, without fear that he was going too far or too fast. The Matteotti affair had shaken him and caused a serious setback to his popularity; but it was soon almost forgotten. In the chamber he had to contend with only a dozen or so independent liberals and as many Communists. When newspapers like Sturzo's *Popolo,* the Socialist *Avanti* and Amendola's *Mondo* belatedly tried to impeach him, he replied with a new press law in July 1924 and gave the prefects the right to confiscate issues of "seditious" journals almost at will.

The Fascist Dictatorship, to 1939.—Mussolini's final move was precipitated by the incriminating revelations of a former leading Fascist, Cesare Rossi, which left most politicians expecting that the king would have to force Mussolini to resign. It was, however, too late, and on Jan. 3, 1925, Mussolini dared to take full responsibility for the illegal actions of subordinates which hitherto he had repudiated. He formally announced that he would assume dictatorial powers and challenged his opponents to arraign him before the courts. At last the liberal ministers resigned. Leading members of the opposition were arrested—if they were lucky enough not to be attacked and mortally wounded, as was Giovanni Amendola. The most important national newspapers were forthly acquired by pro-Fascist interests: the *Corriere della Sera* at Milan, the *Giornale d'Italia* at Rome, *La Stampa* at Turin and the *Mattino* of Naples. Mussolini declared his intention to *fascistizzare* the state. Roberto Farinacci, the former labour boss of Cremona, was made general secretary of the Fascist party in Feb. 1925 and proceeded to reorganize it on much more intransigent lines. Other parties were dissolved. Henceforward there was no further room for anything that was not Fascist.

When a bill for reorganizing the army met opposition in military circles, Mussolini himself took over the war ministry, with Gen. Ugo Cavallero as undersecretary. Gen. Badoglio was appointed chief of staff and entrusted with co-ordination of the army, navy and air force. Adm. Thaon di Revel resigned in 1925, and Mussolini took over the ministry of marine and the newly created air ministry as well.

Mussolini's amazing self-confidence had been a great contributory factor in the rise of his party to power but was in the end to prove disastrous to himself and to Italy, for he centralized more and more in his own hands and became increasingly intolerant of criticism or even the delegation of power. Before long his henchmen saw that their only hope of keeping his good will was not to criticize but instead to give him the illusion that he was always right. Becoming corrupted by power, he thus concealed from himself his own clumsiness in administration and in the formation of policy.

By trade he had been a journalist, and this he always remained, writing frequent anonymous articles in the press and treating every matter as something essentially simple which he could tackle by a mere surface acquaintance with the facts. At various times he held eight different portfolios himself, and the other ministers were seldom allowed a policy of their own. In return for permission to grow rich and corrupt, the Fascist *gerarchi* cheerfully left responsibility for decisions to Mussolini. As a result, decisions were not taken, the inefficiency and graft of subordinates was not checked, and in the end Italy was to declare war without anyone's knowing or daring to say that it was shockingly unprepared. Yet Mussolini's self-confidence never allowed him to perceive that all was not well, and he developed a pathetic trust in his own powers of intuition, even reaching the point of provoking the war for which he was so unready.

Economic Reforms.—After 1925 the relatively liberal economic policy of De Stefani was gradually abandoned, and politics played increasing havoc with finance. Expensive projects were undertaken for reasons of prestige or morale, despite the protest of some of the less doctrinaire and more honest and courageous ministers.

In the spring of 1925 financial difficulties had arisen resulting in a serious depreciation of the lira, which fell from about 100 to the pound sterling to close on 150. The government tried to put the blame for this on certain members of the opposition: it was said that they had hoped to break fascism through a financial disaster and had caused a panic by spreading the rumour that the government intended to emulate Germany and wipe out its debts by destroying the currency. So, as De Stefani had by now succeeded in reorganizing the fiscal system and balancing the budget, he was replaced by Giuseppe Volpi with a policy of revaluation. In the years 1925–26, Volpi successfully negotiated in Washington and London to reduce the heavy war debts which had been weighing on Italian finance.

Like many other previous governments, fascism made some effort to bring southern Italy up to the standard of the more progressive north, and a series of measures was enacted for co-ordinating land reclamation, drainage and the building of roads and railways. But once again it was to be proved how little necessary relation there was in Italy between legislation and its results. Like so many other Fascist measures, these had their most obvious effect in increasing the bureaucracy as a half-concealed way of meeting the unemployment problem; and the result was to eat up much-needed capital unprofitably, while the growth of bureaucratic regulations led to inefficiency and corruption on a yet larger scale.

Active state intervention in economic life thus became a principal characteristic of the regime, coupled with the aim to achieve self-sufficiency. The heavy industries certainly gained from this policy, for Ansaldo and some of the other big concerns had collapsed when World War I put an end to their artificial prosperity. Some of the landowners also profited from the "battle for wheat," in which heavy subsidies were used to raise output from 5,500,000 to 8,800,000 short tons a year. But both these types of production were uneconomical in Italy and could only be fostered by artificially inflated prices far above world levels: this was hard on the consumer and resulted in a sharp rise in the cost of living. In the struggle for autarky, consumption declined, vines and olive trees which had taken years to grow were cut down to make way for cereals, and the big, "uneconomical" industrial cartels were given much indirect protection for political reasons.

Constitutional Reforms.—A sample of other Fascist measures in these early years will give an idea of how the regime appeared when theory was translated into practice. Because of the "unsatisfactory results of the system of municipal elections," the government placed local administrations under the authority of a podesta appointed by royal decree. A law of Oct. 1925 provided for the appointment of a governor of Rome, and in 1926 the idea was extended to other towns and communes. The authority of the prefects was also strengthened in order to secure better co-ordination of the various provincial services and to take away responsibility from elected councils for the advantage of a nominated government official. Another law (Dec. 1925) was aimed against Freemasonry and its political influence. All associations were

obliged to communicate their statutes and membership lists to the authorities, and civil servants were forbidden to belong to secret societies. A law of Nov. 1925 gave power to the government to dismiss any officials who attempted to prevent the enforcement of new legislation or to frustrate government policy.

In April 1926 the Fascist labour syndicates were given legal recognition as exclusively representative of the various categories of workers; 13 corporations were said to exist, representing landlords, peasants, professional men, employers, artisans and so forth, all controlled by the state; strikes and lockouts were declared illegal, and all disputes were to be submitted to compulsory arbitration. The idea, like most else in the Fascist system, was borrowed (this time from D'Annunzio and the Nationalists); but it was said to be something essentially Fascist. The truth was that Mussolini, once in power, had some difficulty at first in finding any positive significance for fascism and snatched at any straw to hand. A National Council of Corporations was set up (on paper at least) as a political body, and thus another army of bureaucrats was brought into being, paid out of union subscriptions.

In Dec. 1925 a law was passed conferring greater power of parliamentary initiative on the prime minister and otherwise extending his authority. The king could no longer exercise his constitutional prerogative to dismiss ministers unless it was by the premier's advice; nor could any motion be debated in parliament without the premier's consent. The premier was also allowed to issue decrees with the force of statute law.

Since the Aventinians continued to remain absent from the chamber, the only opposition was concentrated in the tiny groups round Salandra, Giolitti, Orlando and the Communists. Political life was becoming unreal and artificial. Debates were staged to impress outside observers, but there was no force in them. Decisions were made elsewhere; the reasons for public policy were often kept concealed and the arguments made in public were usually designed just to make good headlines in the press. As formal legislation was henceforth unnecessary, the really important matters were customarily kept away from the public scrutiny. Moreover the actual connection between laws enacted and results achieved was frequently negligible. One fundamental fact was that the Fascist party became identified with the state. Fascist officials, law courts, soldiers and laws grew up alongside their state counterparts, often with a conflicting authority and a duplicating function. By degrees party officials and institutions were recognized to have a defined function in the constitution of the kingdom, and the Grand Council of Fascism became a far more important organ of government than was the cabinet of ministers.

In Nov. 1927 the Grand council drafted a new program for political representation, which became law in May 1928. In the next parliament the deputies were to number 400 instead of 535. Each of the 13 corporations and certain other recognized bodies of national importance had the right to be represented in a fixed proportion and to submit a list of candidates for election. The Grand council then chose the deputies from these lists, but it could modify them at will and exclude or add any names that it wished. Finally the electorate was called upon to ratify the list of names chosen by the Grand council. Only if the agreed list of candidates was rejected was any provision made for another election between rival lists. The result was to create a mere travesty of parliamentary government. There was no longer any representative system, only a means whereby citizens could express their general approval or disapproval of the policy of the government. A plebiscitary dictatorship had been established in law as well as in fact. The powers and composition of the Grand council were determined by the law of Dec. 9, 1928. The prime minister was its chairman, and its members included all the ministers, the *quadrumviri* of the "march on Rome," the commander of the national militia, the secretary of the Fascist party and certain other Fascist leaders, the president of the special tribunal and the presidents of the confederation of workers' syndicates, of the agricultural confederation and of the industrial confederation and those of other semiofficial bodies. The prime minister was to have complete freedom to summon anyone else that he wanted and could say what should or should not be debated in its sessions.

The functions of this Grand council were to ratify the lists of candidates for parliament before presentation to the electors, to decide the policy of the Fascist party and to be consulted on all matters affecting the constitution including the prerogatives of the crown, the succession to the throne, the composition and functions of the senate and of the chamber, international treaties and relations between church and state. It had also to draft and keep up to date a list of persons to be submitted to the crown for succession to the premiership in case of a vacancy. This provision incidentally ensured the continuity of the Fascist regime and welded state and party into what was hoped would be an indissoluble unit.

Resistance Suppressed.—Persecution of opponents was rigorous but unsystematic and less inhuman than in Germany later. In the early years the *squadristi* had freely used rubber truncheons and castor oil; but the more or less complete success of Mussolini by 1925 made further opposition seem almost useless except for the most selfless and high-principled of men. In 1925 Croce published an "antifascist manifesto" which received a number of signatures among the intellectuals. Further over to the left, men like Piero Gobetti, Riccardo Bauer, Ernesto Rossi and Carlo and Nello Rosselli in their various heroic ways helped to keep some liberty of thought and action alive. Most of the old leaders went into exile, including Sturzo, Nitti, Turati, Sforza, Nenni and the Communist Palmiro Togliatti, most of them to return when the Fascist interregnum was over. The Matteotti affair was regarded as closed when a court at Chieti found Amerigo Dumini and two others guilty of unpremeditated, unintentional homicide, with extenuating circumstances. Their sentence was shortly remitted, so that they had to spend only two months in prison.

It was at the end of 1926 that the law was passed dissolving the "antinational" parties; *i.e.*, the Socialists, Republicans and Communists. Special penalties were prescribed for any attempt on the life of the premier and for a new class of offenses now deemed to be treasonable. The punishment of *confino*, or relegation to a fixed place of residence in some insalubrious province, was instituted for persons accused of minor seditious activities. A special tribunal was created for political crimes, which sat *in camera* and proceeded by methods of summary jurisdiction, after which there was no appeal. The paraphernalia of totalitarian dictatorship was almost complete. In November the surviving Aventinian deputies were declared by the chamber to have forfeited their seats. In order to give greater unity to the conduct of the country's policy, Mussolini himself then took over the ministry of the interior from Federzoni. In December the *fascio littorio*, recalling the *fasces* of the ancient Roman lictors, was declared an official emblem, thereby still further identifying fascism with the state.

A plan for a new criminal code was drafted by Alfredo Rocco, a former Nationalist, and published in Aug. 1927. This embodied earlier provisions for the "protection of the state." Penalties were generally made more severe, and new punishments were allocated to certain offenses against morals, the practice and propaganda of birth control, etc. The death penalty was brought back under fascism, and trial by jury was abolished. A special police body was also created, which like the special tribunal was an arm of the Fascist party rather than of the state. The regime was soon spending ten times as much as its predecessors on security—a commentary on the restiveness of public opinion.

There is, however, little doubt that fascism came nearer than any other government of modern Italy to the repression of ordinary crime. Thus the Mafia in Sicily had for generations maintained its secret organization and its system of private justice, intimidating everyone and always preventing the accumulation of evidence against it; but by 1928 the prefect of Palermo, Cesare Mori, was claiming that he had finally destroyed the society. Only 20 years later did it become apparent that this sort of organized illegalism had never wholly disappeared. The Mafia and the Camorra, like the endemic brigandage of the Napoletano, represented the protest of voluntary or involuntary outlaws against a hostile society.

Mussolini failed similarly in his attempt to "italianize" the

200,000 German-speaking inhabitants of the Alto Adige and the 500,000 Slavs of Venezia Giulia which the settlement of 1919–20 had given to Italy. Italy was not bound by this settlement to respect minority rights and indeed claimed that it possessed no minorities. Already in 1925–26 a vigorous campaign was undertaken to introduce Italians into the local government in these areas and to forbid the use of German or Slav languages. Protests from abroad were laughed at. The Bavarian premier accused the Italian authorities of terrorizing the population and advocated a boycott of Italian goods. But a far more formidable obstacle was the simple non-co-operation of ordinary individuals where so much of their way of life was at stake. When it was ordered that religious instruction should be given in Italian only, many devout Catholics preferred to keep their children home, and even the appointment of keen Fascists as bishops in these frontier areas did not prevent passive resistance on a large scale.

The reaction of the country as a whole to Mussolini's dictatorship can only be surmised. The elections of 1929 and 1934 showed only a few thousand votes registered against the national list, but the figures are of course wholly unreliable. Not until the late 1930s were there signs that a substantial number of people were aware that dictatorship meant inefficient government at home and suicidal aggressiveness abroad. Until that moment fascism seemed to be wonderfully successful and was the admiration of many distinguished men even in democratic Europe. It had restored Italian self-confidence, stabilized social order at home and put an end to the postwar orgy of strikes. A nice combination of the carrot and the stick seemed to have rallied almost all Italy behind the regime.

Ecclesiastical Affairs.—One fact which earned for Mussolini much gratitude and admiration was his reconciliation of the Italian state with the Roman Catholic Church. Mussolini and Pius XI were each realists in their way, and both understood the benefits to be reaped from conciliation. There had been a strong secularist or anticlerical faction in fascism, and perhaps the predominant tendency in the movement was the skeptical nonconformism of Mussolini himself; yet by a skilful adaptation, Il Duce turned himself into a favourite son of the church. The Lateran treaty and concordat of 1929 (*see* PAPACY) have been considered Mussolini's greatest diplomatic achievement. They allowed the existence of the tiny independent Vatican City state, over which the pope exercised temporal rule. A financial convention arranged for Italy to pay nearly 2,000,000,000 lire either in cash or consolidated stock as compensation for church properties seized in 1870. The concordat also regulated the status of the church and of religion in Italy.

Mussolini argued that in this settlement he had surrendered the form and retained the substance. Certainly, he had won a great moral victory in persuading the church to yield what it had not accorded to any of his liberal predecessors, and he proceeded to show that, having once gained this point, he was not going to allow the church such independence as would conflict with his totalitarian concept of the state. In the educational system, Catholic instruction was to be allowed only where it did not run counter to the precepts of fascism. The Catholic Boy Scouts could not continue except within the framework of the Fascist Balilla organization. Catholic Action was compelled to change its functions and limit its scope. In the encyclical *Non abbiamo bisogno* of 1931 the pope was even forced into some tentative censure of certain more obviously pagan aspects of fascism; but on the whole churchmen continued to give enthusiastic support to the regime, and church and state worked together in relative harmony. Neither side dared to provoke the other beyond a certain point.

Foreign Policy, to 1933.—Mussolini had begun by saying that he would keep ideology out of foreign politics. But he soon changed this view to one in which every aspect of state policy had to reflect some peculiarly Fascist quality. Fascism was thus identified with national and imperial expansion, with revision of the postwar treaties so that Italy should receive a material reward more consonant with its worth and dignity. In 1925 negotiations with Egypt led to the cession of the Gulf of Sollum in return for acquisition of the important oasis of Jarabub (Jaghbub), headquarters of the Senussi sect. A treaty of conciliation and arbitration was concluded with Germany in Dec. 1926. In China, Italian troops were landed to assist in the protection of Shanghai. Although the Locarno treaty had been signed in 1925, a year or two later found Mussolini speaking publicly of the great European war which in ten years' time would give Italy its due. When Yugoslavia began to show signs of independence in its foreign policy and concluded a treaty of friendship with France in 1927, Italy reacted by making an alliance with Albania and attempting to renew its former protectorate over that country. By 1932 Mussolini was publicly saying that: "the 20th century will be the century of fascism, of Italian power, during which Italy will return for the third time to be the directing force in human civilization. In ten years' time Europe will be fascist."

Economics and the Corporative State.—Italy suffered like other countries from the world economic crisis after 1929. Mussolini's financial policy had already been directed to a revaluation of the lira in 1926–27, from 125 to the pound to 90, which many people thought had gone too far and too fast for equity and prosperity. Among other results it had reduced the profits of the export trade and brought a consequent increase of unemployment. Annual budget deficits began to reappear; the balance of international payments persistently showed a loss; exports greatly decreased; and the level of wages fell. The eight-hour day was given up, and before long unemployment soared to hitherto unprecedented levels. The picture was so bad that the government ceased publishing its statistics on wages and unemployment. Matters began to improve by 1933 but then worsened again when Mussolini began his policy of imperial expansion in Ethiopia.

In order to show that a mere matter of shortage of funds was not interfering with the original revolutionary urge of fascism, big programs of public works were undertaken: showy public buildings in the new "Fascist style," the *autostrade* for tourist traffic, the electrification of railways, the reclamation of the Pontine marshes. Achievements were, however, only partial, and programs usually had a political rather than an economic motive behind them. They had to be spectacular rather than efficacious. On the whole, surprisingly little was spent on works of social welfare by the Fascist state.

One of the more important facts about Italian economic life after 1921 was the drying-up of the great stream of emigration. Before the war, emigrants had numbered more than 500,000 a year, mostly to North and South America; and this had done much to relieve the pressure of population at home, with a distinctly beneficial effect on wages and living standards. Then the United States and other countries of immigration began to impose restrictions on the rate of entry, until after 1924 there were often more Italians returning to their country of origin than there were going out from it.

This was in part deliberate policy, for Mussolini took pride in the high birth rate and evident "capacity for expansion" of his people and found in "overpopulation" a good argument to persuade other countries of his need for colonies. Large families were given economic encouragement, and a substantial bachelors' tax was introduced. But although Mussolini had the fantastic aim of increasing the population from little more than 40,000,000 to 60,000,000 by 1960, he was chagrined to discover that mere legislation was ineffective in stopping Italy from sharing in the general decline of the European birth rate. Meanwhile the great decrease in emigration removed one outlet for economic distress; and the very heavy drop in remittances from overseas settlers to their families at home was to constitute a serious loss in the balance of international payments.

Mussolini affected to believe that the creation of the "corporative state" was the greatest achievement of fascism. It was his object to develop an alternative to both communism and capitalism as a comprehensive method of tackling economic problems. The government had to exercise strict supervision over productive processes, maintaining private enterprise in theory, but reserving the right to intervene when it appeared inadequate. The banking system was remodeled, and government-controlled institutions were created for aiding vital industries in momentary difficulties

and for liquidating those that were "unfit to survive." In fact, Mussolini's alternative was to retain the disadvantages of both capitalism and communism, without much in the way of compensation. The syndicates of employers and workmen were later reduced from 13 to 9, then expanded again to 22, and the government set up special labour courts to hear any disputes between them. A National Council of Corporations, composed of about 170 members, was erected as the general staff of the productive forces of the nation; and the councils of the 22 corporations, composed of approximately 800 members, acted similarly for each individual branch of production. The operation of the whole system was in theory to be supervised by the minister of corporations. This was Mussolini himself, who was also president of each corporation. The machinery was completely top heavy, its functions nebulous, its cost enormous. Yet Mussolini was very fond of it and looked to the day when it would supersede the parliamentary system altogether, when the National council would act in place of the chamber. The first step was to let each corporation issue regulations which had the force of law for the branches of production under its control.

Preparation for War.—Tension with France arose in 1933 out of failure to solve the problem of naval parity at the London naval conference; but the appointment of Sen. Henri de Jouvenel as French ambassador in Rome gave promise of a *rapprochement*. Hitler's rise to power in the same year was welcomed somewhat dubiously. Germany and Italy had much in common: both were revisionist powers abroad and totalitarian states at home. Nevertheless, it was by no means an Italian interest for Germany to extend its boundaries into Austria, and in 1933 Mussolini met the Austrian chancellor Engelbert Dollfuss and promised him Italy's friendship. In March 1934 protocols were signed in Rome by Mussolini, Dollfuss and the Hungarian Gen. Gyula Gömbös, which provided for a closer economic union between their states and bound them to consult each other on all political questions of mutual interest. In June 1934 Hitler visited Mussolini at Venice and undertook not to intervene in Austria. But Italy's confidence in Germany was shaken by the purge of the Nazi party at the end of June and by the assassination of Dollfuss in July by the Austrian Nazis with German connivance. Italian troops were sent to the northern frontier ready to defend Austrian independence, and Mussolini extended his patronage to Ernst Rüdiger von Starhemberg and Kurt von Schuschnigg, the new Austrian chancellor.

These events brought about a temporary change in Italian foreign policy. The failure of the disarmament conference and of the London economic conference had caused dissatisfaction with the League of Nations, and at the end of 1933 the Grand council had announced that Italy's membership in the League was dependent on a radical reform of that institution. But in 1934 Italy's break with Germany was followed by a resumption of friendship with the League powers, and negotiations were at once opened with France. The French foreign minister, Jean Louis Barthou, was about to leave for Italy to sign an agreement when he was assassinated at Marseilles in October. His successor, Pierre Laval, resumed discussions and brought them to a satisfactory conclusion in Jan. 1935. In May 1934 supplementary estimates for thousands of millions of lire had been issued to cover expenditure on the air force and navy, and it was decided to lay down two new 35,000-ton battleships. In Sept. 1934 measures were passed to tighten up the obligation on all males to do military service. From the age of six, boys were to begin military instruction in the Balilla organization.

Italy was at this time just beginning to emerge from the economic slump, but the new war preparations were before long to cause a yet further decline in the standard of living of the people. In April 1934, for the second time, the salaries of civil servants were slashed by 12%. The situation of the treasury was temporarily relieved by conversion of the huge consolidated loan from 5% to 3.5%; but in the following year it had to be reconverted back to 5% under the stress of the Ethiopian campaign.

The Ethiopian War.—Ever since 1932 Mussolini had been preparing the great war against Ethiopia that was to wipe out the humiliating memory of Aduwa. By this time the permanent officials in the foreign office who had restrained the wildest antics of Fascist policy had retired or been swamped by party placemen. Instead of concentrating the diplomatic and military efforts of the country to keep German influence out of the buffer state beyond the Brenner, ideological arguments were used to divert attention to colonial expansion, and this started the chain of cause and effect which led to the Axis pact and Italy's loss of all its colonies in World War II.

Mussolini at first had stood patron to Ethiopia, signing a pact of friendship and introducing it into the League (1923). It had then been his claim that he had no territorial ambitions and was no "collector of deserts." But for ten years since then he had been preaching the glories of war and the necessity of expansion; he could hardly remain inactive for much longer without trying to apply his theories. A minor clash over the Ethiopian frontier at Wal Wal in Dec. 1934 had not attracted much notice at the time. Then, in Jan. 1935, came the agreement with Laval which seemed to presage a formal military alliance. Emilio De Bono, the minister of colonies, was appointed high commissioner of Italian East Africa, and two divisions were mobilized for dispatch to Eritrea. In March 1935 Gen. Rodolfo Graziani, the most experienced of Italy's colonial commanders, was appointed governor of Italian Somaliland. Next month Italy, Great Britain and France affirmed at Stresa their desire to collaborate in maintaining European peace. This was a part of Mussolini's smoke screen and an attempt to cover his flank against a German move while he was busy in Africa.

Early in 1935 Ethiopia had appealed to the League of Nations under the terms of the covenant; but no action was taken, since it was hoped that the two parties would reach an understanding by direct negotiation. The British minister without portfolio for League affairs, Anthony Eden, then went to Rome with a proposal that Ethiopia should yield some territory to Italy and receive compensation in an adjoining part of the British empire. This Italy refused, for it would have given Ethiopia independent access to the sea and also have foiled the plan to obtain a striking military victory for purposes of prestige. Again in September a five-power committee of the League made compromise proposals; but while Ethiopia accepted them, Italy refused.

In Oct. 1935 open hostilities began, by which time Italy had 250,000 men under arms in east Africa. The Fascist party nominee, De Bono, had to be replaced almost at once by Pietro Badoglio, but there was little serious fighting possible for the Ethiopians against Italian strength backed by all the resources of modern military science, including poison gas. (*See* ITALO-ETHIOPIAN WAR.)

The League had at once declared Italy to be the aggressor and in Nov. 1935 brought economic sanctions into force. The absurdity of this action can be judged from the fact that oil was specifically exempted from the embargo. Sanctions just allowed Mussolini to justify his action at home and to point out to Italians how they were being victimized by the "have" powers who resented its intrusion among them. Sanctions also split the League countries and in the end forced Italy into alliance with Germany, which was one of the few states not to apply them. Laval and Sir Samuel Hoare, the British foreign secretary, prepared another compromise in December, but there was an outcry by British public opinion at what seemed like concession to an aggressor. Sir Samuel had to resign and was succeeded as foreign secretary by Eden, who already had the reputation of being an enemy of Italy. The whole sanctions policy was attributed to Great Britain by Italian public opinion, and the resultant tension was one more wedge driven into the Stresa front.

Addis Ababa fell in May 1936, and Victor Emmanuel III (without being consulted) was given the grandiose title of emperor to mark the establishment of Italian sovereignty over Ethiopia. Badoglio and then Graziani were made viceroys of the new colony. The victory had not reflected any great glory on the Italians, though the organization of the campaign had been workmanlike. Their boasting about the poison gases sprayed on Ethiopian villages was not received well in the rest of Europe. But victory seemed to have done something to reconcile doubters at home to

the regime. Fascism was being justified by success, and some even among the "opposition" approved of the war. The Catholics, in particular, seem to have been far more sympathetic to it than to that of 1915–18.

Several more years passed before Ethiopia was effectively occupied and subdued, and during this time the corruption now typical of fascism was much in evidence in the government of the colony. Despite the "economic necessity to expand" that had been argued as a principal cause of the war, the colonies continued to eat up more and more of the limited resources of the fatherland (which many of the skeptics thought might have been more profitably employed in backward areas at home) and gave a disproportionately small return in terms of wealth. Another deleterious effect of the war was its harmful impact upon the domestic economy. The law on the gold reserves of the Bank of Italy had to be repealed, and a tendency toward inflation was not long in showing itself. The budget indicated that the national accounts were wildly out of balance, and even the compulsory loans and other expedients now adopted proved quite ineffective to restore an equilibrium.

Mussolini later confessed that his power and prestige had been at their highest in 1937. After that, matters got out of hand. The fact that Italy, singlehanded, had with apparent success defied 52 nations of the League gave him the false impression that the country was powerful and could afford to throw its weight about and that the democracies were decadent and could be safely pushed along the path of appeasement. This was to prove a fatal illusion, but not even the other Fascist leaders dared criticize the infallible Duce. *Mussolini ha sempre ragione* ("Mussolini was always right") was one of the slogans of the regime.

Mussolini and Galeazzo Ciano, his son-in-law and, from June 1936, his new foreign minister, were ill-informed and thought that they could conduct the diplomacy of a major power with very little preparation or initial study. Italian policy thus remained unpredictable until the last. It was usually based on the shallowest of arguments, and never remained constant for long. Most of Mussolini's subordinates showed themselves to be trivial, irresponsible and incompetent, for he did not like strong men about him, or men with ideas.

The Spanish Civil War.—A few weeks after Ciano's appointment as foreign minister the Spanish civil war broke out, and it was discovered that ideological reasons compelled Italian intervention against the democratic republic and in favour of the insurgents. Italy stood to gain little save prestige from this war. As things turned out, it gained little even of this and lost considerably in the way of men and military matériel. Mussolini associated himself with the agreement by which outside powers were not to intervene; but his soldiers still remained in Spain, and semiofficial estimates gave them as at least 50,000 in number. Too late Mussolini discovered that, while victory would not bring any material reward, defeat would be ruinous. What he had expected to be a short and glorious war in fact continued for three years, and Black Shirt troops suffered some notable reverses at the hands of an army in which anti-Fascist refugees from Italy were represented.

Germany meanwhile rejoiced to see the rift widening between France and Italy. To save itself from isolation Italy had to pay Germany's price and sacrifice its protection of Austrian independence. In Oct. 1937, moreover, the lira had to be revalued, and a new tax of 10% was imposed on the capital of limited liability companies. Before long the cost of prestige was to seem almost excessive.

The Ascendancy of Germany.—Ideological arguments were behind the establishment of the Axis pact with Germany. Naziism and fascism agreed in their totalitarianism, in their opposition to liberalism and democracy and in their violent, revolutionary methods. As Hitler in the early years had learned a great deal from Mussolini, so after 1937 it was Italy that learned increasingly from the more efficient and more successful regime in Germany. The imposition of sanctions had indicated how little Mussolini could expect from the western democracies. So he followed Francesco Crispi's example in giving up a position of independence between the power groups of Europe and set his hopes on reaping some incidental gain from Germany's determination to upset the treaty of Versailles. As Italy's interests were mainly concentrated in the Mediterranean, it was against France and Great Britain that its claims were primarily directed.

In Sept. 1937 Mussolini visited Hitler in Germany, where he received a great welcome which flattered his vanity and persuaded him that Germany was bound to win the next war. Italy joined the German-Japanese anti-Comintern pact in November and withdrew from the League in December. This policy coincided with an increased armaments program, and in Jan. 1938 it was decided to lay down two more 35,000-ton battleships and a fleet of submarines. In the interests of further appeasement, however, care was taken not to antagonize Great Britain irretrievably while these preparations were being built up. March 1938 brought the German occupation of Austria, to which Italy had perforce to assent; and so, with the reappearance of a strong state upon its northern frontier, Italy threw away its chief gain from the settlement of 1919. Again in Sept. 1938 at Munich, although Mussolini intervened to prevent a premature war to conquer Czechoslovakia, Hitler was allowed to occupy the Sudetenland. The Munich conference confirmed Mussolini's underestimation of France and Great Britain and forced him all the more into the position of poor relation of Germany.

In Oct. 1938 the Grand council advocated certain measures limiting the professional activities of the Jews and excluding them from the fighting forces and the civil service. This was another sop to Hitler. Until this moment Mussolini had prided himself on his racial tolerance; he had in fact feared that the Germans despised Italians as non-Aryan. This difficulty was then tacitly overlooked, and scholars were turned on to show that the Italians were essentially Nordic. Some leading Italians were dismissed from their posts, to the damage of science and industry.

There is evidence that these new racial laws aroused considerable popular indignation and that they were sometimes disregarded. As fascism continued to become more and more totalitarian, it became more unwieldy, more inefficient, more corruptible and more disliked. The increasing interference in private life was resented by many who had once approved the exaggeration of the state which fascism had originally stood for; and the natural anarchism of Italians made much even of Fascist legislation a dead letter. Peasants refused to co-operate with the government in its policy of requisitions, fixed prices and compulsory acquisition of crops by the state. Scholars refused to take the oath of allegiance when it was extended to cover the regime as well as the king and the state. Enrico Fermi (*q.v.*), the greatest of Italian scientists, escaped to America. The philosopher, Benedetto Croce, in his magazine *La Critica*, kept up a continual fire of veiled criticism which must have had considerable influence among the intellectuals.

This is not to say that opposition was widespread or even very important. But as Mussolini's whimsical intuition became ever more decisive in the formation of policy, more and more people became alarmed. About the year 1938 Mussolini seems to have started reverting to the socialism which had dominated his early life and which had always infected one wing of his party. He began to attack everything that was "bourgeois," whether it was golf or first-class compartments on the railway or the pacifist mentality of those who put prosperity before national glory and power. After 1934 the budget was nowhere near balanced, but Mussolini ridiculed the forebodings of his finance minister, Felice Guarneri, who warned him that the country could not stand the pace. From this moment can be dated the growth of a defeatism among many of the financiers and industrialists whose support had once helped fascism into power. Il Duce even announced a measure for splitting up the large estates of Sicily.

By the beginning of 1939 matters were getting out of hand. The deputies in parliament were instructed to clamour vociferously for conquest of Nice, Corsica, Tunisia, Djibouti, Malta and Suez. Then parliament was told to vote itself out of existence and to give way to the chamber of fasces and corporations which was to take its place (Jan. 1939). It could not be allowed that fascism had played itself out. The country had to be in

a continual state of revolution. Mussolini in Dec. 1938 denounced the Italo-French agreement of Jan. 1935; but at the same time his jealousy of Hitler made him anxious not to appear to play second fiddle to Germany, and he was soon trying to assert his independence in a separate policy of his own. On a sudden impulse he converted the Rome-Berlin Axis into a formal alliance in May 1939; but there was little real friendship there, and this "pact of steel" gave Italy many of the disadvantages of a formal tie without some of its compensations.

Italy had exercised a predominant influence in Albania for many years; but in April 1939, after Hitler had invaded what was left of Czecho-Slovakia, Mussolini decided to assert himself by converting the protectorate of Albania into an actual colony. At the very last minute it was decided to land an expedition there. Victor Emmanuel became king of Albania in Zog's place, and a personal union of crowns was thus established. But the other Balkan states were thereby antagonized, and the manner of the occupation was not such as to inspire much confidence in Italy's capacity to carry out a major war. Mussolini secretly told Hitler that the country would evidently not be ready for such a war within three years, and Italy began to plan on this supposition.

In his less sane moments, however, the Duce was carried away by his own rhetorical statements about mobilizing "8,000,000 bayonets"; and the evident willingness of the British prime minister Neville Chamberlain to suffer almost anything in the cause of peace confirmed his false illusion of strength. He was content just to assume that fascism had succeeded in militarizing the nation and in mobilizing industry to produce a sufficient war potential. Occasionally he pierced the bluff of the service ministries which had multiplied on paper the strength of their units to earn his good opinion. But he chose to ignore the evidence at crucial moments when the issue was that of peace or war.

World War II.—When he made his pact with Germany evidently Mussolini had not known that Germany, far from intending to wait three years until Italy was ready, was already preparing an invasion of Poland. Hitler also kept his ally quite uninformed about his intention to make a pact with the U.S.S.R. in Aug. 1939. Surprised by German bad faith, Italy became anxious lest it should be drawn into war, and Ciano was dispatched to Berchtesgaden in August. Hitler was, of course, unmoved by Mussolini's attempt to preserve peace and was content to allow that the *casus foederis* had not arisen so that Italian help would not be invoked.

The Italian army leaders were strongly in favour of neutrality, knowing how weak the armed services were. They had always resented the attempt to *fascistizzare* the army. The naval commanders knew how risky it was for a country so dependent on supplies from overseas to challenge the British and French navies. Balbo, De Bono and Federzoni were also reputedly neutralist, and after Germany had begun hostilities in September, Ciano obtained the succession of the less bellicose Ettore Muti to Achille Starace as secretary of the Fascist party (Nov. 1, 1939).

This turn of events put Italy back into an arbitral position in Europe, where (as in 1914–15) it could barter its support between either side and profit from the exhaustion of both belligerents. But Mussolini felt this situation to be ignominious. War to him was something glorious and good in its own right; and as he greatly exaggerated Italian power, he could hardly continue for long without following one of his intuitive urges toward joining Germany. Little was done in the meantime to put Italian industry and armed forces on a war footing. Yet Mussolini was overcome with humiliation at having to stand idle while others made history without him. Badoglio and the king reminded him how completely unready the country was for the test of a major war; but when the news arrived of German victories in France and Scandinavia, he became frightened that further delay might make his intervention too late; and without consulting his ministers or the military experts he declared war against Great Britain and France on June 10, 1940. (*See* WORLD WAR II.)

The record of Italian armed forces during the second half of 1940 was far from brilliant. Despite the fact that France was already reeling from the German onslaught, Italian troops were able to penetrate only a few miles beyond the French border before their two-weeks' war was concluded on the basis of the *status quo* at the time of the armistice. Mussolini had hoped to receive Nice, Savoy and the ports of Tunisia, but Hitler was more anxious to purchase the confidence of the new regime in France than to satisfy the ambitions of his fellow dictator.

To compensate for this there were victories in Africa against Great Britain. British Somaliland was taken in August. There were infiltrations into the eastern Sudan and northern Kenya. Then, meeting very slight resistance, the Italians began to invade Egypt. But this was not enough, and soon Mussolini had to reconcile himself to the unpalatable fact that the war was not going to be the short and glorious campaign that he had anticipated. In Dec. 1940 the British counterattacked and drove the Italians out of Egypt into Libya as far as Tobruk. The British navy managed to reassert itself in the Mediterranean, and as a result of an attack on the Taranto naval base in November the Italian fleet for the time being was partially crippled.

These disasters were slight compared with the ignominious defeat of Italian armies in Albania and northern Greece. On Oct. 28, 1940, Mussolini sent his army into Greece with the object of staking out his claims in the Balkan peninsula before Hitler could do likewise. He did not inform Hitler in advance. The views of the Italian general staff were not considered, their objections being overruled as sheer defeatism. Then, to Mussolini's great surprise, the Italians were soon driven back from Greece in retreat through their own colony of Albania. This unprovoked attack provided the Allies with bases in the Balkans and also damaged the Axis in that the Italian defeat persuaded the Spaniards to remain neutral. Furthermore, it compelled Italy to beg German aid. Gradually the Germans took over the Italian war effort, and before long they were exploiting Italy almost as a defeated enemy.

In the spring of 1941 Italian East Africa fell to the British, together with a large army under Amedeo, duke of Aosta (son and successor of Emanuele Filiberto). Ethiopia regained its independence. The Italian troops in north Africa had lost two-thirds of their strength in casualties and prisoners, and the history of Italy as an African power seemed near its end. In March the battle of Matapan off the southern tip of Greece had resulted in the loss or serious damage of one Italian battleship and three heavy cruisers.

At this point the Germans came to the aid of their ally. Gen. Erwin Rommel took over responsibility for the Libyan campaign. Nazi troops in the Balkans forced the British to transfer the bulk of their army from Africa to Athens and Salonika. The German and Italian forces by-passed Tobruk and, in April, crossed once again into Egypt. In the same month Yugoslavia was invaded from the north, and the Greeks were speedily compelled to surrender. Mussolini hardly dared announce the fact to his people. Although the Italian contribution to the conquest of the Balkans had been slight, the Germans rewarded their allies with a small segment of Yugoslavia and certain Adriatic islands. Aimone, duke of Spoleto, the second son of Emanuele Filiberto, was allowed to call himself king of Croatia. Mussolini made the most of this; but he became increasingly impatient of infiltration by the Germans and began to talk of fortifying the northern frontier of Italy for the not-so-distant day when he would be fighting them.

The war extended eastward when the Germans opened hostilities against the Soviet Union—once again without warning their ally. Mussolini, in the folly of desperation, insisted against German advice that Italian units should fight on the new Russian front, as if they had not already more than enough to do elsewhere. At the end of 1941 Japan brought the United States into the battle, and Italy cheerfully declared war on this new enemy. A British offensive in the Egyptian Western desert in Nov. 1941 was followed by a second German counterattack in the spring of 1942, which took the front as far into Egypt as El Alamein.

But the longer the war continued, the more Italy was outdistanced in the field of provision and munitions. British convoys found it as easy to reach Malta as did Italian convoys to cross the narrow straits of Sicily. In the autumn of 1942, at the same time as the Soviets won the defensive battle of Stalingrad, the Anglo-American landings in Algeria and Morocco, together with

Gen. Sir Bernard (later Viscount) Montgomery's sweep from El Alamein, loosened the Axis' hold on north Africa, all of which was to be in Allied hands by the middle of May of the next year.

Civilian morale in Italy now sank disastrously. The king, some of the army leaders, some of the surviving liberals like Orlando, Bonomi and Croce, the Socialist underground and even *frondeurs* inside the Fascist party all began to cast about for some way of extricating the country from the war without too much physical damage or loss of face. It was the dissident Fascists who first had the courage to move, seeing that the uncontrollable Mussolini was losing everything for which they had struggled. The Allied invasion of Sicily on July 10, 1943, followed by the bombing of Rome which had hitherto been inviolable, at last brought home to Italians some of the realities of war. On the night of July 24–25 the Fascist Grand council supported by 19 votes against 7 a motion of no confidence in the government. Among those who voted against Mussolini were De Bono, De Vecchi, Ciano, Grandi, Federzoni and Giuseppe Bottai.

Badoglio.—The king then took advantage of this division inside fascism and, instead of allowing the rebels to take over the government, arrested Mussolini. Nor was there much protest when Marshal Badoglio was charged to form a new ministry (July 25, 1943). Fascism in fact had fallen, even though the war continued. Badoglio took some time to evade German vigilance and make the first secret overtures for peace. Only toward the end of August did his envoy meet the British and the Americans in Lisbon, and by that time the Germans had been strongly reinforced. The Italian armistice was signed early on Sept. 8. At the same time the Allies landed in Calabria. But all Italy north of Naples passed at once into German hands; and though the Italian fleet sailed to Malta, the Italian army was for the most part easily disarmed by its former allies. In September a German parachute band carried out a brilliant escapade to recapture Mussolini, and a Republican-Fascist government was set up in northern Italy at Salò. Meanwhile Badoglio reconstituted the king's government at Brindisi and, in October, declared war on Germany.

Debates soon began on the nature of Italy's future government, especially on whether the king had become too far compromised with fascism to stay. The six anti-Fascist parties of the liberation movement agreed on suspending this issue and joining a coalition. Palmiro Togliatti, returned from the U.S.S.R., joined the Liberals and Christian Democrats round Croce and De Gasperi. The Maximalist Socialists reformed under Pietro Nenni, and the milder Reformists under Giuseppe Saragat. A coalition government thus took shape under Badoglio in April 1944.

Bonomi, 1944–45.—When in June 1944 Rome fell to the Allies, Bonomi took over from Badoglio with another broad coalition. The country was allowed the status of a co-belligerent but not of an ally in the war against Germany. Italians played a considerable part in the liberation, and the Allies gradually relaxed their control of civil administration as the front line moved farther north. Great physical destruction, as well as inflation and the bitterness of civil war, left the country in a terrible state.

In April 1945 the Allies opened a general offensive in northern Italy. Italian partisans often seized power in advance of this offensive, and hence the extreme left emerged in control of much local administration. A partisan force intercepted Mussolini and his mistress Clara Petacci near Lake Como and executed both near Dongo after a summary trial (April 28, 1945). Ciano and De Bono had already been executed by Mussolini. Grandi and Bottai survived, but most of the other *gerarchi* were dead. Germany capitulated in May.

The Last Year of the Monarchy.—In June 1945 Bonomi gave way in the premiership to Ferruccio Parri, a former partisan and a member of the radical Partito d'Azione. Just after his accession to power the dispute with Tito over Trieste was temporarily settled by a compromise agreement under which Allied and Yugoslav troops partitioned Venezia Giulia. At home, famine conditions were widespread, inflation reached new heights and banditry received a new impetus from deserters, who armed themselves with the weapons that littered the countryside. The Allied occupation, however, was accompanied by substantial food shipments and other forms of economic aid from the United States. The introduction of DDT for malarial control by itself effected a major revolution for the good. Unable to solve domestic problems, Parri was succeeded by De Gasperi in Dec. 1945 with another coalition, including Communists, Socialists and Christian Democrats.

On May 9, 1946, in anticipation of a referendum to be held on June 2 on the issue of republicanism, King Victor Emmanuel abdicated in favour of his son Humbert (Umberto) II. The referendum, however, went against the monarchy by 12,717,923 votes to 10,719,284. Accordingly Italy became a republic, and Humbert went into exile after a month's reign. The referendum had confirmed that southern Italy was stoutly monarchical, and this constituted one more dangerous division between north and south.

G. The Republic

De Gasperi, 1946–53.—The constituent assembly, elected during the referendum, comprised 207 Christian Democrats, 115 Socialists, 104 Communists, 23 Republicans and only 19 Liberals. It elected a Neapolitan, Enrico de Nicola, as provisional chief of state; and De Gasperi on July 12 formed a second cabinet with Christian Democrats in coalition with Socialists and Communists. De Gasperi was to prove himself the ablest Italian political leader since Cavour: in the exceptional difficulties of the period, he managed to preserve a working majority through six more successive administrations till 1953. In Jan. 1947, however, the Socialist party divided itself again, when Saragat formed a separate group (Social Democrats) and Nenni made common front with the Communists. The Communists left the government coalition in May 1947, after which De Gasperi usually relied on support from Liberals, Republicans and Saragat Social Democrats.

The treaty of peace after World War II was finally ratified in Sept. 1947. Yugoslavia received Fiume (Rijeka), Zara (Zadar), Pula (Pola) and Istria (Istra), while the future of Trieste was left doubtful. France obtained small portions of territory along the frontier. The Dodecanese Islands went to Greece, and Italy's African colonies (which subsequently attained independence) remained at the disposition of the United Nations. Italy's inclusion among the United Nations was vetoed by the U.S.S.R., but the western democracies were soon to be in need of Italian support and so made substantial revisions of the treaty in Italy's favour.

The new constitution, devised by the assembly to replace Charles Albert's constitution of 1848, came into force on Jan. 1, 1948 (see *Administration and Social Conditions* below). It provided for an elected senate and chamber of deputies, for some regional autonomy in Sicily, Sardinia, Trentino and Aosta, and for the institution of a president of the republic. De Nicola became the first president and was succeeded by Luigi Einaudi in May 1948. Elections of deputies for the first parliament, held in April, gave 307 seats to the Christian Democrats (with 48% of the votes) and 182 to the Popular Front of Communists and Nenni Socialists combined. Despite this majority De Gasperi wisely persevered with a broad coalition program and even began to give land to the southern peasants by expropriating the larger estates. There was, however, a growing conflict between left and right wings of the Christian Democrats (Luigi Gedda, leader of Catholic Action, on the right, Giuseppe Dossetti and Giulio Pastore of the Catholic unions on the left), which weakened the government and held up social reform. De Gasperi's coalition was weakened in 1950–51 by the defection of the Saragat Social Democrats and the Liberals on its two extreme wings, but both groups continued to give general support to the government. Reconstruction proceeded well, and Giuseppe Pella's deflationary policy brought some good results. The discovery of oil in several areas and of large supplies of methane gas opened prospects of an industrial revolution. An unfavourable trade balance was partially covered by an increase in tourism. An ill-advised attempt by De Gasperi to rig the electoral law turned many moderates against him in the general elections of June 1953, when the Christian Democrats won only 40% of the votes. His eighth and last government fell on July 28.

The Successors of De Gasperi.—With the elections of June 1953 the period of relative governmental stability was over, as both right and left in the parliament gained at the expense of the

centre, which itself became less cohesive. The Christian Democrats had then only 262 deputies, the Saragat Socialists 19 (instead of 33), the Republicans 5 (instead of 9), the Liberals 14 (instead of 18). On the left, meanwhile, the Communists had 143 seats and the Nenni Socialists 75; and on the right the Monarchists had increased their number of seats from 14 to 40 and the neo-Fascists (Movimento Sociale Italiano) theirs from 6 to 29. Pella, who succeeded De Gasperi as prime minister in August, formed a caretaker government of Christian Democrats in coalition with Liberals and Monarchists; but this move to the right disturbed those who believed in agrarian reform. Amintore Fanfani therefore tried in Jan. 1954 to find an alternative coalition more to the left, but could win neither the Saragat Social Democrats nor Achille Lauro's Monarchist party. In Feb. 1954, however, the Sicilian Mario Scelba, who as minister of the interior under De Gasperi had taken stringent police measures against the agitation of the country's 2,000,000 Communists, was able to restore De Gasperi's precarious equilibrium with Liberals and Saragat Social Democrats in the cabinet.

The problem of maintaining unity within the Christian Democratic party between its more conservative elements and the radicals was again posed on De Gasperi's death (Aug. 1954), when Fanfani was chosen to succeed him as secretary of the party. Likewise, when Einandi's term of office as president of the republic came to an end, a left-wing Christian Democrat, Giovanni Gronchi, was elected in April 1955 as his successor, on the fourth ballot, as soon as it became clear that the party's official candidate was losing. Whereas Fanfani wanted some radical social reforms and a continuation of the coalition with Liberals and Social Democrats, Scelba stood well over to the right. So also did Antonio Segni, Scelba's successor as prime minister from July 1955 to May 1957; but his conservative policy led to the defection of the secular parties from the government and to an end of the coalition of centre parties that had lasted since 1948. Adone Zoli then formed a single-party government based on right-wing support.

The elections of May 1958 resulted in a small swing back to the Christian Democrats (42.3% of the votes), a defeat for the right and for the smaller centre parties and a strengthening of Fanfani's group within the government party. Fanfani became prime minister in June, in coalition with the Social Democrats, advocating educational reforms and greater aid to the depressed areas of the south. Once again the political balance was so nicely poised that the slightest reverse was enough to unseat the prime minister. Though the country as a whole was enjoying unprecedented prosperity, many areas had little share in it; and in Sicily the dissident Christian Social group led by Silvio Milazzo captured the government in Oct. 1958, despite open intervention by the Vatican in regional elections. There was unrest in Alto Adige, where the German-speaking population alleged ill-treatment.

Segni, with his more conservative policy, returned to power in Feb. 1959. His task seemed likely to be easier since Nenni had just broken away from his long alliance with Communists and since Ezio Vigorelli, hitherto a follower of Saragat, had formed yet another Socialist group. In March the Christian Democrats elected Aldo Moro secretary of the party in Fanfani's place, and in October, at the party congress, Segni retained control. Milazzo, who after the Sicilian parliamentary elections in June had become regional prime minister in July by turning to the extreme left for support, fell from power in Feb. 1960 and was replaced by a government of the extreme right. When President Gronchi visited Moscow, however, and some members of Segni's cabinet began to show sympathy with the Nenni Socialists, the Liberals withdrew their support from the government. Segni resigned, and in March 1960 a new single-party government was formed by Fernando Tambroni. This won the parliament's vote of confidence only through support from the neo-Fascists, who then began a series of self-assertive demonstrations that provoked violent counteraction. Tambroni resigned in July, and Fanfani in August was invested as prime minister by a vote of 310 deputies (Christian Democrats, Liberals and Social Democrats) against 156 (neo-Fascists and Communists), the Monarchists and the Nenni Socialists abstaining. In March 1961 the right wing government of Sicily fell. By the end of the year the Social Democrats were threatening to withdraw support from Fanfani unless he moved toward the left, away from the Liberals; on Feb. 2 he resigned. Within three weeks he returned with a coalition cabinet of 19 Christian Democrats, 3 Social Democrats and 2 Republicans. In the presidential elections of May 1962 Segni, who had been foreign minister under Fanfani, was elected to succeed Gronchi by 443 out of 870 votes, but only after eight previous ballots had failed to win him the requisite majority. (D. M. Sh.)

At the parliamentary elections of April 1963 the Christian Democrats obtained 38.3% of the votes and gained only 260 seats out of 630 (instead of 273 out of 596 in 1958). Fanfani resigned and Moro was at first unable to form a coalition with the Socialists. Provisionally, therefore, Giovanni Leone formed a minority government of Christian Democrats on July 30. At the end of October the Socialist party's convention approved—on terms—the idea of entering a coalition government with the Christian Democrats. Leone resigned on Nov. 5, and two days later the national council of the Christian Democratic party decided to open negotiations with the Socialists. On Nov. 11 Moro was asked by the president to form a new government.

In foreign policy, Italy under De Gasperi became a member of the North Atlantic Treaty organization (1949) and of the European Defense community (1952). When the latter collapsed (1954), Italy joined the Western European union (1955) and signed the treaty of Rome (1957), which created the European Economic Community (Common Market) in 1958. In Dec. 1955, Italy was admitted to membership of the United Nations.

The question of Trieste was settled in Oct. 1954 by an agreement on the division of the territory between Italy and Yugoslavia. The problem of the Germans in Alto Adige remained, and in July 1960 Austria brought it before the United Nations, which in October recommended Italy and Austria to resume negotiations. The establishment of NATO missile bases on Italian territory was accepted despite strong Communist objections. (X.)

VI. POPULATION

In the 75 years between the censuses of 1861 and 1936, the population of Italy rose from 25,000,000 to 42,993,602. The population at the 1961 census within the boundaries laid down by the treaty of 1947 and including the city of Trieste (which returned to Italian sovereignty in 1954) was 50,623,569, compared with 47,515,537 at the 1951 census. The birth rate declined between 1861 and 1951, but so did the death rate, particularly infant mortality; these trends continued after 1951 and the natural increase in population averaged about 400,000 annually. The over-all density figure rose from 359 per square mile in 1936 to 435 per square mile in 1961. This does not seem high compared with Great Britain and Belgium, but its effect is intensified by the mountainous nature of the country and by the large proportion of the employed population engaged in agriculture.

In 1961 nearly 22,700,000 persons lived in the eight northern regions, which include the great industrial areas of Turin, Genoa, Milan and the other big towns of the Po valley; over 9,350,000 in the four central regions (Tuscany, Umbria, the Marches and Lazio), more than 12,400,000 in the five southern regions, more than 4,700,000 in Sicily and about 1,420,000 in Sardinia. Within these main divisions the density per square mile varied in the north from 80 in the Valle d'Aosta and 149 in Trentino-Alto Adige to 830 in Liguria; in the centre from 243 in Umbria to 596 in Lazio; and in the south from 167 in Basilicata to 907 in Campania. It was 475 in Sicily and only 152 in Sardinia.

The average density of population on agricultural land is high, being 624 persons per square mile for the whole country, 790 in northern Italy, 614 in the centre, 553 in the south and 404 in the islands. The region with the highest density on agricultural land is Liguria with 1,989 inhabitants per square mile; those regions with the lowest are Sardinia with 199, Basilicata with 223 and Valle d'Aosta with 236. These considerations apply with particular force to the southern regions, where far too many people are still trying to eke a living from agriculture.

Regions, Areas, Population and Density (1961)

Regions	Area (sq. mi.)	Population	Density
Abruzzi e Molise	5,881	1,564,318	265.9
Basilicata	3,856	644,297	167.1
Calabria	5,822	2,045,047	351.3
Campania	5,249	4,760,759	907.0
Emilia-Romagna	8,542	3,666,680	429.3
Friuli-Venezia Giulia	3,031	1,204,298	397.3
Lazio	6,642	3,958,957	596.0
Liguria	2,091	1,735,349	829.9
Lombardy	9,191	7,406,152	805.8
Piedmont	9,807	3,914,250	399.1
Puglia	7,470	3,421,217	458.0
Sardinia*	9,301	1,419,362	152.6
Sicily*	9,926	4,721,001	475.6
The Marches	3,742	1,347,489	360.1
Trentino-Alto Adige*	5,256	785,967	149.5
Tuscany	8,876	3,286,160	370.2
Umbria	3,265	794,745	243.4
Valle d'Aosta*	1,260	100,959	80.1
Veneto	7,095	3,846,562	542.2
Total	116,303	50,623,569	435.3

*Autonomous regions with special statute.

The great industrial towns are mainly in the northern plain and the valley of the Po; in the south, excepting the ports (notably Naples), the towns are essentially large agricultural centres. In the north and centre the industrial population lives in the towns and the rural population is scattered over the countryside in small towns and villages. But in the south and islands climatic conditions, security and land distribution have caused the agricultural population to live in towns of varying size from which they go to work in fields anything from five to ten miles away, with disastrous effects on the agriculture.

Natural Increase.—The birth rate fell from 36.8 per 1,000 of the population in 1872–75 to 23.7 in 1938 and to 18.4 in 1961. In 1961 it varied greatly in different regions: from 12.6 per 1,000 in Liguria and 13.4 in Piedmont to 24.1 in Calabria, 23.9 in Puglia and 24.8 in Campania. Thus the natural rate of growth was greatest in the districts which were the poorest, the most overpopulated and the most dependent on agriculture. Nevertheless, the birth rate has fallen steadily in every southern region; even in Campania, it was in 1961 only a little above the average for the whole country 20 years earlier. Male births in 1960 exceeded female births by about 5% but there was a greater male mortality. In 1961 women constituted 51% of the population. The number of illegitimate births fell from 41 per 1,000 births in 1938 to 24 in 1960.

Despite the falling birth rate, the rate of natural increase of the population has grown because of a steady decline in the death rate. This fell from 30.5 per 1,000 in 1872–75 to 14.0 in 1938 and to 9.3 in 1961, the last figure being comparable with the lowest world rates. This decline was undoubtedly the result of progress in health measures, the effect of which was particularly marked in the great decrease in infant mortality. During the first 50 years of Italian unity, the infant mortality rate dropped from 219 per 1,000 live births in 1872–75 to 128 in 1922. The decrease continued, reaching 106 in 1938 and 40.1 in 1961, though even this was about double the rates in the U.K. Moreover the over-all figure of 40.1 for Italy concealed great variations in different regions; in Tuscany the rate was only 25.8 per 1,000, but it was 59.5 in Basilicata. The consequence of the very considerable fall in the general death rate was that the rate of natural increase rose from 6.3 per 1,000 of the population in 1872–75 to 9.7 in 1938 and was 9.1 in 1961.

One of the most dreaded diseases in Italy was for many years tuberculosis. The number of deaths from all forms of the disease fell steadily from an annual average of 1,362 per 1,000,000 inhabitants in 1924–30 to 808 in 1937–39. It rose to 983 during the war years 1943–45 but by 1960 it had fallen to 171, or less than one-quarter of the prewar rate. The greatest improvement in health is attributable to the virtual disappearance of malaria, formerly the scourge of the south and islands. From 1931 to 1936 the average annual mortality from malaria was 2,242; as a result mainly of the determined onslaught on the *Anopheles* mosquito with DDT the number of deaths fell to 102 in 1949 and to 53 in 1950, after which it became negligible. The disappearance of malaria after 2,000 years was perhaps the most important event in south Italy after 1945. It enabled southerners to do a full day's work, a thing which few had hitherto been able to do because they were ridden by disease.

The marriage rate averaged about 7.5 per 1,000 of the population before 1939. It rose for a short time after World War II but was 7.9 in 1961. Divorce is forbidden by the Roman Catholic Church, but the number of judicial separations increased considerably after 1945.

Migration.—The consequence of the great and continuing increase of population is a condition of serious overpopulation, particularly in the poor agricultural regions of the south. This problem, resulting in an average of more than 1,500,000 unemployed in the late 1950s, is basic to the whole economy and one that confronts every Italian government. Before 1915 and between 1919 and 1925 a considerable measure of relief was found in mass emigration from the most overpopulated areas. There were two main streams of emigration: one overseas which tended to be permanent; the other to European countries which was mainly temporary and often seasonal. The emigrants not only raised their own standard of living but by their remittances raised the standard of their families at home and also helped to balance Italy's foreign trade.

After 1945 the Italian government sought to promote emigration as a partial solution of overpopulation. The former mass emigration was no longer possible, and from 1946 various agreements were made with European and South American countries for the reception of emigrants, the most important being those with France and Argentina, but the results were disappointing. The creation of the European Common Market aroused hope in Italy, which has continually urged freedom of movement in the labour market, labour being its most valuable asset.

After 1950 and particularly toward the end of the 1950s an important movement of population took place inside the country. The most discussed migration was from the southern agricultural regions to the industrial north, particularly to the large towns, where the low standard of living of the newcomers caused considerable social difficulties. There was also a movement in the north from the countryside into the towns and in the south from the crowded hill towns to the plains (no longer malarial), and into the larger cities such as Palermo, Messina and Catania in Sicily or Bari in Puglia. It is argued that this much-abused drift into the towns is a sign of social and economic progress, and that ultimately it will permit the allocation of adequate pasture and forest areas from land which by reason of population pressure is currently used for arable farming. The national increase in population over the period 1951–61 was 3,108,032 or 6.5%. But the percentage regional increases in Lombardy, Piedmont, Liguria, Lazio and Campania exceeded the national average, reaching 18.5% in Lazio, while actual decreases were recorded in Friuli-Venezia Giulia, Veneto, the Marches, Umbria and Abruzzi e Molise.

VII. ADMINISTRATION AND SOCIAL CONDITIONS

1. Constitution.—On June 2, 1946, the Italians voted in favour of replacing the monarchy by a republic. A constituent assembly drew up a new constitution to replace the old constitutional statute of 1848, which had been amended almost out of recognition but never abolished by Mussolini, and on Dec. 22 adopted the new constitution by 452 to 62 votes. It was promulgated on Dec. 27, 1947, and came into force on Jan. 1, 1948.

The constitution is rigid and can be revised only by a lengthy procedure. It was expressly designed to secure a system of parliamentary democracy and to prevent unconstitutional developments of the Fascist type. Like many modern constitutions, it includes provisions that cannot strictly be considered as constitutional, particularly those covering social and labour legislation. The revulsion against interference with individual liberty resulted in the large number of articles which lay down fundamental principles regarding the rights of man, equality of all men before the law, the inviolability of personal liberty and of the home, and freedom of speech, of assembly, of religion and of the press. Two of the general provisions are of special interest when viewed in the light of the history of Italy. Article 6 states that the republic

will protect linguistic minorities, and Italian constitutional jurists maintain that the term republic covers not only the state of central authority but also the regions, provinces and communes. This is an important undertaking in a country where the German and Yugoslav minorities were badly treated between 1919 and 1939, and has been frequently cited since 1948 by the German-speaking minority of Alto Adige. Articles 7 and 8 define relations between church and state. Article 7 says: "The State and the Catholic Church are each, in its own order, independent and sovereign. Their relations are regulated by the Lateran Pacts [of 1929]. Modifications of the Pacts which are accepted by both parties do not require the procedure of constitutional amendment." No other modern constitution contains any similar provision, which involves a revision of the constitution if church or state desires to repudiate the concordat.

The constitution can be revised only by a constitutional law adopted by each chamber of parliament in two successive meetings at intervals of not less than three months. An absolute majority is required in each chamber on the second vote. Revision can be subject to a referendum like other laws. But one thing is not subject to constitutional amendment—the republican form of government.

Article 1 of the constitution affirms the principle of popular sovereignty: "Italy is a democratic republic based on work. Sovereignty belongs to the people, who will exercise it in the forms and within the limits prescribed by the Constitution." The sovereignty of the people is secured by the establishment of universal, adult suffrage, exercised both in elections to parliament and in the referendum, this last being one of the new features of the constitution. The centre of the constitution is parliament, which consists of two chambers with equal powers: the chamber of deputies and the senate. These meet in joint session in certain cases provided for by the constitution: for the election or impeachment of the president of the republic; for the impeachment of ministers; and for the election of one-third of the members of the supreme council of the judiciary.

Legislative power belongs to the two houses collectively; legislation can be initiated by the government, by members of either house and by bodies on which it is conferred by constitutional law. The people may also promote legislation by presenting a draft bill supported by at least 50,000 electors. Bills can be initiated in either chamber and must be approved by both before being promulgated by the president of the republic, who may request a fresh deliberation by the chambers but must promulgate the law if it is approved a second time. A referendum for the abrogation of a law (other than laws dealing with taxation, the budget, amnesties or the ratification of international treaties) must be held if it is asked for by 500,000 electors or by five regional councils. Special attention is paid by the constitution to the subject of decree laws. It was largely by the use of decree laws that the Fascists imposed a totalitarian system on Italy within the framework of the constitution of 1848. Under the constitution of 1948 the government may not issue decree laws without the previous consent of parliament; if in case of extraordinary necessity the government adopts measures having the force of law, it must on the same day present them for conversion into law by the chambers, which must be specially convened for the purpose if they have been dissolved. Parliament authorizes the ratification of international treaties and approves the national budget.

The makers of the constitution, while recognizing the danger of conferring executive power on the president, felt the need for a stabilizing and unifying influence and did not wish to make the president a mere figurehead. The president, who must be at least 50 years of age, is elected for seven years by secret ballot at a joint session of both chambers and must obtain a two-thirds majority. He is head of the state and commander of its armed forces; he announces the holding of new elections and can dissolve the chambers; he promulgates laws, declares war, has the right of pardon and presides over the supreme council of the judiciary. But the president does not govern. No act of his is valid unless confirmed by the ministers proposing it, who assume responsibility for it, and he cannot be held responsible for any act taken as president—except in a case of high treason or attack on the constitution, in which case he must be impeached before a joint session of parliament.

2. Government.—Executive power lies with the government which consists of the president of the council and of the ministers, who together constitute that council. The president of the republic nominates the president of the council and, on his advice, the ministers. The government must have the confidence of both chambers, and Italian constitutional lawyers regard this requirement as establishing the responsibility of ministers to parliament. The constitution of 1848 failed in that respect, as it merely said that ministers were responsible, not to whom they were responsible. The president of the council decides on the general line of policy and is responsible for it; the ministers are collectively responsible for the acts of the council and individually for those of their own ministries.

An important new organ of government set up in 1955 was the *corte costituzionale* (constitutional court) empowered to give decisions on the constitutional character of laws and of acts having the force of law emanating from the state and the regions. It consists of 15 judges, one-third nominated by the president of the republic, one-third by parliament sitting jointly and one-third by the supreme judicial bodies.

Electoral Law.—According to the constitution both houses, the chamber of deputies and the senate, are elected by universal, direct suffrage. The chamber of deputies has one deputy for every 80,000 inhabitants, the senate (elected on a regional basis) one senator for every 200,000. Men and women over 21 may vote for the chamber, those over 25 for the senate; deputies must be 25 years of age, senators 40; the chamber is elected for five years, the senate for six. Former presidents of the republic become senators for life, as do five senators nominated by the president of the republic for their outstanding contributions to the social, scientific, artistic and literary life of Italy.

The decree of Feb. 5, 1948, adopted for election to the chamber a system of proportional representation with voting for a party list. There were 32 multiseat constituencies, and every voter could indicate his preferences regarding individual candidates within that list; 530 deputies were to be elected in constituencies and 22 seats would be divided among the parties under a national pooling system (*collegio unico nazionale*).

The decree of Feb. 6, 1948, concerned with election for the senate, combined proportional representation with uninominal constituencies. Besides the 237 elected senators the first senate of the republic included, exceptionally, 107 senators by right (*senatori di diritto*), their qualifications being that they were former prime ministers, former presidents of the chamber or former deputies who suffered more than five years' imprisonment for their opinions under the Fascist regime. These posts disappeared after the 1953 election.

3. Local Government.—The republic is divided into regions, provinces and communes. The 1948 constitution provided for the establishment of self-governing regions, "autonomous bodies (*enti*) with powers and functions of their own in accordance with the principles laid down by the Constitution." In 1861 Cavour's successors had been absorbed in securing the unity of Italy and were afraid to introduce any measure of local autonomy. Mussolini later found the centralized system admirably adapted for securing a stranglehold over the country. In consequence the opponents of fascism were anxious to secure a large measure of decentralization and of local self-government, though this had not been achieved by the early 1960s.

The Region.—The name region (*regione*) is not new; certain statistical and other information had always been given under the headings of the various regions—Piedmont, Tuscany, Sicily, etc. It had been, however, merely a convenient name for a group of provinces and had no administrative or legislative implications. Under the constitution of 1948, 19 regions were established: Piedmont, Valle d'Aosta, Lombardy, Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia, Liguria, Emilia-Romagna, Tuscany, Umbria, the Marches, Lazio, Abruzzi e Molise, Campania, Puglia, Basilicata, Calabria, Sicily and Sardinia. Five of these regions, Sicily,

Sardinia, Trentino-Alto Adige, Valle d'Aosta and Friuli-Venezia Giulia, belong to a different category from the rest. Each of the other 14 regions was intended to have a statute of its own to bring into force a system of government on the general lines laid down in the constitution. These statutes were to be approved by an ordinary law of the republic but by the early 1960s the 14 regions had still not acquired administrative or legislative functions. The statutes of the five special regions are less restricted and had therefore to be adopted by the passing of a constitutional law; they can be amended only by the procedure laid down in the constitution for constitutional revision. The first four special regions obtained their statutes on Feb. 26, 1948; but since the future of Friuli-Venezia Giulia was felt to depend on that of Trieste, this region was treated as an ordinary region in the years following 1948, and even after Trieste city became Italian territory in 1954, Friuli-Venezia Giulia did not acquire a special statute. The four special regions are each under a government commissioner with a regional council (*consiglio regionale*) and government (*giunta regionale*) having legislative and administrative functions adapted to the needs of the region. For the regions *see* Table; *see* also separate articles in respect of most regions.

The Provinces.—The 91 *provincie*, artificial creations of united Italy which do not correspond to the old areas existing before 1861, have a dual character. Each province is an area of the state and, as such, the seat of various local administrative agencies of the central government; it is also an autonomous local body with the duty of providing for local interests. It therefore has two sets of officials and administrative bodies. The prefect, the chief government official, is a high-ranking, salaried civil servant, appointed by a decree of the president of the republic on the recommendation of the minister of the interior with the approval of the whole cabinet. He is charged with administering national legislation and the decrees of the ministries and, although primarily responsible to the minister of the interior, is also the local representative of all other ministries. He also has the task of supervising public security and has the right to use the police and to call upon the help of the armed forces of the state. Justice, the armed forces and the railways are exempt from his direct control. All deliberations of the communal council and executive are submitted to the prefect, who can annul any decision of the commune or the province that he may judge to be contrary to the law; he is free from legal restriction by local government bodies. The prefect is assisted by a council (*consiglio di prefettura*) of three members, paid officials presided over by himself or his deputy. They also preside over a committee (*giunta provinciale amministrativa*) consisting of two members of the council and four members elected by the provincial council (*see* below). All contracts entered into by the communes or provinces involving more than a small sum are supervised by the council, and the administration of their real property is watched over by the committee.

The local provincial organs of government are the provincial council (*consiglio provinciale*), an elected body varying in size according to the size of the province, and its executive committee (*deputazione provinciale*). The council has charge of public buildings and other property belonging to the province and must provide for poor relief and public health, for provincial roads and bridges and their upkeep and for certain public works. The funds of the province come partly from property in land and buildings, partly from taxation, partly from loans.

The Communes.—According to the 1961 census there were 8,035 communes. Every square inch of Italy forms part of a commune, which may vary in size from a tiny village to a great city with more than 1,000,000 inhabitants, such as Rome or Milan. All, whatever their size, have the same administrative bodies and all are responsible for certain services: local police, public health, lighting, fire precautions and local public works. The funds of the commune come either from the possession of land and buildings or from various taxes, the chief of which is the *imposta di consumo* (commodity tax). All citizens, 21 and more years of age living within the commune can vote in both communal and provincial elections. After Jan. 1946 local elections were based on proportional representation in communes with a population of more than 30,000 and in all provincial capitals; in other communes election is by majority vote with certain special provisions intended to secure representation of minority groups. The organs of government are the mayor (*sindaco*), a council and an executive committee (*giunta*), all elected.

4. Political Parties.—The main political parties of Italy after 1948 were the Christian Democrat, Communist, Socialist, Social Democrat, Liberal, Republican, Monarchist and the neo-Fascist Italian Social Movement; all except the last two trace their origin to the pre-Fascist period and played an active part in the committees of national liberation that were formed during the latter part of World War II.

The Partito della Democrazia Cristiana (D.C., or Christian Democrat party), succeeded the Partito Popolare (People's party), founded in 1919 by the Sicilian priest Don Luigi Sturzo, who was an active member of the party and a life member of the senate from 1952 until his death in 1959. Although not an official Roman Catholic party, it was strongly supported by the church, which regarded it as Italy's bulwark against communism. Led by Alcide De Gasperi the Christian Democrat party had a great victory in the first parliamentary elections held under the new constitution in April 1948. In the 1953, 1958 and 1963 elections it polled a smaller percentage of votes but remained the largest single party in parliament although no longer commanding an absolute majority in the chamber. The party contained many progressive, democratic Italians determined to improve social conditions and to strengthen Italy's position as a European power, but it also included landowners bitterly opposed to the party's land reform plans and industrialists hostile to reforms of the fiscal system. The interests of landowners and industrialists were more anti-Communist than progressive and by 1958 this made the government precariously dependent on the support of the smaller parties.

The Partito Comunista Italiano (P.C.I., or Communist party), is the second largest party in Italy with about 1,500,000 inscribed members, and the largest Communist party in Europe outside the Soviet bloc. Founded in 1921 it was particularly strong in Turin, where there arose a group of communist intellectuals including Palmiro Togliatti, its postwar leader. In 1948 the Popular Front of Communists and Socialists combined polled 31% of the total votes. In 1953 and 1958 the Communist party alone polled over 22% of the votes and in 1963 over 25%. Its strength was attributable partly to economic conditions, particularly in the south where communism among agricultural workers was an economic not a political doctrine.

The Partito Socialista Italiano (P.S.I., or Italian Socialist party), was founded in 1892 and at the 1919 elections emerged as the largest party in parliament. It suffered from internal divisions; in 1921 when the Communists broke away the remaining socialists were divided and were unable to act decisively even in face of growing Fascist violence. A similar cleavage resulted in the defection in 1947 of the group known later as the Social Democrats led by Giuseppe Saragat. Under the leadership of Pietro Nenni the P.S.I. collaborated with the Communist party, although in the 1953, 1958 and 1963 elections it had a separate list of candidates and in 1963 obtained 13.8% of the total votes. The party advocated widespread nationalization and land reform but realized that political and economic issues could not be separated when poverty prevailed to the extent that it did in Italy. The main strength of the P.S.I. lay in north Italy, particularly in Lombardy.

The Partito Socialista Democratico Italiano (P.S.D.I., or Social Democrat party), formerly the Partito Socialista dei Lavoratori Italiani (Socialist Party of Italian Workers), became a small party with able leaders and at the 1953 and 1958 elections obtained less than 5% of the total votes, increased in 1963 to 6.1%. The party opposed collaboration with the Communists and supported many of the Christian Democrat social reforms, although fundamentally hostile to the Christian Democrat clerical policy.

The Partito Liberale Italiano (P.L.I.) and Partito Repubblicano Italiano (P.R.I.), the small liberal and republican parties, have old traditions and both are strongly anticlerical. Under fascism, liberal beliefs were kept alive by the philosopher Benedetto Croce

(*q.v.*) and his followers, but the postwar party was divided into small hostile groups. The Republican party always held to the Mazzinian ideal (social justice in a free society) of an Italian republic, and with the disappearance of the monarchy in 1946 the reason for its existence was less apparent. Its chief aims were a free economy and European union.

The Partito Nazionale Monarchico and the Partito Monarchico Popolare (National Monarchist and Peoples' Monarchist parties) are groups into which the National Monarchist party split in 1958. Despite the large vote (45.7% of the total) for retaining the monarchy in the 1946 referendum, the Monarchists polled only about 700,000 votes in 1948 and obtained 14 seats in the chamber. In 1953 it increased its vote to over 1,850,000 (6.9%), but in 1958 the two monarchist parties together failed to obtain 5% of the total votes cast. In 1959 the two parties merged to form the Partito Democratico Italiano di Unità Monarchica (Italian Democratic Party of Monarchial Unity), which in 1963 shared only 1.7% of the votes.

The Movimento Sociale Italiano (M.S.I., or Italian Social movement), a neo-Fascist party, obtained 5.8% of the total votes in 1953 but only 5.1% in 1963. In itself the party was of little importance, but its threat to democracy lay in the possibility of a combination between the Monarchists, the neo-Fascists and the right wing of the Christian Democrat party. In 1960 the government relied on this combination for its majority, and although the resulting storm of indignation forced the government to resign, the threat remained.

5. Trade Unions.—Twenty years of fascism resulted in a lack of political and economic education among the workers, and the reorganization of the trade union movement in 1943 was the work of three labour leaders, Bruno Buozzi, a Socialist killed by the retreating Germans in 1944; Achille Grandi, a Christian Democrat; and Giuseppe Di Vittorio, a Communist. On June 3, 1944, they signed the Rome Pact of Trade Union Unity, which established one united body, the Confederazione Generale Italiana del Lavoro, or C.G.I.L. This was to be the sole federation representing all organized workers and was to be generally independent of political parties.

In the early postwar period the political unity which had prevailed during the resistance and liberation periods fostered cooperation of trade unions, but political unity disappeared by 1947, and the effects were felt within the C.G.I.L.

After the attempt on Togliatti's life on July 14, 1948, many workers came out on strike and were supported by the C.G.I.L. Giulio Pastore, a Christian Democrat who had succeeded Grandi as secretary of the C.G.I.L., urged workers belonging to the Christian Democrat party to leave the C.G.I.L. and set up the Libera Confederazione Generale Italiana dei Lavoratori, which was replaced in 1950 by the Confederazione Italiano Sindacati Lavoratori, (C.I.S.L.), the second largest trade union confederation. In March 1950 the Unione Italiana del Lavoro (U.I.L.) was founded by Italo Viglianese for those workers who objected to Communist control of C.G.I.L. and to the Christian Democrat leanings of C.I.S.L.

Despite their differences all three bodies strove to preserve a united front on purely economic claims and usually succeeded as regards specific short-term trade union problems. All were agreed on the importance of strengthening economic trade unionism among the underpaid agricultural workers of the south. The C.G.I.L. remained the largest and most important federation.

6. Taxation.—The outstanding characteristics of the Italian taxation system are the heavy incidence of indirect taxation, which bears most on the poor; and the general evasion of direct taxation by rich individuals and by big industrial concerns, although in the 1950s the government made determined efforts to deal with evasion.

Taxation has been one of the chief grounds of complaint of the south against the north since 1860. Southerners maintained that the heavy taxes levied in the south were spent on the development of the north, to the detriment of such small industry as existed in the south. The justice of this complaint was at least covertly recognized by post-1945 governments and the creation of the *Cassa per il Mezzogiorno* (see *Economic Regions* above) to aid the south and other especially needy areas was an attempt to restore the balance.

7. Manpower.—One of Italy's most valuable assets is its labour force. Only centuries of skilled labour could have produced so much from a country which is predominantly barren and mountainous, while the work of the skilled artisans can be turned to good account in many modern factories. Unhappily there is not yet enough work for this labour force, which steadily increases.

The lack of exact figures for unemployment led to the appointment of a parliamentary commission of inquiry, whose report in 1953 disclosed that in Sept. 1952 there were about 1,500,000 unemployed, 67.1 of them men. This figure covered only persons formerly employed and young people (about 600,000) seeking their first jobs. Two features emphasized by the report were the widespread underemployment (particularly in agriculture) and the lack of any special qualifications by the vast majority of the unemployed, only 5% of whom had had any kind of professional training. Unemployment continued to be severe in the mid-1950s but decreased with the upsurge in the economy that began in 1959. By 1961 the figure for registered unemployment had fallen below 1,000,000 and further industrial expansion promised continued reduction. But underemployment, evidenced by subnormal levels both of productivity and of remuneration, was still widespread, particularly in the south and in agriculture.

In 1960 the Italian Institute of Statistics gave the working population of Italy as 20,991,000, of whom 28.6% were engaged in agriculture and 39.5% in industry, but whereas in the north 24.7% were in agriculture and 42.9% in industry, in the south 42.1% were in agriculture and only 29.8% in industry, while in Abruzzi e Molise the percentage in agriculture was 49.5.

Wages are fixed by collective agreement; important additions to the basic wage include cost-of-living bonuses and family allowances. Minimum wages are fixed by law, but in many cases, particularly where southern agricultural day labourers are concerned, excess of population until 1961 made a mockery of the law.

8. Housing.—Many houses were damaged or destroyed by bombing during World War II, and in the early postwar years little was done for housing with the result that the already serious shortage grew to vast proportions. In 1949 a start was made in building workers' houses under the plan prepared by Amintore Fanfani, the minister of labour and later prime minister. During the 1950s large numbers of houses were built by the government working through the Istituto Nazionale Assicurazione (National Insurance institute), this branch of the institute being known as I.N.A.–Casa; and are let at moderate rents.

By the early 1960s housing conditions in the north had greatly improved and many new housing estates such as those in Milan and Florence were excellently laid out. But in the south conditions were often still appalling. The 1961 census gave a national average of 1.2 persons per room, with 1.7 in Naples and Bari and 1.8 in the Matera province of Basilicata. The figure for Naples failed to convey the overcrowding of the city, where in 1958 there were still 43,500 *bassi* (cellar dwellings) with an average of five people to a room. Rural housing remained an urgent problem in south Italy, where in the hill towns families of eight and ten were still often sharing one windowless room with a pig, hens and even a mule. The new houses built by the agrarian reform agencies were often admirable, but there were not enough of them.

9. Social Insurance and Welfare Services.—Social insurances fall roughly into four groups: family allowances, by far the most important; insurance for periods of difficulty (unemployment, accidents at work, illness); insurance for special occasions involving extra expenditure (marriages and births); insurance for the time when work is no longer possible (old age, disability and dependents after a worker's death). The legislation involved began early in the 20th century; enactments comprised workers' compensation (accidents), 1904; maternity benefits, 1910; unemployment, disability, old age, 1919; tuberculosis, 1927; family allowances, 1934; and sickness, 1939 and 1943. All these insurances were made applicable to workers and employees in industry, commerce and banking; later they were extended to agricultural la-

bourers and all except family allowances and unemployment insurance were extended to peasant proprietors. All were put on a contributory basis, plus treasury grants; though for a time after June 1946 contributions were paid only by employers, by 1961 employees contributed to the insurances for sickness, old age and widows and orphans.

There is a great tradition of charity in Italy and there are a large number of charitable foundations. They include such institutions as day nurseries, orphanages, homes for beggars and homes for old people. Since 1862 all these foundations have been incorporated as juridical by the state, which has the right to inspect them, to audit accounts and to reorganize the foundations. There is a lack of co-ordination among the charitable institutions and between them and the more modern welfare services supplied by social insurance. Administration is in the hands of various independent agencies, some of them nation-wide (*enti parastatali* —semiofficial bodies), others provincial or local.

The Ente Comunale di Assistenza (the Commune's Institution for Relief) is the body which provides general assistance throughout Italy. Its general function is legally defined as that of giving direct and temporary assistance, including aid in money or in kind or in services. Specifically, it provides legal assistance, shelter and food for the homeless poor, help for minors and for the aged in institutions and emergency cash relief to people in temporary need.

Child welfare throughout the country is in the hands of the Opera Nazionale per la Protezione della Maternità e dell'Infanzia (National Association for the Protection of Mothers and Babies), founded in 1925. Its main work lies with expectant and nursing mothers and with babies less than six years of age, and its methods are up-to-date and progressive. By the early 1960s it employed about 8,500 consultant doctors and controlled more than 400 nursery homes, numerous feeding centres for mothers and about 400 homes for mothers and babies, and gave help to about 350,000 mothers and 1,500,000 infants annually. In the south the most important voluntary body is the Associazione per gli Interessi del Mezzogiorno d'Italia (Association for the Interests of South Italy) founded in 1910 which has established nursery schools in many of the poorest and most inaccessible villages.

10. Health.—In 1958 a new ministry of public health replaced the high commissioner's office for hygiene and public health. The ministry controls all state medical and health services, working through the health offices of the provinces and communes. It therefore exercises ultimate control over hospitals, school medical services, health in factories and other medical services administered by the communes. The communes employ doctors (*mèdici condótti*) and midwives, whose services are free to those local residents enrolled on the list of the poor (*elenco dei poveri*). These people are entitled to free treatment in the local hospital if they are not covered by insurance.

The ministry also controls the services concerned with widespread diseases such as tuberculosis, poliomyelitis, cancer, venereal diseases, etc. Among the most important of these are the *Consorzi provinciali antitubercolosi* set up in every province by a law of 1927. More than half of the population is covered by the compulsory tuberculosis insurance of all workers, which includes their families.

All workers are insured against sickness and sickness benefits are available for 180 days, as is hospital treatment; most medicines are free. Hospitals and convalescent homes are unevenly distributed, for although nearly 40% of the population live in the south, in the late 1950s only about 16% of the 262,000 beds in public hospitals were in the southern regions. The virtual eradication of malaria by mid-20th century was an important factor in the social and economic revolution in progress in the south.

11. Justice.—Italian law is fundamentally based on Roman law; but it also owes much to French law, and Italian lawyers have been greatly influenced by French juristic literature and by the decisions of the French court of cassation. The development of a unified system of justice was not easy in a country where the administration of justice had been so varied before 1870, but the influence of France, exerted through Piedmont, was a strong unifying element in the late 19th-century codes, on which the Italian system of justice was based. Immediately after World War I a group of distinguished Italian lawyers was appointed to draw up new codes, which were issued as the Codici Mussoliniani. New codes for criminal law and procedure came into force in June 1931; the new civil code, which included commercial law (formerly incorporated in a separate code), the code of court procedure and the navy code came into force only in April 1942. In theory the new codes were supposed to further "Fascist justice"; in fact they were the outcome of years of work by eminent Italians. Certain articles, such as those which had made strikes and lockouts illegal, were deleted after the destruction of the Fascist regime, and the Italian parliament continued to discuss various other reforms; but by the early 1960s it seemed likely that, with some amendments, the codes would remain.

The main lines of the theory and practice of the administration of justice are laid down by the constitution of 1948, which devotes a whole section to the judicial system and procedure. Experiences under Fascist government showed how important it was that the judiciary should be independent. The constitution accordingly states that "justice is administered in the name of the people; the judges are subject only to the law." The judiciary is an autonomous order independent of all others, and the judges cannot be removed. Judicial functions can only be exercised by ordinary magistrates. No extraordinary or special courts can be set up, as they were under Fascist rule.

The Legal Profession.—There are two separate branches of the legal profession in Italy, and they are not interchangeable. The one branch is strictly legal and consists of *avvocati* (advocates) and *procuratori* (agents). Except in the lowest courts the *procuratore* is in charge only of the preliminary procedure and pleading is done by the *avvocato*. Both act as solicitors or barristers and a professional lawyer may be both a *procuratore* and an *avvocato*. The other branch of the profession is the judicial. Responsibility for the administration of justice belongs to the minister of justice. The magistracy is a part of the civil service, and advancement is by competitive examination, although seniority is taken into account for some of the highest posts. The magistrates rise in rank from the *giudici conciliatori*, who correspond roughly to the British local justices of the peace, through the *pretori* and the judges of the *tribunali* (tribunals) and the *corti d'appello* (courts of appeal) to those of the supreme court, the *corte di cassazione* (court of cassation); the highest post is that of the first president of the *corte di cassazione*.

Courts.—The lowest civil courts are the local *uffici di conciliazione* (offices of conciliation), each presided over by a *giudice conciliatore* who deals with minor cases involving sums of not more than 10,000 lire. Much stress is laid in Italy on conciliation, and normally 80% of disputes are settled in these courts or in those of the next grade, the *preture* (district courts). These courts are held in each large district or *mandamento* (there are more than 950) and are each presided over by a single *pretore* (corresponding to a British stipendiary magistrate), whose competence extends to cases involving sums not exceeding 200,000 lire. The next highest courts are the *tribunali*, each of them with a bench of three judges; and above them are the *corti d'appello*, each with a bench of five judges. These *corti* usually deal with appeals from the *tribunali*, but they may also sit as courts of first instance. There are *corti d'appello* in Genoa, Turin, Milan, Brescia, Trento, Venice, Trieste, Bologna, Florence, Ancona, Perugia, Rome, L'Aquila, Naples, Bari, Lecce, Potenza, Catanzaro, Messina, Catania, Caltanissetta, Palermo and Cagliari, and a subsidiary court in Reggio di Calabria. Decisions of the *corti d'appello* are final on points of fact, but appeals on points of law may be taken from the *preture*, the *tribunali* and the *corti d'appello* to the "supreme" court, the *corte di cassazione* in Rome.

Minor criminal offenses involving imprisonment for less than three years are dealt with by the *pretore* sitting as a single judge in his court. The *tribunali* have a bench consisting of a president and two judges and consider appeals from the *preture;* the *corti d'appello* have four judges and have appellate jurisdiction to review sentences pronounced by the criminal divisions of the *tri-*

bunali. In addition there are the *corti d'assise* (assize courts) which act as courts of first instance in cases of major crimes and felonies involving life sentences or long terms of imprisonment. They consist of a mixed bench of three professional and five lay judges, these last being chosen from a panel of men who possess certain educational qualifications. Final appeals from sentences delivered by the *tribunali* and the *corti d'assise* can be taken to one of the two criminal divisions of the *corte di cassazione,* which, as in civil cases, acts as the supreme court in cases involving points of law but not of fact. Each division has a bench of seven judges, and they can combine to form a *sezione unita.* (*See* also ITALIAN LAW.)

The most important function of the *corte costituzionale* is to pronounce on the constitutionality of government legislation (see *Constitution* above).

The death penalty was abolished in 1877 but restored by the Fascists in 1926 for certain crimes against the safety of the state (in particular for attempts on the life of the king or of Mussolini). It was again abolished by article 27 of the constitution of 1948. The practice of *confino,* or confinement to remote places on the mainland or to small islands like the Lipari, for political prisoners, was abolished in Dec. 1948.

Police.—In each province the police are under the control of the prefect as the representative of the minister of the interior. In each principal town or capital (*capo*) of a province an official called the *Questore* is in charge of the police station, the *Questura.* The police force is known as the *corpo degli agenti di pubblica sicurezza* (corps of agents of public safety) and is responsible for the safety of persons and property, for the prevention and suppression of crime, for the maintenance of public order and for the enforcement of the law.

A special body of police, the *carabinieri,* come under the minister of the interior as far as the ordinary police duties are concerned, but they also constitute a military corps recruited and organized by the minister for war. The corps was set up by King Victor Emmanuel I in 1814 to keep order in Piedmont and Sardinia, and in 1861 their duties were extended to cover the whole of Italy. The *carabinieri* carry on all ordinary police duties in the countryside and in smaller towns; in the large towns they perform special duties such as executing warrants of arrest or maintaining public order. There are also local municipal police such as *vigili urbani* (town watch) or *guardie civili* (civil guards) under the orders of the local mayor, the *sindaco.* They carry out duties such as traffic control and enforcement of local municipal regulations.

12. Education.—The Italian educational system has long been highly centralized under the minister of education. The state provides schools of every grade and most of the universities are state universities with rectors appointed by the minister. Primary schools are administered by the communes, whose chief educational function is to provide school buildings; this bears heavily on local taxpayers because of the widespread shortage of classrooms. The government recognized that it was an impossible burden for the smaller communes of south Italy to carry, and in 1955 the provision of nursery and primary schools in communes with populations up to 5,000 (extended in 1959 to 10,000) was entrusted to the *Cassa per il Mezzogiorno* ("fund for the south").

Primary and secondary education is controlled in each province by a *provveditore agli studi* (director of education) appointed by the minister of education. The *provveditore* works through inspectors; under the inspectors is a class of officials known as *direttori didattici* (teaching directors) each of whom controls a group of schools.

Education is compulsory from 6 to 14 years of age. Primary education is free, but in the 1950s many children (700,000 in 1954) did not attend school, while the attendance of many others was irregular. This was true even in the north, particularly in some of the mountain areas, but it was much more marked in the south, where it was attributable not only to poverty but to the great shortage of schoolrooms and to lack of housing accommodation for teachers. There was no shortage of teachers (indeed unemployment among them was a problem) but many were poorly trained and their frequent failure to live in the villages where they taught tended to retard educational progress.

Primary and Secondary Education.—Nursery schools (*asili infantili* or *scuole materne*) are not compulsory and do not come under the state. Some are conducted by the communes and others by various private societies both lay and clerical. Their number increased rapidly after 1950 and they perform valuable social and educational work, particularly in the south. The primary schools consist of five classes and include some of the most progressive schools in Italy, conducting all kinds of interesting experiments within a highly centralized system controlled at every stage by annual examinations.

Secondary education is not free, although the fees are negligible, but the cost of school books is high. The normal child proceeds to a secondary school at 11, but many children leave school at 11 or 12 to start work. Those who continue enter the lower secondary schools, either the *scuola media unica,* where for three years they receive a general education on academic lines, or a *scuola di avviamento professionale*—schools with a professional bias (industrial, commercial, agricultural and nautical). From these professional schools pupils can proceed only to purely technical schools of a higher grade. From the *scuola media* the pupils may go on to higher secondary schools from 14 to 19. There are three main types of higher school: the classical and scientific *licei* (grammar schools); the *istituti magistrali* (teacher-training institutes); and the *istituti tecnici* (technical institutes). Various other institutes impart special professional training, *e.g.,* industrial and agricultural institutes; but many more are needed, particularly in the south.

In addition to the state schools there are a number of private schools mostly run by Roman Catholic orders. Children, mostly from well-to-do families, go to these schools but number only about 5% of those in the state primary schools. Private primary schools can obtain state recognition and a subsidy if they follow the state program of studies. Private secondary schools can also obtain recognition (*parificazione*) if they teach the subjects prescribed for examination in the corresponding state schools.

Universities.—There are 24 state and 3 independent universities besides the state university for foreigners at Perugia and a number of higher institutes of university standard. The state universities are those of Bari, Bologna, Cagliari, Camerino, Catania, Ferrara, Florence, Genoa, Macerata, Messina, Milan, Modena, Naples, Padua, Palermo, Parma, Pavia, Perugia, Pisa, Rome, Sassari, Siena, Trieste and Turin; the independent are those of Urbino and Lecce and the Roman Catholic University of the Sacred Heart in Milan. The number of university students was always large by European standards and increased considerably after World War II; by the early 1960s it exceeded 230,000. Students enter the universities from the *licei* and *istituti tecnici-commerciali* after passing a stiff examination; from the *istituti magistrali* they enter the faculty of *magistero* (education). The university course lasts from four to six years and the student undergoes numerous examinations. Even when he has obtained his degree (*laurea*), he has to take the *esame di stato* (state examination) before entering any profession. The *laurea* confers the title of *Dottore.*

The universities are governed by rectors. There are four grades of teachers in the Italian as in other continental European universities. The lowest grade is that of the *assistenti* (assistants) appointed year by year by national competition or by the professors. The next grade, the *liberi docenti,* lecture and receive practically no pay. *Professori incaricati* (those "entrusted with teaching") are appointed for one year at a time by the universities with a low rate of pay. Full professors, *professori titolari,* are appointed by national competition on production of published work.

Illiteracy.—Despite the country's high intellectual tradition, there is a high proportion of illiteracy, particularly in the south. The national figure given at the 1951 census was 13.6% of the population, and though serious illiteracy prevailed in some parts of the north and centre it was so serious in the southern regions as to constitute a grave obstacle to social progress. In some communes of Basilicata and Sicily over 40% of the people were illiterate and in parts of Sardinia the figure reached 53%. These figures excluded the very large numbers of semiliterates, young men aged 20–35 who had left school at 11. The government and

the workers realized the need to fight illiteracy if there was to be progress in the industrialization of the south and in fitting young workers for employment in north Italy or abroad. The government established numerous *scuole popolari* (schools for the people) after World War II and these were initially well attended. Some continued to be successful, but many (particularly in the south, where the need was greatest) failed to survive largely because suitable teachers were not forthcoming.

Academies, Libraries and Museums.—The most famous academy is the Accademia Nazionale dei Lincei founded in 1603. It was re-established in 1944 with both Italian and foreign members and possesses a valuable library; its headquarters are in Rome.

Italy is one of the world's richest repositories of books, manuscripts and works of art. There are numerous libraries and museums, even those of small cities being often rich in incunabula and valuable objects of all kinds. The public libraries benefited greatly after 1870 by their acquisitions from suppressed monastic institutions. The richest in manuscripts is the Vatican library which at mid-20th century contained about 60,000 manuscripts; the Vatican archives are also very important. Most large towns possess notable state or communal archives and the various societies for local history (*Società di Storia Patria*) issue excellent publications. The private archives of the great families often contain documents of the highest interest and many have never been investigated. (*See* also ACADEMIES; LIBRARY; MUSEUMS AND GALLERIES.) (M. M. C.)

13. Defense.—The Italian army grew out of the old Piedmontese army, which had played a major part in the unification of Italy. The law of 1875 introduced conscription, but, chiefly for financial reasons, only a proportion of the available recruits were drafted. Under the law of July 17, 1910, the Italian army was organized in 25 divisions, each consisting of four regiments of infantry; there were also three divisions of cavalry. At the beginning of 1914 the peace strength of the army was 15,123 officers and 289,910 other ranks. By the end of World War I, in which Italy participated from May 24, 1915, it was estimated that 5,068,000 men had been mobilized. The navy, which in 1914 had a peacetime strength of 1,987 officers and 38,000 other ranks, had 114,000 men mobilized at the end of World War I.

Between World Wars I and II the army was reorganized and expanded, and by May 1940 it comprised 20 divisions with about two-thirds of the necessary armament and training and another 20 divisions at half strength. The air force, created by the royal decree of Jan. 24, 1923, comprised about 1,200 aircraft in May 1940, one-sixth of them out of date. The navy at the beginning of World War II had 6 battleships, 22 cruisers, 61 destroyers, 71 torpedo boats and 105 submarines. The period of compulsory service was 18 months but, as before, there were frequent reductions of service and exemptions.

After World War II Italy's military position was strictly defined by the treaty of Paris in 1947. The treaty compelled Italy to destroy or remove all frontier fortifications near the French and Yugoslav frontiers; ordered the demilitarization of Pantelleria, the Pelagie Islands and Pianosa; and strictly limited the maintenance of naval installations and fortifications in Sicily and Sardinia. The strength of the armed forces was limited by the treaty to 300,000 as follows: army, 250,000, including frontier guards and 65,000 *carabinieri* (police); navy, 25,000; air force, 25,000.

Strict limits were also imposed on Italy's possession or construction of war material. The number of heavy and medium tanks was limited to 200, the air force was limited to 200 fighter and reconnaissance aircraft and to 150 transport, air-sea rescue, training (school type) and liaison aircraft. Naval armaments were also limited. But radical postwar changes in the alignment of powers quickly transformed the former enemy into an ally of the western democracies. Italy became in 1949 a founder member of the North Atlantic Treaty organization (NATO). The military clauses of the Paris treaty were not formally revised because the U.S.S.R. refused its consent; but they were in 1952 actually allowed to lapse, and the only limit to Italian rearmament was determined by finance.

By the early 1960s Italy was divided into six military regions and had ten infantry divisions, five Alpine brigades and two armoured divisions. The air force territorial organization comprised three zones with headquarters at Milan, Rome and Bari and additional commands for Sardinia and Sicily. Combat aircraft were organized in air brigades consisting of two or three squadrons each of 25 aircraft and totaled about 400; four air brigades were assigned to the NATO air forces. The navy consisted of cruisers (some with guided missiles), destroyers, frigates and submarines with a number of auxiliary vessels; its main bases were at La Spezia, Naples, Taranto and Venice. Military service was compulsory for a period of 18 months. Total effectives of the armed forces amounted to about 450,000; *i.e.*, 360,000 in the army (including 77,000 *carabinieri*), 40,000 in the navy and 50,000 in the air force. Expenditure on defense represented about one-fifth of the total budget expenditure.

VIII. THE ECONOMY

Until 1931 over half the occupied population of Italy was engaged in agriculture (including forestry and fishing) but thereafter the structure of the Italian economy changed rapidly. The country's relative poverty in fuel was increasingly compensated by exploiting its hydroelectric potentialities, a line of development continued since World War II in the tapping of methane resources. At the same time another of the country's greatest assets, its abundant and relatively cheap labour, was moved into large-scale industry. It was first employed mainly in textiles, and after 1930 in engineering, especially in the lighter branches, in which traditions of craftsmanship could be effectively utilized, and into chemicals and man-made fibres. By the early 1960s industrial workers (including miners) considerably outnumbered those in agriculture and those in the service industries, and Italy, taken as a whole, was following the western rather than the southern European pattern. In terms of gross national product, the share of agriculture decreased from 32% in 1950 to 22% in 1960 and was expected to fall to 13% by 1970. Industrial output trebled between 1938 and 1961; it doubled in the 1950s and in the latter part of that decade and stimulated both by new technical advances and by the European Economic Community Italy had the highest rate of industrial growth in Europe. These changes accelerated the movement of manpower from agriculture to industry and thus went some way to overcome unemployment and underemployment, but they occurred mainly in the northwest and even accentuated the contrasting difficulties of the south, leaving the problem of regional imbalance unsolved. The relative poverty of the south limits the purchasing power of the internal market and so restricts the expansion and modernization of industry.

Italy's industrialization involved increasing imports of raw materials and of semimanufactures. This brought a balance of payments problem which in the late 1950s was largely solved by the great growth of the tourist industry. Italy's entry into the European Economic Community also opened out further possibilities of industrial specialization, availability of capital and outlets for surplus labour.

Since the crisis years following World War I the Italian government has given much financial assistance to industry, particularly to heavy industry. In 1933 the Istituto per la Ricostruzione Industriale (I.R.I.) was set up with powers to co-ordinate public interests in industry and to grant long-term loans. These powers were increased in connection with the prewar campaign for autarchy and in the defense industries. The I.R.I. now has a large measure of control over industry through its holdings in iron and steel, shipbuilding, petroleum and natural gas, the transportation and electrical equipment industries, shipping, air transport, electricity production, telephones, radio and television, banking, chemicals and cement. Rationalization and integration continue. Agriculture was not neglected. To encourage Italian agriculture to withstand the threat of competition within the Common Market, in June 1961 the *Piano Verde* or 5-year "green plan" for agriculture was approved by parliament. It provided for an investment of 550,000,000,000 lire and aimed at modernization, raising incomes of smallholders, balancing demand and supply (both foreign and domestic) and price stability.

A. Production

1. Agriculture.—Despite its high proportion of mountainous and hilly terrain Italy has a higher percentage of arable land than any other European country except Denmark and Poland. This is the result of intensive effort in reclaiming swamp lands, terracing hill slopes and improving naturally infertile soils. Even so, it is only in the areas that have exceptionally fertile soil, mild climate or the possibility of irrigation that yields are high. Against these must be set the large areas in which altitude, relief and soil are unfavourable and the long dry season and unreliability of rainfall in much of the south and islands.

The regional distribution of the crops shows that the proportion of cereals, leguminous crops and garden crops rises toward the south; the rotation fodder crops occupy a higher proportion in the centre and are lowest in the south; the highest proportion of meadows for hay is in the north; and that of grazing land in the south. The vine areas are greatest in the north and south and olives and citrus both increase in importance in the south. Forest is mainly in the Alpine zones.

Cereals.—Wheat is the most widely grown cereal. As a wheat producer Italy is rivaled in Europe only by France. The crop was given high priority in government planning before World War II, with an intensive campaign for the introduction of better varieties, better cultivation and more fertilizers, with the result that the country became self-sufficient and in good years even a net exporter. Although the greatest wheat area is in the southern peninsula and islands, with Sicily in the first place, yields there are low (only half the national average) and the main production is in the north and centre, the leading producers being Emilia-Romagna, Lombardy, Veneto, the Marches and Piedmont. Lower yields in the south, where the climate best suits the harder varieties for the manufacture of *pasta* (spaghetti and the many other forms of wheat paste) mean that imports usually consist of the harder wheat. Wheat accounts for about three-fifths of the carbohydrate and over half the total calories in the Italian diet.

Maize (corn) is produced mainly in the north, the northern plain being responsible for about three-quarters of the production. Although one of the largest producers in Europe, Italy still requires a considerable import. Over nine-tenths of the rice area and production are in eastern Piedmont and western Lombardy, where unusual facilities for irrigation particularly favour the crop. Italy is the leading rice producer of Europe and is an exporter. The northern plain has also an enormous production of fodder from rotation meadows.

Viticulture.—As in other Mediterranean countries tree and bush crops play a vital part in the economy and especially in raising the standard of living where they can be grown. Most important is the vine. More than two-thirds of the vines are grown along with field crops, tree crops or both; and this form of viticulture is widespread throughout the country. All but about 7% of the grapes are used for wine. Among the wine-producing districts best known abroad are the Monti del Chianti in Tuscany, the districts of Asti in Piedmont, Orvieto in Umbria and Marsala in western Sicily.

Fruit, Vegetable and Industrial Crops.—About nine-tenths of the olive crop is from the peninsular south and the islands and the olive is frequently regarded as an index crop for the more typical Mediterranean climate. All but a small fraction of the crop is converted into oil, of which Italy is second only to Spain as a producer. In citrus fruit Sicily predominates, more especially in lemons, grown mainly on the coastlands north of Catania and an important export. Oranges, though a much larger crop, are absorbed by the home market. Apples, pears, peaches and cherries on the other hand are mainly northern crops.

There is a very large output of tomatoes, particularly in Emilia-Romagna, Campania and Sicily, mainly for the production of canned concentrated juice, a main concomitant of the national dish spaghetti. Campania, and particularly the rich, warm, well-watered and intensively cultivated volcanic soils around Vesuvius, is the principal area of vegetable production (potatoes, cabbages, cauliflowers, peas, beans, onions and garlic), while the sheltered coastlands of Liguria are outstanding in floriculture.

Among industrial crops, sugar beet and hemp are grown mainly in Emilia and Veneto and tobacco in Campania and Puglia. Silkworm rearing, introduced into Italy with the mulberry in the 14th century, is now carried on preponderantly on the hill lands of the northeast.

Livestock.—The greatest concentration of cattle is in the central section of the northern plain. The chief dairying area is also there, one-third of the cows' milk being produced in Lombardy alone, and it is Lombardy and Emilia that have the largest production of cheese, including well-known export varieties such as Gorgonzola and Parmesan. In the same region are found a similar proportion of the pigs. But sheep are mainly on the rough grazings of the peninsular south and islands, which together account for half the total.

Agricultural Enterprises.—In the early 1960s the number of enterprises exceeded 4,300,000 and covered more than 26,000,000 ha. (64,246,000 ac.). Over half this area (comprising about 3,500,000 enterprises) was worked by the occupiers and more than a quarter (about 295,000 enterprises) was farmed by owners with hired labour or sharecroppers. Most of the remaining area was worked by share tenants (*colonia parziaria*).

After World War I there was an increase in small peasant-operating ownership, largely by purchase with the help of emigrants' remittances. This type of enterprise was further encouraged by legislation after World War II and was augmented by the agrarian reform. The holdings that are not worked by families are operated most frequently with the help of share tenants, especially on a modified half-share basis (*mezzadria*) or with hired labour and to a less extent with sharecroppers (*compartecipazione*). After World War II there was an increase in the number of tenants, share tenants and sharecroppers and a decrease in that of hired labourers, partly reflecting the rise in small peasant proprietorship and the agrarian reform but also the increasing tempo of industrialization.

There are great regional variations. Small peasant-operating ownership is found especially in the Alps, in Liguria and the hills of central Italy; middle-sized peasant tenancy and holdings depending entirely on hired labour are found on the Po plain; middle-sized holdings with *mezzadria* are especially common in central Italy and sharecropping in Sicily.

Agrarian Reform.—Many peasant families have inadequate holdings and there is much casual agricultural labour and rural underemployment but the remedy for this cannot be found on the land alone. The agrarian reform laws of 1950 provided, with compensation, for partial expropriation of large holdings, the percentage expropriated from any owner varying inversely with average yield per hectare so that holdings run on nonintensive lines were more severely affected. Many of the large owners depended on profits from cereal, wool and cheese production with low capital expenditure spread over a large area. Under the reform laws land was made available not only by expropriation but by purchase. Nine areas were scheduled for these operations: La Sila, in Calabria; an area covering much of Puglia, Basilicata and Molise; the plain of the Sele river in Campania; the lower Garigliano-Volturno area in Campania; Sicily; a large part of the Campidano in Sardinia; the Maremma, in Tuscany and Lazio; the Fucino basin in the Abruzzi; and the Po delta.

The reform agencies not only redistribute the land but carry out vast operations of reclamation, equipment and credit. They have control over much wider areas than those on which redistribution is carried out. The agrarian reform was a social and political operation as much as an economic one. The problem however is largely a technical one of dealing with difficult conditions of climate, soil and market.

Land Reclamation.—This has a long if spasmodic history in Italy. In the 12th and 13th centuries the Cistercians and Benedictines did much in Lombardy to encourage irrigation and drainage, and reclamation has a long history in the valleys of Tuscany too. In the mid-19th century the construction of irrigation canals in Piedmont and Lombardy was given new impetus, and large-scale drainage projects were started in Emilia and Veneto in the latter part of the 19th century. The introduction of modern pumping machinery assisted the draining of swampy coastlands and river

basins and before World War II the successful reclamation of the Pontine marshes (Agro Pontino) south of Rome received wide publicity. Other areas of reclamation include the plains of the Sele and lower Volturno rivers, the Tavoliere di Puglia and large areas in Calabria and Basilicata. The problems of these areas were linked to those of the hill lands since they had been winter pastures for sheep that grazed on the Apennines in summer and they had suffered from the irregular drainage resulting from deforestation at higher altitudes. It was in Italy that the concept of "integral land reclamation," in which the problems of agriculture, forestry and settlement over a defined area were fully taken into account, was most comprehensively developed in the years preceding World War II.

2. Forestry.—Italian forest resources cover nearly 20% of the area of the country and are mainly on the mountains (62% of the forest area) and the hills (34%). The forest area has been slowly increasing with development of the forestry service and new plantings as well as conservation. Of the 5,826,000 ha. (14,396,000 ac.) in 1960 nonconiferous forest accounted for three-quarters. Timber output consisted mainly of chestnut, fir, beech and poplar.

The regions with considerably higher than average percentages of their total area under forest are Liguria, Trentino-Alto Adige and Tuscany, with high proportions of mountain in the first two and of hill in the third. Exceptionally low percentages (less than 5%) are found in Puglia and Sicily. Both climate and terrain in the south are unfavourable to forest except in Calabria, where the plateau of La Sila has still some very fine forest land.

3. Fisheries.—Italy's Mediterranean fishermen catch principally anchovies, sardines and mackerel. Generally half of the landings are in Adriatic ports and one-quarter each in Sicily (especially on the south and southwest coasts) and the Tyrrhenian coastal areas, where the sea bottom is relatively favourable. Larger vessels engage in more distant fisheries, mainly off Mauritania and Newfoundland. But fishing is mostly carried out on a very small scale and nearly three-quarters of the fishing vessels and over one-quarter of the gross tonnage are still sailing vessels or rowboats. The tunny fishery is notable in Sicily. Total catch, which includes mollusks and crustaceans, averages more than 180,000 metric tons annually.

4. Power.—As the modern Italian economy developed, the fuel demands of industry and transportation outran the relatively small production of coal and increasing imports of fuel became a strain on the balance of payments abroad. Most of the hard coal is mined in the Sulcis region of southwestern Sardinia; otherwise there is only a small production of anthracite at La Thuile in the Valle d'Aosta and in southeastern Sardinia. Lignite is produced mainly in the Arno valley.

The first great easement of Italy's energy problem came with the exploitation of the great hydroelectric potentialities of its mountain zones, especially in the Alps. While some electricity was generated from imported coal it was increasingly the Alpine valleys that provided the energy. Total electricity output (in kw.hr.) rose from 220,000,000 in 1901 to 2,200,000,000 in 1913; it was 15,500,000,000 by 1938 and by the early 1960s exceeded 60,000,000,000. About four-fifths of this was from the hydroelectric stations. Three-quarters of the hydroelectric production and about two-thirds of all electricity production are from the regions with an Alpine sector—Lombardy, Trentino-Alto Adige, Piedmont, Veneto, Valle d'Aosta and Friuli-Venezia Giulia. Supplies from the Alps have been supplemented by the construction of reservoirs and hydroelectric stations elsewhere, notably in the Abruzzi, Sardinia and Calabria. Included in the thermal output is the electricity from the volcanic gas at Larderello in southern Tuscany. Since water supply in the Apennines is much smaller than that in the Alps thermal stations are required in order to maintain regular supplies through the grid. The first Italian nuclear power station was built at Latina, 37 mi. S.E. of Rome. Italy became a member of the European Atomic Energy Community (Euratom) in 1958 and the nuclear centre at Ispra, on Lake Maggiore, contributes to the community's research effort.

In 1958 two-thirds of the electric energy was consumed by industry, including about one-third in the chemical, electrochemical and electrometallurgical branches, while 7% was taken up by transportation.

A further, more recently exploited source of energy is the methane produced mainly from the Miocene of the Po plain, especially near Cortemaggiore in Emilia but also in southern Lombardy, in Basilicata (Lucania) and in the Po delta, and distributed both by a network of pipelines to the industrial areas of the north and in containers to household consumers throughout the country. Petroleum is also produced in Emilia and in the Ragusa district of southeastern Sicily and prospecting continues elsewhere.

By the 1960s about half Italy's total energy requirements were being met from its own production and half from imports. Expressed as a percentage of the total national consumption of energy, coal supplied 54% in 1938, 31% in 1953 and 22% in 1958, while the share produced by hydroelectric plants remained at about 30% over the period. But natural gas and oil, which together contributed only 16% of the total energy in 1938, increased their share to 32% in 1953, 47% in 1958 and 54% in 1960, and by 1970 were expected to be contributing no less than 70%.

5. Mining.—In metallic minerals, as in coal, Italy is on the whole poor; but two areas, southwestern Sardinia and southern Tuscany, are more highly mineralized. Iron is extracted on the island of Elba and on the Tuscan mainland, in the Valle d'Aosta and in southwestern Sardinia but a much greater quantity of iron ore has to be imported. The pyrites of Tuscany are used principally for sulfuric acid production. The greater part of the lead and zinc ores is mined in southwestern Sardinia; there are exports of both, but especially of the latter. Bauxite is mined in Puglia, where production increased considerably after World War II. More than one-third of the non-Communist world's production of mercury comes from Monte Amiata in Tuscany. Sulfur, mined mainly in the Tertiary deposits of southern Sicily, is less important than formerly. There is also an export of marble. Small quantities of manganese, arsenic and antimony are also produced. Salt is extracted both from the rock-salt deposits of Tuscany and from salt pans in Sardinia, Sicily and Puglia. (For oil and gas see *Power* above.)

6. Industries.—According to the sample survey of 1961 almost two-fifths of the occupied population (about 8,130,000 people) were engaged in industry, including not only manufacturing but mining and quarrying, work of construction and equipment and the supply of electricity, gas and water.

Engineering.—The engineering industries take first place both in numbers employed and in value of net product. About two-thirds of this group is located in Lombardy, Piedmont and Liguria, with the province of Milan easily taking the lead. The heavier branches are particularly in Sesto San Giovanni (just north of Milan) and Genoa. In Piedmont, Turin dominates the Italian automobile industry, with Milan, Brescia and Desio following in Lombardy. A very high proportion of the automobile output is exported. Closely linked are the production of ball bearings (largely in Turin) and magnetos (Sesto San Giovanni). Liguria has the country's greatest array of shipyards; not only at Genoa, whose yards produce two-thirds of the tonnage constructed, but round the gulf from Pietra Ligure to La Spezia. In electrical engineering there is the stimulus of a large home market in a country depending so largely on exploiting its hydroelectric resources. Many of the smaller towns in the northwest have specialized light engineering industries, such as the production of typewriters and calculating machines at Ivrea and sewing machines at Pavia; the last, like the bicycle industry, finding a large home market amongst the rural population of the Po plain. Automobiles, typewriters and calculating machines had by the early 1960s reached ten times their prewar output. Italy is now one of the world's leaders in automobile production and in shipbuilding. Italy launched its first space rocket from Sardinia on Jan. 13, 1961.

Textiles.—The textile industry, though second in numbers employed, is fourth in value of net product. In Italy as elsewhere the older industries (woolens, cotton, silk and hemp) have had to meet increased competition not only within their own branches but from new textile materials. In the cotton industry half the numbers employed, half the spindles and three-quarters of the

looms in 1951 were in Lombardy (Milan, Busto Arsizio, Monza, Gallarate), where cotton had a comparative advantage since the greater intensity of agriculture had discouraged sheep rearing. The industry showed only slow growth in output after World War II. In Lombardy the cotton industry has a complementary relationship with heavy industry since it employs mainly female labour.

The woolen industry is mainly in Piedmont, particularly in the Biella district; in Tuscany, where Prato is the chief centre; and in Veneto, especially in the district north of Vicenza. It thus retains much of its association with the hill lands, formerly the source of its raw material. About 90% of the wool is imported. The silk industry, too, originally obtained its raw material from sericulture on the poorer northern fringe of the plain, especially in Lombardy, where the mulberry and the silkworm were introduced in the 14th century. Nowadays it depends partly on imported raw silk, but two-thirds of the firms and of the workers are still in Lombardy. Hemp is the only textile industry using purely home-grown raw material but, though its products are of high quality, competition from other sources and from other hard fibres is severe.

Man-made fibres, particularly rayon yarn, produced especially in Piedmont and largely used in modern silk factories, and nylon, much of it produced in Lombardy (especially northwest of Milan), showed rapid development after World War II. In contrast with the natural fibre textile industry that of man-made fibres is carried out in big plants requiring large supplies of power.

A notable feature of the clothing industry already before World War II was the development of the fashion trade, particularly in Turin, and this made further progress both there and in Florence and Rome after the war.

Chemicals.—Chemicals were one of the most important growth industries after World War II and showed a high ratio of net product to employment. Italy enjoys the advantages of raw materials such as salt, sulfur, pyrites and methane, as well as of hydroelectric energy. As elsewhere, technical requirements have favoured large-scale organization and much of the industry is controlled by the Montecatini group. The doubling of prewar sulfuric acid production by 1960 indicates the pace of development. Both Genoa and Porto Marghera (the port of Venice) have large outputs of sulfuric acid and synthetic ammonia. Italy's large agricultural requirements of fertilizers and pesticides were the basis of its position as one of the largest producers of superphosphates and of copper sulfate. Dyestuffs, pharmaceuticals, photographic materials, plastics, all largely in the Milan area, the methane-based synthetic rubber plant at Ravenna and the petro-chemical factory at Gela in Sicily illustrate the variety of industry.

A great constructional activity in housing, roads, hydroelectric installations and land reclamation led to more than trebling of the prewar cement production by 1960 and Italy by then had become one of the world's leading producers.

Metallurgy.—Italy produces little crude iron in relation to its rapidly growing steel output. With relatively heavy dependence on imports of iron and steel scrap, iron ore, pig iron and coking coal, the modern development of the Italian steel industry has been highly dependent on protection and subsidies and on government policy in general. Large integrated iron and steel plants are at Cornigliano Ligure (Genoa), Piombino in Tuscany (conveniently located with regard to the iron ore of Elba), Bagnoli near Naples and at Taranto in the far south. Other important plants include those at Aosta and at Terni in Umbria. One-third of the steel is produced in Lombardy, the main market for its products, where there are large establishments in Milan, Sesto San Giovanni, Dalmine, Lecco and Brescia. Relatively high proportions of Italian steel are from open-hearth and electric furnaces. There is considerable interchange of semimanufactured steel with other countries in the European Economic Community.

Lead ores are smelted at San Gavino Monreale and Miniera di Monteponi in Sardinia and at Pertusola near La Spezia; zinc ores at Miniera di Monteponi in Sardinia, Vado Ligure, Porto Marghera and at Crotone in Calabria. Aluminum, with its heavy demands on electric energy, is produced at Mori and Bolzano in Trentino-Alto Adige (these two plants producing half the Italian output), at Borgofranco d'Ivrea and at Porto Marghera.

Other Manufactures.—Food manufactures are widely dispersed, including the large production of *pasta* such as spaghetti, and of its most popular seasoning, concentrated tomato, and of various fruit conserves. The furniture industry is highly localized in the Brianza, a foothill district north of Milan, where it is centred on Cantù. Similarly, a high proportion of Italian shoe manufacture is in Varese province, also in the hill fringe of Lombardy. Both these industries are thus near the largest market. Paper is still produced at Fabriano in the Marches, one of the oldest centres of the industry, but mainly in Lombardy and Piedmont, where both hydroelectric energy and markets encouraged its location. The rubber industry is mainly in the northwest, at Milan and Turin, in close association with the automobile industry.

7. Tourism.—The tourist industry is the most important source of net receipts from services in the Italian balance of payments. Italy was one of the countries that gained most from the resumption and extension of travel abroad after World War II. A high proportion of the tourists continues to come from Germany and the contiguous countries. The increasing proportion of entrants by road reflects not only the general tendency in means of transportation but also the fact that in these statistics the one-day excursion visitor counts for as much as the tourist making a longer stay. The data for visitor-days, though they do not include those staying outside hotels and similar establishments, are financially more significant. In these, while German tourists retain the first place, citizens of the U.S. and U.K. play a larger part than those of Switzerland and Austria, who take a much higher place in the entrance data. The most popular month is August, followed by September, July and June. By the early 1960s annual tourist entrances exceeded 18,000,000, about four times those of 1938.

(C. J. Ro.)

B. Trade and Finance

1. Domestic Trade.—Until the 1950s a consumer economy predominated in Italy, particularly in the south. The development of manufacturing industry stimulated home trade which became increasingly adapted to a modern economic structure, with growing commercial activity and an exchange economy.

On the basis of trade licences issued, there were in the early 1960s more than 995,000 commercial undertakings, of which about 82,000 were wholesale businesses. Licences for itinerant trade numbered more than 300,000 and for public amenities (such as hotels, restaurants and bars) 260,000. Licences for retail trade comprised more than 465,000 for the sale of foodstuffs, nearly 220,000 for textiles, clothes and furnishings, 77,000 for mechanical and related products and exceeded 150,000 for miscellaneous goods.

2. Foreign Trade.—Italian imports consist mainly of raw materials for the manufacturing industries and supplies for the primary needs of the population; in 1962 the principal imports were maize, coffee, meat, cotton and wool, rubber, metals, fuel oil, wood and pulp, machinery and chemicals. About 13% by value of total imports were made up by fuels, 19% by foodstuffs, 15% by minerals and metals, 13% by machinery and equipment and 11% by textile materials. The country supplying the greatest proportion of Italian imports is the Federal Republic of Germany (about 17%), closely followed by the United States; France, the U.K. and Argentina come next. For many years Italian customs duties were rather high, but after World War II Italy became a party to the General Agreement on Tariffs and Trade with comparatively low customs duties. Since then Italy has pursued a policy of increasing freedom of trade, both with European countries and with those of the dollar area.

The agricultural and industrial structure of Italy is such as to yield exports consisting mainly of finished goods made from imported raw materials and of high quality foodstuffs. The principal exports are the products of mechanical industries (about 35% of the total value); foodstuffs such as fruit, citrus fruit, vegetables and tomato preserves, wines and cheeses (about 15%); and textile yarns and fabrics (about 14%). Other exports include footwear, metallic minerals, metals and scrap, chemicals and a wide variety

of other wares. The country taking the greatest proportion of Italian exports is the Federal Republic of Germany (about 19%), followed by the United States (about 10%), France, the U.K. and Switzerland.

Balance of Payments.—The gross value of Italian imports habitually exceeds that of exports, leaving a trade deficit to be balanced by invisible exports of which the chief items are expenditure by foreign tourists, remittances from Italians working abroad, miscellaneous services and shipping receipts. The most important of these items is the tourist trade, which by the early 1960s yielded credits exceeding 450,000,000,000 lire annually; remittances from expatriates totaled about two-thirds of this. At the same time the upsurge in the economy and the consequent firmness of the lira attracted foreign capital; these accretions greatly exceeded withdrawals and fresh Italian investments abroad. This movement of capital combined with latterly favourable aggregate current balances to produce national reserves of gold and convertible currencies equivalent to 2,515,000,000 lire by the end of 1962.

3. Banking and Credit.—The banking system is regulated by a law of 1936, with various later additions of minor importance. This law controls banking activities by a few general rules designed to ensure the solvency of the banks and to direct their business and investments. The inspectorate of credit supervises the banks' observance of the rules and prevents the adoption of policies harmful to the national interests.

By the law of 1926, the Banca d'Italia (Bank of Italy) is the only bank of issue and holds the gold and currency reserves. It has financial relations with the state and other banks but not with private customers. It issues and rediscounts bills of exchange, advances loans against goods and securities, makes loans to the treasury, accepts deposits from the banks, etc. In the period immediately after World War II the Banca d'Italia was chiefly concerned with financing the deficit on the national budget. Later the financing of economic activities assumed primary importance, by means of discounting and loans and by financing foreign trade through the Ufficio dei Cambi (Foreign Exchange bureau), which has the monopoly of buying and selling foreign exchange at the official rate. The Banca d'Italia finances the excess of purchases of currency over sales.

The banking law distinguishes sharply between short-term commercial credit and money credit whether medium or long-term. Commercial credit is handled by six chartered banks (*istituti di diritto pubblico*) which are the Banco di Napoli, the Banco di Sicilia, the Banca Nazionale del Lavoro, the Instituto di San Paolo di Torino, the Monte dei Paschi di Siena and the Banco di Sardegna; by three national banks with numerous branches, the Banca Commerciale Italiana (Milan), the Credito Italiano (Genoa) and the Banco di Roma; by 156 large banking institutions organized on national lines; by 213 "people's co-operative banks"; by 38 private banking firms; and by other concerns. These banks are required to lodge 22.5% of their deposits in a current account with the Banca d'Italia. After 1936 a voluntary agreement between the banks prescribed uniform rules for various transactions and rates of interest and discount. This agreement was periodically renewed but by the 1960s some deviations of a competitive nature were discernible in interest rates and charges.

The 79 savings banks, 18 pledge offices (*monti di credito su pegno*) and 731 rural and artisan banks (*casse rurali e agrarie*) also accept short-term deposits and make short-term investments. In all, credit institutions totaled over 1,250 with nearly 10,000 branches by the early 1960s. The post-office banks also accept deposits, lodging their funds with the Cassa Depositi e Prestiti (Bank for Deposits and Loans) which, besides financing the treasury, makes long-term loans to local authorities for public works. Private credit, both medium and long term, is handled by the chartered banks and by private bodies controlled by special regulations. These include: the Istituto Mobiliare Italiano (I.M.I.), which handles industrial credit and finances business, takes up shares in private business and obtains the necessary funds by issuing bonds; the Consorzio per Sovvenzioni su Beni Industriali, for granting subventions based on industrial values; the Consorzio di Credito per le Opere Pubbliche, for financing public works; and the Istituto di Credito per le Impresa di Pubblica Utilità, for financing public utilities. Also operating in the field of medium and long-term credit are Mediobanca set up by three national banks; the Centrobanca, the credit institute of the people's co-operative banks; l'Ente Finanziario Interbancario (Efibanca); the special branches of the Banca Nazionale del Lavoro; the institute for the economic development (Isveimer); the regional institute for financing industry in Sicily (Irfis); the Sardinian Industrial bank (Cis); and the regional institutes of credit for medium-sized and small industries. Other establishments handle credit for land, agriculture, hotels, cinemas, etc.

The Istituto per la Riconstruzione Industriale (I.R.I.; *see* introduction to *The Economy* above) and the Ente Nazionale Idrocarburi (E.N.I.) are controlled by special regulations, the first being responsible for state-owned industry and the second for activities concerning natural gas, indigenous petroleum and petroleum products.

4. Currency.—From the unification of Italy to World War I the Italian currency was based on gold, except for periods when special economic and political conditions caused recourse to a non-convertible paper currency. The latter was adopted during and after the war, with consequent deterioration of the value of the lira in terms of the dollar and pound sterling, until in 1927 the lira was stabilized by law at 0.079191 gr. of fine gold, 19 lire being equal to $1 and 92.46 lire to £1. After the devaluation of the chief world currencies, the value of the lira was in 1936 reduced to 0.04677 gr. of fine gold, its relation to the dollar and pound being re-established as it was in 1927.

A body of restrictive legislation relating to foreign exchange, introduced before World War II, brought all economic dealings with other countries under the Ufficio dei Cambi, an organ of the Banca d'Italia. During and after the war the restrictions were tightened. Inflation decreased the value of the lira, and during the occupation that began in 1943 the Allied military government fixed a rate of exchange of 100 lire to the dollar and 400 lire to the pound. In 1946 the official rates were raised to 225 lire to the dollar and 907 lire to the pound; in 1948 they reached 575 lire to the dollar and 2,317 lire to the pound. But when in 1949 the pound was devalued the dollar value of the lira suffered less than those of the pound and other European currencies and the official rate was fixed at 625 lire to the dollar (1,750 lire to the pound). At the same time a free market was tacitly allowed to operate with rates often higher than the official ones.

The progressive improvement of the Italian economy in the 1950s permitted a gradual removal of exchange restrictions, and by 1959 almost all limitations on the spending of lire by non-residents, as well as currency restrictions for residents, had been abolished. The exchange rate was maintained at 625 lire to the dollar, the Ufficio dei Cambi intervening as a buyer when the value of the dollar fell to 620.5 lire and as a seller when the value of the dollar rose to 629.5 lire. The limits of fluctuation for other currencies were pegged to these dollar limits.

Italy joined the International Monetary Fund on its foundation in 1945 but for some time did not declare its official parity with the fund, although U.S. aid and the home policy of defending the lira made it possible for Italy to respect the substance if not the letter of the Bretton Woods agreements. By 1959 the situation had improved sufficiently for official parity of the lira to be declared, and by a law of Jan. 28, 1960 the standard was formally established at 0.00142187 gr. of fine gold to the lira, equivalent to 625 lire to the dollar.

The currency consists of metal coins and notes issued by the government and of notes issued by the Bank of Italy. Coins are of 1, 2, 5, 10, 20, 50, 100 and 500 lire and notes of 500, 1,000, 5,000 and 10,000 lire.

5. National Finance.—The organization of Italian public finances comprises the national exchequer and the budget of the local authorities (regions, provinces and communes), each of which has defined financial obligations and fiscal revenue, revenue from property (*entrate patrimoniali*) and expenditure determined by the nature of these obligations.

The national budget has rarely shown favourable balances. It is usually in deficit because of the government's obligatory expenditure on public services and its investment in public works. Between the late 1950s and the early 1960s revenue increased from about 2,800,000,000 lire to about 4,700,000,000 lire and expenditure from about 3,000,000,000 lire to 5,350,000,000 lire, so that the annual deficit was about 650,000,000 lire. These deficits were in great part covered by increasing the public debt, which at June 30, 1963, totaled 5,877,000,000,000 lire, of which 2,052,000,000,000 lire constituted long-term debts and 3,825,000,000,000 lire were floating debt made up by treasury bonds, loans from the Bank of Italy and other debts.

The budgets of the local authorities are also habitually in deficit and the problem is usually circumvented by the authorities entering into debt, though the state sometimes intervenes with subsidies.

Taxation.—The Italian fiscal system is complicated by reason of the multiplicity of taxes and of authorities empowered to exact them. The central government collects the bulk of the taxes. The major part of the revenue is derived from taxes on movable property, income tax, taxation on the manufacture of mineral oils and their products and taxation on tobacco consumption. Chief items of expenditure are concerned with the national economy and production, defense (including international defense obligations), social services, education, interest on public debt, subsidizing autonomous industries, subventions to local authorities and financial, treasury and budget services.

The fiscal organization of the regions, provinces and communes is strictly regulated by laws that leave them with little financial power. Generally the communes supplement their revenues by additional taxes on the rents on land and buildings and on movable property; in addition they exact a family tax from the incomes of citizens. But in the main the communes' finance is based on consumption taxes at varying tariffs, direct or indirect according to locality. Provinces and regions join in contributions (based on resident population numbers) to certain taxes collected by the central government.

In Italy many assurance and assistance organizations have the right to exact contributions on various scales from individual salaries, in order to fulfill their obligations relating to disability and old age pensions, sickness payments and those for occupational injuries and diseases, maternity benefits, workers' housing, etc. These contributions are effectively taxes. (L. L.)

C. Transport and Communications

The long peninsular shape and strongly marked regional differences of Italy made the establishment of efficient systems of transportation and communications vital for effective unification. Both road and rail systems consist essentially of the west-east route from Turin through Milan and Venice (Mestre) to Trieste; the north-south routes on either side of the Apennines, one following the ancient Via Aemilia and the other the Tyrrhenian coast; and two main trans-Apennine links, Milan to Genoa and Bologna by way of Florence to Rome. The mountainous nature of much of the country made much tunneling necessary.

The first railway (between Naples and Portici, 8 km. [5 mi.]) was inaugurated in 1839 and the state service in 1905. In the early 1960s Ferrovie dello Stato (Italian State railways) controlled over three-quarters of the total route length of about 13,250 mi., of which nearly 90% was standard gauge, 22% double-track and 43% electrified. The railways used about 850,000 tons of coal, 70,000 tons of oil, 1,510,000 cu.m. of methane and 2,400,000,000 kw.hr. of electricity annually; about half their income is derived from passenger traffic.

In relation to area the road network is densest in Veneto and Emilia-Romagna and sparsest in the Valle d'Aosta, Sardinia and Basilicata. The use of the automobile as a form of transportation has grown rapidly and the number, about 2,000,000 in 1960, had doubled since 1955 but regional variation was great, Piedmont and Lazio having twice as many in relation to population as Campania and more than three times as many as Basilicata. Italy was a pioneer in toll motorways (*autostrade*) in the interwar years and by the early 1960s was constructing motorways such as the *Autostrada del Sole* from Milan to Naples and the *Autostrada della Serenissima* from Turin to Venice, Trieste and Udine. A tunnel under Mont Blanc was bored in 1962 and another under the Great St. Bernard pass was being built to provide all-season links with transalpine Europe. All road construction and maintenance are administered by the Azienda Nazionale Autonoma delle Strade Statali (National Autonomous Road Corporation).

In air transportation two-thirds of the passengers embark, disembark or transit at Rome where Fiumicino international airport was opened in 1961, and a quarter at Milan. The greatest internal air traffic is between Rome and Milan, followed by the lines between Rome and Sicily and between Rome and Sardinia. In 1957 the two remaining competitors were merged into Alitalia, the national airline, in which the government has a majority holding.

Italy's geographical location and long coast line favoured the development of marine transportation. The mercantile fleet ranks sixth in the world's merchant shipping. Its tonnage, which was 3,500,000 gross registered tons in 1940, fell to 500,000 as a result of World War II but rapidly recovered, overtaking the prewar level and exceeding 5,000,000 in the early 1960s.

In the international movement of shipping about half is through the ports of Genoa and Naples and three-quarters through the six leading ports (Genoa, Naples, Venice, Leghorn, Trieste and Savona). Genoa especially has heavy imports of raw materials. Porto Marghera, the port of Venice, follows it in this respect. As a whole the import traffic greatly preponderates.

The navigable rivers and canals of Italy have a total length of about 1,250 mi., but inland navigation is of little importance. The navigable waterways are mainly north of the Po in Lombardy and at the head of the Adriatic in the Veneto. The freight transported on the waterways, including the lakes, averaged 2,500,000 metric tons annually in the early 1960s.

Postal and telegraph services are controlled by the state. The telephone service, controlled partly by the state and partly by concessionary private companies, expanded rapidly in the 1950s. The cable and radiotelephone services are also operated by concessionary companies.

Radiotelevisione Italiana in Rome, a joint-stock company with radio and television concessions, is responsible to the ministry of posts and telegraphs; the Società Italiana Pubblicità Per Azioni in Turin has a complete monopoly on all radio and television programs.

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ITASCA, LAKE, the main source of the Mississippi river, is located approximately 25 mi. S.W. of Bemidji, Minn., in Itasca State park, where the state maintains Douglas Lodge and other recreational facilities. It is a glacial lake that has an altitude of 1,475 ft., an approximate depth of 35 ft., and an irregular shore line that encloses a surface of 1.75 sq.mi. From it, the Mississippi river flows southward 2,348 mi. to reach the Gulf of Mexico. Its shores are lined with virgin pine.

Although a fur trader employed by Astor's American Fur company, William Morrison (1785–1866), claimed to have visited the lake in 1803, Henry Rowe Schoolcraft, the United States superintendent of Indian affairs for Michigan in 1832, is considered by most authorities to be the man who proved that the lake is the main source of the Mississippi river. Many geologists, however, believe that a number of glacial lakes in the region supply the headwaters of the river. Schoolcraft is also credited as being the originator of the name "Itasca." By combining syllables of the Latin words *veritas* (truth) and *caput* (head or source), he formed the name Itasca.

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ITCHING: *see* SKIN, DISEASES OF.

ITHACA (modern Gr. ITHAKI), after Paxos (Paxoi) the smallest of the seven Ionian Islands, with an area of 38 sq.mi., included in the *nomos* (department) of Cephalonia. It consists of two mountain masses, connected by a narrow isthmus of hills, west of a wide inlet, the Gulf of Molo (Kolpos Molou). The northern culminates in Anoyi (2,644 ft.), the southern in Ayios Stefanos. Ithaki, the chief town and port of the island, lies at the northern foot of Mt. Stefanos (2,100 ft.), its whitewashed houses stretching for about a mile round the deep bay, to which it owes its alternative name of Vathi ("deep"). As there is little arable land the inhabitants are dependent on commerce for their grain supply; olive oil, wine and currants are the principal products.

In the old Venetian maps Ithaca is called Fal or Val di Compare, and at a later date it not infrequently appears as Little Cephalonia; its former name, Thiaki, is a corruption of Ithaki. The fame of the island is almost solely attributable to the Homeric story of its king Odysseus (*q.v.*). In the *Odyssey* the island is described with picturesque topographical detail. The Homeric localities for which counterparts have been sought are Mt. Neritos, Mt. Neion, the harbour of Phorcys, the town and palace of Odysseus, the fountain of Arethusa, the cave of the Naiads, the stalls of the swineherd Eumaeus, the orchard of Laërtes, the "raven cliff" (Korax) and the island Asteris, where the suitors lay in ambush for Telemachus. Some have placed the Homeric town at Polis on the west coast in the northern half of the island (W. M. Leake, Gladstone, etc.), others (Sir William Gell, H. Schliemann) at Aetos on the isthmus. But no amount of ingenuity can fully reconcile the descriptions in the *Odyssey* with the actual topography, and the passage in the *Odyssey* which describes Ithaca as "farthest up toward the darkness," while the other islands "face the dawn and the sun," hardly fits an island lying, as Ithaca does, just to the east of Cephalonia. Accordingly, W. Dörpfeld suggested that the Homeric Ithaca should be identified with Leukas (*q.v.*). He succeeded in fitting the Homeric topography to this latter island, and suggested that the name may have been transferred in consequence of a migration of the inhabitants. Leukas does in some respects fit the Homeric descriptions much better than Ithaca; but, on the other hand, it is perhaps a mistake to treat the imaginary descriptions of a poet as if they were portions of a guidebook or to look, in the author of the *Odyssey*, for a close familiarity with the geography of the Ionian Islands. Excavations by the British School at Athens at Polis, Aetos and elsewhere have confirmed occupation during the appropriate period (Mycenaean) but nothing has come to light which can certainly be identified with Homeric localities. These same excavations have revealed traces of an unsuspected Corinthian colony at Aetos after about 800 B.C. For the medieval and later history of Ithaca *see* IONIAN ISLANDS. It was devastated by the earthquake of 1953; the towns were subsequently almost entirely rebuilt.

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ITHACA, a city of New York, U.S., 56 mi. S.S.W. of Syracuse, at the southern end of Cayuga lake; the seat of Tompkins county. Ithaca is situated in rolling hill land of the Finger lakes country. Recreational opportunities are provided by neighbouring lakes and excellent state parks which are maintained in the area: Buttermilk falls, Fillmore glen, Robert H. Treman State park, Taughannock falls (215 ft. high) and Watkins glen.

Among the leading manufactures of Ithaca are adding machines, power-drive chains and shotguns, while nearby Groton is a significant manufacturer of typewriters. Surrounding agricultural lands are important chiefly for sales of dairy products, poultry and poultry products. Ithaca is the southern terminal of the New York Barge Canal system. Pop. (1960) 28,799. (For comparative population figures *see* table in NEW YORK: *Population.*)

History.—The site of Ithaca, formerly in the Cayuga nation territory of the Iroquois confederation, was visited by a Continental raiding party during the Sullivan-Clinton campaign of 1779. In 1782 the area was included within the Military tract given to veterans of the American Revolution and the land was acquired by Simeon De Witt, surveyor general of New York, who in 1806 named the community Ithaca. Settlement commenced in 1789. Development of the community was fairly rapid, and was early based upon availability of water transportation and power, in addition to accessibility of lumber, salt, gypsum and products of fertile agricultural lands. Ithaca was incorporated as a village in 1821 and as a city in 1888. The city, with its vicinity, was once a location for silent motion pictures.

Education.—An outstanding educational centre, Ithaca is the

home of Ithaca college and Cornell university. Ithaca college is a private liberal arts college established in 1892; its students specialize mainly in physical education, music or drama.

Cornell university, situated on a hill commanding a wide view of Ithaca and Cayuga lake and occupying over 7,000 ac. of campus,

BY COURTESY OF CORNELL UNIVERSITY; PHOTOGRAPH, FENNER STUDIO

VIEW OF CORNELL UNIVERSITY CAMPUS OVERLOOKING CAYUGA LAKE. IN THE CENTRE IS MCGRAW CLOCK TOWER WHICH HOUSES THE CORNELL CHIMES

farm, conservation and recreation land, is an unusual combination of endowed and public-supported institution. It was founded as a result of the Morrill act of 1862, under which New York received a substantial grant of public land for support of colleges teaching "agriculture and the mechanic arts." Ezra Cornell (*q.v.*) established the foundations and Andrew D. White determined the form of the new university; both were members of the New York legislature. Cornell, a citizen of Ithaca who had come into a fortune from his holdings in the Western Union Telegraph company, contributed an initial grant of $500,000 and 200 ac. on the condition that the college be located at Ithaca and that the state endow the institution with all its proceeds from the federal grant. Cornell himself took an active part in supervising the sale and allocation of these lands, and more than $3,000,000 was realized in profits. Cornell later gave the university an additional $400,000 of his own money.

A charter was granted April 27, 1865. White prepared the scheme of internal organization and the trustees elected him president in 1866. On Oct. 7, 1868, the university began operation. It was nonsectarian and coeducational and was to embrace any instruction and investigation deemed useful and proper by the trustees in addition to those branches of learning specified by the Morrill act. In the latter part of the 20th century the university comprised 15 colleges and schools, including the medical college (1898) and school of nursing (1942) in New York city and four university colleges supported by legislative appropriation, which have been part of the State University of New York since its creation in 1948.

The four colleges in the state university system, with their dates of foundings, are the veterinary college (1894), college of agriculture (1904), college of home economics (1925) and school of industrial and labor relations (1945). Other divisions are the college of architecture (1871), law school (1887; became a graduate school in 1925), college of arts and sciences (1868), graduate school (1909), college of engineering (1868), school of hotel administration (1922), school of education (1931), graduate school of nutrition (1941) and graduate school of business and public administration (1945). (R. C. He.)

ITINERARIUM, a late Latin word denoting the roadbooks and route maps of the Roman empire, which were in common use both by private individuals and by officials. The construction of these manuals and maps depended fundamentally on the Greek cartographic tradition successively represented by the maps of Eratosthenes, Agrippa, Marinus of Tyre and Ptolemy. The route maps might be regional and contain more or less detail, not only, that is, the basic information of distances between stations but also notes on the condition of the roads, with careful sketches of short cuts, minor roads, mountains and rivers (compare the road maps and route sheets of modern automobile associations). It is a mistake to think of the station lists and the maps as two independent sources, since each continually influenced the other, despite, or rather because of, the fact that they disagreed in major or minor detail.

The Roman milestones, together with the fragmentary remains of inscriptions with itinerary information, while interesting in themselves, give nothing like the all-over picture provided by the few large-scale station lists or maps which have survived, covering the area of the Roman empire or even going beyond it. Such are the Antonine Itinerary, the Ravenna Cosmography and the Peutinger Table.

The Antonine Itinerary gives the simplest form of such a Roman roadbook, mere lists of several thousand place names throughout the whole Roman empire with the distances between them. The general arrangement is to give the chief roads followed by the minor roads of the particular region. The order is as follows: north Africa from west to east; the islands of the western Mediterranean; Italy; Milan–Sirmium–Antioch–Egypt; Viminacium (on the Danube)–Nicomedia (Izmit, opposite Istanbul); the roads from Pannonia to Gaul; Dyrrachium–Byzantium; Milan–Boulogne; Milan–northwestern Spain; Arelate (Arles)–Castulo (Cazlona, in southern Spain); Augusta Emerita (Mérida)–Caesaraugusta (Saragossa); Asturia–southern France; in England, from Hadrian's wall to Richborough.

The book is full of great and small mistakes, presumably due to many different causes. The roads of Italy are particularly marred by errors and confusions, which is rather surprising. One of the aims of the compiler was clearly to include as many places and road sections as possible. The book is not a road manual for Christian pilgrims but rather a compilation of traditional itinerary materials, perhaps based on maps of the early 3rd century A.D. and first published toward the end of that century.

The "Geographer of Ravenna," an unknown Christian author, wrote a *Cosmographia* in five books, probably in the 7th century. The first book is a general introduction based on biblical ideas. Then comes a list of place and river names covering the known world, treating in turn Asia, Africa, Europe, the Mediterranean and the islands in the various gulfs and the Atlantic ocean. Much of his information is that of the ordinary itineraries and is probably derived from an earlier world map.

The Peutinger Table (*q.v.*), so named after the scholar who acquired it in the 16th century, a 13th-century copy of a painted Roman world map, is the only extant example of the *itinerarium pictum.* *See* MAP.

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ITŌ HIROBUMI, PRINCE (1841–1909), Japanese statesman who played a leading role in the making of modern Japan. He was born Sept. 2, 1841, in southwestern Japan, where he attended the school of the patriot Yōshida Shoin. Inflamed with a desire to rescue the country from the foreign danger which seemed to be pressing in from all sides, he made an attempt to burn the British embassy in 1862. In 1863, with fellow clansman Inoue Kaoru and three others, he took passage to England. This was done secretly, because at that time visiting a foreign country was a capital offense in Japan. Itō saw conditions abroad at first hand and understood for the first time the impossibility of driving foreigners out of Japan. Upon receiving news of his clan's attack on a British ship, he hastened back to Japan to urge compromise.

Itō became one of the major figures in the new government after the overthrow of the shogunate in 1868 (*see* JAPAN: *History*). He went with government missions to Europe and the United States in 1871 and 1872 and then returned to work with Okubo Toshimichi (*q.v.*) for the modernization of the country. After the death of Okubo in 1878, Itō succeeded him as minister of the interior and became the leading member of the government. A cabinet system was established in 1885 and Itō became Japan's first prime minister.

When a popular demand arose in the 1880s for a constitution and the establishment of a parliament, Itō showed that genius which characterized his entire political career: he could see when compromise was necessary. He therefore urged the government to give the country a constitution. On a mission abroad to study European governments he found that of Prussia congenial to his ideas of monarchy. Upon his return he became the chairman of a drafting committee which formulated a constitution that included many Prussian ideas; it was proclaimed by the emperor in 1889. Itō was the dominant figure in the ministry during the next decade, which was a period of adjustment to the new constitutional government.

He saw that the government could not expect the co-operation of parliament unless it made some effort at organizing political support. He therefore left the government to form the Seiyukai or Constitutional Political Friends' party, which became one of the dominant conservative parties and remained so until the outbreak of World War II. After the Russo-Japanese War, Itō was the first resident general in Korea and as a result became the target of Korean patriots.

In 1909 Itō was assassinated on Oct. 26 by a Korean while on a visit to Harbin, Manchuria.

No statesman of the Meiji period contributed more to the making of modern Japan. Itō was a realistic and enthusiastic modernizer; he was also profoundly Japanese and sought to adapt Japanese tradition to the modern world rather than to destroy it. Like his colleagues, he believed in the personal rule of the emperor, and sought to accomplish his means through the throne. But more quickly than most of his colleagues, he understood popular aspirations for a less autocratic form of government; he was one of the first to recognize the need for a constitution and for a parliament as an organ of public opinion; he was also one of the first to see the potentialities of political parties.

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ITONAMA, an Indian tribe of South America, speaking a unique language. Formerly, they lived on both sides of the Itonamas river (a tributary of the Guaporé in northeastern Bolivia), from the *laguna* of the same name (also called Lake St. Luis and Laguna Carmen) to the Machupo river (latitude 13°–15° S., longitude 63° W.). Although they numbered well over 4,000 in the 1830s, by 1914 only 300 of these Indians were reported to remain in the vicinity of San Ramón. Christianized in the 18th century, they retained few elements of their aboriginal culture in the 1960s.

The Itonama are a sedentary, agricultural folk, good canoeists and makers of excellent cotton textiles. They formerly practised the betrothal of children soon after birth. They believed illnesses resulted from capture of the soul. Itonaman shamans (*see* SHAMANISM) put themselves into a trance with narcotics. They believed that the souls of the dead became snakes, butterflies and birds and threatened the living. Lest death strike other people, they stopped the nose, eyes and mouth of a dying person. Each species of animal was thought to have some supernatural link to its own particular plant; if the animal were dangerous, the plant was avoided.

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ITURBIDE, AGUSTÍN DE (1783–1824), emperor of Mexico, was born at Valladolid (Morelia, Michoacán) of an aristocratic family. Like many young men of the upper classes in Spanish America, he entered the army, becoming an officer in the provincial regiment of his native city in 1797. In 1810 Miguel Hidalgo y Costilla offered him a post with his revolutionary army, but Iturbide refused and joined the royalists instead. For his part in the defeat of the revolutionary forces under José María Morelos y Pavón, Iturbide was given command of the military district of Guanajuato and Michoacán. However, in 1816 grave charges of extortion and violence led to his removal.

By 1820 most of the revolutionary activity had been put down in Mexico. Both Hidalgo and Morelos had been captured and executed, and only guerrilla bands under such men as Vicente Guerrero and Nicolás Bravo prevented the complete victory of the royalists. At this time, with the revolt of Col. Rafael del Riego y Núñez, the government of Spain suddenly became liberal. Mexico (New Spain) also received a new and liberal government. The Inquisition was ended, and the Spanish constitution of 1812 had been introduced. Iturbide took control of the conservative opposition to the viceroy to lead a new revolutionary movement, gaining the support of Antonio López de Santa Anna, Bravo and other revolutionary chieftains. His Plan of Iguala, published on Feb. 24, 1821, consolidated the classes of Mexico against Spain as Hidalgo and Morelos had never done. By July 1821, the viceroy had capitulated, and on Aug. 24, Juan O'Donojú, the new representative of the Spanish king, signed the treaty of Córdoba, which recognized the independence of Mexico.

United in war, the revolutionary coalition quickly fell apart in peace. Some wanted a republic, while others desired a Bourbon monarchy. Iturbide took advantage of the divisions to make himself monarch of Mexico. On May 19, 1822, the congress proclaimed him Emperor Agustín I.

Mexico was still basically conservative, and had Iturbide acted wisely he might have brought order and stability to his country. But he proved arbitrary and extravagant, and soon all parties turned against him. In Dec. 1822 Santa Anna issued his revolutionary *pronunciamiento* in opposition to the emperor. On March 19, 1823, Iturbide abdicated and went into exile in Europe. When the European powers threatened in 1824 to restore the Bourbons in Spanish America, Iturbide returned to Mexico to save his country, unaware that the congress had decreed his death. On July 15 he was captured near Soto la Marina and four days later he was executed. For the Roman Catholic Church in Mexico and for the conservative classes, Iturbide has remained the great hero of independence. (R. E. Q.)

ITZÁ, a Mexican Indian group prominent in Yucatán in the centuries immediately preceding the Spanish conquest. Confusion in native sources impedes their precise identification, but they may have been Chontal-speaking Maya from Tabasco. Chichén-Itzá (*q.v.*), today the most visited ruins in Yucatán, was their capital. Some students attribute to them the introduction there (*c.* A.D. 950) of the worship of Quetzalcóatl and other gods of the Mexican plateau and also the very distinctive architectural and sculptural styles found at Tula, Hidalgo, north of Mexico City; others, placing the conquest of Chichén-Itzá three centuries later, dissociate the Itzá from the introduction of those alien influences. Maya historical records refer to them both as the holy Itzá and disparage them as lewd, dissolute, without wisdom and practicers of erotic cults. On their defeat and loss of Chichén-Itzá (about A.D. 1200), or at the breakup of the Mayapán "empire" (A.D. 1450), depending on which theory is accepted, some of the Itzá moved south to establish themselves at Tayasal, now Flores, an island in Lake Petén, Guat., where they maintained their pagan Maya culture until 1697 when their independence was extinguished by a Spanish expedition from Yucatán. *See* also MAYA INDIANS; CENTRAL AMERICA.

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ITZEHOE, a town of Germany, *Land* (state) of Schleswig-Holstein, which after partition of the nation following World War II became part of the Federal Republic of Germany, lies on the southern edge of the Holstein uplands surrounded by woods, 64 km. (40 mi.) N.W. of Hamburg by road. Pop. (1962) 36,081. Itzehoe lies on the Stör river, its districts being the right-bank Altstadt (old town) and Neustadt (new town). The church of St. Laurence (1196) was almost completely rebuilt in 1716. Of the Cistercian convent (1256) the courtyard survives. Its library and archives are preserved in the house of the abbess (1698). St. Jürgen's chapel, with charming half-timber work, is a fine example of late baroque, with beautiful ceiling frescoes. The town hall (1695, extended 1893) is in the market place of the new town. The Breitenburg, 4 km. S.E., is the residence of the counts Rantzau. It contains the fine collection of the humanist Heinrich Rantzau and a piano which belonged to Mozart. Itzehoe is a road junction and on the railway from Hamburg to Sylt. There are manufactures of cement, nets, pumps, ceramics, textiles, machinery and hardware; also food processing, printing and distilling.

In 810 Charlemagne built a castle in the bend of the Stör. In 1227 the castle and settlement were acquired by the counts of Schauenburg, who granted the town civic rights in 1238. The place was destroyed by the Swedes in the 17th century.

IVAN, the name of three grand princes of Moscow and of two tsars and one emperor of Russia.

Ivan I Danilovich (1304?–1341), grand prince of Vladimir and Moscow, the son of Daniel of Moscow, acceded to the Muscovite throne in 1325 when his brother Yuri was murdered at the Golden Horde by Grand Prince Dimitri Mikhailovich of Tver. Though Dimitri was executed by the khan for this murder, Ivan did not get the patent for the grand principality of Vladimir; instead Dimitri's brother Alexander was appointed. But in 1327 the Tverites rose up and massacred Mongol merchants and officials in Tver. Khan Uzbek immediately summoned Ivan to the Horde and ordered him to lead an expedition against Alexander. With an army from the Moscow and Suzdal districts stiffened by Mongol detachments, Ivan sacked Tver. In 1328 he was rewarded with a half share of the grand principality of Vladimir, and in 1331 he was given the title of grand prince.

Alexander continued the struggle with Ivan for ten years. He sought refuge in Pskov, but fled to Lithuania when the metropolitan Theognost excommunicated him and all the Pskovites. In 1338 he appeared again briefly in Tver, having obtained the patent for the principality; but in 1339 the khan, at Ivan's instigation, summoned him to the Horde with his son and executed them both.

There was little change in the actual dimensions of the territories of Moscow during Ivan's reign, but by the shrewd purchasing of lands in outlying districts Ivan spread his influence over other principalities as well. By appropriating the right to collect Tatar tribute throughout the Russian lands (hence his nickname Kalita, "Moneybag"), Ivan greatly increased the financial power of Moscow, making it not only the most powerful state in northeastern Russia, but also the richest. At the same time he insured the spiritual leadership of Moscow by closely allying himself with the metropolitan, whose seat was transferred in 1326 from Vladimir to Moscow. Thanks to Ivan's subservient attitude to the Horde, Russia enjoyed peace during his rule. Ivan died on March 31, 1341.

Ivan II Ivanovich (1326–1359), grand prince of Moscow, the son of Ivan I, succeeded his brother Semen on the throne of Moscow in 1353 and was granted the patent to the grand principality by the khan in spite of the vigorous claim laid by Konstantin Vasilievich of Suzdal. Apart from Suzdal, only Ryazan tried to resist Moscow; but by supporting the rival princes of Pronsk, Ivan weakened Ryazan and avoided a serious clash. At home the boyars (advisers of the grand prince) were politically prominent; the metropolitan Aleksei himself, one of Ivan's main advisers, was a boyar by birth. In 1357 Ivan's *tysyatski* (chiliarch) in Moscow, Aleksei Khvost, perhaps the leader of a boyar plot against Ivan, was murdered; as a result several senior boyars fled to Ryazan. Ivan II died on Nov. 13, 1359.

Ivan III Vasilievich (1440–1505), called the Great, grand prince of Moscow, was born on Jan. 22, 1440. He succeeded his father Vasili II on the throne of Moscow on March 27, 1462. At his accession the Great Russian lands of Novgorod, Pskov, Vyatka, Tver, Ryazan, Rostov and Yaroslavl were not yet under Muscovite control; the entire Ukraine and the upper Oka districts were part of the Polish-Lithuanian union and Ivan himself, in name at least, was a tributary of the khan of the Golden Horde. He set himself the task of reconquering from Poland-Lithuania the Ukrainian possessions of his forefathers. But first the independent Great Russian lands had to be annexed or subdued and subservience to the Tatars had to be repudiated.

After rendering the Kazan Horde on his eastern flank temporarily impotent by a series of campaigns (1467–69), Ivan tackled Novgorod and its huge northern empire. On the pretext that he was saving his "patrimony" from the vile "Latins" of Poland-Lithuania or stamping out treason, he thrice invaded Novgorod (1471, 1477, 1478), formally forced it to accept his sovereignty (1478), stripped it of the last vestiges of political freedom, secularized large tracts of its church lands, annexed its colonies, replaced many of its citizens with reliable elements from the "lower lands" and depleted its trade by closing the Hanseatic office (1494). By 1489, when Khlynov (Kirov), the last of Novgorod's former colonies, was subdued by force, Novgorod could offer no more resistance to Ivan. Of the remaining Russian lands still technically independent in 1462, Yaroslavl and Rostov were annexed by treaty (1463 and 1474 respectively). Tver (from 1478 surrounded by Muscovite possessions) offered small resistance and meekly yielded to Moscow in 1485. Alone Ryazan and Pskov retained their independence at the cost of abject subservience to their virtual suzerain.

Freedom from subjection to Khan Ahmed of the Golden Horde came in 1480. To counterbalance Ahmed's friendship with Poland-Lithuania (at Casimir IV's instigation Ahmed had invaded Muscovy in 1472), Ivan concluded an invaluable alliance with Khan Mengli Girei of Crimea. Ahmed's troops appeared on the Ugra river in the autumn of 1480. For Ivan the situation was grave. His brothers Andrei and Boris had rebelled, and the Livonian Order was troubling the northeastern frontier. However, the brothers returned in time to defend the front and Casimir IV, harassed in the south by Mengli, failed to support Ahmed. Ahmed withdrew; and although his sons continued to worry Moscow and Crimea until their final defeat in 1502, Ivan from 1480 no longer considered himself a vassal of the khan and entered the field of European diplomacy as an independent sovereign. By tact and diplomacy he managed to maintain his friendship with Mengli and to avoid serious trouble in Kazan for the rest of his reign.

Before attacking Poland-Lithuania, Ivan attempted to form a coalition against the Jagiello dynasty. With Hungary (1482–90) and the Holy Roman empire (1486–93) he had little success; but he acquired useful allies in Stephen of Moldavia and in John of Denmark; his friendship with the latter assured him of Scandinavian neutrality in the event of war. He courted the Turks assiduously, but, though friendly, they were too busy to help. The first phase of the war, which was confined to border skirmishes, ended in 1494: Poland-Lithuania ceded considerable areas and Ivan's daughter Elena was married to Alexander, grand duke of Lithuania (and king of Poland from 1501). In 1500 war broke out again after several Russian princes in Lithuania had transferred land and allegiance to Ivan. The Muscovites were really successful only in the south, where thanks to timely desertions they occupied nearly all the land between the Desna and the Dnieper rivers. In spite of a great victory over Lithuania on the Vedrosha river (July 14, 1500) and in spite of gigantic raids by the Crimeans into the heart of Lithuania and Poland, Ivan failed to take his main objective—Smolensk. Still, the truce of 1503 extended Ivan's border considerably to the west, sufficiently indeed to constitute a direct threat to Smolensk and Kiev.

At home Ivan's policy was to centralize the administration by stripping the appanage princes of land and authority. In 1472 his eldest brother Yuri died childless and Ivan appropriated his entire estate. The two eldest surviving brothers, Andrei and Boris, were appalled; their grievances were further increased by Ivan's refusal to give them a share of conquered Novgorod and by his

arbitrary treatment of a "free servant" who transferred his allegiance to Boris. In 1480 they rebelled, marched west with their armies to the Russo-Lithuanian frontier and only with difficulty were persuaded to return and defend the Ugra line against the Tatars. In the 1480s they signed treaties with Ivan, agreeing to acknowledge all his territorial acquisitions, including the escheat of yet another brother, Andrei the Younger, who died in 1481. But Ivan was not satisfied and eventually, on a trumped-up charge, removed Andrei (1491). Only the rather stupid Boris managed to bequeath his lands to his sons. As for his cousin, Mikhail of Vereya, Ivan deprived him of his appanage (Vereya and Beloozero) and obliterated his family.

At the end of his reign Ivan had to deal with a dynastic crisis of alarming proportions. His eldest son (Ivan, born in 1458) by his first wife, Maria Borisovna of Tver, died in 1490. In 1497 he decided to nominate Ivan's son Dimitri (b. 1483) as heir, probably in order to placate Stephen of Moldavia (the father of Dimitri's mother Elena). Sophia (Zoë) Palaeologus, Ivan III's second wife (from Nov. 12, 1472), who wished her son Vasili (b. 1479) to be named heir, then planned rebellion with Vasili, backed no doubt by her influential supporter, Joseph of Volokolamsk. The plot was discovered, Sophia and Vasili were disgraced and Dimitri was crowned grand prince (1498). But after Vasili had attempted rebellion a second time, Ivan was forced to compromise: he gave the title to Vasili (1502) and imprisoned Dimitri and Elena. Ivan III died on Oct. 27, 1505.

As for the boyars, they were stripped of much of their authority and swiftly executed or imprisoned if suspected of treason. Ivan's reign saw the beginning of the *pomestie* system, whereby the servants of the grand prince (*dvoryane*) were granted estates on a basis of life tenure and on condition of loyal service.

See J. L. I. Fennell, *Ivan the Great of Moscow* (1961).

(J. L. I. F.)

IVAN IV VASILIEVICH (1530–1584), called "THE TERRIBLE," tsar of Russia from 1547, was born on Aug. 25, 1530, the son of Vasili III, grand prince of Moscow, by his second wife, Elena Glinskaya. His father died on Dec. 4, 1533, when Ivan was three, and his mother (probably poisoned) when he was eight. During the next eight years various groups of boyars fought for control of the person of the young grand prince and for power. This continuous squabble for the reins of government to the detriment of the realm made a profound impression on Ivan and imbued him with a lifelong dislike of the boyars. In 1546 Ivan decided that he would start to rule. On Jan. 16, 1547, he was crowned "tsar and grand prince of all Russia." The title tsar was derived from the Latin Caesar and was translated by Ivan's contemporaries as emperor. On Feb. 3 Ivan married Anastasia Romanovna Zakharina-Yurieva (a member of the family later known as Romanov).

Since 1542, Ivan had been greatly influenced by the views of the metropolitan of Moscow, Makari. The churchman imbued the young ruler with a conception of the dignity and responsibility of a Christian ruler; and it was in the light of Makari's theories that, during the early part of his reign, Ivan attempted to rule justly and to secure peace within the realm. Discontent, which had been widespread during Ivan's minority, changed to hope as the young tsar's government embarked on a wide program of reforms and of reorganization of both central and local administration. Forty new Russian saints "whose glory had shone forth in the land of Russia" were canonized by the church councils of 1547 and 1549. This betokened an attempt to strengthen and centralize the church. In 1549 the first *zemski sobor* was summoned—this was a national assembly to which most of the members were appointed but some were elected. The tsar, addressing it, stressed the need for a peaceful solution to Russia's social problems. In 1550 a new legal code (*sudebnik*) was drawn up, more detailed than the previous one of 1497. The new code upheld the right of the peasant to leave his master, but only on one day in the year: St. George's day (Nov. 26). This code was confirmed by the council of 1551, which also issued its own code of ecclesiastical legislation in an attempt to improve and regulate church affairs and to do away with irregularities in the administration of the church and of its properties. Several administrative and fiscal measures were also passed at this time to improve the lot of the population. Measures were also introduced to protect the interest of the gentry by providing them with both money and estates. Ivan aimed at forming a class of landed gentry which would owe everything to the sovereign. The armed forces were reorganized and the system of command altered. Commanders were to be appointed on merit and not simply by virtue of their noble birth. Field artillery was improved.

These reforms took place under the aegis of the so-called chosen council (*izbrannaya rada*), an informal advisory body, in which the leading spirits were the tsar's favourites Aleksei F. Adashev and the priest Silvester. Its influence waned and then disappeared at the beginning of the 1560s, after the death of the tsar's first wife and of the metropolitan—when the tsar's views and his entourage changed.

Russia was at war for the greater part of Ivan's reign. In 1547–48 and in 1549–50 unsuccessful campaigns were undertaken against the hostile khanate of Kazan. In 1552, after lengthy preparations, the tsar set out for Kazan and the Russian army then succeeded in taking the town by assault. In 1556 the khanate of Astrakhan—in which, as in Kazan, the spheres of interest of Muscovy and the Crimean khan overlapped—was peacefully annexed. From that moment onward the Volga became a Russian river and the trade route to the Caspian sea was made safe. The members of the chosen council considered that an end should be made of the aggressive Crimean Tatars, who were being supported by Turkey; and several military expeditions were in fact sent against the Crimea. The tsar however rejected his advisers' views and attempted to secure an exit to the Baltic sea in order to open up the trade route to western Europe.

Accordingly, in 1558, Ivan undertook the so-called Livonian War, in which Russia was at first victorious. An advantageous peace treaty could have been signed in 1566, but the *zemski sobor*, which had been summoned to consider this possibility, advised that the war should be continued. The Livonian knights were destroyed, but their ally Lithuania became an integral part of Poland in 1569. The war dragged on: while the Swedes supported Poland against Russia, Turkish and Crimean forces attacked Astrakhan and even attempted to construct a Don-Volga canal in order to facilitate the Turkish fleet's access to the Volga. In 1571 the Crimean Tatars made an extensive incursion into Russia; they burned Moscow, leaving only the Kremlin standing. In 1572 Sigismund II Augustus of Poland died. Ivan then became one of the candidates for the throne, but finally, in Dec. 1575, Stephen Báthory of Transylvania was elected instead. Báthory reorganized the Polish army, reinforcing it with German and Hungarian mercenaries; and in 1577 Ivan's vassal Magnus, a Danish duke to whom he had granted Livonia, deserted to Poland. In 1579, Báthory retook Polotsk (which the Russians had captured in 1563) and carried the war onto Russian territory. He took a number of Russian towns and, in 1581, laid siege to Pskov. The Swedes recaptured Narva and Karelia. Ivan at last asked Pope Gregory XIII to intervene; and as a result of mediation by the nuncio Antonio Possevino, a ten-year truce with Poland was signed on Jan. 15, 1582. Russia had lost everything that had been gained. In May 1583 an armistice was concluded with Sweden, by which Russia had to give up towns on the Gulf of Finland. Russia's only success was in the east, where Ermak Timofeevich annexed Siberia.

Russia's internal policy was dictated from 1560 onward by military considerations. Ivan did not agree with his advisers over the direction of the war. His first executions and the disgrace of various boyars occurred as the result of military reverses and suspected treason. The flight of his favourite, one of the best Russian generals, Prince Andrei M. Kurbski (*q.v.*) to Poland in 1564 startled Ivan. He announced in Dec. 1564 his intention of abdicating in view of the boyars' betrayal. The Muscovites, however, led by the clergy, implored him to continue to rule, and in 1565 he acceded to their request on condition that he should be allowed to deal with the traitors as he wished and that he should form an *oprichnina, i.e.*, an aggregate of territory to be separated from the rest of the realm and put under his immediate control as

crown land. A praetorian guard of 6,000 men, known as the *oprichniki*, was raised; and specified towns and districts all over Russia were included in the *oprichnina*, their revenues being assigned to the maintenance of the tsar's new court and household, which was to consist of a number of carefully selected boyars and lower dignitaries, with their families and suites. In this entourage Ivan henceforth lived exclusively. The boyars' *duma* (council) still attended to the administration, and the old boyars still retained their ancient offices and dignities; but the tsar had cut himself off from all communication with them except on extraordinary occasions. The *oprichniki* trampled with impunity on everyone beyond the charmed circle.

Historians differ in their interpretation of Ivan's activities. The *oprichnina* was undoubtedly brought into being because of the military situation, but its secondary aim was to create a centralized state and to destroy the economic strength and the political importance of the former appanage princes and the high nobility. The boyars struggled to retain their former position and plots undoubtedly occurred, but the reign of terror that the tsar initiated was more dangerous to the stability of the country than the danger which it was designed to suppress: in 1570, for example, Novgorod the Great was destroyed and several thousands of its inhabitants were executed. After 1572 the *oprichniki* were sent to join the army, some of the confiscated estates were returned to their owners and the word *oprichnina* fell out of use.

After his defeat in the west Ivan returned to one of his early ideas—that of close contact with England. English merchants had been much in evidence at the Russian court since 1553, when they had entered Russia by the White sea. Ivan was interested in establishing diplomatic and trade relations with England because, in view of the blockade of Russia by neighbouring states, Russia's only hope of contact with western civilization lay with England.

Ivan was passionate and cruel, though not more so than his contemporaries. Intelligent and a firm believer in the divine right of kings, Ivan was deeply dissatisfied with his achievements. This dissatisfaction increased after the death of his second son and heir, the tsarevich Ivan, whom he killed in a moment of fury in Nov. 1581.

Ivan's reign of terror and the prolonged and unsuccessful war resulted in the depopulation of a number of provinces and the weakening of the aristocracy. Even so, at his death on March 18, 1584, he left his realm far more centralized both administratively and culturally than it had been previously. He had also succeeded in his aim of forming a strong landowning class who were ready to support the sovereign because they owed their rise to power to the tsar and not to the accident of their birth alone.

Ivan IV had had seven wives. After the death, in 1560, of Anastasia, mother of Dimitri (1552–53), of Ivan (1554–81) and of Fedor (1557–98), he married successively: in 1561, Maria Temryukovna, who died in 1569; in 1571, Marfa Vasilievna Sobakina, who died in the same year; in 1572, Anna Alekseevna Koltovskaya, whom he divorced two years later; in 1575, Anna Vasilchikova, whom he divorced soon afterward; then Vasilisa Melentieva; and finally, in 1580, Maria Fedorovna Nagoi, by whom he had another son Dimitri (1584–91). Ivan's elder surviving son succeeded him as Fedor I (*q.v.*); for the consequences of the younger son's early death *see* DIMITRI, FALSE.

See S. F. Platonov, *Ivan Grozny* (1924); R. Vipper, *Ivan Grozny* (1947). (N. AN.)

IVAN V ALEKSEEVICH (1666–1696), tsar of Russia from 1682, was born on Sept. 6 (new style; Aug. 27, old style), the younger son of the tsar Alexis by his first wife Maria Ilinichna Miloslavskaya. A chronic invalid, deficient in mind and body, afflicted with scurvy and bad eyesight and in his later years partly paralyzed, Ivan never played any part in the government of Russia other than that of a tool in the hands of his clever and ambitious elder sister Sophia (*q.v.*). Immediately after the death of his elder brother Tsar Fedor III in 1682, Ivan's half brother Peter, son of his father's second wife Natalia Kirillovna Naryshkina (*see* PETER I the Great), was acclaimed tsar; but Sophia succeeded in altering this decision. On May 25 (N.S.) the discontented *streltsy*, enraged by the rumour—emanating from the Miloslavskis—that the Naryshkins had strangled Ivan, burst into the Kremlin and massacred many members of the Naryshkin family and their adherents. On June 2 the *streltsy* demanded the accession of Ivan; and on June 5 the *duma* of the boyars, complying with their demands and with the wish of the vestigial Moscow *zemski sobor*, formally proclaimed Ivan first tsar and Peter second tsar. On July 5 both were crowned. In 1689, during the trial of strength between Sophia and the Naryshkins, Ivan adopted a conciliatory attitude toward Peter and acceded to his demand that the leader of the anti-Naryshkin conspiracy, F. L. Shaklovity, should be handed over. Of a pious disposition, Ivan devoted much of his time to prayer, fasting and pilgrimages. In 1684 Sophia had arranged his marriage with Praskovia Fedorovna Saltykova, by whom he had five daughters, including Anna, the future empress. Ivan V died on Feb. 8 (N.S.; Jan. 29, O.S.), 1696. (L. R. LR.)

IVAN VI ANTONOVICH (1740–1764), emperor of Russia from 1740 to 1741, was born on Aug. 13 (new style; 2, old style), 1740, the son of Prince Anton Ulrich of Brunswick and Anna Leopoldovna, niece of the Russian empress Anna Ivanovna (*see* ANNA). Having declared the child her heir on Oct. 27 (N.S.), 1740, the empress Anna died the next day, whereupon Ivan was proclaimed emperor. For three weeks Ernst Johann Biron, duke of Courland, acted as regent; then, on Biron's fall (Nov. 20), the regency passed to Anna Leopoldovna, though the government was in the hands of the vice-chancellor, Andrei Osterman. A *coup d'état* on Dec. 6 (N.S.), 1741, placed the tsarevna Elizabeth on the throne and Ivan and his family were imprisoned in the fortress of Dünamünde (1742). In 1744 they were transferred to Kholmogory on the White sea, where Ivan, seeing nobody but his jailer, remained for the next 12 years. In 1756 he was secretly transferred to the fortress of Schlüsselburg, where even the commandant was left in ignorance of his identity. In 1762, his condition was for a short time improved during the few months' reign of Peter III, but on the accession of Catherine II orders were given that the prisoner was not to be delivered alive into anyone's hands. By this time, 20 years of solitary confinement had disturbed Ivan's mental equilibrium, though he does not seem to have been actually insane. A sublieutenant of the garrison, Vasili Yakovlevich Mirovich, learned his identity and formed a plan for proclaiming him emperor. At midnight on July 15 (N.S., 4, O.S.), 1764, Mirovich won over some of the garrison, arrested the commandant and demanded the delivery of Ivan, who there and then was murdered by his jailers.

See K. Stählin, *War der 1764 getötete Gefangene von Schlüsselburg der russische Ex-Kaiser Iwan VI?* (1927).

IVANO-FRANKOVSK (formerly STANISLAV), an *oblast* and town located in the western part of the Ukrainian Soviet Socialist Republic, U.S.S.R. The *oblast* was formed in 1939 from territory annexed from Poland. Pop. (1959), 1,094,639. Area, 5,367 sq.mi. It lies on the northern flank of the Carpathian mountains, extending from the crestline to the Dniester river and including a small area on the Dniester left bank. The climate, although mild in the sheltered valleys with January temperatures above freezing, becomes increasingly severe with height. The series of parallel Carpathian ranges are densely forested, with beech on the lower slopes and coniferous forest higher up. The gently rounded summits are in grass meadows, of great importance for summer pasture.

The *oblast* is one of the most densely settled parts of European Soviet Russia. More than three-quarters of the population is rural, concentrated along the Dniester and in the mountain valleys. Most of the inhabitants are Ukrainians, but in the mountains are found the related Hutsuls. Arable land, on which wheat, rye, maize (corn), sugar beet, flax and hemp, sunflowers and tobacco are cultivated, is found chiefly along the Dniester. Cattle and sheep rearing, on a transhumance basis, is highly developed. In the lower regions pigs are also kept. Industry is based mainly on the extraction of a wide range of minerals (including oil and natural gas, salt and potassium, lignite and brick clays) and on timber working, especially furniture making. The oil refining centre is Nadvornaya. In all there are 12 towns and 28 urban districts, but none is large.

Ivano-Frankovsk town, the administrative centre of the *oblast,* is on the Bystritsa river, a few miles above its confluence with the Dniester and 75 mi. S.E. of Lvov. Pop. (1959) 66,000. Founded in 1661 by Stanislaw F. Potocki (*q.v.*) and named Stanislawow, the town was part of Poland; in 1772 it came under Austrian rule, returning to Poland in 1919. It was annexed by the U.S.S.R. in 1939 and occupied by the Germans from 1941 to 1944. Its name was changed to Stanislav in 1945 and to Ivano-Frankovsk in 1962 (Ivan Franko [1856–1916] was a noted Ukrainian poet).

The town controls one of the key Carpathian passes, the Yablonitski pass. It is an important rail junction with lines to Lvov, Chernovtsy and Yasinya. Its industries include timber working, furniture making, engineering (especially locomotive repairs), ceramics, food processing and other light industries. The town has pedagogic and medical (1945) institutes. (R. A. F.)

IVANOV, VYACHESLAV IVANOVICH (1866–1949), Russian philosopher, scholar and Symbolist poet, was born in Moscow on Feb. 28 (new style; 16, old style), 1866. He studied the classics and published several scholarly works. For many years his dignified, stiff and rhetorical verse remained unpublished, but with the appearance of *Kormchya zvezdy* ("Pilot Stars") in 1903 he was accepted as a leading figure by the Russian Symbolist movement.

From 1905 to 1911 his "Wednesdays" in his St. Petersburg flat were a meeting place of the Russian literary world, and in 1911 he published *Cor Ardens,* the two volumes of which are his most important poetical work. In 1921 he became professor of Greek at Baku university, but in 1924 left for Italy, where he was converted to Roman Catholicism. He died at Rome on July 16, 1949. (R. F. Hr.)

IVANOVO, an *oblast* of the Russian Soviet Federated Socialist Republic, U.S.S.R., lies northeast of Moscow, astride the middle Volga. By far the greater part of its area of 9,266 sq.mi. lies south of the river, and is drained by minor tributaries of the Volga and Klyazma, notably the Uvod, Teza and Lukh. In the east of the *oblast* the Volga broadens out into the great lake formed by the Gorodets barrage, above Gorki. The surface of the *oblast* is a rolling, morainic plain, becoming rather more hilly to the northwest. The natural vegetation cover is usually forest, dominated by spruce, with pine and fir. Lower areas are often very swampy, while broad flood plains fringe the rivers. In the southwest the area known as Yuryevo Pole is more open and is largely under the plow. Soils are usually highly podsolized and infertile sands or, at best, sandy loams. Yuryevo Pole has darker, richer soils, probably of bog origin. The climate is continental, with long, cold winters and warm summers. Precipitation is about 20 in. a year.

The population by the census of 1959 numbered 1,322,152, of whom 876,000 (66%) were urban dwellers and 446,000 rural. There are 17 towns and 30 urban districts, the largest being the administrative centre of Ivanovo (332,000), Kineshma (84,000), Shuya (65,000) and Vichuga (52,000). The greatest concentration of population is in a belt along the railway through Ivanovo to Kineshma and along the Volga.

Ivanovo *oblast* was created in 1929 and forms part of the important central industrial region, focused on Moscow. The textile industry developed there in the 18th century and even in pre-Revolutionary times this was a major area of textile manufacturing. The *oblast* now supplies nearly one-third of all the cotton made in the Soviet Union. Other textiles, notably linen, are produced and there are widespread associated clothing industries. The other main industries, notably engineering and chemicals, provide machinery and dyes for the textile mills. Agriculture, most important in the more fertile southwest, is dominated by fodder crops, oats, rye, potatoes and vegetables. Flax is of considerable significance in the east and parts of the north. Large numbers of livestock, particularly dairy cattle, are kept, utilizing the abundant natural pasture. The peat reserves of the *oblast* are much used for fuel. The navigable Volga system and a network of railways and roads serve the *oblast* and unite it to the rest of the central industrial region. (R. A. F.)

IVANOVO, a town and *oblast* centre of the Russian Soviet Federated Socialist Republic, U.S.S.R., stands on the small river Uvod, a tributary of the Klyazma, about 233 km. (145 mi.) N.E. of Moscow and 185 km. (115 mi.) N.W. of Gorki. Pop. (1959) 332,000. It was created from two villages, Ivanovo and Voznesensk, in 1871 and until 1932 was known as Ivanovo-Voznesensk. Before the Revolution there were 23 textile mills and Ivanovo was known as "the Russian Manchester." It remains one of the major textile towns of the U.S.S.R., with two large cotton spinning mills, a cotton weaving and dyeing mill and a number of clothing factories. Worsted and silk goods are also made. Many of the other industries are geared to textiles, producing textile machinery and dyes. Also manufactured are peat-working machines, cranes, leather goods and footwear, saw timber and foodstuffs. Around Ivanovo is a group of subsidiary textile towns, producing cotton (Teykovo, Kokhma, Yuzha, Rodniki, Furmanov and Vichuga) and linen (Privolzhsk, Puchezh, Yuryevets and Novo-Pistsovo). A thermal electric station in Ivanovo and a peat-burning plant nearby supply power. Ivanovo has a number of higher educational establishments including textile, chemical technical, power, agricultural, medical and pedagogical institutes. There are rail and road communications with Moscow, Yaroslavl, Vladimir and Kineshma on the Volga. (R. A. F.)

IVEAGH, EDWARD CECIL GUINNESS, 1ST EARL OF (1847–1927), British philanthropist, chairman of the famous Guinness brewery from 1886 to 1927, was born in County Dublin, Ire., on Nov. 10, 1847, the son of Sir Benjamin Guinness, 1st baronet. He was educated at Trinity college, Dublin, and entered the family business. He retired from active management in 1889, marking his retirement by a gift of £250,000 for the housing of the poor in Dublin and in London. A little later he provided another £250,000 for the clearing of an insanitary area in Dublin and the erection of workmen's dwellings. His other great benefactions included £250,000 to the Lister Institute of Preventive Medicine in London for bacteriological research. Last of all he rescued Ken Wood, north of Hampstead heath, for the benefit of Londoners by purchasing the remaining portion of the estate in 1925 and arranging that the house with its collection of pictures and the 76 ac. on which it stood should become public property. From 1905 onward when he purchased Elveden hall, Suffolk, most of his time was spent in England, but he never lost touch with his native city, of which he was a constant benefactor, and he did not allow his unionist principles to interfere with his civic patriotism. Guinness received a barony in 1891, a viscounty in 1905 and an earldom in 1919. He died in London on Oct. 7, 1927.

IVES, CHARLES EDWARD (1874–1954), U.S. composer whose works anticipated many later developments in 20th-century music, was born in Danbury, Conn., on Oct. 20, 1874. He received early instruction in music from his father, a military bandmaster. In 1894 he studied composition with Horatio Parker at Yale university and after graduation in 1898 became engaged in an insurance business, in which he continued until 1930. At the same time he began to compose music in which popular tunes, fragments of religious anthems and other music were integrated into works of enormous complexity, freely employing sharp dissonances, polytonal harmonies and polymetric constructions. Nearly all of his principal works were written before 1915; a few years later chronic diabetes and hand tremor forced him to give up composition. It was not until the last years of his life, however, that his music gained acceptance. In 1947 he received the Pulitzer prize for his Third Symphony, written in 1911. His Second Symphony (1897–1902) was first performed 50 years after its composition. His Fourth Symphony (1910–16) still defies performance, owing to the extreme difficulties of its rhythmic and instrumental writing.

The music of Ives is intimately related to the American scene, as indicated in the titles *Thanksgiving* (1904), *Washington's Birthday* (1909), *Decoration Day* (1912), *Fourth of July* (1913) and *Three Places in New England* (1903–14), his best-known work. His Second Piano Sonata (1909–15) is subtitled *Concord, Mass., 1840–60,* and its four movements are named after the U.S. writers Emerson, Hawthorne, the Alcotts and Thoreau. Ives also wrote a great number of songs (some to his own texts), four violin so-

natas and other chamber music. He died in New York city on May 19, 1954.

See H. and S. Cowell, *Charles Ives and His Music* (1955).

(N. Sy.)

IVES, FREDERIC EUGENE (1856–1937), U.S. inventor, remembered especially for his contributions to the technique of photoengraving, was born on Feb. 17, 1856, on a farm in Litchfield, Conn., and was apprenticed as a printer on the *Litchfield Enquirer* in 1869. Ives diligently studied photography, and it was in those early days that he first dreamed of a quick and popular photomechanical process of illustration. So expert a photographer had he become at 18 that he was placed in charge of the Cornell university photographic laboratory, where he developed a new "swelled gelatine" line process by which beautiful illustrations were produced for the undergraduate periodical. At Cornell in 1878 Ives invented the first process called "halftone." Although the results were identical with those of today, the process was different. The method now in universal use he invented in 1885–86 in Philadelphia, where, in Feb. 1881, he had begun the first commercial production of halftone printing plates (by his first method). In 1885 he exhibited at Philadelphia a colour reproduction made with trichromatic halftone process printing plates. Among his other important inventions were the halftone photogravure (anticipating rotogravure); the modern short-tube single-objective binocular microscope; the photochromoscope, a device for optically reproducing objects in both full modeling and perfect colour as well as photographs and motion pictures in natural colours. Specimens of his early prints are preserved in the Smithsonian institution. Ives died in Philadelphia on May 27, 1937.

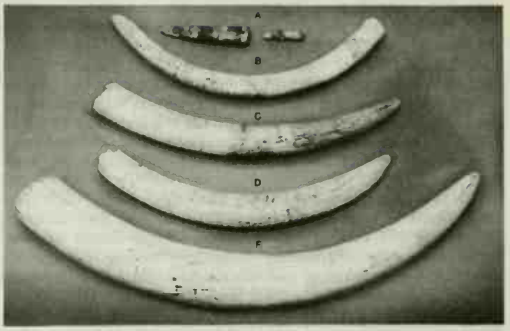
His son Herbert Eugene Ives (1882–1953) was an outstanding engineer in the development of television and the transmission of pictures by wire (*see* TELEVISION: *History of Television*).

See F. E. Ives, *The Autobiography of an Amateur Inventor* (1928); L. W. Sipley, *Frederic E. Ives* (1956). (W. T. I.)

IVO (YVES), **SAINT,** OF CHARTRES (*c.* 1040–1116), bishop of Chartres, the most learned canonist of his age, was born of a noble family near Beauvais and was educated in Paris and at Bec under Lanfranc. About 1078 he became prior of the canons regular of St. Quentin in Beauvais and in 1090 bishop of Chartres. As bishop he incurred the hostility of Philip I, who wished to leave his wife and marry the Countess Bertrada of Anjou; for his opposition he was imprisoned in 1092. In the Investiture Controversy (*q.v.*) his policy was one of moderation. His importance as a canonist is apparent from his *Decretum* (in 17 books) and his *Panormia* (in 8 books), both composed before 1096. Ivo's 288 letters throw much light on the political, religious and liturgical questions of his day. In addition to these works, which together with the surviving 24 sermons are printed in J. P. Migne's *Patrologia Latina* (vol. clxi and clxii), Ivo wrote a collection of canons, *Collectio Tripartita,* as yet unpublished. His feast is celebrated on May 20 or 23. (B. Ty.)

IVORY, the material of the tusk of the elephant and certain other animals. The male and female African elephants and the male Asiatic (Indian) elephants produce good-sized tusks; the female Indian elephant produces tusks that are much smaller or produces none at all.

Ivory has been described as a modification of dentine that in transverse sections or fractures shows striations arranged in arcs. Minute curvilinear lozenge-shaped spaces are formed by exceedingly small tubes placed very close together, radiating outward. It is this structure that gives ivory its fine grain and almost perfect elasticity and the peculiar marking resembling the engine turning on a watchcase. Elephant tusks are the upper incisor teeth and continue to grow during the whole of the animal's life, starting from a semisolid vascular pulp that gathers phosphates and becomes hardened. The tusk is built up in layers, the inside layer being the last produced. About a third of the tusk is embedded in the bone sockets of the skull. This end is hollow for some distance but gradually becomes solid with a narrow nerve channel running through the centre to the tip. The bark or outer coat is similar in density to the ivory and cannot be peeled off. The teeth of the hippopotamus, walrus, narwhal, sperm whale and some types of



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TYPES OF TUSKS

(A) Shelly scrivello (baby elephant tusks) or milk teeth; (B) solid (or close-grown) scrivello tusk (suitable for the turning of billiard balls); (C) wide (or hollow-grown) tusk coming from male elephant; (D) close (or solid-grown) tusk probably coming from female elephant; (E) wide (or broad and hollow-grown) tusk coming from male elephant

wild boar and wart hog are recognized as ivory but have little commercial value because of their small size. Elephant tusks from Africa average about 6 ft. in length and 100 lb. per pair in weight. Asiatic tusks average about 5 ft. and 70 lb. per pair. (*See* ELEPHANT.)

There are two main types of elephant ivory: hard and soft; as a rule, hard ivory comes from the western half of Africa and soft from the eastern. A hard tusk is darker in colour, more slender and straighter than a soft tusk, which is white, has a blunt point and is more twisted in growth pattern. Internally a hard tusk has colour and is more brittle than a soft tusk, which is an opaque white with a fibrous texture.

Ivory is a very durable material and is not easily damaged or destroyed; it will not burn and is very little affected by immersion in water. Tusks have been recovered from ships that have been sunk for a number of years and when cut they show that the water has penetrated only about $\frac{3}{8}$ in., causing a slight discoloration. Ivory is similar to a hard wood in some properties. It is quite dense, polishes beautifully and is easily worked with woodworking tools; ivory used in commerce is usually sawn in water to make it easier to cut, to prevent cracking, to clear the dust and to cool the saw.

Sources of Ivory.—Most of the ivory used commercially comes from Africa, and India has to import ivory from Africa to augment its home supply. Elephants are found throughout Africa from the Sudan to Rhodesia and Tanganyika, and their tusks vary considerably in growth and colour according to location; an expert can usually discover the source on examination. Every pair of tusks that comes to the market represents a dead elephant, but not necessarily a recently killed one as is sometimes supposed. Sales are held periodically in all the east African ports and in Rhodesia; a certain amount of ivory is shipped to England and resold in the London market, where sales are held four times a year. The tusks are laid out for inspection on the "ivory floor" in the London docks, and the sales are held in Mincing lane in the City of London, which became the centre of the trade in the 19th century. Sales were once held in Hamburg, Bordeaux and Liverpool but they closed long ago because of the shrinkage of the trade. Congo ivory has always been shipped direct to Belgium, where sales are held three times a year in Antwerp. Buyers in the United States normally purchase their requirements in the European market or direct from Africa. Before the London sales were instituted at least one firm of manufacturers, Nathaniel Bowers and Son, who started in business as ivory combmakers in 1685 and whose descendants were still in the trade in the 1960s, collected ivory on the west coast of Africa and transported it to London in its own ships. The U.S.S.R. has been a source of supply of mammoth tusks, which are very similar to elephant tusks although rather more twisted, and quite large quantities have been collected from the glaciers and rivers in Si-

beria and sold in the world markets. Mammoth has also been found in other parts of the world.

Uses of Ivory.—Ivory has always been regarded as a precious material and from early times was used for carving and for inlaying and manufacturing furniture and ornaments. It is still used for both utilitarian and luxury articles, although the shape and size of the article is controlled by the size of the tusk: it is not practical to join pieces together because the joint shows as a dirty line. Ivory is used for the fittings of musical instruments. White piano keys can be made of ivory, the ivory being supplied in thin pieces known as "heads and tails." These are glued to the top of the keys, the "head" being the wide part that comes under the fingers and the "tail" the thinner piece between the black keys. The cutting and matching is a skilled job as each set (*i.e.*, 52 heads and 52 tails) has to match in colour, grain and thickness.

Toilet articles, dressing table sets and hairbrushes may be made of ivory. Ladies' sets are made mostly from flat pieces cut from large tusks so that a mirror up to 6 in. wide can be supplied; gentlemen's brushes usually come from the hollow part of the tusk, which gives a concave back and a curved face, making the brush easy to hold. Combs to accompany these sets are also made of ivory, as are small toothcombs. The ivory for these is specially selected for its fine grain as the finest small toothcombs have as many as 70 teeth to the inch cut with a very thin circular saw and unless the grain is extremely fine the teeth will not remain straight. As ivory is little affected by heat and moisture it is used for the handles of surgical instruments, which need to be sterilized by boiling, and for the scales of thermometers that are used in hot and cold liquids. Ivory is also a good heat insulator and is therefore ideal for handles of teapots, coffeepots and dishes; it also is used in electronic equipment.

Thin leaves of the very best quality ivory are sought after by miniature painters as the natural colour of the ivory provides a good background for painting (*see* MINIATURE PAINTING). Probably the greatest use of ivory is for carving articles ranging from large statues to tiny animal figures, earrings and ornaments. Every sort of ivory is used, even the smallest waste pieces left over from other processes. Ivory carvers in the far east are especially skilled and are famous for their concentric ivory balls, the inner sphere of which is cut free from within the openwork of the enclosing sphere. (*See* also IVORY CARVING.) The Odenwald district of southern Germany is a centre for making beads, brooches, earrings and animal figures, and also for inlaying. Ivory bangles have a particular significance in parts of India where they are made and worn as a status symbol. Formerly one of the chief uses of ivory was for billiard balls but these are now made of synthetic materials because of the length of time taken to season an ivory ball and the consequent cost of manufacture.

Vegetable Ivory and Ivory Substitutes.—Vegetable ivory is the fruit of the ivory nut palm or tagua (*Phytelephas*), which is found in tropical South America in groves in damp localities. It is a short-stemmed or stemless palm and the seeds, which are contained in a woody shell, harden on maturity into a white substance used locally for carving small ornaments.

Many substitutes for ivory have been produced, but it is impossible to synthesize a material that cannot be recognized as an imitation when compared with real ivory; the graining of ivory is impossible to copy for it has no uniformity and the creamy white colour, which yellows with age, cannot be reproduced. (D. G. B.)

IVORY-BILLED WOODPECKER (IVORY BILL; *Campephilus principalis*), the largest North American woodpecker, reaches a length of 20 in. Formerly extending north to Illinois, Indiana and North Carolina, the ivory bill is nearing extinction, being confined to primeval cypress swamps in one or two isolated portions of Florida. The white beak and large size are diagnostic. The plumage is black, with the secondaries and shorter primaries white, and a pair of white stripes down the back. The long crest is scarlet in the male, black in the female. The call is a sharp nasal *yap-yap*. The heads were used for ornaments by the Indians. *See* also WOODPECKER. (HT. FN.)

IVORY CARVING. The use of ivory for sculpture and decoration has been universal in the history of civilization. In Europe elephant tusks, from Africa and later from Asia, have always been the main source of ivory. In the middle ages walrus tusks were also much used in northern countries, a practice which was gradually discontinued except in Russia. In the 18th and 19th centuries hippopotamus teeth were fairly widely used in France and England.

Until about 1900 all schools in all countries used much the same tools: an ax, adz or chisel for removing the bark, a bow saw or bucksaw for cutting the trunk into sections, a special tool called a float for paring the surface, and gauges, hand chisels, fret saws, etc. The lathe was used only in Europe and India. The great change came with power-driven rotary saws for cutting and peeling the ivory and dental drills for carving it easily and quickly. In the 20th century these machine tools soon spread from Europe to Japan and India, and even to the Alaskan Eskimo for use on walrus ivory carvings for the tourist trade.

This article is a historical survey of ivory carving in the Near East and Europe, in the Orient and in North America. It is divided into the following main sections:

I. The Near East and the West
  A. Ancient History
    1. Carvings of the Paleolithic Period
    2. Egyptian
    3. Phoenician
    4. Babylonian and Assyrian
    5. Aegean, Etruscan, Greek and Roman
  B. The Middle Ages
    1. Late Antique and Early Christian Ivories
    2. Byzantine
    3. Islamic
    4. Carolingian
    5. Ottonian
    6. Anglo-Saxon
    7. Romanesque
    8. Gothic
  C. From the Renaissance to Modern Times
II. The Orient
  A. China
    1. Early Chinese
    2. Peking Work
    3. Canton Work
    4. Other Centres
    5. Artists
  B. Japan
  C. India
III. North America
    1. Eskimo Ivory Carving
    2. Scrimshaws

I. THE NEAR EAST AND THE WEST

From early times ivory has been considered an article of luxury. Its qualities of fine grain, soft colour and smooth texture were frequently combined with gold, jewels, enamels and pigmentation. Carvings in ivory were often dedicated to the highest religious and secular purposes of the time, as for example the Minoan snake priestess found in Crete and the lost chryselephantine statue of Zeus carved by Phidias for the temple at Olympia. In late classical times carved ivory diptychs were issued by the emperors, by consuls on taking office in the new year and by patrician families to celebrate the profession of a priestess or a marriage. About the year 432 A.D. the patriarch of Alexandria, Cyril, sent an ivory chair as a gift to the patriarch of Constantinople, and a little more than a hundred years later the emperor Justinian sent an ivory chair among the *egregiis muneribus* to his viceroy, Archbishop Maximian, at Ravenna, Italy. In the middle ages in the imperial workshops at Constantinople ivory was used for sceptres, to frame relics of the True Cross, to express litanies for the imperial welfare, to proclaim a marriage or a moment of imperial autocracy. At a time when so much emphasis was placed on ritual, the display of precious materials in the Chrysotriclinos of the Great Palace or on the altar of Hagia Sophia was an integral part of the sublime ceremonies. The onlooker was expected to be overawed by these tangible riches and indeed saw in them a forecast of heavenly splendour. So, too, in the west under the Carolingian and Ottonian dynasties the display of works of gold, ivory and precious stones was one of the principal means by which the western emperors showed to the world the plenitude of their power and their devotion to God.

Ivory carvings were not only used as gifts in the course of religious and political diplomacy; they served as ambassadors of style and iconography. A consular diptych of the 6th century might be copied in stone by a Visigothic sculptor in Spain; early Christian ivory carvings from Rome, Constantinople and elsewhere became models for the court artists of Charlemagne; Byzantine ivory carvings may have influenced Romanesque and even Gothic sculpture; the extension of the Gothic style throughout Europe from its centre in the Ile-de-France may be in part due to the ivory statuettes and polyptychs issued from the School of Paris.

During the Renaissance the material was used hardly at all, except in Germany; already in the late Middle Ages ivory had lost its high religious and political significance. In the 16th, 17th and 18th centuries ivory carving became essentially an *objet de vertu;* ivory cups, statuettes and reliefs display the taste with which German princes and Netherlandish plutocrats furnished their cabinets and anterooms. In the 19th century the material came into some prominence once more, chiefly for making forgeries. (J. G. Bh.)

A. Ancient History

1. Carvings of the Paleolithic Period.—Carvings in ivory, bone and horn are so numerous from certain periods of the Stone Age that one of these, the Aurignacian, has been called the "ivory period." Most of the carvings have been found in southern France, in the Dordogne and Arriège districts, though a few come from the Riviera and Germany. The earlier examples usually take the form of nude female figures, mostly of scant aesthetic worth, except for a small head of a girl found at Brassempouy (Landes, France). The animal carvings belong almost entirely to the succeeding Magdalenian period; many of these have great merit. The material is usually reindeer horn, *e.g.*, a magnificent dagger handle from Laugerie Basse, France (now in the museum at St. Germain), with a figure of a kneeling reindeer; more rarely mammoth ivory is used, as for example a tusk in two parts carved in the round with reindeer, found at Montastruc (Bruniquel, France) and now in the British museum. Engraving is probably rather later than carving in the round. The engravings usually represent animals, often rendered in a masterly manner and combined to form scenes, but occasionally human figures are represented in a rudimentary and animal-like form.

Although the early stone tools ultimately gave way to better ones and various refinements were gradually learned, the methods of the Paleolithic period have remained essentially the same through the ages. First, the heavy outer rind or bark had to be removed, then the inner substance was worked—generally in conveniently small sections—with careful attention to the direction of the grain, and finally the result had to be cleaned and polished, after which it might be painted or stained.

2. Egyptian.—Ivory and bone, in the form of elephant tusks from the Sahara and the teeth of hippopotamuses, were worked from a very early period in Egypt. Many combs, hairpins and other utensils dating from the predynastic and early dynastic periods have been found at Nagadah and other sites; a fine handle carved with hunting and other scenes found at Gebel el-Arak is now in the Louvre. To the same period belong some nude female figures carved more or less crudely and probably worn as amulets to ward off evil or harm.

Many ivory figures of men and women, some in embroidered robes, were found by J. E. Quibell at Hierakonpolis. Several of these are very beautiful. But among the masterpieces of early Egyptian carving are two statuettes, both found at Abydos: one, a king belonging to the 1st dynasty (now in the British museum) wearing the crown of upper Egypt and a richly embroidered robe; the other, in the Cairo museum, represents the 4th-dynasty king, Cheops or Khufu (*c.* 2600 B.C.), builder of the Great Pyramid. Pictures were also incised on flat slabs, and sometime after 3000 B.C. the technique of carving in relief was introduced. Later work, much of it of fine quality, is mostly decorative in intention, being largely used for handles, spoons, inlays for caskets and furniture. (*See* also Egypt: *Archaeology.*)

3. Phoenician.—The ancient Phoenicians used Syrian and African ivory, and seem to have specialized in inlays for woodwork, often overpainted or encrusted with lapis lazuli or glass. Some remnants survive from the ruins of Nineveh and other sites.

4. Babylonian and Assyrian.—There have been only a few finds up to the early years of the 1960s, but it seems that ivory was carved in Babylonia from a period at least as early as in Egypt. The later work, of about the 9th to the 7th centuries B.C., is represented in the British museum by an unrivaled series of ivories from Nimrud (Kalakh), many of which show strong Egyptian influence. Many are inlaid with gold and lapis lazuli, a method of decoration which is found elsewhere (*e.g.*, at Mycenae and throughout the Aegean). Apparently contemporary with these is a series of fragments, chiefly heads, more purely indigenous in type. Both groups show an admixture of other influences and it has been plausibly suggested that the carvers were Phoenicians.

5. Aegean, Etruscan, Greek and Roman.—Among the earliest Aegean ivory carvings of any aesthetic value are the small ivory figures of acrobats found at Knossos in Crete, and now in the museum at Candia. These must be rated with the masterpieces of Minoan art and may be dated about the 16th century B.C. The celebrated figure of the snake goddess (now at Boston) has also been ascribed to the same period. Many ivories of superior workmanship (British museum), which may be assigned to a date between the 14th and the 11th centuries, were found at Enkomi, Cyprus. One is a gaming box carved on the sides in low relief with hunting scenes, and two mirror handles depicting combats between human beings and monsters. Ivories similar in style and of about the same period have been found in Greece, at Sparta and Mycenae; both groups are in the museum at Athens. They were probably made in Syria or possibly on the south coast of Asia Minor. The main influence is Asian.

To a period between the 9th and 6th centuries B.C. belong extensive groups of carvings which seem to derive from the same cultural source as the earlier ivories. These groups, which show close analogies of style both among themselves and with the Nimrud carvings, have been found on various sites—at Ephesus, Rhodes, Sparta and in Italy and Spain. The dominant style is Asian, with occasional traces of Egyptian influence. The ivories from Sparta (now in the Athens museum) were excavated in the sanctuary of Artemis Orthia and date mainly from the 8th and 7th centuries; they show traces of Ionic influence and were possibly worked locally. Among them are plaques carved in relief to decorate pins, figures of animals carved in the round, statuettes and a fine relief with a warship, this last inlaid with amber. The carvings from Ephesus, now in the museum at Istanbul, were found in the temple of Artemis and date from about the same period. They consist chiefly of statuettes, the costumes of which show Asian (perhaps Hittite) influence, and some well-conceived animal figures.

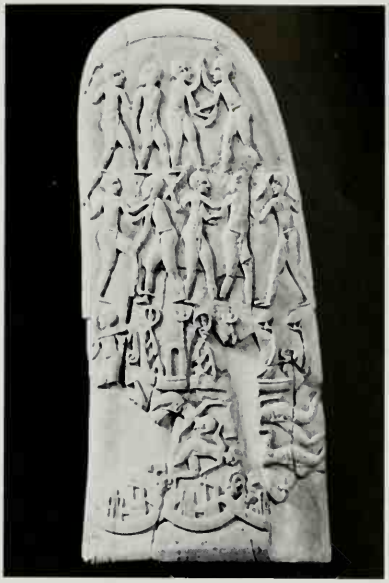
The earliest ivories found in Etruscan tombs in Italy belong to about the same period (700–670 B.C.) and present many difficulties as to origin. Some of the best were found in the Barberini tomb at Praeneste, south of Rome; among them are a *tazza* (ornamental cup or vase) on a high foot, and three arms and hands the use of which is not clear; all are decorated with bands of centaurs, griffins and animals in procession. These were very likely imported from Cyprus, probably of Phoenician workmanship, but even if they are native Etruscan imitations the motives are derived from an oriental source. Slightly later in date is a box found at Chiusi in northern Etruria, now in the Museo Archaeologico at Florence.

No ivories of importance belonging to the earlier classical period of Greek art have survived, though it is known from documentary evidence that they existed. To the Greco-Roman period should probably be assigned a beautiful head found in the Roman amphitheatre at Vienne (Isère, France), now in the Musée Archéologique of that town. A fine head of a goddess, together with fragments of arms (in the Vatican), probably belongs to the same period, but it may serve to give an idea of the chryselephantine statuary of Greece known only from the descriptions of classical writers. A number of smaller ivories of the Roman period have survived, among them a small figure of a tragic actor (in the Dutuit collection in Paris) and a statuette of a hunchback (in the British museum), but most of these ivories are objects for domestic use.

(M. H. L.; X.)

Warrior fighting a griffin, on a mirror handle from Tomb 17, Enkomi, Cyprus. Late Mycenaean. The British museum

Pair of reindeer (male following female) carved on point of mammoth tusk; Montastruc (Bruniquel), France; Magdalenian period. The British museum



Knife handle carved with hunting and other scenes; found at Gebel el-Arak, Egypt. Predynastic. The Louvre

Appliqué of a female figure from a wooden box; Etruscan. Early 5th century B.C. The British museum

Statuette of a hunchback; Greco-Roman. About 1st century B.C. The British museum

Carved panel showing seated lion with Pharaonic collar; found at Nimrud in Mesopotamia. Phoenician work, 9th–8th centuries B.C. The British museum

EARLY IVORY CARVING

BY COURTESY OF (TOP LEFT, TOP RIGHT, BOTTOM LEFT, BOTTOM CENTRE, BOTTOM RIGHT) THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPH, (CENTRE) MANSELL—GIRAUDON

IVORY CARVING

Christ teaching, detail from the Brescia casket; Early Christian, probably Roman. Late 4th century. Museo Cristiano, Brescia, Italy

Detail of the chair of Archbishop Maximian of Ravenna; Early Christian, Constantinople. About 546. Museo Arcivescovile, Ravenna, Italy

The Virgin and Child (Theotokos Hodegetria): Byzantine, Constantinople. Late 11th or early 12th century. Victoria and Albert museum, London

Casket made for Prince al-Mughira, son of 'Abd-ar-Rahman III; Islamic, Córdoba, Spain; 968. The Louvre

Deësis (Christ between the Virgin and St. John the Baptist) and saints on the Harbaville triptych; Byzantine, Constantinople. Mid-10th century. The Louvre

Personification of Alexandria; Early Christian, Alexandria. Late 4th or early 5th century. Dumbarton Oaks collection, Washington, D.C.

Emperor Leo VI crowned by the Virgin and accompanied by the archangel Gabriel on fragment of a sceptre; Byzantine, Constantinople. Late 9th century. Ehemals Staatliche museum, Berlin

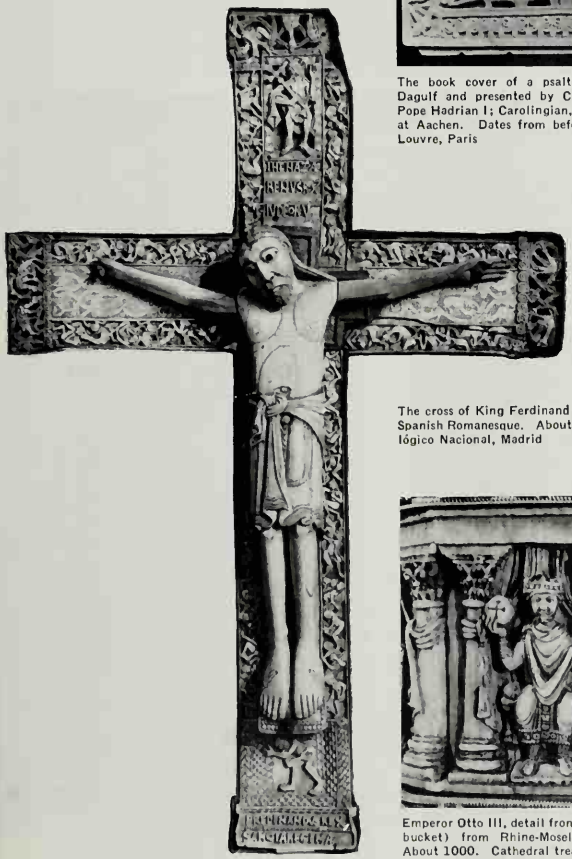
EARLY CHRISTIAN, BYZANTINE AND ISLAMIC IVORY CARVING

BY COURTESY OF (BOTTOM LEFT) VICTORIA AND ALBERT MUSEUM, CROWN COPYRIGHT, (CENTRE RIGHT) THE LOUVRE MUSEUM, (BOTTOM CENTRE) THE DUMBARTON OAKS COLLECTION, (BOTTOM RIGHT) EHEMALS STAATLICHE MUSEEN, BERLIN—FRÜHCHRISTL.-BYZ. SAMMLUNG; PHOTOGRAPHS, (TOP LEFT) MANSELL—ANDERSON, (TOP RIGHT) HIRMER VERLAG, (CENTRE) MANSELL—GIRAUDON, (CENTRE RIGHT) VICTORIA AND ALBERT MUSEUM

The Nativity; Anglo-Saxon. Early 11th century. Liverpool, Public museum

The book cover of a psalter written by Dagulf and presented by Charlemagne to Pope Hadrian I; Carolingian, possibly made at Aachen. Dates from before 795. The Louvre, Paris

Whalebone relief showing the Adoration of the Magi; English Romanesque. Early 12th century. Victoria and Albert museum, London



The cross of King Ferdinand I of Castile and Leon; Spanish Romanesque. About 1063. Museo Arqueológico Nacional, Madrid

Emperor Otto III, detail from situla (holy water bucket) from Rhine-Moselle area; Ottonian. About 1000. Cathedral treasury, Aachen

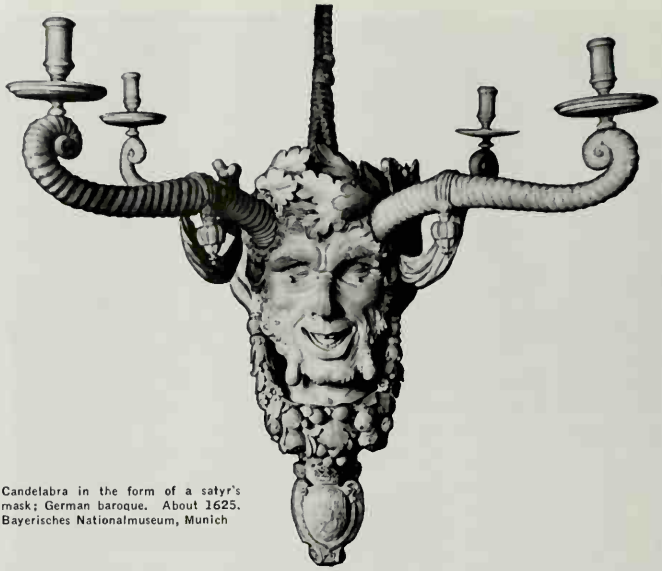
Walrus ivory relief with Nativity scene from Cologne; German Romanesque. About 1140. Victoria and Albert museum

CAROLINGIAN, OTTONIAN, ANGLO-SAXON AND ROMANESQUE IVORY CARVING

BY COURTESY OF (TOP LEFT) VICTORIA AND ALBERT MUSEUM, CROWN COPYRIGHT, AND THE LIVERPOOL LIBRARIES, MUSEUMS AND ARTS COMMITTEE, (TOP RIGHT, BOTTOM RIGHT) VICTORIA AND ALBERT MUSEUM, CROWN COPYRIGHT, PHOTOGRAPHS, (TOP CENTRE) MANSELL—GIRAUDON, (BOTTOM LEFT) FOTO MAS, (BOTTOM CENTRE) FOTO ANN BREDOL-LEPPER

IVORY CARVING

The Deposition from the Cross; French Gothic, School of Paris. 13th century. The Louvre



Candelabra in the form of a satyr's mask; German baroque. About 1625. Bayerisches Nationalmuseum, Munich

Matthew Raper by David le Marchand (1674–1726); English late baroque. Dated 1720. Victoria and Albert museum, London

Bacchanal of Children by Gerhard van Opstal (1595–1668); Flemish baroque. Mid-17th century. Victoria and Albert museum

Christ and the Virgin in Majesty, detail from the Grandisson triptych; English Gothic. Mid-14th century. The British museum, London

Statuette of the Virgin and Child by Giovanni Pisano (c. 1249–c. 1314); Italian Gothic. Cathedral sacristry, Pisa

Statuette of St. John of Nepomuk by Peter Hencke (d. 1777); German rococo. Mid-18th century. Victoria and Albert museum

GOTHIC, BAROQUE AND ROCOCO IVORY CARVING

BY COURTESY OF (TOP RIGHT) BAYERISCHES NATIONALMUSEUM, MUNICH, (CENTRE LEFT, CENTRE RIGHT, BOTTOM RIGHT) VICTORIA AND ALBERT MUSEUM, CROWN COPYRIGHT, (BOTTOM LEFT) THE TRUSTEES OF THE BRITISH MUSEUM, PHOTOGRAPHS, (TOP LEFT) ARCHIVES PHOTOGRAPHIQUES, (BOTTOM CENTRE) MANSELL—BROGI

Elephant ivory plaque, with pattern similar to those on contemporary bronzes. Shang dynasty, about 1300 B.C. Musée Guimet, Paris

CHINESE IVORY CARVING

Left, obverse and reverse sides of ivory foot rule. T'ang dynasty, 8th century. Tokyo National museum

Right, Manchu abstinence plaque of walrus ivory. Ch'ing dynasty, 18th century. University museum, Philadelphia, Pa.

Underside of armrest for scholar's desk, showing relief carving of Buddhist saints. Peking work, 18th century. Victoria and Albert museum

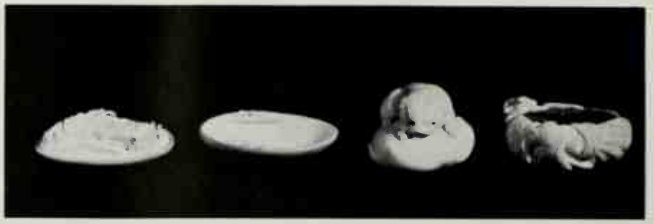
Figure from late Ming or Ch'ing period. North China, 16th or 17th century. Victoria and Albert museum

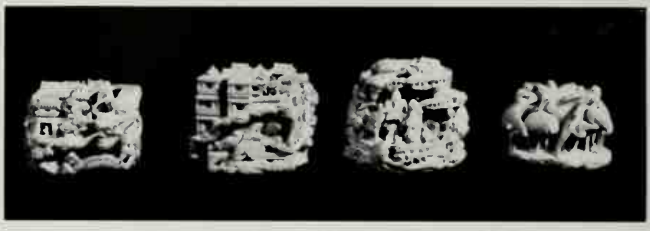
Pendant styled in the balls-within-balls motif, made for foreign trade. Canton work, 19th century. Victoria and Albert museum

BY COURTESY OF (TOP LEFT) TOKYO NATIONAL MUSEUM, (TOP CENTRE) MUSÉE GUIMET, (TOP RIGHT) UNIVERSITY MUSEUM, PHILADELPHIA, (BOTTOM ROW) THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM, PHOTOGRAPHS, (TOP RIGHT) REUBEN GOLDBERG, (BOTTOM ROW) C. N. CANNINGS. © ENCYCLOPÆDIA BRITANNICA, INC.

IVORY CARVING

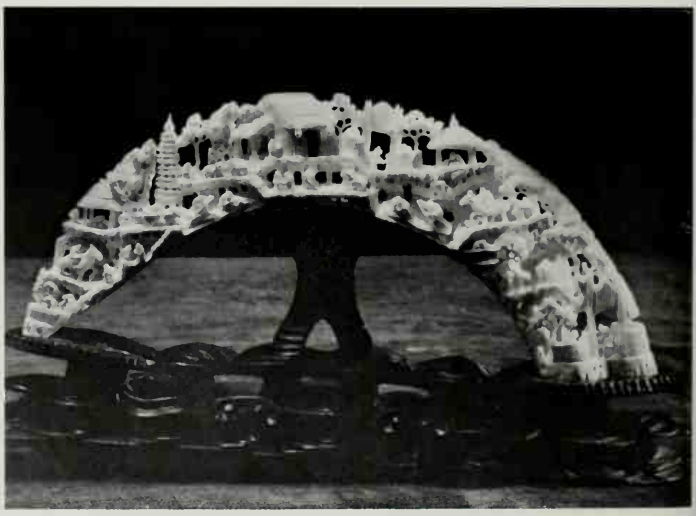
Historical scene carved directly into the ivorylike casque of a hornbill bird. Chinese, 19th century. University museum, Philadelphia, Pennsylvania





A selection of netsuke, Japanese ornamental pieces used to attach medicine boxes and pipe and tobacco pouches to men's sashes. 19th century. Tokyo National museum

Inro, Japanese medicine boxes, showing inlay work on ivory. 19th century. Tokyo National museum



Cantonese landscape bridge carved in a lower canine tooth of a hippopotamus. Chinese, 20th century. Long San Ti company, New York

CHINESE AND JAPANESE IVORY CARVING

BY COURTESY OF (TOP LEFT) UNIVERSITY MUSEUM, PHILADELPHIA, (TOP RIGHT, BOTTOM LEFT) TOKYO NATIONAL MUSEUM, (BOTTOM RIGHT) LONG SAN TI CO.; PHOTOGRAPHS, (TOP LEFT) REUBEN GOLDBERG, (BOTTOM RIGHT) WIDE WORLD

Female figure from Brahminabad-Mansura in Sind. 10th century A.D. British museum

The goddess Sri, probably from Malwa, found at Pompeii. About 50 A.D. National museum, Naples

Carved figure, probably a chessman. Western India. About 12th century A.D. Bibliothèque Nationale, Paris

Plaque from Begram, Afghanistan. About 200 A.D. Kabul museum

Female figure from Ter in the Deccan. Late 1st century A.D.

Leg of throne in the form of an elephant; Orissa. 12th–13th century A.D. Freer gallery, Washington, D.C.

Buddha from Kashmir. About 8th century A.D. Prince of Wales Museum of Western India, Bombay

INDIAN IVORY CARVING

BY COURTESY OF (TOP LEFT) THE TRUSTEES OF THE BRITISH MUSEUM, (CENTRE RIGHT) THE MUSÉE GUIMET, PHOTO BY D.A.F.A., (BOTTOM LEFT) SMITHSONIAN INSTITUTION, FREER GALLERY OF ART, WASHINGTON, D.C., (BOTTOM CENTRE) PRINCE OF WALES MUSEUM OF WESTERN INDIA; PHOTOGRAPHS, (TOP CENTRE) SOPRINTENDENZA ALLE ANTICHITÁ DELLA CAMPANIA, NAPLES. (TOP RIGHT) MANSELL—GIRAUDON, (BOTTOM RIGHT) DOUGLAS BARRETT

IVORY CARVING

Engraved box with wooden base and lid

Scratcher for imitating the clawing of seals on ice

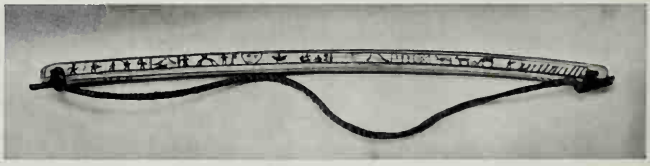
Bucket handle, carved at one end to represent a whale, at the other a monstrous bear attacking a whale

Bucket handle

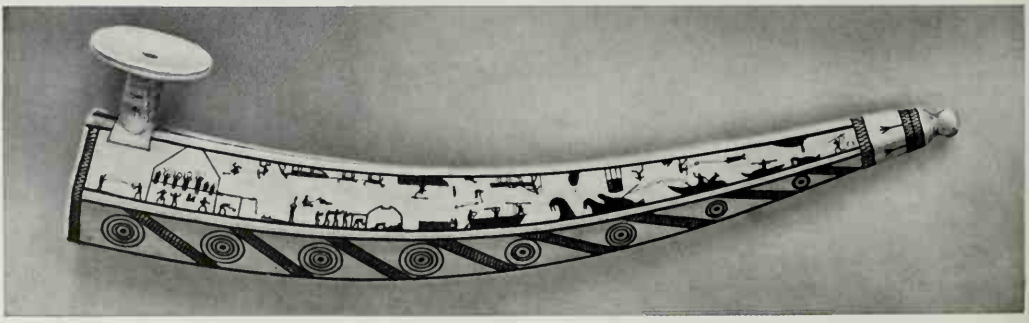
Mouthpiece of a bow drill

This piece and the one directly below are scrimshaw work of the mid-19th century. From the Maritime museum, Hull

Needlecase and thimble holder



Handle of a bow drill



Pipe with both geometric and realistic engraving

MODERN ESKIMO IVORY CARVING AND SCRIMSHAWS

BY COURTESY OF (ALL EXCEPT THIRD ROW RIGHT, FOURTH ROW RIGHT) THE NATIONAL MUSEUM OF CANADA; PHOTOGRAPHS, (THIRD ROW RIGHT, FOURTH ROW RIGHT) HULL MUSEUMS

B. The Middle Ages

1. Late Antique and Early Christian Ivories.—Of the late antique period probably the earliest western carving in ivory happens to be Christian. Most scholars agree that the Brescia casket should be dated to the third quarter of the 4th century, although an attempt has been made to place it as early as the second quarter. Its scenes from the Old and the New Testaments echo in style numerous 4th-century sarcophagus reliefs, and Christ is depicted as a beardless young man. Opinions differ on the place of workmanship but Rome seems the most likely centre. On the other hand a small group of particularly distinguished ivory carvings from the end of the century is rather different in style. One of the most beautiful of all late antique carvings in ivory, the Nicomachi-Symmachi diptych, divided between the Musée de Cluny, Paris, and the Victoria and Albert museum, London, was certainly executed in Rome. The Nicomachi and Symmachi families were firm supporters of the old pagan beliefs and the diptych was probably issued to celebrate the profession of a priestess (although a marriage between the two houses in 401 has been suggested), and the style represents a revival of Hellenistic excellence which was to deteriorate in the course of the 5th century. This diptych and that of Probianus, vicar of Rome about 400, now in the Staatsbibliothek, Berlin, determine the provenance of a number of superb ivory carvings: the Aesculapius-Hygieia diptych at Liverpool; a small casket in the Bibliothèque de l'Arsenal, Paris; the Trivulzio relief carved with the Maries at the Sepulchre in the Castello Sforzesco, Milan; the Ascension relief in the Bayerisches Nationalmuseum, Munich; and probably, but less certainly, the diptych showing Adam and St. Paul in the Bargello, Florence, and the Querini diptych in the Museo Cristiano, Brescia. In spite of the reactionary paganism entrenched at Rome, the workshops served both paganism and Christianity.

Milan.—Not wholly successful attempts have been made to assign a number of ivory carvings to workshops in Milan. It is possible, since the Theodosian house preferred Milan to Rome as their seat of government in the late 4th century, that the so-called Stilicho and Serena diptych in the cathedral treasury at Monza, near Milan, and the diptych of Probus (406) with a representation of the Emperor Honorius are Milanese. The five-part ivory diptych with scenes from the life of Christ and embellished with gold and enamels, now used as a bookcover in the cathedral treasury at Milan, dating probably to the first half of the 6th century, may also have been made in the city.

Rome.—On the other hand, the general run of consular diptychs issued in the course of the 5th century seems to have been made in Rome. Between 430 and 440 the panels carved with scenes from the life of Christ (now divided among Berlin, Paris and Nevers), the panels decorated with incidents from the lives of Moses, St. Peter and St. Thekla (British museum), and the Pula casket, because of their stylistic relationship with the carved wooden doors in the Church of Santa Sabina at Rome (about 430), were almost certainly made in that city. From the third quarter of the 5th century there are two superb panels illustrating games in the circus (the *venatio* leaves at Liverpool and Leningrad), a Bellerophon panel and another bearing an apotheosis possibly commemorating the tercentenary of the *consecratio* of the Emperor Antoninus Pius (463), in the British museum, the Dionysus-Selene diptych at Sens and the Andrews diptych carved with six miracles of Christ, formerly at Palermo, now in the Victoria and Albert museum. After the abdication of the last western emperor in 476, although four authentic consular diptychs are known, there is a marked decline in quality; the last of all, issued by Rufus Gennadius Probus Orestes in 530 and now in the Victoria and Albert museum, is a coarse copy of a Constantinopolitan diptych of 513.

Constantinople.—Some scholars have stressed the conventional aspect of the consular diptychs issued by patricians and the imperial house at Constantinople in the first half of the 6th century, but, in fact, there were constant innovations. The diptychs issued by Areobindus in 506 are, indeed, apt to be disappointing in quality, but the superb leaf of Magnus (518) in the Cabinet des Médailles, Paris, the imposing panels carved with a standing and a seated Empress, probably Ariadne (d. 515), divided between Florence and Vienna, and the Barberini five-part diptych in the Louvre, variously assigned to the emperors Zeno (474–491), Anastasius (491–518) and Justinian I (527–565), all reflect the serene, rather stolid elegance of late antique metropolitan style. The diptych issued by Justinian as consul in 521 stands apart from the main sequence of Anastasian reliefs: it has an austere, delicate, highly sophisticated design with lions' masks emerging from leafy rosettes and a central medallion bearing an inscription. Both the Barberini diptych and the diptych of Justinus (540)—the last to be issued, as the consular office was abolished in 541—introduce a representation of Christ. Among the other ivory carvings with a religious connotation is the leaf of a diptych now in the British museum which bears a Greek inscription and depicts the archangel Michael: an attempt has been made to date it to the year 519 as a commemoration of the reunion signed with Rome at Constantinople. This work, together with a magnificent diptych with a representation of Christ enthroned between St. Peter and St. Paul and of the Virgin and Child between angels (now in Berlin) and Maximian's chair at Ravenna, about the middle of the 6th century, represent aspects of the *renovatio* which seems to have taken place during the reign of Justinian (*see* also Byzantine Art). To this phase should be assigned the Poet and Muse diptych at Monza, wherein before a complicated architectural structure seen in depth both figures are carved with a feeling of monumentality of form, intricacy of posture and drapery folds and a sensitive perception of layers of flesh and muscle. The style is close to the silver chased during the reign, particularly a dish with a representation of Silenus, now in the Dumbarton Oaks collection, Washington, D.C.

Alexandria.—In the past ivory carvings have been assigned to Alexandria on the flimsiest grounds; it is therefore best to consider only those bone and ivory carvings actually found in Egypt. The earliest is an ivory relief of a poet or a philosopher inscribed in Greek "of Andropolis"—a Roman district of Egypt; the relief dates from the 2nd century A.D., and is in the Dumbarton Oaks collection. The carving is of superb quality and presents some of the characteristics which have been said to define Alexandrian style: illusion of space, picturesque effects and an element of caricature, in the figure standing behind the seated poet or philosopher. A relief with a genre scene of carpenters, found at Ramleh near Alexandria (now at Princeton, N.J.), may be dated to the 3rd or 4th century; a small fragment in the Victoria and Albert museum carved with a Dionysiac procession, found at Oxyrhynchus in Middle Egypt, and a figure of a rustic deity (Walters art gallery, Baltimore, Md.), dating from the 4th century, may be considered to reflect Alexandrian style. But the candidate of the highest quality with only a supposed Egyptian provenance and dated usually to the 4th or 5th century is an ivory medicine box at Dumbarton Oaks. The lid is carved with a *tyche* (representation of the goddess of fortune, here a personification of a city), crowned with a *uraeus* (headdress portraying the sacred asp) and holding in one hand a rudder, in the other a cornucopia; it seems reasonable to suppose that this figure, decked with an Egyptian royal diadem and holding the emblem of a seaport capital, is the personification of Alexandria. The box bears all the marks of an essentially conservative school and would seem to establish the theory that the art of Alexandria followed a path sharply divergent from that of Coptic Egypt as seen at Oxyrhynchus and Heracleopolis Magna (Ahnas).

The most typical of Alexandrian style, however, are those reliefs in bone and ivory depicting mythological figures—Silenus, Nereids, Bacchantes, Dionysus—carved in a fluid, vapid manner which proposes a general decline in aesthetic achievement. Probably the best of this category is a bone statuette of a naked girl (now at Baltimore) dating from the 4th or 5th century, which has been compared with a relief of Apollo and Daphne in the Museo Nazionale at Ravenna and with sculpture at Ahnas. A number of ivory pyxides have been assigned to Alexandria on either stylistic or iconographic grounds, but it is still difficult to give a firm opinion on their provenance. A pyx with personifications of Egypt and the Nile, at Wiesbaden, and another, with a representation of the Egyptian saint St. Menas, in the British museum, are strong candidates. To these should be added a panel with mythological

scenes showing the Dioscuri and Pasiphae and the Bull at Trieste, a panel with a Dionysiac procession (formerly at Bourges, now in the Cabinet des Médailles, Paris), two panels with a rout of maenads, satyrs and warriors on a book cover at St. Gall and a leaf of a five-part diptych with scenes from the Old and the New Testament now at Ravenna; all reflect Coptic style, with their reduced, fleshy, slightly disjointed forms, the boneless, rubbery consistency of the bodies, and the spongelike treatment of the hair familiar on many textiles from Egyptian burial grounds.

2. Byzantine.—No Byzantine ivory of the 7th–9th centuries appears to have survived. The Iconoclastic controversy (726–843; *q.v.*) is presumed responsible for this lack of material but the deficiency is none the less strange since the Iconoclast emperors raised no objection to the representations of imperial triumphs, to scenes of the chase and the circus and to mythological fables. The void is almost constant in other media: apart from one manuscript (a copy of Ptolemy's astronomical writings), a few textiles, some coins and some Iconoclast changes in the mosaic decoration in the churches of St. Irene and Hagia Sophia at Constantinople, nothing has survived. Yet in the 10th century the ivory carvers working in the Great Palace at Constantinople produced some of the finest achievements of Byzantine art.

The sequence begins with a fragment of an ivory sceptre with an inscription referring to the emperor Leo VI (886–912), now in Berlin; next comes a group of the highest quality all bearing inscriptions referring to the Emperor Constantine VII Porphyrogenitus (913–959): a triptych carved with a *deësis* (Christ with the Virgin Mary and St. John the Baptist, one on either side) and saints in the Palazzo Venezia, Rome; three panels carved with saints in colloquy "to preserve Constantine from harm" at Venice, Dresden and Vienna; and the Epiphany of Constantine VII as emperor autocrator, about 945, in the Museum of Fine Arts, Moscow. The Epiphany of the Emperor Romanos II (959–63) as a boy with his child-wife Eudokia, in the Cabinet des Médailles, Paris, dates between 945 and 949. To the same time a number of carvings in ivory without specifically imperial inscriptions but obviously produced under imperial patronage may be assigned, chief of which are the Harbaville triptych in the Louvre and a triptych in the Vatican. The style of these reliefs may be described as strongly classicizing, grave, monumental, frozen. The last dated ivory carving with an imperial inscription in the 10th century is the Reliquary of the True Cross now in the Church of San Francesco at Cortona; the inscription refers to the emperor Nicephorus Phocas (963–969).

In the late 10th and early 11th century may be isolated a small group of ivory carvings presenting a more fluid, narrative and, in certain cases, harsher style. The relief of the Dormition on the late 10th-century book cover of the so-called Evangeliary of the Holy Roman emperor, Otto III (983–1002), given to the cathedral of Bamberg by Henry II (1002–24), and a relief carved with the entry into Jerusalem, now in the Ehemals Staatliche Museen, Berlin, seem to reflect a more "popular," "pictorial" approach. At the same time, it must be remembered that this style is related to that of the Veroli casket in the Victoria and Albert museum, a document of primary importance for illustrating the purity of the classical tradition at Constantinople, and which, since a scene is copied from the Joshua roll executed in the imperial scriptorium about the middle of the 10th century, may well be palatine work.

The ivory statuette of the Virgin and Child (Theotokos Hodegetria) in the Victoria and Albert museum is unique, and the fact that the figure is carved completely in the round has led some scholars to suggest a western, perhaps Venetian, workshop. The head of the Child is certainly a western restoration, but there seems no reason to doubt the Byzantine provenance. The statuette clearly descends from a series of 10th-century reliefs, all central parts of a triptych, such as that in the Archepiscopal museum, Utrecht, at Liège, in the Metropolitan museum, New York, and at Hamburg. The elongation of form and the more fluid treatment of the drapery suggest, however, a later date toward the end of the 11th century or into the 12th century. To the same period should be assigned a magnificent pierced relief of St. John the Baptist and four saints, also in the Victoria and Albert museum.

Scholars have been reluctant to assign or date any ivory carvings to Constantinople after the sack by the fourth crusade in 1204, but it has been suggested that two reliefs with representations of the Forty Martyrs, in Berlin and Leningrad, may conceivably date from the early 14th century, because of the more emotional penetration into the subject, the increased diversity of attitudes and the simulation of flowers and grass in the foreground, all akin to the miniature mosaics of the same period and to the work in St. Saviour in Chora. Finally a small ivory pyx carved with imperial portraits, now in the Dumbarton Oaks collection, may be dated to the years 1348–52.

3. Islamic.—Carvings in ivory were used extensively in the Near East to decorate furniture, tables, doors and minbars (pulpits). The decoration consists of geometric and vegetable arabesque, sometimes inhabited by birds and animals; most of the panels date from the 13th and 14th centuries.

Spain.—An important group of ivory caskets has survived from Hispano-Arabic workshops of the 10th and 11th centuries. Two of the earliest known were made for a daughter of the first western caliph, Abd-al-Rahman III (912–961), probably in the palace-town of Madinat az-Zahra, near Córdoba. The first at Burgos, Spain, is a cylindrical box opening up like a diptych to reveal two sets of five concave compartments, possibly for cosmetics, appearing from the inscription to date about 961; the second, a small rectangular box, in the Victoria and Albert museum, from the tone of its inscription suggests that it was made after the death of the caliph. Apart from the inscriptions, the ornament consists of wiry, deeply cut, vegetable arabesque carved with severe elegance. A circular casket (formerly at Zamora, now in the Museo Arqueológico Naçional, Madrid) carved with a rather more lush arabesque and with the addition of peacocks and antelopes was commissioned by the caliph al-Hakam in the year 964 for the Princess Subh. Two other caskets were made for the same princess, "the most loved mother of a son," at Madinat az-Zahra in 966; the inscription on the casket in the parish church of Fitero adds that it was made in the workshop of Khalaf. This workshop signed another casket, now belonging to the Hispanic Society of America, New York, and in this case the inscription states the purpose of the casket: "The sight I offer is the fairest, the firm breast of a delicate girl. Beauty has invested me with splendid raiment, which makes a display of jewels. I am a receptacle for musk, camphor and ambergris." A small circular casket in the Victoria and Albert museum was made for the caliph al-Hakam (961–76); one of the most elaborate, in the Louvre, with scenes of hunting, music making, drinking and lions mauling an ox, was made for al-Hakam's younger brother, al-Mughira, in 968; and another, also in the Victoria and Albert museum, with scenes representing a person of rank administering justice, hawking and traveling in state, was made in 969–970 for Ziyad ibn Aflah, prefect of police at Córdoba.

In 981 the dictator Al-Mansur was installed in his own palace, Madinat al-Zahira, near Córdoba. In this palace, probably, was executed a richly decorated casket for the second son of al-Mansur, Abd al-Malik, in 1004–05. The style of the casket, now in the cathedral treasury at Pamplona, is bolder and coarser than those made in Madinat az-Zahra, but the scenes represent the usual themes of feasting, hunting and consorts of musicians. Between 1004 and 1007 a second casket, now at Braga, was made for Abd al-Malik: a cylindrical box with a domed lid, decorated with horseshoe arcades enclosing palm trees with pairs of men and birds on either side—scenes which were to be echoed in Christian manuscripts.

About the middle of the 11th century a group of craftsmen at Cuenca are known to have worked for the Muslim kings of Toledo. The ornament of the caskets made there lack the complexities of those made for the Omayyad house at Córdoba; there is much mechanical repetition, a marked simplification of the vegetable arabesque and a general flattening of forms. Although the floriated Kufic inscriptions are stylish, the work done at Cuenca shows marked provinciality.

In Sicily throughout the 11th and 12th centuries a number of works in ivory were produced: caskets, oliphants and decorative

panels. A great many painted and gilded caskets have survived, on some of which Christian and Islamic subjects are intermingled.

4. Carolingian.—The key to the Carolingian *renovatio* lies in the wholehearted acceptance of the Mediterranean heritage by a northern ruler. The reign of Charlemagne (*q.v.*; 768–814) was one of the most formative periods of European civilization. The Frankish king saw clearly enough that the Church should serve as a pattern for the rest of Christendom; the advancement of learning, therefore, joined hands with religious reform. The central institution for education was the royal school, which moved about with the court, but toward the end of the reign the seat of government became static at Aachen where the court workshops were almost certainly situated. The intention was to recreate a past Christian civilization, that of 4th- and 5th-century Rome, but in spite of the careful study of late antique, Byzantine and Italian models, this civilization was transformed by the northern imagination.

Probably some of the earliest ivory carvings in the court styles are the panels with representations of David and St. Jerome, now in the Louvre, which once formed the cover to the psalter written by Dagulf and presented by Charlemagne to Pope Hadrian I (772–795). Not far removed in date from these panels is an ivory book cover in the Bodleian library, Oxford, carved with Christ treading the beasts and scenes from the life of Christ copied from a late antique model. The Lorsch book cover, divided between the Vatican and the Victoria and Albert museum, bears another representation of Christ treading the beasts, the Virgin and Child between Zacharias and St. John the Baptist, and scenes from the Nativity, and seems to echo a five-part sacred diptych executed at Constantinople in the 6th century. The style of these carvings is by no means identical but the group exemplifies an aspect of a court art studiously following the hallowed works of late antiquity and yet unable to resist the northern temptation to make a flat decorative pattern: the treatment of the drapery on the Oxford and Lorsch book covers is particularly instructive.

When Ebbo, a royal serf, who had been for a time director of the imperial library at Aachen, became Archbishop of Reims in 816, the extension of the court style became visible in the workshops under his supervision. The dedicatory verses in the Gospels now at Epernay state that the book was executed under the direction of Peter, abbot of Hautvillers, near Reims, on an order coming from Ebbo. Moreover, the close correspondence of the Utrecht psalter to the Ebbo gospels suggests that this, too, was commissioned by the archbishop. Metalwork and ivory carvings from the same school present a vivacity and an imagination eager to communicate both externally between artist and spectator and internally between the figures represented. The effect is more lively, more expressive, more extended in an illusion of space and would seem to be linked with a late antique Roman pictorial tradition. This style developed throughout the Carolingian period; the ivory carvings in particular are usually known as the "Liuthard group" after Liuthard who wrote a psalter (now in Munich) between 842 and 869 for Charles the Bald.

Another aspect of the court style was developed at Metz under Archbishop Drogo (826–855), an illegitimate son of Charlemagne, chaplain to Lothair I and papal legate. It is possible that it was to enhance his prestige as legate that the famous sacramentary was commissioned. On the basis of this manuscript and others of the school a group of ivory carvings has been assembled and divided into two parts: the early Metz group, dating from the middle of the 9th century, of which one of the most beautiful is a book cover with scenes from the life of Christ, formerly at Metz, now in Paris; and the later Metz group, dating from the late 9th or early 10th century. The style of the carvings is lively and classicizing but with broader, heavier forms than those of the Reims school, lower relief and a more confined illusion of space.

Ivory carvings may be assigned to various Carolingian schools; a flabellum (fan) in the Bargello, Florence, was probably made at the abbey of St. Martin of Tours; a casket at Quedlinburg and related pieces have been assigned to Fulda; toward the end of the 9th century some remarkable book covers were made by the monk Tuotilo at St. Gall.

5. Ottonian.—The Holy Roman Empire was created by Otto I (936–973): a union of the German and Italian states and a protectorate of the papacy. The Empire lacked the universality of that of Charlemagne; not only were France and Spain outside its frontiers but, within, the spirit of nationality was beginning to emerge and the time was not far off when the great merchant cities were to weaken the ties of the imperial command. Similarly Ottonian art was narrower than that of Carolingian times; it was less open to the lessons of late antiquity and its sources were less varied. There was renewed emphasis on public worship; works of art tended to be commissioned with the solemn liturgy of the Church in mind.

Two superb situlae (holy-water buckets) appear to have been made in Milan for the visit, in 980, of Otto II, his empress, the Byzantine princess Theophano and the young Otto III. The first, carved with the figures of the Virgin and Child and the four evangelists, now in the treasury of Milan cathedral, bears an inscription stating that it was commissioned by Archbishop Gotfredus (975–980) who, in fact, died before the arrival of the emperor. The second, in the Victoria and Albert museum, with scenes from the Passion and Resurrection of Christ, is based largely on a Carolingian ivory diptych now in the treasury of Milan cathedral. The inscriptions are quotations from the *Carmen Paschale* written by the 5th-century poet Sedulius and a prayer for the emperor Otto. An ivory panel in the Castello Sforzesco, Milan, with the imperial family kneeling before Christ, the Virgin and St. Maurice, inscribed "Otto Imperator," would seem to have been made about the same time. A series of panels, known as the Magdeburg antependium but now divided among various collections, carved with scenes from the life of Christ, may well be Milanese since the style is not far removed from that of the ciborium in Sant' Ambrogio at Milan.

A third situla in the treasury at Aachen is much heavier and more monumental in style than the Milanese buckets and would seem to be related to a number of panels carved with Moses receiving the Law, Christ and St. Thomas, the Crucifixion, St. Paul, and a Christ in Majesty, all assigned to Trier or Echternach toward the end of the 10th century.

In the course of the 11th century a number of centres in the empire were producing ivory carvings: Mainz, Minden, Cologne, Liège, and a Franconian school based on either Würzburg or Bamberg executed several reliefs under strong Byzantine influence. Generally speaking, however, the monastic schools copied Carolingian works of art, but the figures lengthen, become more monumental, more solid, and are either isolated in space or are composed into simplified groups of vertical rhythms.

6. Anglo-Saxon.—The Anglo-Saxons who had given so much to the Carolingian *renovatio* were to be equally indebted to it. After the monastic reforms of the 10th century, the Anglo-Saxon workshops produced a distinctive style of drawing and sculpture derived partly from Aachen, Reims and Metz. The chief centres were probably Canterbury and Winchester. An ivory panel of the Nativity at Liverpool may be compared with a similar scene in the Benedictional of St. Aethelwold; an ivory Christ on a gold and enamel cross in the Victoria and Albert museum echoes the Winchester style; two panels in the same museum, on the other hand, with representations of the Transfiguration and the Ascension, seem to reflect work done at Canterbury in the late 10th and 11th centuries.

7. Romanesque.—Scholars are coming to realize that this term when applied generally to the art of the late 11th and 12th centuries is unsatisfactory; and it is certainly of little use in connection with ivory carvings. In this period several important areas practised a variety of styles.

Germany.—The output of Cologne was considerable but the school did not distinguish itself by its imagination; the subject matter is apt to be restricted and repetitive, and although the products have a monumental authority, the quality is far from constant. The best work of Cologne is perhaps represented by a series of panels, probably originally an antependium (covering for the front of the altar) but now divided between the Victoria and Albert museum and the Metropolitan museum, New York,

carved with scenes from the life of Christ in a rather ponderous rescript of a Carolingian model. Two large reliquaries in the form of a domed church, one originally part of the Welf treasure at Brunswick, the other in the Victoria and Albert museum, are imposing because of their size and, considering the mixture of ivory carving, enamels, copper and bronze gilt, their showiness. Reliquary caskets at Berlin, Darmstadt, Fritzlar and Regensburg, carved in the first half of the 13th century, witness the end of the tradition.

The Mosan schools tended to produce work of higher quality than the Cologne schools. Under strong Byzantine influence, forms and drapery are light and elegant, revealed by a beautiful series of panels, executed about 1100, now in Berlin, Florence and London, with scenes of the Annunciation, the Crucifixion and the Holy Women at the Sepulchre.

England.—Some of the finest carvings in ivory during the 12th century seem to have been done in England. The much debated whalebone relief of the Adoration of the Magi in the Victoria and Albert museum has been assigned to northern France, the Belgian province, and to Spain, but in view of similarities with work done at St. Albans, an English provenance seems most likely. The relief is one of the finest examples of high medieval art. The old Carolingian tradition still continued in English art of the 12th century; an ivory relief of the Ascension, also in the Victoria and Albert museum, is closely related to the British museum's Harley Ms. 603 (a copy of the Utrecht psalter made at Canterbury in the course of the 11th and 12th centuries); a tau cross is carved in late Winchester style with busts of Christ and the Virgin and Child in the medallion and in the volutes at either side a serpent with a man in his jaws, but the lush acanthus foliage harks back to the school of Metz. One of the most original creations of the English schools is a superb head of a pastoral staff carved with the Nativity and the Annunciation to the Shepherds on one side, and on the other, scenes from the life of St. Nicholas, in the Victoria and Albert museum. On a lower level a series of draftsmen may be connected with the school of St. Albans, and some unusual chess pieces, found on the island of Lewis, Scotland (now in the British museum), would seem to be English rather than Scandinavian in origin.

Spain.—Christian carvings in ivory in Spain possess marked individuality of character. The 11th-century figure style is immediately recognizable: the faces with heavy noses, protruding eyes, thick lips and oval contours; the drapery treated in broad flat planes with wide spaces between the folds; the uneasy relation of the figures to an architectural background, which not infrequently consists of Islamic elements. These characteristics may be studied in panels either on or from reliquary caskets in the Colegiata de San Isidoro, León (about 1059), at San Millan de la Cogolla (about 1070) and in the Museo Arqueológico, Madrid, the latter by Master Engelart whose portrait with that of his son Rudolfo is carved in ivory on a panel now in the Hermitage. Attention should be drawn to the magnificent ivory crucifixes at Madrid (about 1063), in the Camara Santa, Oviedo (second half of the 12th century), the Christ in ivory at León (about 1100), to some paxes (small tablets depicting a sacred subject; kissed by the priest at mass) in gold and ivory at León and New York, and to an ivory and gold reliquary in a more delicate style in the Camara Santa, Oviedo (1162–75).

Italy.—Italian ivory carvings present a variety of styles, all more or less under strong Byzantine influence. A group of ivory carvings in the Victoria and Albert museum, including a panel of the Last Judgment usually called Byzantine, has been assigned to a Venetian workshop in the 12th and early 13th century. The so-called Grado panels, divided between various collections and frequently attributed to a 6th-century workshop at Alexandria, are almost certainly south Italian and date from the 11th or 12th century. Some of the architectural elements on these panels are close in style to a large antependium in the cathedral at Salerno with scenes from the Old and the New Testaments and dating from the same time; other details in both Grado and Salerno sequences suggest a workshop permeated by Islamic and middle-Byzantine influences.

8. Gothic.—*France.*—In the course of the 11th and 12th centuries intellectual and artistic forces had gradually shifted from the monasteries to the cathedral schools and the universities. By the middle of the 12th century the Ile-de-France was one of the main centres of intellectual and artistic activity and from this time the School of Paris begins to dominate. The bulk of the creative force was directed toward building the new cathedrals, decorating them with monumental sculpture and stained glass, and erecting large shrines within. From this time ivory carving ceased to be a major art or an important adjunct to imperial or religious liturgies. The workshops began to serve private needs and the flood of diptychs and triptychs carved with scenes from the life of the Virgin and from the Passion of Christ are clearly intended for a wide market. At the same time, it seems reasonable to suppose that in the 14th century, with the extension of the Gothic style throughout a large part of Europe, Paris was not the only centre to produce carvings in ivory.

There seems little doubt, however, that the finest came from Paris. Statuette groups of the Deposition, the Coronation of the Virgin (both in the Louvre), seated or standing figures of the Virgin and Child, reliefs of the Holy Women at the Sepulchre, a series of Passion diptychs headed by the Soissons diptych in the Victoria and Albert museum, all bear witness by their consummate elegance of style and craftsmanship to the authority of the Parisian workshops in the late 13th and 14th centuries.

England.—A series of reliefs may be assigned with some assurance to English workshops. The style tends to be more monumental and less elegant than that of the French products and varies greatly in quality. At the head of the sequence stand a noble diptych of Christ blessing and the Virgin and Child, dating from the early 14th century, in the Victoria and Albert museum, and the Grandisson triptych (1327–58), in the British museum, to which a diptych divided between the latter museum and the Louvre may be closely related. Among the less distinguished is a rustic triptych divided between the Victoria and Albert museum and the Wernher collection, Luton Hoo, Bedfordshire, dating to about 1300, in which iconographical eccentricities are carved with provincial ineptitude.

Germany.—Attempts have been made to assign a number of Gothic ivory carvings to German workshops based on provincial execution, iconographical details and elements of style. It is possible that the Master of the Casket of St. Ursula of Cologne was, in fact, active in Cologne, and it is difficult to believe that the master of the diptych in the abbey treasury at Kremsmünster could be anything but German. A number of ivory writing tablets, carved in coarse style and decorated with paintings and prayers in German—there is one of particular interest in the Bayerisches Nationalmuseum, Munich—would seem to be south German work. These points of reference carry with them sequences of reliefs previously regarded as French, and the corpus of French Gothic ivories assembled by R. Koechlin in *Les Ivoires Gothiques français* (1924) should now be treated with some reserve.

Italy.—Carvings in the Gothic style were also done in Italy. Although the beautiful ivory statuette of the Virgin and Child by Giovanni Pisano (*c.* 1249–*c.* 1314) in the cathedral at Pisa is so individual in style that some scholars have been led to deny any widespread Italian work in this material, the fact remains that ivory carvers appear to have been active in Venice, Milan—where a number of pierced reliefs of high quality were probably made—and, possibly, Naples in the late 14th and early 15th century. The School of the Embriachi, active in north Italy in the early 15th century, produced a number of altarpieces, antependia, combs and caskets with religious and mythological subjects in a debased Gothic style. Caskets for secular use, combs, mirror cases, writing tablets, cups, dagger handles and chessmen were also issued by a number of workshops. The subjects depicted are scenes of courtly love, extracts from romances such as the story of Tristram and Iseult, or allegories of the "storming of the castle of love."

C. From the Renaissance to Modern Times

Ivory was rarely used during the Renaissance except for inlay and domestic articles. Most of the small statuettes in ivory at-

tributed in the past to Italian artists are probably Spanish. The small diptych in bone, mounted on horn, in a frame of silver parcel gilt, with a representation of the Annunciation, in the Victoria and Albert museum, is probably unique since it may be assigned with some confidence to a Florentine workshop in the last quarter of the 15th century.

In the second half of the 15th and in the first half of the 16th century a number of ivory carvings were executed in Germany, Flanders and France, but these are for the most part domestic articles—combs, knife handles and the like. Attention, however, should be drawn to a series of chaplets, pendants and small statuettes (*memento mori*), carved chiefly in Germany, wherein beauty and subtlety of execution override the macabre.

In the 17th century in Germany and Flanders there was a revival of interest in ivory carving. Large cabinets enriched with carved plaques and statuettes were made to contain coins and *bibelots*. Candelabra sprouting from satyrs' masks, princely portraits set in ornate frames, crucifixes, small altars for private devotion, more *memento mori* figures, large tankards mounted in silver, proliferate. Although the majority of these artifacts may be only generally attributed, a number of artists with marked individual talent arise. Christoph Angermair (active 1606–32/33) produced reliefs of mythological scenes with remarkable delicacy of craft. Georg Petel (1590–1633) and his school carved statuettes which have a stout, monumental quality for all their smallness of size. Mathias Rauchmüller (1645–86), Johann Michael Maucher (active in the second half of the 17th century), Leonhard Kern (1585–1662), Christoph Daniel Schenk (active at Constanz; d. 1691), Ignaz Elhafen (active in the late 17th and early 18th century), Magnus Borg (born in Norway but active in Denmark in the early 18th century) and Antonio Leoni (born in Venice but working in Düsseldorf about the same time) all did work of distinctive quality, chiefly mythological and pastoral scenes with an occasional busy Rape of the Sabines. Netherlandish artists copied Bacchanalian scenes after François Duquesnoy (1594–1642) which in comparison with the work of some of the German masters appear tepid. The Fleming Gerhard van Opstal (1595–1668) on the other hand was capable of producing a series of reliefs, now divided among a number of collections, on which a Bacchanal of Children is presented with great verve and sensitivity. The Austrian Jakob Auer (active in the late 17th and early 18th century) produced highly intricate religious confections which are more interesting for their virtuosity than their appearance. Johann Christoph Ludwig von Lucke (1705–80) excelled in portraying laughing and crying babies. Probably the most refined of all these artists were Balthasar Permoser (1651–1732), who also worked in porcelain and decorated the Zwinger museum at Dresden, and Peter Hencke (d. 1777), who carved crucifixes and statuettes of St. John of Nepomuk with considerable delicacy of feeling.

There was a large production of devotional ivory carvings in Spain and Portugal in the course of the 17th and 18th centuries. Much of this is coarse, stereotyped work but occasionally something approaching a work of art emerges, notably among the School of Valencia about 1700. Provincial work of little artistic merit was done in Latin America. A veritable clash of cultures at Goa, Macao and in Japan was produced by the Spanish and Portuguese missionaries to the far east. The Indo-Portuguese ivory carvings were turned out in some numbers from Goa, the principal subjects being Christ as the Good Shepherd and the Virgin of the Immaculate Conception. Occasionally a Chinese artist working for a Spanish or Portuguese patron produced a Virgin and Child in almost direct descent from a Kuanyin (representation of a popular Buddhist goddess).

Toward the end of the 17th century portraits carved in ivory became fashionable. The reliefs were executed by Netherlandish, German and French artists of which Jean Cavalier (active 1680–1707), who worked in various parts of Europe, and David le Marchand (1674–1726), based on London, are particularly noteworthy. Le Marchand carved a series of allegorical groups; but his bust of Anne Churchill, Countess of Sutherland, and his relief of Matthew Raper, scholar and mathematician (signed and dated 1720), both in the Victoria and Albert museum, have considerable charm. Workshops in Paris and Dieppe produced quantities of snuff rasps and boxes, fan handles, bottles for scent, shuttles, and lace bobbins, many of these decorated in the fashion of the time but hardly rising to any aesthetic eminence.

In the 19th century a series of caskets, clock cases and batons, many with precise dates, royal arms and the names of kings, ranging from Louis XIV to Charles IX, were executed in France and should perhaps be regarded as historical souvenirs rather than plain forgeries. Similarly, the flood of mid-19th-century statuettes which represent such historical figures as Marie de'Medici, Cardinal Richelieu, Elizabeth I of England, and which open up to reveal historical scenes in the interior, for instance the Siege of La Rochelle, the marriage of Henry IV and Marguerite de Valois, and diptychs and isolated panels with portraits of the Valois kings were not carved to deceive at the time that they were made. But with the establishment of the great international museums, the renewed interest in medieval, chiefly Gothic, art and the extension of antiquarian interests among collectors, workshops in France, Spain and Germany were not slow to satisfy the demand for medieval ivory carvings of all kinds. Hispano-Arabic caskets were copied with great skill in the late 19th or early 20th century by D. Francisco Pallas y Puig (1859–1926) at Valencia. The copies were sold at an ordinary commercial price as frank imitations but, after passing through several hands, the imitation is apt to pass as the original. By the middle of the 20th century it has become clear to the experienced museum official that hardly any period in the history of art has failed to attract the interest of the forger.

Islam.—After the Ottoman conquest of the eastern empire, which culminated in the capture of Constantinople in 1453, the Turks were supreme in the eastern Mediterranean, a supremacy which was defined still further by the conquest of Egypt in 1517. At first ivory carving executed in the near east continued to follow the old Mameluk styles but gradually a specifically Turkish style emerged which may be seen in numerous mirror backs, cups, fan handles and pen cases. The ornament consists, as a rule, of an intricate arabesque of foliage and flowers and the use of a cursive script. (J. G. Bh.)

II. THE ORIENT

A. China

1. Early Chinese.—Ivory carving is one of China's oldest arts. Examples of skillfully carved ivory, together with the earliest of the fine bronzes for which China is famous, have been found in the tombs of the Shang kings at An-yang (north Honan). These Shang dynasty carvings are so handsomely designed and well executed that they suggest a previous long development, probably going back into prehistoric times.

In Shang times elephants still roamed the forests of the Yellow river region, so that the supply of ivory was close at hand, as is known from linguistic, historical and archaeological evidence. Most of the Shang ivories that have been recovered consist of small plaques, ornamental hairpins or scraps of inlay from the furnishings of the tombs, but the *Book of Songs*, which contains some ancient Chinese odes, also speaks of ivory bow tips, and the last king of the Shang is said to have invented ivory chopsticks as one of his acts of refined extravagance. Even at that early date, ivory seems to have been valued on a par with gold and jade.

Only a few rather doubtful pieces of ivory carving have survived from the succeeding Chou dynasty (*c.* 1122–256 B.C.), although the substance continued in high favour. Ivory was especially noted as a product of the Yangtze river delta area and of the state of Ch'u, which ruled in the middle Yangtze districts and to the south of that river. By that time the elephant had doubtless been driven south, so the people of Ch'u more or less controlled the supply of ivory. The Chou sovereigns are said to have had chariots of rare substances, one of which was of ivory, and Meng Ch'ang-chun (d. 279 B.C.), an official of the state of Ch'i, is said to have had an ivory bed among the ornate furnishings of his household.

At the Chou court it became fashionable for princes and high officials to carry narrow memorandum tablets of ivory and other

substances. Called *hu*, these were generally worn as girdle pendants. In the Han dynasty (202 B.C.–A.D. 221) the ivory ones came to be considered as marks of rank, required for formal dress and reserved for feudal princes and the highest officials; lower officials were restricted to wooden ones. Later, during the T'ang dynasty (A.D. 618–906) and the Sung (960–1279), these tablets were greatly elongated, and were carried by court officials as a kind of sceptre as well as a writing surface for memoranda. These later *hu* tablets were more than a foot long, tapering to conform to the natural narrowing of the tusk toward the tip, and slightly curved to follow the natural arching of the tusk. The tablets continued to be carried as a mark of court rank until the fall of the Ming dynasty in the 17th century.

A few ivory figurines have survived from the T'ang dynasty, showing the existence of a highly developed art of figure sculpture in ivory. But the T'ang ivory work is best known from the examples that were sent to Japan for the dedication of the Great Buddha at Nara in 752, and are still preserved there in the Shosoin storehouse. These represent another tradition of decoration. Instead of deep undercutting such as is usually found in the figures of the time, the work is mostly on flat pieces which were painted or stained a dark colour and then carved to form intricate patterns of birds and animals or geometrical figures, the carvings being stained with other colours or left plain. Among the objects treated in this way are several foot rules in bright blue and red, an ivory plectrum for a stringed instrument in vivid red, numerous red and blue game pieces, a few ivory knife hilts and several scabbards.

Several finely carved ivory figures in occidental collections have been ascribed to the Sung dynasty on stylistic grounds. These, like the T'ang figurines, show traces of colouring, as even the stone sculptures were painted in those days. The colouring matter is not solid and opaque as it was on the earlier flat ivories, preserved in the Shosoin, but was applied in the form of a stain which sank into the natural grain of the ivory to enhance its effect. By Sung times, the elephant had been driven far into the wilderness areas of the southwest (modern Yunnan), which then belonged to another nation, the kingdom of Nanchao. Accordingly, new sources of ivory were sought overseas, and it was apparently at this time that the first African elephant tusks were brought from Zanzibar to China by Arab traders. Kublai Khan, whose Mongol armies finally overthrew the Sung Chinese and the kingdom of Nanchao, had a vast stable of elephants, some taken from the Burmese as spoils of war and others presented to him in tribute, and allusions by Marco Polo and other European travelers of that time indicate that much ivory must have been used at his luxurious court.

When the Mongol dynasty was in turn overthrown by the Ming Chinese in 1368, the new nationalistic-minded native dynasty proceeded to revive the arts, and in ivory carving, as in porcelain making, there was a renaissance of fine craftsmanship. The Ming ivory carvings that have survived are mostly in the form of handsomely carved figures, not stained or painted but with the natural colouring of the ivory slightly mellowed by time. Many imitations have since been made, and the antique tone has been imparted artificially by soaking in infusions of tobacco or tea leaves, but the imitations cannot compare with the originals in graceful lines or sureness of carving.

2. Peking Work.—The tradition of fine Ming carving seems to have carried over into the first half of the Ch'ing dynasty, after the Manchus came down into China in 1644. The second Manchu emperor, K'ang-Hsi, was a generous patron of Chinese arts and industries, and in 1680 he established 27 imperial workshops in the capital at Peking, one being devoted to producing fine carvings in ivory. These workshops were later abandoned during the Ch'ien-Lung reign (1736–96) but this did not mean the end of the work. The Ch'ien-Lung period is still noted for its exquisite tinted ivory figures. The art of colouring the ivory was revived at that time, and both stains and lacquers were used to enhance the delicately carved figures, which many connoisseurs have considered the finest productions of the Chinese carvers' art. At this time, the T'ang style of carving through a surface layer of opaque lacquer was also revived, particularly for table screens, brush holders and other appurtenances of the scholar's desk.

Peking continued to be a centre for the finest Chinese ivory carvings until after the fall of the Ch'ing dynasty in 1912. In subsequent years the output declined, resulting from the lack of imperial patronage. From that time on, the industry was devoted chiefly to supplying foreign residents and tourists. Because these buyers were not discriminating, the quality, which had been declining after the mid-19th century, deteriorated at an accelerating pace. Modern Peking ivory work has been especially noted for minute engravings of poems, scenes, etc., on flat ivory, but these productions, accomplished with the aid of a magnifying glass, would rank as tours de force, not as works of art.

The chief products of the Peking workshops traditionally were figures, singly or in groups, and other ornamental carvings; cylindrical brush boxes (*pi t'ung*), table screens, armrests carved in flat relief on the convex upper surface and in high relief on the concave side below, and other desk fittings; *ju-i* sceptres, snuff bottles, snuff dishes and accessories for opium smoking; stands for fine porcelains; and perfume boxes, mirror cases and all manner of other things for the court ladies.

3. Canton Work.—The second great centre of ivory carving in China during the past 300 years has been Canton, which, with nearby Macao, was a centre of occidental trade with China until other ports were forcibly opened by foreign pressure in 1842. Even after that, Canton continued to enjoy an extensive trade with the west. Sailors from Portugal, Spain and the Netherlands, and later from England, France and the United States (after 1790), greatly prized the carvings in ivory which they found in Canton, and an extensive industry in carvings for foreign taste arose to meet their ever-increasing demands. In addition to card cases, cane heads, lacelike fans and other objects of ornamental utility for the European market, the Cantonese developed the art of making balls within balls, sometimes containing as many as ten concentric spheres, to satisfy the westerners' desires for novelties to amuse or amaze their families at home.

Since these things were being made for a foreign market, the Cantonese craftsmen did not take care to avoid sharp edges, as they would have if they had been working for Chinese patrons. In the orient, tactile values are especially appreciated, and the connoisseurs among the nobles and scholar gentry admired the feel of ivory, stroking it to enjoy its smooth surfaces; hence the figures and ornaments made for them had large expanses of polished areas, with a minimum of sharp angles or edges. In short, the Cantonese work which westerners considered so typical of China was not characteristically Chinese at all. In addition to its great intricacy and emphasis on small details, the Cantonese work was further distinguished from the Peking products by absence of colour because the Canton ivories were never tinted.

4. Other Centres.—In addition to Canton and Peking, there were other, less prominent centres of ivory carving, which developed after the opening of the treaty ports in the second half of the 19th century. Of these, Foochow became famous for its artistic productions, especially in the form of architectural models of houses, pagodas and temples. The Foochow work declined around the turn of the century but revived briefly in the 1930s. After Shanghai rose from a fishing village to a metropolis of world trade, it too became noted for its extensive ivory industry, which manufactured such utilitarian objects as chopsticks, mah-jongg sets, combs and seals on a mass-production basis. Wenchow was briefly noted for its genre groups illustrating peasant occupations, which were popular with foreign travelers. The old city of Ningpo was long famed for its fine ivory inlay work in redwood furniture, but the decline of Ningpo as a port after the rise of Shanghai, and changes in taste following western influences, caused this to decline by the 1920s. At the beginning of the Chino-Japanese War in 1937, many of the ivory carvers from Canton's famous Tai Sun street fled to the British colony of Hong Kong and set up new shops there. Other Cantonese ivory workers later followed them to escape the communists. Thus, Hong Kong, which previously had been merely a sales centre for Cantonese work, developed a full-fledged ivory carving industry of its own, in the traditional Cantonese style.

5. Artists.—Northern Chinese ivory carvings are sometimes

dated (usually falsely, to give them a spurious antiquity), but are rarely signed. When the artists did sign them, they usually used only a given name. However, a few names of artists whom the Chinese connoisseurs considered great have been preserved in literary records. Thus it is known that Wang Liu-chiu of the Sung dynasty was noted for his skillful carving of religious figures and of covers for Buddhist scriptures (*sutras*).

In the Ming period the greatest artist was said to have been Hsia Pai-yen, who gained his skill by carving olive stones, and Pao T'ien-ch'eng, Chu Hsiao-sung, Wang Pai-hu, Chu Hu-yai, Yuan Yu-chu, Chu Lung-ch'uan and Fang Ku-lin, all of whom carved scent boxes, fan handles and figures of Buddhist saints or Taoist immortals. During the Ch'ing dynasty, Wu Feng-tsu and Tu Shih-yuan attained fame as ivory carvers in the K'ang Hsi reign; while Ch'en Yang-shan, Li Te-Kuang and Chu Hung-chin were noted ivory artists in the Ch'ien Lung reign.

All of these artists were from north China or the Yangtze river delta. In Canton, as a result of the more commercial nature of the work, few individuals stood out. In the second half of the 19th century, two brothers who operated a shop called Ho-a-ching on Honam Island are said to have done the finest and most original work in that region and their products were highly prized by the foreign residents. In the 1950s Liu Chia was hailed as Canton's foremost ivory carver. In the latter cases, intricacy and dexterity, rather than artistic skill, were the bases for judgment.

B. Japan

Since it is generally conceded that the ivory objects in the Shosoin storehouse in Nara, dating from the 8th century A.D., were actually products of T'ang China, it is not possible to claim any great antiquity for ivory carving in Japan. However, although they learned the art rather late, the Japanese ivory carvers of the Tokugawa period (1603–1867) quickly developed an astonishing mastery of this medium and created many miniature works of art which still excite admiration. Kyoto was traditionally the first centre of ivory carving, turning out products for the imperial court, but eventually the lead was taken by Tokyo, which developed into an important mercantile centre as the capital of the Tokugawa shoguns.

The Japanese ivory carving industry apparently developed along two lines. The first was a purely utilitarian one, devoted to producing such objects as the plectrum for plucking the strings of the samisen, and the ends of the rollers for traditional scroll paintings. The other was the more artistic production of a kind of toggle, called a netsuke, which formed an indispensable item of men's costumes in the Tokugawa period. Netsukes were used to fasten the medicine box (inro) and the pipe and tobacco pouches to a man's sash. Since the members of the newly risen middle class, ranking below the samurai, were not allowed to wear jewelry, netsukes took the place of other personal adornment. Originally carved from boxwood, netsukes soon were made in various kinds of ivory.

Among the early carvers of ivory netsuke was Ogasawara Issai. He worked in the late 18th century, using both elephant and whale ivory. Others also used narwhal tusks. In addition to the small netsukes which were seldom more than an inch in diameter, some of these artists also produced larger carvings called *okimono* which depicted the same subjects on a somewhat larger scale and were intended to ornament the alcove (*tokonoma*) in the principal room of a Japanese home. The netsuke makers, in the latter part of the 18th century, devised a method of inlaying, using coral, ivory, pearl shell, horn and precious metals on lacquer and wood. Some of these other substances also were used for inlaying ivory. Even the very small ivory netsuke carvings were sometimes so inlaid. Rarely was the ivory lacquered.

With the end of the Tokugawa regime in 1867, leading to new customs of dress, and the introduction of the cigarette shortly after, netsukes became obsolete, although some were still carved to supply the demand of foreign residents and tourists who found them amusing. The former carvers, like the Cantonese, gradually turned to making things for foreign trade, and eventually they produced jewel boxes, chests, card cases, chessmen, buttons, brooches and other objects to appeal to Victorian tastes. They decorated them by engraving and carving and even by painting designs in gold lacquer, a technique which had been developed for decorating tortoise shell in Nagasaki and Osaka.

There was a parallel trend for the manufacture of figures like the *okimono*, purely ornamental but depicting animals and people with excessive detail and a sense of realism tending toward the macabre or the ridiculous. In most cases these seemed a sad parody of the miniature figures on the netsuke, unworthy of the old tradition. However, an occasional product showed the old taste and artistry.

By about 1900 endless repetition and the use of machine tools for mass production had destroyed the remaining elements of the art. From that time, most Japanese ivory carving seems to have been directed toward the copying of old netsukes, complete with signatures of dead artists, and the forging of Chinese antiquities.

(S. v. R. C.)

C. India

Ivory has always been plentiful in India. It was exported to the Mediterranean area during the period of the Roman empire and to the west and China up to modern times. Though ivory carving is mentioned fairly frequently in early Indian literature, little has survived to illustrate the art during the 4,000 years it has been practised. From the Harappan culture of the 3rd and 2nd millenniums B.C. a few simple game pieces and ornaments have been discovered, a plaque from Mohenjo-Daro carved with a human figure, if of this date, being the only evidence of more ambitious work. The finds of the Early Historic period (500–100 B.C.) are no more rewarding, apart from a small number of primitive figures of the mother goddess from Rupar and Nagda.

The systematic excavation of the several cities at Taxila in Pakistan has yielded several small pieces, but the most important is an ivory comb, now in the National Museum of India, New Delhi, on which the reclining figure of a woman, beautifully placed within the lunate field, is carved with a sure economy of line. The comb may be dated from the 1st century A.D. From the same century is a female figure of great beauty carved in the round which was excavated at Pompeii whither it had been exported before the destruction of that city in A.D. 79. The exact provenance of this piece remains uncertain, but it probably came from north India, perhaps Malwa.

During the first three centuries A.D. trade relations between India and the Roman empire were very close, as is known from archaeological finds in the subcontinent and from the evidence in classical sources. *The Periplus of the Erythraean Sea*, a Greek trading manual which was probably written some time between A.D. 50 and 130, mentions Tagara, which is probably the modern village of Ter, near Osmanabad, as one of the most important of the market towns in the Deccan. Here an important ivory female figure, more austere in style than the Pompeii piece and dating from about A.D. 100, was recently discovered. The Deccan was ruled by the Satavahana dynasty during this period, and, at another of their cities, Kondapur, an attractive 2nd century A.D. fragment of elephant and riders has been excavated. Both pieces were probably local products.

The most important group of early ivories, however, is the rich and generally well-preserved hoard discovered by French archaeologists at Begram, the ancient Kapisa, in Afghanistan. They were found together with many "foreign" objects admirably illustrating the international character of the trade of the period—lacquer from Han China, and glass, bronzes and plaster emblemata from the Roman empire. The ivories, fragments of boxes and furniture, show a mastery of the human figure and a wide range of early Indian floral and animal ornament. They can be dated to the 2nd–3rd centuries A.D. and may have been made locally. Though they share most of their iconography with the contemporary schools of north India (Mathura) and the Deccan (Amaravati), they have nevertheless a distinctive flavour.

Unfortunately nothing has survived to illustrate the art of ivory carving during the classical period of north Indian art in the Gupta period (*c.* 300–600 A.D.). But from northwest India or

Kashmir several fine pieces are known from the 8th–10th centuries A.D. The finest are two Buddhist ivories of the 8th century A.D. in the Prince of Wales museum, Bombay, one a figure of the Bodhisattva Lokesvara, the other a plaque of the Buddha seated in a cave and surrounded by gods and demons. In the latter the tiny supporting figures are carved with a remarkable delicacy and characterization. There is also in the possession of the Committee for the Administration of Cultural Properties, Kansu province, a unique ivory diptych which closed shows the "Transport of the Buddha's Relics" in full three dimensions, and is carved on the two inner faces with minute scenes from the Buddha's life. This, too, probably dates from the 8th century A.D., and was carved in northwest India. A pair of lovers, purchased by Sir Aurel Stein in Khotan Town and now in the British museum, and a Bodhisattva published by Professor G. Tucci complete the group from this region. The former dates from the 8th century A.D., the latter is somewhat later.

Pieces of an ivory box, now in the British museum, were discovered in the 19th century at Brahminabad-Mansura in Sind together with fragments of Chinese and Islamic porcelain and pottery of the 9th–10th centuries A.D. Mansura was the Arab capital of Sind from the 8th to 11th centuries A.D. The ivories, female and animal figures, were probably made in southern Rajasthan or Malwa during the 10th–11th centuries A.D. An important ivory, formerly in the treasure of St. Denis, Paris, and now in the Cabinet des Médailles of the Bibliothèque Nationale, also seems to come from Gujarat or Sind; it is of a kingly personage mounted on an elephant and has often been claimed as the finest chessman ever carved. Though in obvious Indian style it is signed by an Arab craftsman Yusuf al-Bahili(?). There are wide differences of opinion as to its date, but it does not seem to be earlier than the 12th century A.D.

In eastern India a few delicate fragments of Buddhist subjects are known from the Pala period (8th–11th centuries A.D.) in Bihar and Bengal. From Orissa, famous for its ivory from a very early period, have come two magnificent throne legs of the 13th century, one in the Freer gallery, Washington, D.C., the other in the collection of Mrs. John B. Stetson, Jr. Both show an elephant-headed and lion-bodied grotesque gripping the body of a male warrior. They are of a magnificent strength and vitality. There are five other throne legs in Indian collections from Orissa of 15th–16th-century date showing that the early tradition retained its vitality up to the Mogul invasion of the province in the late 16th century.

Very little is known of ivory carving in the Deccan and south India from the 4th to the 17th century A.D. A charming figure of a dancing girl in the Prince of Wales museum, Bombay, may be attributed to the Deccan of the 12th century. A few attractive boxes and other fragments seem to belong to the late Vijayanagar period (16th century A.D.); however, they fall short of the quality of the Sinhalese work of the same period. The ivory carvers of Travancore and the west coast produced a great deal of work during the 17th and 18th centuries especially for the Portuguese settlements. These ivories, commonly called Goanese, are usually of Christian subjects and based on European models. A certain amount of furniture was also made. There is a large group of ivories of 17th- and 18th-century date in the museum of the temple of Srirangam, near Trichinopoly. Many of them represent Europeans and are of good quality. The ivory panels in a famous set of doors in the palace of Mysore are also worth mentioning. They may be dated to the 18th century and depict amorous scenes.

Ivory carving retained a fair standard of craftsmanship well into the 19th century, as can be seen from the numerous small objects, especially chessmen, that have survived. (D. E. B.)

III. NORTH AMERICA

1. Eskimo Ivory Carving.—To the primitive North American Indian unacquainted with metals except the soft copper found in a pure state in certain isolated places, the gleaming ivory teeth of the animals he hunted always possessed a special attraction. The tooth of the beaver made him an efficient knife or graving tool, the tooth of the bear an admirable fish lure. Often he attached rows of teeth to his clothing, partly to show his success in hunting, partly because he found pleasure in their sheen.

There are three animals, the walrus, the narwhal and the elephant, gifted by nature with a larger share of ivory than the rest, and it so happened that in North America two of these animals were available only in the arctic and subarctic regions where the timber that supplies so many of man's needs was either scarce or lacking. The third animal, the elephant, was extinct in every part of America, but its tusks were easily accessible in certain parts of Alaska, although elsewhere rare and usually deeply buried. Consequently it was among the Eskimo tribes inhabiting the arctic and subarctic regions that the art of carving ivory for both utilitarian and aesthetic purposes attained its highest development.

The ivory in commonest use is walrus ivory, which is densest in structure and easiest to secure. Narwhal tusks are twisted and hollow, which renders them unsuited for engraving or carving, although they served the old Eskimos of Hudson bay for harpoon shafts and other implements. Mammoth ivory is almost as dense as walrus ivory, and hollow only toward the base. Fossilization (*i.e.*, darkening through long contact with minerals in the soil) gives a variety of soft, deep colours greatly appreciated by curio collectors; hence traders often immerse white ivory in boiling coffee and other liquids to give its surface a spurious fossilization.

The earliest specimens of Eskimo carving seem to come from the Bering sea region. They are not numerous, and are scattered through several museums, their antiquity unrecognized because they were purchased from unlearned Eskimos and not excavated by trained archaeologists. They may be distinguished by two criteria, deepness of colour (an unsafe guide) and the style of ornamentation; and sometimes a third way, the shapes of the specimens, which often differ from the later Eskimo types. There is carving in the round, apparently—heads of seals and other realistic figures quite similar and perhaps not inferior to anything found in more recent Eskimo remains. But still more abundant are finely etched geometric patterns covering surfaces even of utilitarian objects such as snow goggles and harpoon foreshafts that in later periods seldom carried any ornamentation. The artists of this ancient school, unlike their successors, disliked straight lines, preferring the graceful curves, scrolls and concentric circles that are so characteristic of Maori and Melanesian art. Unlike the Melanesians, however, they did not allow their ornamentation to run riot, but subordinated it in conformity with the shape and purpose of the object so as to produce a natural balance. The freehand drawing on the more carefully worked specimens is admirable; many of the concentric circles with incised dots are so accurate that they seem hardly traceable without compasses.

The period at which this remarkable art flourished is as obscure as its origin. It surely dates back at least 1,000 years, but how much more than this cannot be guessed. (For a discussion of the dating of Eskimo cultures *see* ESKIMO: *Eskimo Archaeology.*)

By about A.D. 1000 Eskimos occupied the whole coast line from Bering sea to Labrador and Greenland. Ivory carving flourished in both the west and the east, but the finest specimens come from the west. Even the most everyday objects, such as needlecases, toggles for the dog harness and harpoon heads, underwent ornamentation or were given a decorative form. There are ornaments made of two unbroken links each carrying a representation of an animal's head, sometimes slightly conventionalized but often quite realistic. Some needlecases with thimble holders attached date from post-European times; they were also carved from one unbroken section of a walrus tusk.

The Eskimo needlecase is a hollow cylinder of bone or ivory that contains a sealskin thong carrying the bone or copper needles. The ivory carvers of ancient days could not remain content with a plain undecorated tube, but for some reason not as yet understood, expanded it into what has been called the winged form, which they engraved with their characteristic geometric designs. Winged needlecases have been found in old ruins from Alaska to the Labrador peninsula, so that the type was established at least 1,000 years ago. In Alaska the artists let their fancy play with the different elements of this conventional form. Sometimes they developed the ends of the needlecase, sometimes the flanges or

wings and the hardly perceptible knobs below them. Since all their sculpture (as opposed to their engraving) tended toward realism, these elements became elaborated into animal forms.

Attached to the sealskin thong that passed through the tube there was always a toggle of some kind to assist in drawing the needles in and out, and it may be that the round, buttonlike toggle, fitting on top of a winged needlecase, suggested the human figure. In any event, many needlecases in human form have been secured from quite early sites. They are always female, for though men were the ivory carvers, women performed all the sewing. In some specimens the head is hollow, in others it is solid and separate from the trunk, serving as the button for the sealskin thong.

Animal heads, usually carved on tools connected with the chase, are nevertheless much commoner than human figures in these old remains. One implement carved in the form of two polar bear heads joined together at the neck is commonly used as a toggle for dragging the carcasses of seals. In such carvings the detail is skillfully executed; the ears are admirably worked and the eyes represented by plugs of dark coloured antler. Possibly the holes marking the nostrils were originally plugged in the same way. The heads would be almost identical if the artist had not fancifully depicted one bear with teeth and one without. Specimens of this type are particularly interesting because of the wide deep groove on the underside, which still reveals the Stone Age method of its formation. The workman first drilled a series of holes, side by side, then broke away the intervening walls.

From a somewhat later period, the early Iron Age, comes the arrow straightener which is regularly surmounted with the heads of what appear to be caribou. Again the artist used plugs of dark ivory to represent the eyes and nostrils, but for the somewhat misplaced ears he contented himself with a conventional design, an engraved dot and circle. This pattern, so widely spread over the globe, makes its appearance fairly frequently in Alaska, even from the earliest times. Skin scrapers and ivory boxes with wooden bases are common objects decorated in this manner.

The Russian explorations of the Chukchi peninsula in the middle and latter half of the 17th century caused a steady stream of iron to flow across Bering strait. The possession of iron tools immediately brought about a striking development in ivory work, particularly in Alaska. Older implements and ornaments appeared in new forms, as skin scrapers, thimble holders, mouthpieces of bow drills and delicate little ear pendants with concentric circles and holes for suspending glass beads. With more efficient tools the artist could give freer rein to his imagination, and for the first time, apparently, he made carvings in the round, or in high relief, arranged to compose a scene. To this post-iron period belongs a remarkable Alaskan bucket handle showing a polar bear seizing a fish. The Labrador peninsula has produced some carved ivory tusks, probably recent, that illustrate the same artistic growth.

Far more striking, however, than either of these developments was the sudden emergence of realistic engravings in Alaska, and the birth, nearly full-grown, of a picture writing. Writers too apt to forget its modernity often compare this picture writing with the scenes painted by Paleolithic man on the walls of French and Spanish caves and the drawings made on rocks by the Bushmen in south Africa. Actually very little realistic engraving seems to occur before the Eskimos had direct or indirect contact with Europeans, and for some time after this contact realistic designs contested the field with the older geometric patterns without gaining the supremacy. In museum collections the oldest pipes (which were first introduced from Siberia about the same time as iron) seem to be carved in relief, and engraved either with geometric designs or with realistic figures of animals arranged without any relation to each other except a purely spatial one. It was not until the 19th century that picture writing became firmly established and succeeded in relegating the older geometric engraving to the background; and even then it failed to gain a foothold in the Eskimo area except in Alaska. From about 1750 picture writing in Alaska overshadowed the older engraving of geometric patterns, but by no means superseded it. Nor did it seriously affect the carving of detached figures, nor of figures in high or low relief.

Among the many articles produced from this time on, the utilitarian form a large and important decorated group. Hunters had for many years employed a scraper with attached claws to simulate the scratching of seals on ice; these, originally without ornament, later attained great delicacy. Even the mesh gauges used in making sealing nets were carved in relief; sometimes with conventionalized representations of seals, at others with hunting scenes. In addition, there regularly would be crude picture writing on the underside. Needles for stitching skin clothing, ornaments for such objects as buckets and pipes, toys and playthings for children, and mythical monsters, feared alike by hunters and homemakers, all were executed with great skill and beauty by the Eskimo artists.

In the 20th century, Eskimo ivory carving in Alaska produced the professional carvers who earned their livelihood by supplying the demands of the curio trade. Undoubtedly these modern artists possess as much ability as their ancestors but they failed to apply their skill to the production of objects that would be acceptable to the civilized world at large.

2. Scrimshaws.—The term scrimshawing is nautical, of unstable orthography and of unknown origin. It may be applied in general to the art of making useful ornamental articles at sea and in particular to engraving fanciful designs on shells, whales' teeth, walrus tusks, etc. These designs were engraved by whale fishermen of American and Anglo-American origin either with a jackknife or a sail needle and etched in black. Among the subjects are whaling scenes, whaling ships, naval action, frigates, brigs, sailors' sweethearts, bouquets of flowers, Masonic emblems, coats of arms and the Irish harp. Some specimens may date from the late 18th century but most were probably done from 1830 to 1850.

See also references under "Ivory Carving" in the Index.

(D. J.; X.)

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IVORY COAST, REPUBLIC OF (RÉPUBLIQUE DE CÔTE D'IVOIRE), formerly a territory of French West Africa and since 1960 an independent state, is bounded west by Liberia and the Republic of Guinea, north by the Mali and Upper Volta republics and east by Ghana. Pop. (1961 est.) 3,343,000, including about 12,000 Europeans. Area 124,502 sq.mi. The capital (since 1934) and chief port is Abidjan (*q.v.*).

Physical Features.—Geologically most of the Ivory Coast belongs to the Archean block of Africa. The coast line along the Gulf of Guinea, about 340 mi. long, exhibits two different characters: in the west the crystalline platform terminates in cliffs and rocky points; but east of Fresco the beach is flat and sandy, and the Guinea current has formed offshore bars which have created lagoons (Fresco, Lahou, Ebrié, Aby). The alluvial coastal belt extends inland about 40 mi., and beyond it the land rises gradually, clothed by rain forest. The forest zone stretches inland for between 50 and 200 mi., having receded in the centre of the country. Its deep laterite soil is based on varied crystalline rocks and is broken only by clearing and by rivers. The relief is marked only in the west, where near Man a granite massif reaches 6,069 ft. in Mt. Nimba. Most of the rivers flow southward; from west to east the chief streams are the Cess and Cavally (each forming part of the Liberian border), the Sassandra (404 mi.), the Bandama (497 mi.) and the Komoé or Comoé (466 mi.). Beyond the forest zone the northern plateaus rise to more than 1,500 ft.

The climate in the south is equatorial, with mean temperatures of 77–82° F (25–28° C), an annual rainfall exceeding 50 in. (often exceeding 175 in. near the coast), and two very rainy seasons. Farther inland the rainfall decreases, the temperature is modified by altitude and a cooler dry season extends from November to February.

The rain forest contains valuable timber species (African mahogany, iroko or African teak, makore) and forest staples include oil palms, bananas, cassava, plantains and yams. About 8° N. a fairly dense savanna covers the plateau, merging near the northern border with the scantier Sudanese savanna. An important afforestation centre is the Banco National park near Abidjan. (J. D.)

The fauna of the forest zone differs little from that of the adjoining Ghana forest, lacking the larger ungulates except the bongo and forest buffalo. There are also about six kinds of dwarf antelope, ranging from the royal antelope to the yellow-backed duiker; the giant forest hog is widespread (though nowhere common) and the red river hog locally plentiful. Manatee probably survive in some rivers. To the north, the savanna woodland has about ten species of antelope, lions and occasional herds of elephant. The Bouna Animal reserve in the northeast is well stocked with wildlife. The Sassandra reserve, near the Liberian frontier, is notable for its pygmy hippopotamuses. (G. S. CE.)

The People.—The following may be distinguished: (1) In the forest west of the Bandama, peoples of the Kru language group, formerly quite primitive, patrilinear and not organized in states (Guéré, Bété, Neyo, Dida). (2) In the eastern forest and adjoining savannas: (*a*) peoples related to the Ashanti, matrilinear, organized in kingdoms and practising plastic arts (Agni, Baulé and Abron); (*b*) on the coast the diminutive "people of the lagoons," mostly matrilinear and speaking various languages such as Ajukru (Adiukru), Ebrié, Apollonians, Abé and Attié. (3) In the north,

E. AUBERT DE LA RÜE

ROCKY SHORE LINE ALONG THE GULF OF GUINEA BETWEEN TABOU AND SASSANDRA, IVORY COAST

the Senufo and Kulango, who are paleonegritic farmers. (4) In the northwest, Malinké and Diula peoples, who are Muslims (*see* MANDINGO). The other groups are pagans or converts to Christianity.

History.—Following Portuguese discoveries in the second half of the 15th century the coast was frequented by traders for ivory and slaves. Toward the end of the 17th century French trading posts were established at Assinie and Grand-Bassam on the east coast. Following a series of surveys and expeditions by Comdt. Louis Édouard Bouet-Willaumez (1808–71), forts were built at these two towns and cessions of neighbouring territory were made by the local chiefs (1842–43). On the outbreak of the Franco-German War in 1870 the garrisons were withdrawn and the protection of the settlements was left to French traders, who effectively resisted the penetration of British influence from the Gold Coast (modern Ghana). One of these traders, Marcel Treich-Laplène (1861–90), made treaties with the chiefs of the Agni and Abron, and collaborated with Capt. Louis Gustave Binger (1856–1936), who in the course of notable explorations in the interior between 1887 and 1892, concluded protectorate agreements with other chiefs. Binger became first governor on the erection of the Ivory Coast into a separate French colony in 1893. Agreements with Liberia and Great Britain settled the western and eastern boundaries, but the northern frontier was not determined until 1898, when the insurgent Sudanese leader Samory was captured. Control of the forest zone by intermittent military expeditions was hampered by yellow fever and by further native risings, but between 1908 and 1918 a progressive occupation was staged by the governor, Gabriel Angoulvant. The railway, building of which started from the coast in 1903, reached Bouaké (196 mi. N.) in 1912 and Bobo-Dioulasso (in Upper Volta, 495 mi. N.) in 1934. The French administration built a good network of roads and erected a new capital at Abidjan, whose port was opened in 1951.

In World War II the Ivory Coast remained under the Vichy regime from 1940 until 1942. In 1946 it became a territory in the French union, with increased autonomy in financial and administrative affairs, and in 1947 the northern districts, at the request of their inhabitants, were separated from the Ivory Coast to form the reconstituted territory of Upper Volta. In the legislative assembly a majority was secured by the Rassemblement Démocratique Africaine party led by Félix Houphouët-Boigny, who subsequently led the Ivory Coast peacefully to autonomy (Dec. 4, 1958) and independence (Aug. 7, 1960). He also created the Sahel-Benin entente with Upper Volta, Niger and Dahomey, envisaging for the four states an identical constitution, a customs union, common foreign and defense policies and a common fund of development capital. Co-operation agreements with France were signed in April 1961. The entente states decided to remain outside the French community. (HU. DE.)

Towns.—After Abidjan, the chief town is Bouake in the centre of the republic, a road junction and trading centre. Also on the railway but farther north lie Katiola and Ferkéssédougou. Other centres for commerce and the collection of produce are Grand-Bassam at the mouth of the Komoé, Sassandra at the mouth of the river of the same name, Daloa and Man in the west on the road leading to the Republic of Guinea, and Agboville about 50 mi. N. of Abidjan. Several of these towns have Roman Catholic or Protestant mission stations.

Administration and Social Conditions.—Under the 1960 constitution, the Ivory Coast is a republic in which the president enjoys wide powers, including the appointment of ministers and principal officials. It has an elected national assembly of 100 members and administratively is divided into 19 *cercles* (districts). The official language is French.

By the early 1960s there were in the republic three hospitals, six leprosaria and a number of medical stations, dispensaries and clinics, with a total of 6,500 beds and about 150 doctors. Educational facilities, including private and mission schools, comprised about 1,600 primary schools (200,000 pupils), about 40 secondary schools (7,000 pupils) and 18 technical schools (1,400 students). A centre of higher studies was opened in Abidjan in 1958.

Economy.—The Ivory Coast is the richest of the former territories of French West Africa, but its wealth comes chiefly from agriculture and forestry, which form the livelihood of 95% of the inhabitants.

In addition to subsistence crops cultivated by the people, plantations (initially began by Europeans) have been developed for raising export crops. In general these plantations have been made by clearing the forest, and the large labour force required for clearance and cultivation has been obtained by migration from the northern plateau. Many of the workers have remained to become themselves planters in the forest, which is thus being progressively cleared. The main plantations are in the east and centre of the forest zone, and the principal crops, with the approximate annual export figures reached in the early 1960s, are coffee (exceeding 150,000 tons), cocoa (60,000 tons) and bananas (72,000 tons). Palm oil from indigenous forest palms is mostly consumed locally, but palm kernels are exported. Other plantation crops are pineapples (cultivated in the coastal zone) and rubber. In the drier northern country the Senufo grow mainly millet, with some maize (corn) and cash crops of sisal, peanuts, cotton and tobacco. Stock raising is confined to the plateau districts. Mechanization of lumber camps and improvements of the facilities for shipment at Abidjan caused timber exports to reach 654,000 metric tons (mainly hardwoods) by the early 1960s.

Alluvial deposits of gold are worked in a number of places and industrial diamonds are mined in the north at Tortiya. Manganese deposits near Grand-Lahou at the mouth of the Sassandra yield about 100,000 metric tons yearly. Bauxite has been located in the region 50–100 mi. from the coast between the Sassandra and Bandama rivers and iron-bearing quartzites exist. Fishing is done off the coast and in the lagoons. Electric power consumption in the early 1960s was only about 33,000,000,000 kw.hr. annually but increased supplies were subsequently obtained from a hydroelectric station on the Bia river in the southeast. Industries include the preparation and canning of fruits and food products, the extraction of vegetable oil, cotton ginning, logging and sawmilling, a tobacco factory at Bouaké and a textile factory nearby at Gonfréville. A motorcar assembly plant was erected at Abidjan in 1960. In 1960 the value of exports exceeded that of imports (mainly machinery, metalwork, textiles, cement and petroleum fuels) by nearly 25%.

The deep-water quays at Abidjan are linked with the open sea by the 3,000-yd. Vridi canal piercing the offshore bar, and northward by the metre-gauge railway which in 1955 was extended to Ougadougou in the Republic of Upper Volta. This route handles about 45% of the exports and 25% of the imports of the eight territories of French West Africa. The road network in the Ivory Coast runs predominantly east and west as a feeder to the railway. Port-Bouet airport, 10½ mi. S. of Abidjan, is connected by regular services with main centres in France and West Africa and local services are also maintained. *See* also references under "Ivory Coast, Republic of" in the Index. (J. D.)

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IVREA (ancient EPOREDIA), a town and episcopal see of Turin province, Piedmont region, northwest Italy, lies on the Dora Baltea, 55 km. (34 mi.) N.E. of Turin by road. Pop. (1957 est.) 19,719 (commune). The cathedral was built between 969 and 1002, but only the two bell towers and the ambulatory remain of the original building. The hill above the town was crowned by the Castello delle Quattro Torri (1358), and S. Bernadino's convent (1455–65) contains interesting frescoes. The Ponte Vecchio was set on Roman foundations. Ivrea is on the railway and road from Turin to Aosta. Its industry includes the manufacture of typewriters and textiles, especially silk. The tourist industry is important, as the surrounding scenery is picturesque. An annual historical carnival is held in February. The importance of its gold mines led to the Roman seizure of the district in 143 B.C. from the Salassi. The

town was a duchy in the middle ages and a marquisate later. Two of its rulers, Berengar II (950) and Arduin (1002), became kings of Italy. Later it submitted to the marquises of Monferrato and in the mid-14th century passed to the house of Savoy. (V. FA.)

IVRY-SUR-SEINE, a town of Seine *département,* France, is situated on the left bank of the Seine, 6 km. (4 mi.) S.S.E. of Notre Dame cathedral, Paris. Pop. (1962) 53,229. Formerly a vine-growing village with country houses, it became an industrial and commercial town. Chemical and medicinal products, oils, glues, paint and varnish, electrical appliances, tiles, rubber and chocolate are manufactured, and there is distilling and brewing. Through its port on the Seine, it is an entrepôt for wholesale trade, chiefly in foodstuffs, fuel, timber and barrels. The hospital for incurables was moved there from Paris in 1870 and there is a large cemetery for the capital. (H. DE S.-R.)

IVY, popularly and traditionally, the name for certain species and varieties of *Hedera*, a genus of evergreen, woody climbers or shrubs of the ginseng family (Araliaceae). The numerous kinds often listed are, botanically speaking, variants of only a few species. Other plants with "ivy" in their names are listed below, after the *Hedera* species.

True Ivies.—The English ivy (*H. helix*), sometimes called European ivy, with its varieties and many horticultural forms, shows numerous variations in the form and colour of its leaves but tends to produce a three- to five-lobed form when climbing and a regular ovate form when flowering and fruiting. The Algerian or Canary Island ivy (*H. canariensis*) is a native of north Africa, the Azores and the Canary Islands. It is the common large-leaved climbing ivy. It also varies but in a less marked degree than *H. helix,* from which its leaves differ in their larger size, rich deep green colour and a prevailing tendency to a five-lobed outline. When in fruit the leaves are usually three-lobed but they are sometimes entire and broadly ovate. The colchis ivy (*H. colchica*), considered to be a form of *H. helix*, has ovate, obscurely three-lobed leaves of a leathery texture and a deep green colour; in the tree or fruiting form the leaves are narrower than in the climbing form and without any trace of lobes.

ENGLISH IVY (HEDERA HELIX)

Distinctive characters are also to be found in the appendages of the pedicels and calyx, *H. helix* having 6-rayed stellate hairs, *H. canariensis* 15-rayed hairs, and *H. colchica* yellowish 2-lobed scales.

It is important to note the difference of characters of the same species of ivy in its two conditions of climbing and fruiting. The first stage of growth is essentially climbing without attachment (juvenile stage) and the leaves are more or less lobed. This stage is accompanied by a plentiful production of the claspers or modified roots by means of which the plant becomes attached and obtains support. When it has reached the summit of the tree or tower, the stems, being no longer able to maintain a perpendicular attitude, fall over and become horizontal or pendent. Coincidentally with this change they cease to produce claspers and the leaves are strikingly modified in form, being now narrower and less lobed than on the ascending stems. In due time this treelike growth produces terminal umbels of greenish flowers, which have the parts in fives, with the style united into a very short one. These flowers are succeeded by smooth black or yellow berries containing two to five seeds. The yellow-berried ivy is found in northern India and in Italy but elsewhere it is known only as a curiosity of the garden, where, if sufficiently sheltered and nourished, it becomes an exceedingly beautiful and fruitful tree.

A question of practical importance is the relation of the plant to its means of support. A moderate growth of ivy is not injurious to trees; still the tendency is from the first unfavourable to the prosperity of the tree, and at a certain stage it becomes deadly. Therefore the growth of ivy on trees should be kept within reasonable bounds, more especially in the case of trees that are of special value for their beauty, history or the quality of their timber. In regard to buildings clothed with ivy, there is nothing to be feared so long as the plant does not penetrate the substance of the wall by means of any fissure. Should it thrust its way in, its natural and continuous expansion hastens the decay of the structure. But a fair growth of ivy on sound walls that afford no entrance beyond the superficial attachment of the claspers is beneficial. It promotes dryness and warmth, reduces to a minimum the corrosive action of the atmosphere and is altogether as conservative as it is beautiful. Many varieties are cultivated in gardens. Growing these is an extremely simple matter, as they will thrive in a poor soil and endure a considerable depth of shade, so that they may with advantage be planted under trees. For example, the common Irish ivy (a variety of *H. helix*) is often used as a ground cover beneath large trees where grass has difficulty in thriving.

Ivies have long been cultivated outdoors in mild, moist regions in Great Britain and Europe and increasingly in North America. In the northern United States and southern Canada the winters are not more severe than the ivy can endure but the summers are too hot and dry. In districts where native ferns abound the ivy will usually thrive, and varieties of *H. helix* should have the preference. But in the drier districts ivies should be planted on the north side of buildings, and encouraged with water and careful training for three or four years. A strong light is detrimental to the growth of ivy, but there are no hardy plants that may be compared with it for variety and beauty that will endure shade equally well. Ivies, in their many forms, are also popular house plants.

Other Ivies.—Because of their ivylike leaves or their growth habits many unrelated plants are called ivy, with modifying terms. The North American poison ivy (*q.v.*), of the sumac or cashew family (Anacardiaceae), is a climber with three-lobed leaves and whitish fruits in clusters. Ground ivy (*Glecoma hederacea*) is a small creeping plant of the mint family (Labiatae), widely established in the northern hemisphere and sometimes cultivated for its dense mat of dark green leaves and bluish flowers. Boston ivy (*q.v.*) and grape ivy (certain cultivated species of *Cissus*) are of the grape family (Vitaceae; *q.v.*); Kenilworth ivy or ivy-leaved toadflax belongs to the figwort family (Scrophulariaceae; *q.v.*). The ivy-leaved ferns are *Hemionitis* species and ivy-leaved geraniums, *Pelargonium peltatum* varieties (*see* GERANIUM).

IWAKURA TOMOMI, PRINCE (1825–1883), one of Japan's most influential statesmen in the 19th century, was born in Kyōto to the family of a court noble (*kuge*) of relatively low rank. Adopted as son and heir of the more important Iwakura family, he gained an important place in court circles after the coming of Commodore Matthew Perry to Japan in 1853. In 1858 he was influential in arranging the emperor's refusal to ratify the treaty of commerce negotiated for the United States by Townsend Harris, thereby inaugurating the interference of the emperor in affairs previously delegated to the shogun (military governor). When this brought a strong reaction from the shogun, Iwakura retreated and advocated a reconciliation between the two parties, symbolized by the marriage of the emperor's sister to the young shogun. For this he was reviled by loyalists, and from 1863 to 1867 Iwakura lived under house arrest near Kyōto.

As the Tokugawa shogunate lost influence and power, Iwakura was able to regain his standing with the loyalists of Satsuma and Chōshū, and after his return to favour at court he was the Kyōto member of the small group of conspirators that succeeded in forcing the last shogun into a show of resistance in 1868 (*see* MEIJI). Iwakura was one of the most powerful men in the new administration that utilized the Meiji emperor's prestige in modernizing Japan. In 1871 he was appointed to lead a group of about 50 leading government figures on a mission to western countries. Ostensibly devoted to the task of treaty revision, in which it failed,

the embassy became a great "learning mission," its members dividing into teams to study education, administration, finance and law. Upon its return Iwakura helped thwart plans for war with Korea that had been made in his absence because he was convinced that internal reforms were the first order of the day. In the late 1870s he was the unchallenged, though not the nominal, head of the government, and was vigilant in moderating and directing the revolutionary changes that were transforming Japan. A foe of the movement for democratic rights, he ended his career by inaugurating the preparation of a constitution that would safeguard the imperial prerogative. He died on July 20, 1883. *See* also JAPAN: *History*. (M. B. J.)

IWATE (IWATE-KEN), a prefecture in north Japan, on northeastern Honshu, borders the Pacific ocean on the east. The greater part is mountainous, and the climate is cold. Agriculture, forestry and fishery support more than half of the population. Paddy fields, occupying about half of the cultivated land, yield only one crop a year. Area 5,897 sq.mi.; pop. (1960) 1,448,517.

Morioka (pop. [1960] 157,441), the capital city, is the cultural and communications centre of the prefecture. (R. B. H.)

IWO, a town of Nigeria, Africa, 27 mi. N.E. of Ibadan, the capital of the Western Region. Pop. (1961 est.) 117,169, of whom four-fifths were Muslim and one-tenth Christian. The town is the capital of the traditional kingdom of Iwo, which was designated Iwo district, with an area of 180 sq.mi. embracing 16 smaller towns with a total population of about 56,000. The town is situated on a low hill on the edge of savanna and forest. Modern single and multistory houses have replaced many of the traditional Yoruba compounds with their rectangular courtyards. In the centre of the town is the palace, of traditional design but now incorporating a modern building and the local government offices. There is a modern hospital, a boys' secondary grammar school and a large mission station established by the American Southern Baptists in 1922. The town has a piped water supply and radio and telephone services.

Agriculture is the main occupation, more than half the men being farmers; the others are mostly traders and craftsmen. Staple food crops are grown to the north of the town and cocoa to the south. The Lagos-Kano railway reached Iwo station, 6 mi. S. of Iwo, in 1906, but most traffic is now road-borne.

According to legends the son of a female oni (ruler) of Ife left his home in the 16th or 17th century and his descendants settled in various districts south and east of Iwo before founding Iwo itself on the site of a hunter's camp. The town grew rapidly in the early 19th century with the influx of refugees from Oyo on the savanna, which was destroyed by civil wars and by Fulani raids, and from settlements attacked by Iwo itself. Traditionally Iwo is governed by the oluwo (king) and by chiefs chosen from, and by, the principal families, many of whom are the direct descendants of the early chiefs of Iwo. The oluwo is ex-officio president of the Iwo district council, the modern unit of local government. One-quarter of the members of the council are nominated by virtue of their status as chiefs and three-quarters are elected by universal adult suffrage. (D. A. A.)

IWO JIMA, a volcanic island in the North Pacific that was under Japanese control until 1945 when it became the scene of one of the fiercest and most costly battles in U.S. history, measured in terms of the ratio of casualties to the number of men engaged. More than 700 mi. S.E. of Tokyo, it is irregularly shaped, about 5 mi. long, ranging in width from 800 yd. to 2½ mi.

The island was strategically important both for the United States and Japan, since it was the best available air base between Saipan, about 700 mi. S., which U.S. forces had taken in 1944, and Tokyo. Two marine divisions landed on Iwo Jima between Feb. 19 and 21, 1945, followed by a third later in the month. The Japanese had entrenched themselves so effectively in caves that weeks of preliminary bombardment failed to weaken appreciably their ability to offer desperate and tenacious resistance, and Japanese fire directed against the beaches was heavy and accurate. The struggle for the possession of the island, fought at close quarters, continued for almost a month before it was officially pronounced captured by the United States. The hardest struggles were for the occupation of Meatgrinder hill, in the northern part of the island, and of Mt. Suribachi, an extinct volcano which rises 546 ft. above sea level in a southern corner of the island. The former position was taken and lost five times before U.S. marines held it permanently.

The raising of the U.S. flag over Mt. Suribachi, which was photographed by Joe Rosenthal of the Associated Press, proved to be one of the most dramatic episodes in the Pacific war. Rosenthal's photograph was widely reprinted, and paintings, a three-cent postage stamp, statues, etc., were based on it.

About 22,000 Japanese troops were killed or captured, and the U.S. casualties totaled more than 21,000, including over 4,500 men killed. Under the Japanese peace treaty, signed in Sept. 1951, administration of Iwo Jima and the other Volcano Islands formally passed to the United States. *See* also WORLD WAR II: *The War in the Pacific*.

I.W.W.: *see* INDUSTRIAL WORKERS OF THE WORLD.

IXION, in Greek legend, son either of the god Ares or of Phlegyas, king of the Lapithae in Thessaly. Having treacherously murdered his father-in-law he could find none to purify him until Zeus did so and admitted him as a guest to Olympus. Ixion abused his pardon by trying to seduce Zeus's wife, Hera; but the goddess substituted for herself a cloud (by which he became the father of the Centaurs). Zeus, to punish him, bound him on a fiery wheel, which rolled unceasingly through the air or, according to the later version of the story, in the underworld. A plausible but by no means certain explanation of this myth connects it with the not uncommon practice of carrying a blazing revolving wheel through fields that needed the heat of the sun; according to this theory the legend was invented to explain the custom.

IXTACIHUATL (Aztec *ixtac*, "white," *cihuatl*, "woman"; IZTACCIHUATL), a dormant volcano on the Mexico-Puebla state boundary, Mexico, 10 mi. N. of its twin Popocatépetl (*q.v.*) and about 40 mi. S.S.E. of Mexico City. It has three summits, the centre one reaching a height of 17,342 ft., but has no crater. As seen from Mexico City the three snow-covered peaks give a fancied resemblance to the head, breast and feet of a recumbent woman. Hence the popular designation "sleeping woman." *See* also MEXICO: *Physical Geography*.

IXTLILXOCHITL II (*c.* 1500–1550), chief of Texcoco, one of the allied cities of the valley of Mexico which formed the nucleus of the Aztec empire. At the beginning of the Spanish conquest, an active rivalry existed between Texcoco and Tenochtitlán, the capital of the confederation. Moreover, Ixtlilxochitl was engaged in a dispute with his brother over the chieftainship. When Hernán Cortés offered to support his claims and the aspirations of Texcoco, Ixtlilxochitl brought his people over to the side of the invaders and assisted the Spaniards in the siege of Tenochtitlán. Thereafter he remained an ally of Spain but in the end lost the favour of his disillusioned subjects. (L. N. McA.)

IZABAL, a department of Guatemala which borders the Caribbean sea. Area 3,489 sq.mi.; pop. (1960 est.) 81,610. Its capital is Puerto Barrios. The department includes the lowlands of the Río Sarstún, of the Río Dulce and Lake Izabal, and of the lower Motagua. High ridges separate these three lowland areas. Plantations in the department produce bananas and abacá; and other crops include maize (corn), beans and coconuts. A railroad connects Puerto Barrios with Guatemala City, and there is also a highway connection. (P. E. J.)

IZHEVSK, a town and the capital of the Udmurt Autonomous Soviet Socialist Republic of the U.S.S.R., stands on the Izh river, a right-bank tributary of the Kama, 440 km. (273 mi.) W. of Sverdlovsk. Pop. (1959) 285,294. The town was one of the earliest centres of the Urals metallurgical industry, its armaments factory being established in the mid-18th century. Metallurgy remains the most important industry, with the production of steel, armaments, machine tools, building machinery and motorcycles. There are also large-scale sawmilling and timber working based on the extensive forests of the republic, and furniture and pianos are made. In addition, Izhevsk has various food-processing industries. There are rail links north and south to Agryz and Glazov, both on east-west trunk railways, and branch lines to Votkinsk and Kilmez.

Izhevsk is the cultural and educational centre of the republic, with a scientific institute of the Udmurt language, literature and history, and pedagogic, medical and agricultural institutes. (R. A. F.)

IZMAIL, a town of Odessa *oblast* of the Ukrainian Soviet Socialist Republic, U.S.S.R., is a river port on the north bank of the main distributary of the Danube, about 50 mi. from the Black sea. Pop. (1959) 46,600. Izmail was established in the 16th century as a Turkish fortress controlling the Danube mouth. In 1790 the Russians under A. V. Suvórov took the town by storm. Between World Wars I and II, Izmail, as part of Bessarabia, was included in Rumania. Its present importance is as a transshipment point, with a rail link to the rest of the Ukraine. There are fishing and food industries (especially canning), wine making and light engineering. (R. A. F.)

IZMIR (formerly SMYRNA), capital of the *il* (province) of Izmir, Turkey and, after Ankara, the most important city in Asia Minor, is situated at the head of the sheltered Gulf of Izmir on the deeply indented Aegean coast. Pop. (1960) 360,829. The city is built mainly on the small delta plain of the Kizilcullu (ancient Melas) river around the eastern end of the gulf, and on the heights and ridges to the south. Karsiyaka (formerly Kordelia), pop. 69,489, now an important part of the city, lies across the gulf and is practically connected to Izmir proper by a chain of newly developing suburbs. The highest point within the city limits is Kadifekale (Mt. Pagus, 540 ft.), and the Yamanlar mountains to the north rise to 2,500 ft.

More than three-fifths of the town was destroyed during the Greek retreat in 1922 (see *History,* below). Its reconstruction, planned by René Donje in 1924, was largely complete by the 1960s. The spacious avenues and modern buildings are evidence of the regained prosperity. Among public buildings are the Izmir National library (1912) and the Museum of Archaeology (1951), with a fine collection of antiquities of Smyrna. Konak is the commercial centre, spreading out to Basmahane and Pasaport. The residential quarters are in Karantina and Guzelyali to the southwest, and Esrefpasa and Tepecik. Alsancak, to the north, is the site of a newly constructed and enlarged harbour, while the main concentration of industry is in Halkapinar, to the northeast. Izmir is also the site of the Aegean university, founded in 1955. The chief archaeological sites are the Agora, or ancient market place, the Kadifekale citadel and the aqueducts of Kizilcullu. The site of ancient Ephesus (*q.v.;* now Seljuk) is to the south and that of Pergamum (*q.v.;* Bergama) to the north. (*See* SMYRNA.)

Izmir is an important commercial and industrial centre and the port of rich hinterland, the products of which include tobacco, grapes, figs, cereals, cotton, olives, valonia and vegetables, as well as carpets and silk. It is the principal export outlet of Turkey and second to Istanbul in import trade. Its economic importance and its rapid development are largely due to its excellent geographical location which also accounts for its choice in 1952 as the site of the headquarters of the southeastern command of the North Atlantic Treaty organization (NATO). Industrially, also, Izmir is second only to Istanbul. There are processing plants for grapes, figs, tobacco and olives and industrial products include cement, soap, dyes and woolen and cotton textiles. An international trade fair is held annually from Aug. 20 to Sept. 20 in the Kulturpark, north of Basmahane. Basmahane and Alsancak are terminal stations for the railway lines from the north (Manisa and Balikesir) and from the south (Aydin and Denizli) the Manisa-Afyonkarahisar line links Izmir with the main Anatolian system. The first Turkish railway was the Izmir-Aydin line (1856) constructed by a British company. Excellent highways radiate in all directions, linking the town with the rest of the country. Internal air services to the principal Turkish cities and external services to Athens operate from Cumaovasi airport (12 mi. S.).

The *il* of Izmir occupies the largest part of the Aegean coast of Anatolia. Its area is 4,623 sq.mi., population (1960) 1,063,490. It includes the agriculturally important and largely irrigated valleys and delta plains of the Kucuk Menderes, the Gediz and the Bakir Cay rivers. These fertile plains are separated by parallel mountain ranges (Boz Dag, Aydin, Yamanlar, Dumanli) extending eastward from the coast. Climate and vegetation are typically Mediterranean; summer is warm (July 28° C. [82° F.]) tempered by westerly sea breezes and winter is mild (January 8° C. [47° F.]) with occasional snow and frost. The area is one of the most densely inhabited regions of Turkey with a high percentage of urban population. Its agricultural products, chiefly for export, are composed mainly of tobacco, raisins, figs and cotton.

(N. TU.; S. ER.; E. TU.)

History.—For archaeology and for history up to the 14th century *see* SMYRNA.

After Izmir had come under the rule of the Seljuk princes of the Aydin dynasty (*c.* 1329 B.C.) it was used as a base for piratical raids against shipping and the eastern Mediterranean coast. Because of this a crusader naval force, sponsored by Pope Clement VI, attacked the city in 1344. Although the citadel held out, the rest of Izmir was captured and the defense of it was entrusted to the Knights of St. John who constructed there the fort of St. Peter which survived until the mid-19th century. The Christian rulers of Izmir were driven out (*c.* 1402) by Timur (*q.v.*) and the greater part of the population was massacred. When Timur left about a year later he restored the Aydin dynasty, but soon afterward it was deposed by the adventurer Djunaid, a Seljuk Turk, and it was not until *c.* 1425 that Izmir was conquered by Sultan Mohammed I and became part of the Ottoman empire.

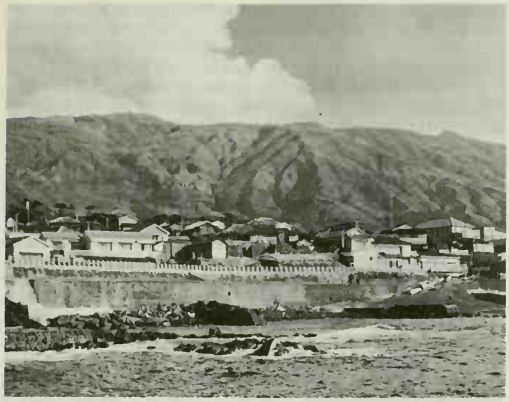
In the wars between the European powers and the Turks in the 18th century Izmir enjoyed a certain immunity owing to its large European population. A greater danger arose from the raids of savage tribes from inland and the incursions of the Barbary corsairs who, until the conquest of Algeria by the French, used Izmir as a recruiting ground for their crews. But Izmir's principal hazard has been from earthquakes. Both in 1688 and 1778 nearly the whole of the city was destroyed and thousands of lives lost.

After World War I Izmir was claimed by both Greece and Italy. Finally the Greeks were authorized to occupy the area, which they did on May 15, 1919, their first entry being marked by atrocities against the Turkish population. Shortly afterward hostilities broke out between the Greeks and the Turks under Mustafa Kemal Atatürk (*see* also GRECO-TURKISH WAR, 1921–22). At first the Greeks were successful, but on Sept. 9, 1922, Izmir was reoccupied by the Turks, and under the treaty of Lausanne (July 24, 1923) it reverted under full Turkish sovereignty. In addition to the war damage further destruction was wrought by an earthquake in 1928. However, since then Izmir has flourished with redevelopment.

IZMIT (anc. NICOMEDIA), a town and capital of Kocaeli *il* (province) Turkey, is situated near the head of the Gulf of Izmit, Sea of Marmara, 54 mi. E.S.E. of Istanbul. Pop. (1960) 73,488. Nicomedia was founded in 264 B.C. by Nicomedes I of Bithynia as his new capital on the neighbouring site of the famous Megaran city of Astacus, which was destroyed by Lysimachus (*q.v.*). The Roman emperor Diocletian made it the chief city of the east. It contains a fine 16th-century mosque (Pertevpasa Camii) built by the architect Sinan. It lies in an agricultural district, producing cocoons and tobacco, and there are forests of oak, beech and fir. Izmit is the centre of a paper industry and has three paper and cardboard factories which supply 50% of Turkey's consumption. The town is connected by rail and road with Haydarpaşa (a suburb of Istanbul), and with Ankara, Konya and Izmir, also by boat with Istanbul.

The head of the gulf of Izmit is silting up and the port Derince, where an important oil refinery is located, is almost 4 mi. from Izmit. (N. TU.; S. ER.; E. TU.)

IZU-SHICHITŌ, the seven (*shichi*) islands (*tō*) of Izu, administratively in metropolitan Tokyo, stretch in a southerly direction from a point near the mouth of Tokyo bay, and lie between latitude 33° and 34° 48′ N. and between longitude 130° and 140° E. The names, beginning from the north, are: Ōshima, Toshima, Nii-jima, Shikine-jima, Kōzu-shima, Miyake-jima and Mikura-jima. Ōshima (Izu-no-Ōshima), an island 10 mi. long and 5½ mi. wide, became known to western cartographers as Vries Island, a name derived from that of Capt. Martin Heritzoom de Vries, a Dutch navigator who is supposed to have discovered the island in 1643. The group was known to the Japanese from a remote pe-



BY COURTESY OF THE CONSULATE GENERAL OF JAPAN, N.Y.

MIHARA-YAMA, THE SMOKING VOLCANO ON ŌSHIMA, ONE OF THE ISLANDS IN IZU-SHICHITŌ

riod, however, and was used as a convict settlement from the 12th century. The islands, which are of volcanic origin, are known for their camellia oil, scenic beauty and the smoking volcano Mihara-yama (2,487 ft.) of Ōshima. (R. B. H.)

IZVOLSKI, ALEKSANDR PETROVICH, COUNT (1856–1919), Russian diplomat who as foreign minister during 1906–10 was closely involved in the negotiation of agreements with Great Britain, France and Austria-Hungary, was born in Moscow on March 17 (new style; 5, old style), 1856, and was educated at the Imperial Lyceum in St. Petersburg. His career in the diplomatic service was initiated by appointments in Eastern Rumelia, Bucharest and Washington. In 1890, as representative to the Vatican, he secured the resumption of diplomatic relations between Russia and the Holy See. Thereafter he held the post of minister in Belgrade (1896), Munich (1897), Tokyo (1900) and Copenhagen (1903). In May 1906 he succeeded Count V. N. Lamsdorf as minister of foreign affairs.

Assuming office at the conclusion of the Russo-Japanese War, Izvolski faced definite limitations on his conduct of foreign policy. Russia could not afford to adopt active measures until its military establishment was reorganized and its critical domestic situation was ameliorated. Izvolski therefore directed his efforts toward liquidating Russian conflicts in the far and middle east. The peace of Portsmouth, N.H., U.S., signed previously with Japan on Sept. 5, 1905, assured a period of tranquillity on Russia's eastern frontier.

On Aug. 31, 1907, the affairs of the middle east were adjusted by a treaty with Great Britain, hitherto Russia's principal opponent in the area, which partitioned Persia into spheres of influence and settled mutual conflicts in Tibet and Afghanistan.

With Russia's Asiatic frontiers secure, Izvolski was able to turn to European affairs. The Franco-Russian alliance, formulated in the 1890s, together with the Russo-British agreement on the middle east, gave Russia a large measure of security and removed the danger of the formation of a hostile coalition. However, not content with a purely passive policy, Izvolski also wished to achieve positive diplomatic triumphs for Russia. In his desire to modify the straits agreements in the Russian interest, he reopened the Balkan question which had been temporarily shelved by the Austro-Russian agreement of 1897. On Sept. 15, 1908, Izvolski met the Austro-Hungarian foreign minister, A. Lexa von Aehrenthal, a statesman of equal ambitions, at Buchlau (Buchlovice) in Moravia. There the ministers agreed that Austria would support the opening of the straits to Russian warships in return for Russian approval of the Austrian annexation of Bosnia and Hercegovina. In their subsequent accounts of the conversations, Izvolski and Aehrenthal differed sharply on the question of what had been decided concerning the method by which this agreement would be carried out.

The annexation of Bosnia and Hercegovina was proclaimed by a rescript on Oct. 7, 1908, but when Izvolski attempted to secure his part of the bargain, he was met with the opposition of the powers, Great Britain in particular.

The subsequent international crisis over the Bosnian affair, in which Austria-Hungary was able to annex Bosnia and Hercegovina through the firm support of Germany, was a great diplomatic defeat for Izvolski. Although he attempted to recover lost prestige through the Racconigi agreement with Italy, signed on Oct. 24, 1909, the Bosnian crisis demonstrated the strength of the Austro-German alliance. In Sept. 1910 Izvolski, who was replaced as foreign minister by S. D. Sazonov, was sent to Paris as ambassador, a post he held until 1917. There he pursued a policy favouring the close attachment of Russia to France. Leaving his position in May 1917, he died in Paris on Aug. 16, 1919. His *Memoirs*, published in 1920, provide little information about his own activities as minister of foreign affairs. (B. J.)

J THIS letter was not differentiated from I until comparatively modern times. It was the custom in medieval manuscripts to lengthen the letter I when it was in a prominent position, notably when it was initial. As initial I usually had consonantal force, the lengthened form came definitely to be regarded as representing the consonant and the short form the vowel in whatever position they occurred. The process of differentiation began about the 14th century but was not complete until the 17th century. For certain purposes—an alphabetical series, for example—the letters I and J are not always regarded as distinct, the enumeration passing occasionally from I to K.

The original consonantal sound represented by the letter was the semivowel or spirant *i* (the sound of *y* in the word *yacht*). This passed into *dy* and later into the sound *dž* which the letter represents today. This sound was already established in the language in words of Romance origin in which it was represented by *g* (*e.g.*, in words such as *gesture, ginger*), and these words retain their spelling. J represents the same sound (*dž*) in all positions, and deviations from it are extremely rare even in words of foreign origin. In the bird-name *jaeger*, however, the sound *dž* and the sound *y* are both admitted, and in certain personal and local names of Spanish origin, *e.g.*, *Juanita, La Jolla*, the sound of *h* is current in English usage. The minuscule form *j* is the lengthened form, retaining the dot, of minuscule *i*.

See also ALPHABET. (J. W. P.)

JABALPUR, a city, district and division of Madhya Pradesh, India. The city (pop., [1961] 295,375), the third largest in the state, lies 198 mi. S.W. of Allahabad at the junction of the Calcutta-Allahabad-Bombay and Jabalpur-Gondia railway lines. It has a central position with respect to the Narmada (Narbada) valley (to the west), the Mahadeo-Maikal gap (south) and the Bhanrer-Maikal trough (northeast). It lies about 5 mi. N. of the Narmada river in a rocky basin surrounded by granitic outcrops (on one of which is the old Gond castle—the Madan Mahal) rising 1,500–1,600 ft. above sea level and dotted with numerous lakes and temples.

Garha, now a suburb of Jabalpur, was the chief city of one of the four independent Gond kingdoms that arose in the 14th century (*see* GONDWANA). Jabalpur took shape in the British period when it became the headquarters of the commissioner of Narmada territory and has since then developed into a commercial, industrial, educational and administrative centre. Besides the district and divisional commissioner's offices it contains the office of the conservator of forests and the Madhya Pradesh high court. It has its own university to which are affiliated 17 colleges that offer courses in the arts, science and commerce, teacher's training, law, medicine, veterinary science, agriculture and engineering. Jabalpur is a military headquarters with the central gun carriage factory, an ordnance factory and an army workshop. There are several oil, flour and saw mills, *bidi* (local cigarettes) factories, ice factories, engineering and glass works, and hand-loom factories.

JABALPUR DISTRICT (area 3,918 sq.mi.; pop. [1961] 1,273,825) is spread over parts of the Son basin on the east and northeast, the Narmada basin on the south and southwest and the Son-Ken-Narmada watershed on the northwest. The western part of the Narmada valley, called the "Haveli," is one of the most fertile areas in the state; its rich black soil is largely devoted to wheat. The southern and eastern portions of the district are mostly based on the Deccan trap, while in the northern part occur slates, quartzites, limestone, banded jasper and micaceous hematite. These rocks contain iron ore, manganese, lead and copper ores, as well as clay and earths especially suitable for bricks, pottery and glassware.

The Narmada at Bheraghat (11 mi. E.S.E. of the town), after forming the Dhuandhar waterfall 50 ft. long, passes through a gorge in the famous Marble rocks, which are an attraction to tourists.

The principal crops are wheat, rice, jowar (sorghum) and oilseeds. Arable land covers 41% of the area and 21% is under forests. Jabalpur and Katni (Murwara) have steam powerhouses while Kymore, a cement producing centre, has a diesel power station. The principal industries are cement and pottery manufacture and engineering; lesser industries are the making of cloth, toys and brassware. Stone carving is done on a small scale. The railway junction, Katni, has a lime and cement industry.

In addition to the city and cantonment of Jabalpur the district contains the towns of Katni (Murwara), Tikuri, Sihora, Khamaria, Kymore, Katangi, Panagar and Patan.

JABALPUR DIVISION comprises the districts of Jabalpur, Balaghat, Chhindwara, Seoni, Sagar, Mandla, Damoh and Narsimhapur.

See also MADHYA PRADESH. (S. M. A.)

JABAL SHAMMAR (JEBEL SHAMMAR), a province of northern Saudi Arabia, is bounded on the south by Al Qasim, on the west by Hejaz, on the north and northeast by the Northern Frontiers district which separates it from Iraq, and on the east by the Eastern province (Al Hasa). The Great Nafud, which is included in the district, lies to the north. Throughout historical times it has been the habitat of the Shammar tribe, a branch of the almost legendary Taiy, whose chief was Hatim the Generous. From 1834 to 1921 it was an independent principality of the Ibn Rashid dynasty, whose most famous representative, Mohammed ibn 'Abdullah (1872–97), extended his sway over the whole of desert Arabia at the expense of Ibn Saud in 1891 (battle of Al Mulaida). Charles Doughty visited him in 1877–78, and has given a splendid description of his court in *Travels in Arabia Deserta*. 'Abdul-'Aziz Ibn Saud, having recovered Riyadh (*q.v.*) in 1902, captured Ha'il (*q.v.*), the capital, in 1921, when the Rashid dynasty came to an end. Its record of internecine strife and family murders was notorious. During World War I Ibn Rashid sided with the Turks against the Allies, and was consequently involved in hostilities with the Sharif of Mecca and Ibn Saud. (*See* also ARABIA: *History.*)

The principal features of the province are the two great mountain ranges of Aja (granites) and Salma (basalts), and the immense rolling sand dunes of An Nafud. Ha'il is situated on the southern flank of the Aja, while an older capital, Fayd, lies in the midst of Salma. Both towns, at various stages of history, were important stations on the pilgrim route to Medina from Iraq and Iran (Persia). But in modern times this traffic (by motor vehicle) is negligible, as the pilgrims prefer the amenities of Riyadh, which is accessible by air and by rail.

(H. ST. J. B. P.; X.)

JABIR: *see* GEBER.

JABIRU (*Jabiru mycteria*), an American stork found from Mexico to the Argentine. It stands between four and five feet high, with a massive black bill and white plumage. The head and neck are bare, and black and red in colour. The old world storks of the genera *Xenorhynchus* and *Ephippiorhynchus* are nearly allied to the jabiru, but the head and neck are feathered. Less closely related are the adjutant birds (*q.v.*). The name is

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JABIRU, AN AMERICAN STORK (JABIRU MYCTERIA)

often wrongly applied to the wood ibis (*Mycteria americana*), a smaller but somewhat similar bird ranging from Argentina to the coasts from Texas to Florida and North Carolina. *See* STORK.

JABLOCHKOV, PAUL (1847–1894), Russian electrical engineer and inventor, a pioneer in electric lighting, was born at Serdobsk, in the government of Saratov, on Sept. 14, 1847, and was educated at St. Petersburg. In 1871 he was appointed director of the telegraph lines between Moscow and Kursk, but in 1875 he resigned his position in order to devote himself to research on electric lighting by arc lamps.

In 1876 he settled in Paris, and toward the end of the year he brought out his Jablochkov "candles." These consisted of two carbon parallel rods, separated by a nonconducting partition; alternating currents were employed and the candle was operated by a high-resistance carbon match connecting the tips of the rods, a true arc forming between the parallel carbons when this burned off, and the separators volatilizing as the carbons burned away.

For a few years his system of electric lighting was widely adopted, but it was gradually superseded. Jablochkov made various other electrical inventions, but he died in poverty in Russia on March 19, 1894. *See* also LIGHTING: *Historical Development: Electric Lamps*.

JABLONEC (Ger. GABLONZ), a town in North *kraj* (region), Bohemia, Czech., lies in the upper valley of the Nisa (Ger. Neisse). Pop. (1961) 27,533. The town stands about 495 m. (1,623½ ft.) above sea level on the inner side of the Jizerske Hory (Isergebirge); but the Nisa river flows first to the northwest between the Jizerske and Luzicke (Lusatian) ranges and then northward to join the Oder. It now forms part of the frontier between the German Democratic Republic and Poland. Jablonec had a population of about 29,500 after World War I, more than 26,000 of whom were German. By 1928 it had dropped to 27,000 and by 1950 to just over 23,000. It has for long been the marketing centre for Bohemia's glass manufacturers and jewelers of all kinds, both those producing good-quality wares and those making cheap glass and imitation jewelery (including plastic-type ornaments) for the home and export markets. Much industry has traditionally been in small units, with little forges adjoining hillside cottages at considerable heights in the Jizerske Hory. Jablonec is more important as a focal point of this trade than the city's population and its own industries suggest. (H. G. S.)

JABLONSKI, DANIEL ERNST (1660–1741), German theologian who worked for union of Lutherans and Calvinists, was born at Nassenhuben, near Danzig, on Nov. 20, 1660. His father was a minister and his maternal grandfather, Johann Amos Comenius (*q.v.*), a bishop of the Moravian Church. Jablonski studied at Frankfurt an der Oder and Oxford, became a preacher at Magdeburg in 1683, and from 1686 to 1691 was head of the Moravian college at Lissa. He was appointed court preacher at Königsberg in 1691 by the elector of Brandenburg, Frederick III, and soon attained considerable influence in court circles. In 1693 he became court preacher at Berlin, and in 1699 he was consecrated a bishop of the Moravian Church.

The courts of Berlin, Hanover, Brunswick and Gotha were interested in Jablonski's scheme for Lutheran-Calvinist union, and his principal supporter was Leibniz. His idea appears to have been to form a general union of German, English and Swiss Protestants. For several years negotiations to this end were carried on, but eventually it was found impossible. Jablonski's next plan was to reform the Church of Prussia by introducing the episcopate and the liturgy of the Church of England, but again he was unsuccessful. He was one of the founders of the Berlin Academy of Sciences, of which he was president in 1733, and he received a degree from the University of Oxford. He died on May 25, 1741.

Correspondence between Jablonski and Leibniz was published at Leipzig in 1747 and at Dorpat in 1899.

See H. Dalton, *Daniel Ernst Jablonski* (1903).

JABORANDI: *see* PILOCARPUS.

JACA, a city of northern Spain, Huesca province, 160 km. (99.4 mi.) N. of Saragossa by road, is situated at 2,687 ft. on a plateau on the left bank of the river Aragón and in the southern catchment area of the central Pyrenees, 31 km. (19.3 mi.) from the French border. Pop. (1960) 9,856. It has timber and other light industries. Originally settled by the Jaccetani tribe (according to Strabo), the town fell to the Moors early in the 8th century, being reconquered before the time of Ramiro I of Aragon, who held a council there in 1063. Jaca has a Romanesque Gothic cathedral, dating from at least the 11th century, and medieval walls with Roman remains. (M. A. S.)

JACAMAR, any of the moderately small birds (5 to 12 in. long) belonging to the family Galbulidae (order Piciformes), inhabiting tropical forests and forest edges from southern Mexico to southern Brazil. Resembling over-sized hummingbirds, jacamars have graduated tails and long, slender, straight bills. The legs are short and the feet small. Two of the four toes are directed backward as in woodpeckers. Their insectivorous diet is caught on the wing; butterflies and dragonflies are favoured. Solitary in habit, they sit quietly for long periods on low perches, periodically flying forth to catch their prey with an audible snap of the bill. Male and female share in nest-building, incubation and parental care. The unlined nest is a hole in a bank or tree in which two to four white eggs are laid. The incubation period is 20 to 23 days in the rufous-tailed jacamar (*Galbula ruficauda*), the northernmost species. The young, covered with down at hatching, leave the nest when 20 to 26 days old. Species vary from metallic green in the rufous-tailed jacamar to glossy blue-black in the paradise jacamar (*G. dea*) from northern South America and rich chestnut-brown in the Amazonian white-eared jacamar (*Galbalcyrhynchus leucotis*). Most species have white or buffy throats. (D. A. L.)

JÁCANA (ÁCANA), a native name for a common timber tree (*Pouteria* or *Lucuma multiflora*, family Sapotaceae) of the West Indies. The tree grows to a height of 75 to 90 ft. and gives straight logs of very durable timber. The wood, which is hard, very fine grained and very heavy, is used in construction work where great strength is required, formerly for cane-mill rolls, and for furniture manufacture. Jácana has been used in reforestation programs in Puerto Rico.

JAÇANA, any of the small- to medium-sized, marsh-dwelling birds (6½ to 21 in. long) of the family Jacanidae (order Charadriiformes), widely distributed in the warm parts of the world, most abundantly in the tropics. Their typical habitat is a marsh, pond, lake or slow-moving river containing luxuriant marginal vegetation and floating rafts of aquatic plants. They are also called lily trotters because, using their extremely long toes and toe nails, they readily walk across floating plant life. The forehead of some species has a conspicuous red, blue or yellow horny plate or shield. The tail is short; the wings are broad, with a horny spur at the bend. The sexes are alike in plumage, but the female is the larger.

Jaçanas are solitary when nesting, but otherwise congregate in small flocks. They eat seeds of water plants, aquatic insects, snails and other aquatic invertebrates, and occasionally small fish. The nest is a loosely constructed mat of floating vegetation containing a shallow depression. The four eggs common in a clutch are various shades of dark brown, sometimes glossy, and in some species are heavily scrolled with dark brown or black. The incubation period is 22 to 24 days. The chicks, covered with down at hatching, are able to get about on their own within hours.

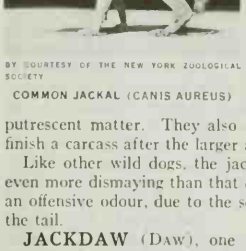
Some species of this family, *e.g.*, the pheasant-tailed jaçana (*Hydrophasianus chirurgus*) and *Jacana spinosa* exhibit a reversal of the sex roles in breeding activity. In most birds the males play the most active role in courtship, while incubation and parental care are duties usually shared by both sexes or left entirely to the female. In some jaçanas the females dominate courtship behaviour and vigorously defend a territory, while the male incubates the eggs and cares for the young without assistance from the female.

Of the new world species one ranges from southern Texas southward through Central America to Panamá (*Jacana spinosa*) and another from Panamá to Argentina (*Jacana jacana*). Both species are black and dark maroon with greenish-yellow wings. The northernmost species has a bright yellow bill and frontal shield; the southern species a red shield. Old world jaçanas are found in tropical Africa, including the smallest, the least or lesser jaçana (*Microparra capensis*); in Malagasy; and in the Indo-Malayan

region, including the Philippines and Indonesia. One Indo-Malayan jaçana, the lotus bird or comb-crested jaçana (*Irediparra gallinacea*) has an extensive range, reaching New Guinea, northern and eastern Australia. (D. A. L.)

JACHYMOV (Ger. SANKT JOACHIMSTHAL; *thal*, "valley"), a spa town in the *kraj* (region) of West Bohemia, Czech., lies in the Ore mountains at about 2,133 ft., near the German frontier and surrounded by forest. Pop. (1952) 6,806. It is an ancient hill city of Bohemia and in the 16th century was famous for its silver mines, its population then numbering about 30,000, of whom about 12,000 were miners. The counts of Schlik from nearby Freudenstein owned the mines, and in 1517 began to mint the famous Joachimsthaler, which was equivalent to a gold gulden and bore the effigy of St. Joachim. This was shortened to *thaler* from which "dollar" is derived. Jachymov lost heavily in wealth and population in the Thirty Years' War. It became a little upland town noted for glove- and lacemaking and with a few summer visitors. In 1863 the mining for uranium began but in connection with dyeing. The discovery of the rays of uranium ore by A. H. Becquerel in 1869, and of the element of radium by the Curies in 1898, brought a new importance to Jachymov. Until 1912 the uranium mine there was the most important in Europe, with an annual yield of 2 g. of radium; by 1938 50 g. had been produced. Jachymov, with its thermal radioactive springs, developed as a spa with curative treatments for many complaints. A fire in the mid-19th century destroyed most of the old city. The new town was small; the population never again reached its former size, and the majority till 1939 were German, many of whom were expelled after World War II. After 1945 the Soviet Union obtained concessionary rights in the uranium mines, but later abandoned them. Tin and tungsten are also mined. (H. G. S.)

JACKAL, any of several wolflike wild members of the same genus as dogs (*Canis*); they share with the hyenas an exaggerated reputation for cowardice. They inhabit southeastern Europe, northern Africa and southern Asia. Jackals resemble wolves and dogs in their dentition, the round eye-pupils, the period of gestation and to a large extent also in habits. The European species (*C. aureus*) grows to a height of 15 in. at the shoulders and to a length of about 2 ft., exclusive of its bushy tail. The fur is grayish-yellow, darker on the back and lighter beneath. The range of the common jackal extends from eastern Europe to southeast Asia and in northern Africa, from Egypt and Uganda to Senegal. The black-backed jackal (*C. mesomelas*), its sides rusty red, shares most of southern Africa with the side-striped jackal (*C. adustus*), which is grayish with an indistinct stripe of dark and pale on the sides. The Abyssinian red jackal (*C. simensis*) is long-legged and is somewhat wolflike.



BY COURTESY OF THE NEW YORK ZOOLOGICAL SOCIETY

COMMON JACKAL (CANIS AUREUS)

Jackals are nocturnal, concealing themselves until dusk in jungles or thickets and then sallying forth in packs to visit farmyards, villages and towns in search of food. This consists chiefly of the smaller mammals and poultry, although their association in packs enables these marauders to hunt down game as large as antelope and sheep. When unable to obtain living prey, jackals feed on carrion and refuse of all kinds, and are thus useful in removing putrescent matter. They also follow a lion or tiger in order to finish a carcass after the larger animal has eaten its fill.

Like other wild dogs, the jackal sings at evening. The cry is even more dismaying than that of the hyena. Like the fox, it has an offensive odour, due to the secretion of a gland at the base of the tail.

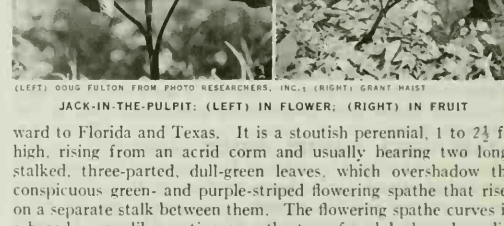
JACKDAW (DAW), one of the smallest species (*Corvus monedula*) of the crow (*q.v.*) genus and a well-known inhabitant of Eurasia and northern Africa. Black, with gray nape and ear coverts, it somewhat resembles both the rook (*C. frugilegus*) and crow but is smaller (13 in.), more active and has unusual pale

JOHN MARKHAM

JACKDAW (CORVUS MONEDULA)

gray eyes. The shorter bill and characteristic chattering voice further distinguish it from other members of the genus. Daws are gregarious and often associate with rooks and starlings. They breed in colonies, almost invariably choosing crevices in trees, buildings or cliffs for their bulky nests of sticks. Church towers and castles often are occupied, and sometimes even rabbit burrows. Only occasionally are nests placed in the branches of trees. The four to six light greenish-blue eggs are spotted and blotched with brown and olive. Incubation, by the female alone, requires 17–18 days, and the entire nesting period about 35 days. Both parents feed the young. The jackdaw's common call is an unmistakable "chak." Pilfering of grain by daws is commonplace, but they also are a considerable control of injurious insects. In North America the name jackdaw is sometimes extended to include similar-looking birds, various grackles of the genera *Quiscalus* and *Cassidix*, which are of an entirely different family (*see* GRACKLE). (E. R. BE.)

JACK-IN-THE-PULPIT (*Arisaema triphyllum*), a North American plant of the arum family (Araceae), called also Indian turnip, bog onion, brown dragon and starchwort, native to wet woods and thickets from Nova Scotia to Minnesota and south-



(LEFT) DOUG FULTON FROM PHOTO RESEARCHERS, INC.; (RIGHT) GRANT HAIST

JACK-IN-THE-PULPIT: (LEFT) IN FLOWER; (RIGHT) IN FRUIT

ward to Florida and Texas. It is a stoutish perennial, 1 to 2½ ft. high, rising from an acrid corm and usually bearing two long-stalked, three-parted, dull-green leaves, which overshadow the conspicuous green- and purple-striped flowering spathe that rises on a separate stalk between them. The flowering spathe curves in a broad canopylike portion over the top of a club-shaped spadix, two to three inches long, near the base of which, concealed within the enclosing spathe, are borne the minute flowers, the staminate and pistillate commonly though not always found on different plants. Fertilization is aided by small insects, especially gnats of the genus *Mycetophila*. The fruit ripens in late summer into a handsome cluster of brilliant red berries. This aroid, in many respects a North American counterpart of the British cuckoopint (*q.v.*), is one of the best-known late spring wild flowers of the eastern United States and Canada. The starchy corm is exceedingly irritating, because of the presence of myriads of needlelike crystals of calcium oxalate. It was formerly used for food, after proper treatment by drying and cooking, by the Iroquois and other American Indians. *See* also ARACEAE; GREEN DRAGON; POISONOUS PLANTS.

JACKLING, DANIEL COWAN (1869–1956), U.S. mining engineer and metallurgist, who introduced porphyry operations that revolutionized copper mining, was born on a farm near Appleton City, Mo., Aug. 14, 1869. Graduated from the Missouri School of Mines (Rolla) in 1892, he taught chemistry and metallurgy there in 1891–93, and in 1894–95 worked as a chemist and metallurgist in the Cripple Creek district, Colorado. While engaged in treating gold ores at Mercur, Utah, he was commissioned to make a report on a copper prospect at Bingham Canyon. His history-making report led a few years later (1905) to the formation of the Utah Copper company for which he exploited copper ore yielding only 25 lb. per ton. Jackling was active in operating

and executive positions in the Nevada Consolidated Copper company, the Kennecott Copper corporation, for which he directed western operations until his retirement in 1942, and the Mesabi Iron company. For his work in constructing and operating government explosive plants, 1917–19, he received the Distinguished Service medal. He died March 13, 1956, in San Francisco, Calif., where he lived from 1914. (A. B. P.)

JACK RABBIT, a name applied to several species of hares—not rabbits—occurring in western North America. The commonest species is the black-tailed or California jack rabbit (*Lepus californicus*), which occurs from Washington and South Dakota to central Mexico. Its tail has a wide black stripe that runs onto the back. The white-tailed jack rabbit (*L. townsendii*) is distinguished from it by its all white or buff-marked tail. The latter is found from Alberta to New Mexico, from Illinois to California. Other species of jack rabbits occur as far south as the Isthmus of Tehuantepec in Mexico. Three or four litters of one to six young are produced each year. *See* also HARE. (K. R. KN.)

JACKSON, ABRAHAM VALENTINE WILLIAMS (1862–1937), U.S. linguist, a specialist in Indo-Iranian languages, was born in New York city, Feb. 9, 1862. He was associated most of his life with Columbia university, both as student and professor, teaching Sanskrit, Avestan, Persian and related subjects. His interest in the orient resulted in repeated trips to Turkey, Iran, Turkistan, Afghanistan and India. In 1903 he made the first photographs of the famous Old Persian inscription of Darius at Behistun. He was a world-renowned authority on Avestan, the language of the sacred writings of Zoroastrianism, and also on the life and religion of Zoroaster himself. His work in comparative linguistics, while sound, was not characterized by great originality, although his comparative study of Avestan and Sanskrit and his *Avestan Reader* have been invaluable aids to generations of students. Jackson's numerous books include: *A Hymn of Zoroaster* (1888), *Avestan Alphabet and Its Transcription* (1890), *An Avestan Grammar in Comparison With Sanskrit* (1892), *An Avestan Reader* (1893), *Zoroaster, the Prophet of Ancient Iran* (1899), *Persia, Past and Present* (1906), *From Constantinople to the Home of Omar Khayyam* (1911), *Early Persian Poetry* (1920), *Zoroastrian Studies* (1928). He died in New York city on Aug. 8, 1937. (R. A. Fs.)

JACKSON, ANDREW (1767–1845), U.S. soldier and statesman, seventh president of the United States, was born on March 15, 1767, at the Waxhaw settlement on the frontier of the Carolinas. The area in which he was born was in dispute between North Carolina and South Carolina, and subsequent boundary shifts and a doubt as to the exact house in which he was born have led both states to claim him as a native son. Jackson always maintained that he was born in South Carolina. Although the question can not be answered positively, the weight of evidence appears to support his contention.

The Waxhaw area offered little opportunity for formal education, and such schooling as Jackson did have was interrupted by the British invasion of the western Carolinas in 1780–81. In 1781, he was captured and imprisoned for a time by the British. Shortly after he was captured, he refused to shine the boots of a British officer and was struck across the face with a sabre. His mother and two brothers died during the closing years of the war, direct or indirect casualties of the invasion of the Carolinas. This sequence of tragic experiences fixed in Jackson's mind a lifelong hostility to Great Britain.

Early Career.—After the close of the American Revolution Jackson studied law in an office in Salisbury, N.C., and was admitted to the bar of that state in 1787. In 1788 he went to the Cumberland region as prosecuting attorney of the western district of North Carolina—the region west of the Appalachians which was soon to become the state of Tennessee.

When Jackson arrived in Nashville, the judicial seat of the district, the community was still a frontier settlement exposed to the danger of Indian raids, with a fluid social structure, no well-established political institutions, and a volatile economy in which virtually every investment had the character of a speculation. As prosecuting attorney, Jackson was principally occupied with suits for the collection of debts. In these he was so successful that he soon had a thriving private practice and had gained the friendship of landowners and creditors. For almost 30 years Jackson was allied with this group in the politics of Tennessee.

Jackson boarded in the home of Col. John Donelson and there he met the colonel's daughter, Mrs. Rachel Robards. Her marriage was a stormy one which had seemed destined to end in separation or divorce even before she met Jackson. Jackson was quickly attracted to her. In 1790, Robards sought a divorce by legislative enactment in Virginia, but the legislature would do no more than empower Robards to sue for divorce in the courts. Jackson and Mrs. Robards believed the legislature had granted the divorce and in 1791 they were married. Robards in fact delayed in suing for divorce until 1793 and then obtained it on the grounds of desertion and adultery. When Jackson and his wife learned the true state of affairs, they were remarried quietly in Nashville. Until the death of Mrs. Jackson, nearly 40 years later, political opponents and others who resented Jackson's impetuous manner did not hesitate to make unflattering insinuations about events leading to his marriage. The marriage appears to have been a happy union of a devoted couple but gossip concerning it kept Jackson on the defensive.

Jackson was a successful lawyer, but his spirit was too restless and his interests too versatile to be confined to a career as an attorney. The expanding economy of frontier Tennessee encouraged adventures in trade and in land speculation, and Jackson became involved in both. He invested heavily in land and horses and he raised cotton, but his investments were so diverse that he could not be regarded as primarily a planter. The course of his investments was a series of reversals of fortune. At times he appeared to be financially secure; on other occasions, he was hard pressed by debt.

Tennessee Politics.—Jackson's interest in public affairs and in politics had always been keen. He went to Nashville as a political appointee, and in 1796 he was a member of the convention which drafted a constitution for the new state of Tennessee. In the same year he was elected as the first representative of the state in the national house of representatives. He refused to seek re-election and served only until March 4, 1797. These were the closing months of the administration of Pres. George Washington, and the chief event of Jackson's brief service in the house was the debate over the response to Washington's farewell address. Jackson was critical of Washington, resenting the president's support of Jay's treaty, which Jackson regarded as too favourable to Great Britain, and he was one of 12 representatives who opposed a cordial reply to the farewell address.

Jackson returned to Tennessee vowing not to enter public life again, but before the end of the year he was elected to the United States senate. His willingness to accept the office reflects his emergence as an acknowledged leader of one of the two factions contending for control of the politics of the state. The leader of the opposing faction was John Sevier, the first governor of Tennessee, who was commonly regarded as the most powerful political figure in the state.

Jackson resigned from the senate in 1798 after an uneventful year in that body. Personal financial pressures were the immediate cause of his resignation but Jackson appeared ill at ease in national politics and was unhappy in being separated from his family. Soon after his return to Nashville he was appointed a judge of the superior court (in effect, the supreme court) of the state, serving until 1804, when financial difficulties again forced him out of public life.

War of 1812.—In 1802 Jackson was elected major general of the Tennessee militia, a position he still held when the War of 1812 opened the door to a command in the field and a hero's role. In the intervening years, though he was nominally out of politics, Jackson maintained his old associations with many of the active political leaders of the state. It was during this period that he renewed his acquaintance with Aaron Burr, whom he met and admired when they served together in congress. For a time, Jackson appeared willing to aid Burr in the latter's nebulous scheme for the conquest of Texas. Later, when he began to suspect that Burr entertained treasonable intentions, Jackson withdrew his support.

He was not fully convinced of Burr's guilt, however, and he appeared as a defense witness in the trial of Burr in 1807.

In March 1812, when it appeared that war with Great Britain was imminent, Jackson issued a call for 50,000 volunteers from the state to be ready for an invasion of Canada. After the declaration of war, in June 1812, Jackson offered his services and those of his militia to the United States. The government at Washington was slow to accept this offer, and when Jackson finally was given a command in the field, it was as the result of action by Gov. Willie Blount of Tennessee. The enemy against whom he marched was not the British but the Creek Indians, who were allied with the British and who were threatening the southern frontier. In a campaign of about five months, in 1813–14, Jackson crushed the Creeks, the final victory coming in the Battle of Tohopeka (or Horseshoe Bend) in east-central Alabama. The victory was so decisive that the Creeks never again were a menace to the frontier, and Jackson was able to impose upon them a treaty whereby they surrendered to the federal government an estimated 23,000,000 ac. of land, comprising about one-fifth of the state of Georgia and more than three-fifths of the present state of Alabama. The campaign against the Creeks thus opened a vast new area to settlement and established Jackson as the hero of the west.

In Aug. 1814, Jackson moved his army south to Mobile. He was without specific instructions, but his real objective was the Spanish post at Pensacola. The motive was to prepare the way for U.S. occupation of Florida, then a Spanish possession. The justification for this bold move, as Jackson viewed it, was the fact that Spain and Great Britain were allies in the wars in Europe. At Mobile, Jackson received information that the British were planning to invade the southern coast of the United States and were using Pensacola as one base for that operation. In the first week of November he made a hurried march into Florida and on Nov. 7 captured Pensacola. He could not linger, however, for at Pensacola he learned that the British were about to invade Louisiana. He hastened with his little army to New Orleans. There, after a series of skirmishes culminating in a major battle on Jan. 8, 1815, he inflicted a decisive defeat upon an army of British regulars and compelled it to withdraw from Louisiana. The news of this victory reached Washington at a time when morale in the capital was at a low point. A few days later, news of the signing of a peace treaty at Ghent, Belg., reached Washington. The twin tidings of victory and peace brought joy and relief to the American people and made Jackson the hero not only of the west but of a substantial part of the nation.

Florida Campaign.—Jackson retained his commission in the army and at the close of the war was named commander of the southern district. His duties were nominal and the actual command in the field was left to others while Jackson retired to his home at the Hermitage, near Nashville. From that congenial environment he was called back to active service in 1818 when the Seminole Indians refused to vacate a portion of the lands ceded by the Creeks in 1814 and then, after being attacked, fled into Florida. The instructions given Jackson were vague, apparently purposely so, and it was well known in Washington that Jackson still believed that the United States should occupy Florida. As was to be expected, Jackson invaded Florida. He captured two Spanish posts, executed two British subjects who were accused of aiding the Indians, and before returning to the United States appointed one of his subordinates military governor of Florida. These bold actions brought an immediate and sharp protest from Spain and precipitated a cabinet crisis in Washington. The staunch defense of Jackson by Secretary of State John Quincy Adams, both in the cabinet and in a note to Spain, saved Jackson from censure and hastened the acquisition of Florida by the United States.

Presidential Prospects.—Jackson's military triumphs led to suggestions that he become a candidate for president, the earliest of these proposals coming soon after the battle of New Orleans. The aggressive conduct of Jackson in Florida in defense of what he conceived to be the national interest revived discussion of his possible candidacy for high office. Jackson disavowed any interest in seeking the presidency and political leaders in Washington assumed that the flurry of support for Jackson would prove transitory. The campaign to make him president, however, was kept alive by his continued popularity and was carefully nursed by a small group of his friends in Nashville, who combined devotion to the general with a high degree of political astuteness. In 1822 these friends maneuvered the Tennessee legislature into a formal nomination of their hero as a candidate for president. In the following year this same group successfully placed pressure upon the legislature to elect him to the United States senate—a gesture designed to demonstrate the extent of his popularity in his home state. By Dec. 1823 when he reached Washington to assume his new duties, Jackson had become an open and formidable contender for the presidency.

In the election of 1824 four candidates received electoral votes. Jackson received the highest number (99), the other three being John Quincy Adams (84), William H. Crawford (41) and Henry Clay (37). As no one had a majority of the electoral votes, the house of representatives was required to elect a president from the three with the highest number of votes. Crawford was critically ill and the actual choice was between Jackson and Adams. Clay, who was speaker of the house, was in a strategic and perhaps decisive position to determine the outcome. Adams was elected on the first ballot (Feb. 9, 1825). When he appointed Clay secretary of state—then regarded as the second most powerful office in the government—it seemed to admirers of Jackson to confirm rumours of a "corrupt bargain" between Adams and Clay. Jackson had long detested Clay but had hitherto admired Adams. His friends persuaded him that the popular will had been thwarted by intrigues, and he thereupon determined to vindicate himself and his supporters by becoming a candidate again in 1828.

Election of 1828.—The campaign to elect Jackson president was resumed almost as soon as Adams took office. The circumstances under which Adams had been elected did not augur well for the success of his administration; skillful politicians flocked to the support of Jackson, whom they recognized as the man of the future, and the efforts of Adams to provide leadership were frustrated by factional opposition. In 1828 Jackson defeated Adams by an electoral vote of 178 to 83 after a campaign in which personalities and slander played a larger part than in any previous national election in the history of the United States. But Jackson's hour of triumph was soon overshadowed by personal tragedy. During the campaign his opponents had resurrected the charges that his marriage had been irregular and this may have hastened a decline in his wife's health. Worn-out and defeated in her long effort to avoid the glare of public life, Mrs. Jackson died at the Hermitage on Dec. 22, 1828.

"Jacksonian Democracy."—The election of 1828 is commonly regarded as a turning point in the political history of the United States. Jackson was the first president from west of the Appalachians, but it was at least equally significant that the initiative in launching his candidacy and much of the leadership in the organization of his campaign came also from the west. The victory of Jackson was evidence of a westward movement of the centre of political power. He was also the first man to be elected president through a direct appeal to the mass of the voters rather than through the support of a recognized political organization. His victory was regarded by contemporaries and by historians as the triumph of political democracy, and the political movement of which he was the central figure is commonly described as the "Jacksonian Democracy."

Jackson was, however, more the beneficiary than the molder of the rising tide of democratic sentiment which was evident in nearly every part of the United States. Between 1815 and the election of 1828, six new states were admitted to the union, and five of these had manhood suffrage. In the same years, four of the older states revised their constitutions, three making provisions for a substantial extension of the suffrage. This trend toward greater political democracy weakened the power of the older political organizations and opened the way for the rise of new political leaders who were sympathetic with the new democracy and skilled in appealing to the mass of voters. This was notably true in New York where Martin Van Buren, after 1824 a supporter of Jackson, became the dominant political figure. It was the new political

leadership, thrust forward by the spread of democracy, that furnished much of the momentum which carried key eastern states for Jackson in 1828.

Not the least remarkable triumph of the Jacksonian organization was its success in picturing its candidate as the embodiment of democracy. Jackson had been aligned with the conservative faction in Tennessee politics for 30 years, and in the financial crisis which swept the west after 1819 he had vigorously opposed legislation for the relief of debtors. He had risen to a position of eminence and by contemporary standards in the west had acquired moderate wealth. In terms of personal qualities, however, he was well cast in the role of the champion of democracy. He had been born on the frontier and had risen to fame as the defender of the frontier against its traditional enemies—the Indians, the British and the Spanish. He was a man of limited education and no pretence to inherited social position. He was the epitome of the self-made man, the ideal admired by hundreds of thousands of his fellow citizens and one which they hoped to emulate. In view of these personal qualities, his conservatism in Tennessee politics was ignored and he was accepted by both friend and foe as the appropriate champion of the new democracy.

Jackson's Personal Qualifications for Office.—As the victory of Jackson reflected the emergence of new forces in U.S. politics so Jackson himself brought to the presidency a new set of personal qualifications which were to become the standard by which presidential candidates would be judged for the remainder of the 19th century. He was the first president since Washington who had not served a long apprenticeship in public life and had no personal experience in the formulation or conduct of foreign policy. His brief periods of service in congress provided no clue to his stand on the public issues of the day, except perhaps on the tariff. Even there, those who sought to know his stand had to rely on inferences drawn from casual statements, such as his assertion that he favoured a "judicious" tariff or that manufactures "properly fostered and protected" were an important asset in the defense of the nation.

There is no evidence that either Jackson or the voters who supported him were disturbed by this absence of any clear guide to his political philosophy. Jackson approached the problems of the presidency as he had approached all other problems in life. He met each issue as it arose, and in the White House he exhibited the same vigour and determination in carrying out decisions which had characterized his conduct as commander of an army in the field. He made it clear from the outset that he would be the master of his own administration, and at times he was so strong-willed and decisive that his enemies referred to him as "King Andrew I" and to his administration as the "reign" of Andrew Jackson. Strong leadership did not guarantee consistency in planning a comprehensive policy. In retrospect, certain fundamental principles which affected his decisions may be discerned, among which were the maintenance of the strength and honour of the union, a distrust of inflation and of paper money, and a conviction that concentrations of power, and particularly of "moneyed power," were dangerous. His practice of acting upon each question as he met it often made it difficult for even his friends to predict the decisions he would make; and on at least one major issue—that of states' rights—his actions on successive problems in which this principle was involved were clearly inconsistent.

In the presidency as in private life Jackson was often influenced by personal feelings, but with advancing years and greater responsibilities he appeared much less impetuous than he had earlier. When the requirements of public policy dictated a forgiveness of former enemies, he was capable of seeking a reconciliation with them. His basis for judging the character of others, however, remained remarkably simple. Those who supported him were his friends; generally, though not universally, those who opposed him were not to be trusted.

The First Term Begins.—When Jackson was inaugurated on March 4, 1829, it was the first time in more than a quarter of a century that the advent of a new president reflected the repudiation of his predecessor. Hundreds who had worked for the election of Jackson hoped this would mean that incumbent officeholders would be replaced by friends of the new president. Jackson and his friends were besieged by office seekers, and within a few weeks the process of removing opponents of Jackson to make way for supporters had begun. Some years later, William L. Marcy defended the principle of "rotation of office" with the aphorism, "To the victors belong the spoils." Critics of Jackson charged that this was the whole motive for the removal of civil servants who had long been employed in federal offices. It is certainly true that among Jackson's closest advisers there were skilled politicians, anxious to build a strong party by attaching the interest of his political friends to the administration through officeholding. Rotation in office, however, did not begin with Jackson. It was an accepted procedure in many states, and Jefferson had set the example by removing a number of unfriendly officeholders after he became president in 1801. Nor did Jackson utilize this practice so extensively as was charged. In eight years as president, Jackson removed fewer than one-fifth of all federal officeholders.

Jackson was in poor health when he became president, and few believed that he would have the strength or inclination to seek a second term. The question of the succession was therefore certain to attract early attention. One obvious candidate was Vice-Pres. John C. Calhoun, from Jackson's native state of South Carolina. Another contender was Martin Van Buren, Jackson's first secretary of state. The harmony of the new administration was threatened by the rivalry between these two men; it was shattered as a result of a social crisis caused by the refusal of Mrs. Calhoun and most of the cabinet wives to associate with Margaret O'Neale Eaton (*q.v.*), the wife of the secretary of war, John H. Eaton. Jackson and Eaton had been close friends for years, and the president was convinced that Mrs. Eaton, like his own wife, was the victim of gossip. Van Buren, also a widower, was conspicuous by his cordiality to the Eatons and thus gained in the confidence of the president. The breach between Jackson and Calhoun became irreparable in 1830 when Jackson learned that Calhoun had favoured a censure of Jackson in the cabinet debates of 1818 over the invasion of Florida. With Calhoun completely discredited in the judgment of Jackson, Van Buren became the probable successor to the presidency.

Threats to Federal Authority.—The feud between Jackson and Calhoun, which began over personal issues, became of crucial importance in national policy in 1830 when Calhoun openly espoused the cause of South Carolina in its opposition to a high protective tariff. Feeling in South Carolina was so intense that there were covert threats that the state would attempt to prevent collection of the tariff within the state. This danger was quickly recognized by the advisers of Jackson; to make his own position clear, Jackson used the occasion of a Jefferson Day dinner (April 13, 1830) to offer the toast, "Our federal union, it must be preserved." When Calhoun followed with a toast to liberty and states' rights, the position of the two antagonists was clear. The situation drifted until 1832, when congressional leaders sought a compromise in the form of a moderate reduction of the tariff. South Carolina was not satisfied, and in reply adopted a resolution declaring the tariff of 1832 null and void and prohibiting its enforcement within its borders. Jackson accepted the challenge, denounced the theory of nullification, and asked congress for authority to send troops into South Carolina to enforce the law. The president believed the tariff to be too high, however, and urged congress to reduce the new rates. In March 1833 congress both granted the authority which he had requested and reduced the offending tariff. Public opinion outside South Carolina appeared to back the president, and South Carolina withdrew its offending resolution but declared Jackson's Force act null and void. There can be little doubt that the vehemence with which Jackson met this threat to federal supremacy was prompted, in part, by his dislike of Calhoun, but personalities alone do not explain the position of either man. Jackson was devoted to the union, Calhoun to South Carolina.

Whatever the motives, Jackson had preserved the integrity of the union against the most serious threat it had yet faced. In contrast, he was remarkably complacent when Georgia defied the federal government. In 1829, Georgia extended its jurisdiction to about 9,000,000 ac. of land within its boundaries but still occupied

by Indians, whose title to the land had been guaranteed by treaty between them and the United States. The Indians appealed to the federal courts, and Jackson was on the horns of a dilemma. He did not wish to condone defiance of federal authority but his sympathies were with Georgia and he held the frontier view that the removal of the Indians was inevitable. Jackson intervened to bring pressure on the Indians to accept lands west of the Mississippi in lieu of those they were asked to abandon, but in this he was only partly successful. The supreme court, in two separate cases, ruled against Georgia, but when Jackson refused to use force to compel Georgia to obey those rulings the Indians capitulated and moved westward. The president appeared to have condoned in Georgia a defiance of federal authority which he had condemned in South Carolina. It is possible that personal antipathy influenced Jackson, for it was well known that he disliked Chief Justice John Marshall. It is also true that he was convinced it would be futile to attempt to protect the Indians against the inevitable march of the frontier.

Election of 1832 and the Bank Issue.—In the meantime, Jackson acquiesced in the pressure of friends to seek a second term as president. As the election of 1832 approached, a new issue was introduced by Jackson's opponents with the hope of embarrassing him. The charter of the Bank of the United States was due to expire in 1836. The president had not clearly defined his position respecting the bank, but there was growing evidence that he was uneasy about the bank as then organized. More significant in an election year was the fact that large blocs of voters who favoured Jackson were openly hostile to the bank. In the summer of 1832, Jackson's opponents rushed through congress a bill to recharter the bank, thus forcing Jackson either to sign the measure and alienate many of his supporters or to veto it and appear as a foe of sound banking. Jackson's cabinet was divided between friends and critics of the bank but the obviously political motives of the recharter bill reconciled all of them to the necessity of a veto. The question before Jackson actually was whether the veto message should leave the door open to future compromise.

Few presidential vetoes have caused as much controversy in their own time or later as the one Jackson sent to congress on July 10, 1832. It was a long document of more than 7,000 words. Much of it was devoted to the argument that the bill was premature or was directed to certain details in the legal status of the bank. At the opening of the message and again near the end, Jackson conceded the value of a national bank, "so organized as not to infringe on our delegated powers or the reserved rights of the states." Judged by comments made prior to the introduction of this bill in congress, there were many friends of the bank who could have agreed with a large part of the veto message. Portions of the message, however, took more controversial ground. Jackson began with the charge that the stockholders would gain a windfall of $7,000,000 through increased value of their stock if the bill became law. In a closing paragraph, he revealed the basic cause for his opposition to the existing bank, asserting that "the rich and powerful too often bend the acts of government to their selfish purpose." In a sentence he had summarized and accepted the widespread fear of the growth of a "moneyed power" which, if unchecked, would in time be able to dictate to the government itself.

As was anticipated, the veto was upheld in the senate. Political opponents of Jackson rejoiced that he had given them an issue, and the conservative press, seldom restrained in its attacks on the president, showered him with abuse. The mass of the people, however, rallied behind Jackson. In November he was re-elected by an even more decisive margin than in 1828.

Subsequent Financial Policy.—The veto of the bill to recharter the bank was the prelude to a conflict over financial policy which continued through Jackson's second term. After the re-election of Jackson, Nicholas Biddle, president of the bank, initiated a policy of calling in loans and contracting the volume of notes issued by the bank, ostensibly because it was necessary to prepare for the time when the charter would expire. Jackson and his associates were convinced that Biddle was seeking to create a panic in order to force congress to recharter the bank. The administration met this threat by refusing to deposit funds of the federal government in the bank, an action which Jackson believed would minimize any effort by the bank to control the volume of bank notes in circulation. Friends of the bank countered with congressional resolutions affirming belief in the solvency of the bank and censuring Jackson; but these had no other effect than to persuade Jackson that Biddle was using political influence to preserve the bank.

Beginning in the autumn of 1833, federal funds were deposited in selected banks in various parts of the country. The banks thus selected had been investigated for assurance that they were well managed, but critics immediately described them as "pet banks." It was in keeping with the spirit of the times that funds should be placed with bankers who had been politically friendly to the administration. The country was already on the threshold of an inflationary era when the "bank war" began; the dispersion of government funds throughout the country gave a further stimulus to this inflationary trend.

In the meantime, Jackson and his advisers had developed a theory of business cycles, in which paper money was the villain which caused alternate periods of inflation and depression. If the circulation of paper could be restricted and the proportion of gold and silver to paper increased, the cycle could be brought under some measure of control. Wage earners and those with fixed incomes would then receive some protection against periodic disaster. These were the very groups which, Jackson believed, usually were not adequately represented in the government and whose champion he should be.

Efforts to persuade congress to enact legislation limiting the circulation of bank notes failed, but there was one critical point at which Jackson was free to apply his theories. Nearly all purchasers of public lands paid with bank notes, many of which had to be discounted because of doubts as to the continuing solvency of the banks which issued them. Partly to protect federal revenues against loss and partly to advance his concept of a sound currency, Jackson issued the Specie Circular (July 11, 1836), requiring payment in gold or silver for all public lands. This measure created a demand for specie which many of the banks could not meet; the effect of bank failures in the west spread to the east, and in the spring of 1837 the entire country was gripped by a financial panic. However, the panic did not come until after Jackson had had the pleasure of seeing Van Buren inaugurated as president on March 4, 1837.

Jackson's Influence on U.S. Politics.—Jackson retired from office more popular than when he entered. The widespread approval of his actions exercised a profound effect on the character of U.S. politics for half a century. The success of Jackson appeared to be a vindication of the new democracy. Powerful voices still questioned the wisdom and even the morality of democracy in 1829; there were few who would question it openly in 1837. Jackson had likewise established a pattern which future candidates for the presidency attempted to imitate. Birth in humble circumstances, experience on the frontier, evidence of being close to the mass of the people, a devotion to democracy, and if possible, some military exploits were all valuable assets for any candidate who hoped to succeed.

The intensity of the political struggles from 1825 to 1837 led to the revival of the two-party system, which had been in abeyance since 1817. Jackson never thought of himself as a master politician, but he and his associates proved themselves the most skillful political leaders of that generation. When Jackson was elected president in 1828 he was the candidate of a faction rather than of a party. When he retired from the presidency he left a vigorous and well-organized Democratic party as one of his legacies to the future. His opponents were less well organized; in the elections of 1832 and 1836 they were more a coalition than a party. It was clear, however, that if they were to prevail they must have an organization and by 1840 they had been transformed into the Whig party. The two-party system has ever since been one of the accepted features of U.S. politics.

Later Years.—Upon leaving the presidency, Jackson retired to his home, the Hermitage. He was virtually an invalid during the remaining eight years of his life, but he continued to have a lively

interest in public affairs. Friends of earlier years, party leaders and aspiring young men made the Hermitage a mecca where they hoped to renew friendships or to receive the counsel and blessings of the former president. His last years, however, were generally uneventful, and he died at the Hermitage on June 8, 1845.

See also references under "Jackson, Andrew" in the Index.

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JACKSON, CYRIL (1746–1819), one of the greatest deans of Christ Church, Oxford, was born in Yorkshire, and educated at Westminster and Oxford. From 1771 to 1776 he was subpreceptor to the two eldest sons of George III. He then took holy orders, and after holding (1779–83) the preachership at Lincoln's Inn was dean of Christ Church, 1783–1809. In this position he showed a genius for government, and maintained a strict discipline. He had a large share in the framing of the Public Examination statute (1800) and always encouraged his pupils to compete for scholarships. In 1799 he refused the offer of the bishopric of Oxford, and in 1800 the primacy of Ireland. Many later famous men studied under him, including George Canning and Sir Robert Peel. Jackson was known as an excellent Greek scholar and reputed to wield great influence in politics. He resigned his deanery in 1809, and retired to Felpham, near Bognor, where he died on Aug. 31, 1819.

JACKSON, FREDERICK GEORGE (1860–1938), British arctic explorer, was born at Alcester, Warwickshire, on March 6, 1860. He was educated at Denstone college and Edinburgh university. In 1887 he sailed to the Greenland sea on board a whaler. He then planned to reach the north pole using Franz Josef Land as a base. To test equipment he sledged, in 1893–94, across 3,000 mi. of Siberian tundra through Lapland to Kirkenes in northern Norway. In 1894 he organized the Jackson-Harmsworth expedition to Franz Josef Land. For three years he and his companions maintained a meteorological station at Cape Flora, did survey work and made geological and natural history collections. On June 17, 1896, he met F. Nansen and F. H. Johansen after their journey across the polar ice from the "Fram" and sent them back to Norway in his vessel "Windward." Jackson served in the South African War and World War I and later explored central Africa. He died in London on March 13, 1938. He wrote *The Great Frozen Land* (1895), *A Thousand Days in the Arctic* (1899) and *The Lure of the Unknown Lands* (1935). (H. G. KG.)

JACKSON, HELEN (MARIA) HUNT (1831–1885), U.S. poet and novelist best known for *Ramona,* was born in Amherst, Mass., Oct. 18, 1831, the daughter of Nathan Fiske, a professor at Amherst college. After the tragic deaths of her first husband, Capt. Edward Hunt, and her two sons, she turned to writing. She married William Jackson in 1875. A prolific writer, she is remembered primarily for her efforts on behalf of the American Indians. *A Century of Dishonor* (1881) arraigned government Indian policy, and the novel *Ramona* (1884) depicted the injustices suffered by the mission Indians. *Ramona* aroused public sentiment for improving the conditions described, but has been admired chiefly for its romantic picture of old California. She died in San Francisco, Aug. 12, 1885.

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JACKSON, JOHN HUGHLINGS (1835–1911), English neurologist who excelled in the observation and minute description of neurological phenomena, was born at Green Hammerton, Yorkshire, on April 4, 1835. He worked mostly in London, being appointed to the National hospital, Queen square, in 1862 and to the London hospital in 1863. His physiological and philosophical interpretations of his findings illuminated the problems of mental and nervous diseases and provided the foundation for much modern research upon the nervous system. In his own day he was known chiefly for his work on language disorders (aphasia). From Jackson's studies on epilepsy and especially "convulsions starting unilaterally" (Jacksonian fit) were developed the modern methods of clinical localization of lesions of the nervous system and, less certainly, the experimental investigation of localization of functions. Jackson's definition (1873) of epilepsy as "a sudden, excessive and rapid discharge" of brain cells has never been bettered and is fully confirmed by electroencephalography. From the wide range of clinical manifestations of epilepsy (positive) and paralysis (negative), he concluded that sensation and movements are represented in the nervous system at several levels of complexity. He was among the first to proclaim that abnormal mental states might result from structural brain damage. In 1878 Jackson was elected a fellow of the Royal society. He died in London on Oct. 7, 1911.

His more important writings are collected in *Selected Writings of John Hughlings Jackson,* edited by James Taylor (1931). (W. GY.)

JACKSON, SHELDON (1834–1909), U.S. Presbyterian minister and educator, generally regarded as the foremost apostle of Presbyterianism in America, was born at Minaville, N.Y., on May 18, 1834, the son of Samuel Clinton and Delia (Sheldon) Jackson. Educated at Union college, Schenectady, N.Y., and Princeton seminary, he was ordained by the Albany presbytery following his graduation in 1858.

After a year among the Choctaws (Indian Territory), Jackson shattered all records as a missionary superintendent by founding (1859–83) over 100 churches in Minnesota, Wisconsin, Iowa, Nebraska, Wyoming, Montana, Colorado, Utah, Idaho and Nevada, besides opening native schools in New Mexico and Arizona. Yet his greatest work was performed after 1883 in Alaska where, in addition to organizing churches and schools, he developed an important and much-needed food resource by introducing domesticated reindeer from Siberia. As general agent of education in Alaska (1885–1908) he was instrumental in laying foundations for Alaska's eventual admission into the union. Jackson was elected moderator of the general assembly in 1897. He died on May 2, 1909.

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JACKSON, THOMAS JONATHAN (STONEWALL) (1824–1863), outstanding Confederate general of the American Civil War, was born at Clarksburg, Va. (now W. Va.), on Jan. 21, 1824. The early death of his father, who left little support for the family, followed by the death of his mother shortly after a second marriage, left the son to grow up in the homes of relatives. He had little opportunity for formal education in his early years but received an appointment to the U.S. Military academy at West Point in 1842. After a slow start he graduated 17th in his class and was commissioned as a second lieutenant of artillery. He joined his regiment in Mexico, where the United States was then at war and soon showed some of the qualities of resourcefulness, coolness and bravery in action for which he was later to become famous.

Finding service in the peacetime army tedious and unrewarding, he became professor of artillery tactics and natural philosophy at the Virginia Military institute in 1851 and resigned his commission. Jackson worked hard but never became a popular or highly successful teacher; he won a reputation for eccentricity that followed him to the end of his career. In the ten years at V.M.I. he experienced the death of his first wife, Eleanor, daughter of the Rev. George Junkin, president of Washington college, and three years later married Mary Anna Morrison, daughter of a North Carolina minister. Meanwhile he had taken a trip to Europe, become more deeply religious and allied himself with

the Presbyterian church. His strong sense of duty and moral righteousness, coupled with great devotion to the cause in which he was engaged, earned for him the derisive title "Deacon Jackson" and comparison with Oliver Cromwell.

On the outbreak of the Civil War he offered his services to his state of Virginia and was ordered to bring his cadets to Richmond. He shortly became a colonel of volunteers in the Confederate army and rapidly gained fame and promotion. His untimely death only two years later cut him down at the height of an increasingly successful career, leaving unanswered the question of his capacity for independent command which his rapid rise suggests he might have achieved. That he was the ablest of Gen. Robert E. Lee's generals is rarely questioned. The qualities of the two generals complemented each other, and Jackson obeyed and co-operated most effectively. In him were combined a deep religious fervour and a fiercely aggressive fighting spirit. He was a stern disciplinarian, but his subordinates and men trusted him and fought well under his leadership. He was a master of rapid movement and surprise tactics. His intentions were so veiled in secrecy that often his own officers did not fully know his plans until ordered to execute them.

Jackson's first assignment in the Confederate cause was the small command at Harpers Ferry, where the Shenandoah river flows into the Potomac, which he was to fortify and hold if possible. When Gen. Joseph E. Johnston (*q.v.*) took over the Confederate forces in the valley, with Jackson commanding one of the brigades, he withdrew to a more defensible position at Winchester.

In July 1861 the Federal invasion of Virginia began and Jackson's brigade moved with others of Johnston's army to unite with Gen. P. G. Beauregard on the field of Bull Run (*q.v.*; battle of Manassas) in time to meet the advance of Gen. Irvin McDowell's Union army and win for himself the famous "Stonewall" title. The spring of 1862 found him again in the Shenandoah valley where his diversionary tactics prevented reinforcements being sent to Gen. George B. McClellan in the peninsula campaign against Richmond and possibly accounted for its failure. Lee, then chief military adviser to President Davis, suggested to Jackson that he use his troops to attack the Federal forces in the valley and thus threaten Washington. By rapid movement he met several Federal forces and defeated them separately. In April he struck in the mountains of western Virginia, then on May 24–25 turned on Gen. N. P. Banks and drove him out of Winchester and back on the Potomac.

He then as quickly turned his attention to the southern end of the valley, defeating the Federals at Cross Keys on June 8, and at Port Republic on the next day. Lee then brought Jackson by road and railroad to Richmond to envelop the right wing of McClellan's army. Jackson arrived a day late and lost some of his reputation for effectiveness, possibly because of lack of experience in such a large-scale action, but McClellan was beaten back and was ordered to evacuate the peninsula.

Lee at once joined Jackson against Federal forces regrouping under Gen. John Pope (*q.v.*). He sent Jackson by a wide encircling movement to attack Pope's rear and bring on the second battle of Bull Run in which Pope was soundly beaten. Lee next crossed the Potomac for the "liberation" of Maryland. To protect Richmond he detached Jackson to capture Harpers Ferry, which he did in time (Sept. 13–15) to rejoin Lee at Antietam. After his return to Virginia, Lee divided his army into two corps, Gen. James Longstreet commanding the 1st and Jackson, now a lieutenant general, the 2nd. At Fredericksburg, Va., in December, Jackson was in command of the Confederate right when Gen. A. E. Burnside's rash attack was easily repulsed.

In April, Gen. Joseph Hooker, Burnside's successor, attempted to turn the Confederate position on the Rappahannock. There the seemingly invincible team of Lee and Jackson made its boldest move. Leaving a small detachment to meet the Federals on the Rappahannock, Lee moved his main body, including Jackson's corps, to meet Hooker's threatened envelopment in the woods of Chancellorsville. He then divided his army again, keeping only 10,000 men to demonstrate against Hooker's front, and he sent Jackson with his whole corps to move secretly around Hooker's right. The maneuver was completely successful. On the evening of May 2, Jackson rolled up the flank of the unsuspecting Federals. Then, in the moment of victory, tragedy struck. Jackson, who had ridden forward to organize the pursuit, was shot down in the dusk by his own men and mortally wounded. He died on May 10 and his place was never filled. Lee had indeed lost his right arm. *See* AMERICAN CIVIL WAR; *see* also references under "Jackson, Thomas Jonathan" in the Index.

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(C. W. TE.)

JACKSON, WILLIAM (1730–1803), English musician, born at Exeter on May 29, 1730. He studied as a chorister at Exeter cathedral, and was appointed organist there in 1777. He published many vocal works, including *Twelve Songs* (1755) and *Twelve Canzonets for Two Voices* (*c.* 1770), and also two operas, of which the first, *The Lord of the Manor* (London, 1780), held the stage for many years. He is associated with a service, of doubtful authenticity, known as "Jackson in F," written in a deliberately simple style for provincial singers. His literary works include the interesting pamphlet *Observations on the Present State of Music in London* (1791), essays on music and painting published in *Thirty Letters on Various Subjects* (1783), and his autobiography, *The Four Ages* (1798), republished in *The Leisure Hour* (1882). As an amateur painter he enjoyed the friendship and correspondence of Thomas Gainsborough. He died in Exeter on July 5, 1803. (Cs. CH.)

JACKSON, a city of Michigan, U.S., on the Grand river, 37 mi. S. of Lansing and 73 mi. W. of Detroit; the seat of Jackson county. Population (1960) city 50,720; standard metropolitan statistical area (Jackson county) 131,994. (For comparative population figures *see* table in MICHIGAN: *Population.*)

The site of Jackson was crossed by nine Indian trails, including the famous St. Joseph trail. Settlement began in 1829, the village being called Jacksonburgh after Andrew Jackson; the name was changed to Jacksonopolis and finally to Jackson in 1833. It was chartered as a city in 1857 and in 1915 adopted a commission-manager form of government. The Republican party was organized at a mass meeting "under the oaks" in Jackson on July 6, 1854.

The growth of Jackson was spurred by the automotive industry. At one time the Hayes Wheel company produced 75% of the wood wheels made for automobiles. In the latter part of the 20th century the more than 200 industrial firms in the Jackson area manufactured, among other products, automotive parts, tires, brakes, garments, toys, lawn mowers, water heaters, grinding wheels, candy, air-conditioning equipment, aircraft parts, extracts and flavouring. The New York Central railway has diesel light repair shops and its headquarters for all off-track equipment maintenance in Jackson. The general offices of the Consumers Power company, which provides electric and gas service for much of the state of Michigan, are located in the city.

The State Prison of Southern Michigan, one of the largest walled prisons in the world, is 5 mi. N. of the city. Jackson junior college, a community college, was established in 1928. Jackson is the home of the Illuminated cascades, man-made waterfalls located in the Sparks Foundation park, that annually attracts thousands of visitors throughout the summer.
(J. B. DA.)

JACKSON, the capital of Mississippi, U.S., and one of the two seats of Hinds county, is on the Pearl river about 35 mi. S.W. of the centre of the state. Pop. (1960) city, 144,422; standard metropolitan statistical area (Hinds county) 187,045, to which Rankin county (pop. [1960] 34,322) was added in 1963. (For comparative population figures *see* MISSISSIPPI: *Population.*)

The city was named for Andrew Jackson, who had been instrumental in negotiating with the Choctaw Indians for the portion of Mississippi where the capital came to be located. Origi-

nally a trading post known as LeFleur's Bluff, the site was picked in 1821 by a special commission appointed by the legislature. It was laid out in 1822 by Peter A. Van Dorn, using a plan of Thomas Jefferson, a checkerboard arrangement with alternate squares designated as parks or greens. These spots were reserved for churches, a cemetery and public buildings. The legislature began to meet in Jackson in 1822. In the 1830s two of the state's best architectural treasures were constructed, the governor's mansion and the old capitol, now a state historical museum.

The city was chartered in 1823 but it was 1833 before a city government was set up. At first there was a board of five selectmen; then in 1839, a mayor and six aldermen were authorized; finally in 1912 the city adopted a commission form of government. The city hall, a beautiful Ionic structure, dates from 1853.

During the American Civil War, Jackson was captured by Gen. Ulysses S. Grant on May 14, 1863, and many of its buildings were burned. After the war, Jackson recovered slowly, and did not begin to emerge as the state's leading city until the 20th century. Because of excellent advantages as a railroad junction and the discovery of natural gas in the late 1920s, Jackson recovered rapidly from the depression years. During and after World War II its growth was phenomenal. Formerly a white-collar city, it began to attract industries but wisely avoided the evil of industrial slums; its wide streets bordered with crepe myrtle, its modern skyscrapers and its smoke-free air give it the clean and spacious appearance of a western city. Much of the population increase was the result of an influx of people from the surrounding countryside. In the 1950s about 45% of the population was Negro. Major industrial items are glass, tile, cans, textiles, electronic equipment and meat and dairy products.

Jackson's educational facilities include Millsaps college, a Methodist institution founded in 1891; Belhaven, a Presbyterian college founded in 1894; Campbell college, a junior college founded in 1890 and controlled by the African Methodist Episcopal Church; the Jackson School of Law, private, founded 1930; Jackson State college, founded 1877; and a school of medicine, a department of nursing and an evening division of the University of Mississippi. The city has two major city libraries, a municipal art gallery, a little theatre, an opera guild and a symphony orchestra. More than 850 ac. of city parks are supplemented by the nearby Natchez Trace parkway. (J. K. B.)

JACKSON, a city of western Tennessee, U.S., seat of Madison county, is 85 mi. N.E. of Memphis. Settled in the early 1820s as a river town on the Forked Deer, it soon became an inland cotton centre. Its economy in the 20th century is based on agriculture, trades and services, and industries producing textiles, store, church and office furniture, barrel staves, hardwood lumber, toys, batteries, offset printing plates, food products and aluminum foil.

Jackson has three co-educational colleges: Union university, established in 1825 and controlled by the Tennessee Baptist association; Lambuth college, a Methodist institution founded in 1843; and Lane college, founded in 1882 and controlled by the Colored Methodist Episcopal Church. Health facilities include two hospitals, a speech and hearing clinic, a mental health clinic, several private clinics and a central blood bank.

Originally known as Alexandria, Jackson was given its present name on Aug. 17, 1823, in honour of Andrew Jackson, the uncle of one of the founding fathers. Among the town's famous citizens were the railroad presidents, Milton Brown and Isaac Tigrett; Adam Huntsman, who defeated Davy Crockett so badly that Crockett is said to have told his constituents that they could go to hell but he was going to Texas; John Luther "Casey" Jones, the famed railroad engineer. Incorporated as a city in 1845, Jackson uses Tennessee Valley authority power. For comparative population figures *see* table in TENNESSEE: *Population.* (E. I. WI.)

JACKSONVILLE, a city of extreme northeastern Florida, U.S., the seat of Duval county, is located on the St. Johns river, 15 mi. from the Atlantic ocean, 22 mi. from the Georgia line and 350 mi. from Miami. Pop. (1960) city 201,030; standard metropolitan statistical area (Duval county) 455,411. (For comparative population figures *see* table in FLORIDA: *Population.*) The deepwater port of entry and its situation at the hub of federal and state highways, trunk-line railroads, commercial airlines, and motor bus and truck carrier routes have made the city one of the foremost distributing and manufacturing centres of southeastern United States. The importance of the port has attracted many foreign and domestic vessels which support three major shipyards and make the city an important Atlantic harbour. The city has a virtual monopoly on domestic distribution throughout Florida and 75 counties in southern Georgia and South Carolina.

Much of the industrial activity of the area involves the transformation of raw materials into finished products. These industries include food and kindred products, transportation equipment, printing and publishing, lumber and paper products, machinery and tobacco products. Because of its location the city has been chosen as the state and regional headquarters of many national businesses; it is the financial centre of the state, its financial and banking institutions including a branch of the Federal Reserve bank. After the passage of favourable insurance tax laws in 1953, several home or regional offices of national insurance companies were established in the city.

In 1940 the U.S. navy commissioned the Jacksonville naval air station at Yukon on the west bank of the St. Johns river, 12 mi. S. of the city. Later, the navy commissioned Cecil field, an auxiliary air station 10 mi. W. of the city. During this time an aircraft carrier base and auxiliary air station were constructed at Mayport, just inside the St. Johns river jetties at the Atlantic ocean. A destroyer base was added to the other facilities at Mayport. Many thousands of aircraft pilots and air crewmen were trained in the Jacksonville area during World War II and these installations continue to be an important segment in the national defense.

In 1957 the city floated a $30,000,000 bond issue to finance a 15-story city hall, auditorium, sports coliseum, sewage construction and treatment plant, and street improvement and drainage program. The Jacksonville expressway authority supervises a $100,000,000 system of motor traffic freeways through the city.

Jacksonville is also a tourist centre, its attractions including sports activities in the Gator bowl, pari-mutuel dog racing and the beaches. The Jacksonville beaches are five adjacent communities: Atlantic beach, Neptune beach, Jacksonville beach and Ponte Vedra on the ocean and Mayport on the St. Johns river. Lying 16 mi. E. of the city, the beaches offer water sports and driving on a strand 600 ft. wide at low tide.

The first European settlement in Florida was made at the site of the Fort Caroline National monument, 10 mi. E. of the city on the St. Johns river, by the French in 1564. Later, the Spanish placed a small fort within the present limits of the city, which during the English period (1763–83) was called Cowford. After U.S. acquisition in 1821, the settlement was named for the first governor, Andrew Jackson. (J. E. D.)

JACKSONVILLE, a city of west central Illinois, U.S., the seat of Morgan county, is 35 mi. W. of Springfield and 85 mi. N. of St. Louis, Mo. Plotted in 1825, and named in honour of Andrew Jackson, the town soon acquired a distinctive educational character which it has to a large degree retained. The establishment of Illinois college in 1829, the first in the state, brought a large group of New Englanders into an area predominantly southern in outlook; the first president was Edward Beecher, brother of Henry Ward Beecher. Other educational institutions were soon started: the Jacksonville Female academy (1830) and the Athenaeum (1864); both later became part of Illinois college, which is affiliated with the Presbyterian and Congregational-Christian Churches. The Illinois Conference Female academy (1846) later became MacMurray College for Women and in 1957 began a co-ordinate college for men; the institutions are controlled by the Methodist Church. The Illinois School for the Deaf, the Illinois Braille and Sight Saving school and the Jacksonville State hospital are also located in the city. While Jacksonville serves as the trading centre for a rich agricultural area, manufacturing has also developed, chiefly in the fabrication of men's clothing, the processing of vegetable oils and plastics; a ferris wheel factory is also there. For comparative population figures *see* table in ILLINOIS: *Population.* (E. G. HI.)

JACKSTONES (Knucklebones), also called Jacks or Dibs, a game of great antiquity and world-wide distribution, played currently with stones, bones, seeds, filled cloth bags and metal "men" (the jacks), sometimes with and sometimes without a ball. The name derives from "chuckstones"—stones to be tossed. The knucklebones, wrist or ankle bones of goats, sheep or other animals also have been used in play. These objects have been found in prehistoric caves in Kiev, and pictures of the game are depicted on jars from ancient Greece.

In the classic game, five or more counters are thrown into the air singlehandedly, the object being to catch them either on the palm or the back of the hand. Those so caught count for the player and those missed count against him.

In contemporary games, there have been two developments: one emphasizing skill (as in the modern game of jackstones or jacks) and the other, the accumulation of as many men as possible.

In the U.S. and Canada, jacks is primarily a girls' game, played with 6 to 12 or more six-pronged iron or plastic jacks and a small rubber ball. After the jacks are strewn on the floor, the player tosses the ball into the air and then tries to pick up the jacks and catch the ball, usually before it bounces. If the player fails in this she loses her turn. The game becomes increasingly difficult; first, one jack has to be picked up, followed by two at a time, then three, and finally all of them must be grasped in the hand before the ball is caught. Then the movements change. The player may have to push a jack or jacks into the other hand. Ten to twelve or more increasingly complex moves are often encountered, one of which includes bouncing the jacks off the back of the hand, or catching them there as in the classic game. The player who completes the series in the shortest time wins.

In Czechoslovakia, girls play the classic game using six seeds, and perform each maneuver first with the right, then with the left hand. In parts of the middle east there developed a game in which four to ten may play: each places four or more knucklebones in a straight line on the ground, the lines close to each other. Players stand at a distance from the lines, and toss a bone at the knucklebones, winning those that are knocked over.

In Egypt, children use apricot seeds, no more than ten to each player, everyone putting up the same number. The first player, chosen by lot, gathers all the seeds together and tosses them into the air; as they fall, he catches as many as possible on the back of his hand; the number caught determines the number of throws to which he then is entitled. The player then scatters all but one of the seeds, tosses that one into the air and snatches as many as possible from the ground before catching the falling seed. If he fails to catch the pit or to pick up any, he loses his turn. The winner is the one who has amassed the most seeds.

Jewish girls of eastern Europe traditionally played "Ghop Bagi" with five bones. On the first play, all were scattered on the ground or carpet, one tossed up and the other four garnered before it fell. In the second play of the set, three were on the floor and two in the air; in the third, two on the carpet and three in the air; and in the last, one on the floor and four in the air. The sets following became increasingly complex as in jacks.

In Japan and in China, a similar game is played using cloth bags filled with rice, sand or beans. The player drops the bags on a table, picks up one and tosses it aloft; while it is aloft he tries to pick up a bag from the table. He then holds this in his hand and repeats the play in an attempt to pick up and retain all the bags. Dib, dibstones or dabs is a game similar to jackstones, using either pebbles or sheep knucklebones. This game was played in ancient Rome using bones marked like dice, but only on four sides.

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(N. F. J.)

JACK THE RIPPER, the pseudonym applied to the perpetrator of a series of gruesome murders committed in or near the sordid Whitechapel district of London in 1888. At least seven killings may be attributed to the unknown assailant with reasonable certainty. All of the victims were prostitutes, and all except one were killed while plying their trade on the public streets. The methods of killing were not in every instance identical, but in each case the throat was cut and in most the bodies were mutilated by someone obviously possessing considerable knowledge of human anatomy. Unusual though futile efforts were made to trap the killer. Hundreds of suspects were interviewed. Bloodhounds were put into service. Even the eyes of one of the victims were photographed on the theory (not then discredited) that the image of the murderer might be recorded on the retinas of the murdered woman. Throughout the investigation the authorities received taunting notes from one purporting to be the murderer. On one occasion half a human kidney, which may have been removed from the body of a victim by the killer, was mailed to the police.

Few cases have so captured the attention and imagination of the public, both in England and America. Jack the Ripper has provided themes for literary and dramatic productions, perhaps the most notable being Mrs. Belloc Lowndes' classic horror novel, *The Lodger* (1913). The identity of Jack the Ripper and the motivation for his crimes have proved tempting subjects for speculation. Although many hypotheses have been advanced, none has been generally accepted. The case remains one of the great unsolved mysteries of English crime.

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(F. A. A.)

JACOB, in the Bible, was the son of Isaac and Rebekah, the grandson of Abraham and the traditional ancestor of the people of Israel. He is represented as the twin brother of Esau (*q.v.*), the ancestor of Edom, and the two are representatives of two grades of social order, Jacob being a pastoral nomad and Esau the typical Bedouin hunter and raider. While Esau is actually the elder, Jacob by a double artifice (Gen. xxv, 29–34 and xxvii) obtains the rights and privileges of seniority. He then goes to the Aramaean tribe from which his ancestry had sprung, and on the way receives a special revelation from God at Bethel. He marries two of his cousins, Leah and Rachel, and after serving their father, Laban, seven years for each of them, and an additional six years during which he amasses a large property, he returns to Palestine. He receives a second revelation at Peniel, meets and is reconciled to Esau and settles in Canaan. Twelve sons are born to him, six by Leah, and two each by Rachel and the female slaves of his wives. The story of his later years belongs rather to the life of Joseph (*q.v.*), and it was as a result of the latter's success in Egypt that Jacob and his sons migrated there in time of famine and took up their residence on the northeastern border—the land of Goshen. There Jacob died; he was buried in Palestine.

These narratives are full of much valuable evidence regarding marriage customs, pastoral life and duties, popular beliefs and traditions, and are evidently typical of what was currently retailed. Their historical value has been variously estimated. The name existed long before the traditional date of Jacob, and the Egyptian phonetic equivalent of Jacob-el (*cf.* Isra-el, Ishma-el) appears to be the name of a district of central Palestine (or possibly east of Jordan) about 1500 B.C. But the stories in their present form are very much later. The close relation between Jacob and the Aramaeans confirms the view that some of the tribes of Israel were partly of Aramaean origin; his entrance into Palestine from beyond the Jordan is parallel to Joshua's invasion at the head of the Israelites; and his previous journey from the south finds independent support in traditions of another distinct movement from this quarter. Consequently, it would appear that these extremely elevated and richly developed narratives of Jacob-Israel embody, among a number of other features, a recollection of two distinct traditions of migration which became fused among the Israelites.

Jacob (Arabic Ya'kub) also figures in the Koran; in the early Meccan *suras* he is counted as the brother, not the son, of Ishak (Isaac) and the son of Ibrahim (Abraham).

See also Israel; Twelve Tribes of Israel.

(S. A. C.; T. H. R.)

JACOB of Edessa (*c.* 640–708), a distinguished Jacobite theologian, historian, philosopher, exegete and grammarian, was born

at 'En-deba and became bishop of Edessa (*c.* 684). His strict discipline giving offense, he retired and devoted himself to study and teaching. He composed Syriac homilies in prose and verse, canons, liturgies, commentaries on the Old and New Testaments and a chronicle, designed to continue that of Eusebius, of which only fragments remain. He revised the Peshitta Old Testament on the basis of Greek and Syriac versions. He translated from the Greek, notably the *Homiliae cathedrales* of Severus of Antioch. He produced the earliest extant Syriac grammar and introduced Greek letters to represent the Syriac vowels.

See A. Baumstark, *Geschichte der syrischen Literatur* (1922).
(W. D. McH.)

JACOB OF SERUGH OR SARUG (451–521), a Syriac writer described for his learning and holiness as "the flute of the Holy Spirit and the harp of the believing church," was born at Kurtam on the Euphrates. Like his father he was ordained priest, and by 503 he was episcopal visitor of Haura in Serugh. In 519 he was made bishop of Batnan in Serugh. He died in Nov. 521. By his contemporaries and some moderns Jacob has been regarded as orthodox, but four of his letters edited by P. Martin prove his monophysitism. His prose writings include discourses, six festal homilies and many letters. He is the reputed author of a liturgy and order of baptism. He wrote also 760 homiletic poems, mostly in dodecasyllabic metre, treating mainly of Old and New Testament incidents and of apostles, saints and martyrs.

See A. Baumstark, *Geschichte der syrischen Literatur* (1922); J. B. Abbeloos, *De vita et scriptis S. Jacobi* (1867). (W. D. McH.)

JACOB, MAX (1876–1944), French poet, whose writings are the product of a complex amalgam of Jewish, Catholic, Breton and Parisian elements; his verbal clowning and apparent buffoonery, which earned him the reputation of a *fantaisiste*, concealed profound sadness.

Born at Quimper, Brittany, on July 12, 1876, of Jewish parentage, he went in 1894 to Paris, where he lived in extreme poverty. A close friend of Picasso, Apollinaire and Salmon, Jacob was an important figure in the Montmartre that was the background to Cubism in its formative period. In 1909 he was converted to Christianity but was not received into the Roman Catholic Church until 1915. Thereafter he oscillated between extravagant penitence and wild bohemianism until 1921 when he retired into semimonastic seclusion at Saint Benoît-sur-Loire. There he lived, supporting himself by painting *gouaches*, apart from a return to Paris between 1927 and 1936, until taken to the concentration camp at Drancy, near Paris, where he died on March 5, 1944.

Outstanding in his voluminous production are: *Le Cornet à dés* (1917; complete edition, two volumes, 1945–55), a collection of ingenious macaronic prose-poems which exercised a deep unacknowledged influence on Surrealist verse; *Le Laboratoire central* (1921; new edition, 1960), "stoppered phials" of lyrical poetry; and his Breton *Poèmes de Morvan le Gaëlique* (1953). *Sacrifice impérial* (1929), *Saint Matorel* (1936), *La Défense de Tartufe* (1919) and his *Correspondance* (edited by F. Garnier, volume i, 1953; volume ii, 1955) show his unrelenting self-examination and emotional conflict. His "novels," mainly epistolary, are exercises in verbal mimicry, reproducing every nuance in the conversation of the *petit-bourgeois*, of whom he was a sardonic and affectionate observer. Jacob was perhaps the only "modern" poet of his period who broke with the traditional form of Baudelaire and Mallarmé, although it was some years before his experiments with poetic form came to be recognized as deeply informing influences on French poetry.

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(S. J. Co.)

JACOBA (JACQUELINE) (1401–1436), countess of Holland, Zeeland and Hainaut, was the only daughter and heiress of William, duke in Bavaria and count of Holland and Zeeland as William VI and of Hainaut as William IV, by his consort Margaret, daughter of Philip the Bold, duke of Burgundy. Born on July 25, 1401, at Le Quesnoy, Jacoba was betrothed as early as 1406 to John of Touraine, second son of Charles VI of France, and married in Aug. 1415. John, who in Dec. 1415 had become dauphin, died in April 1417, and on May 31 Jacoba also lost her father. In 1416 the German king Sigismund had refused to recognize her as her father's heiress, and he now supported the claims of her paternal uncle, John of Bavaria, bishop-elect of Liège. Jacoba's marriage to her cousin John IV, duke of Brabant, was arranged in Aug. 1417 by her maternal uncle, John the Fearless, duke of Burgundy. It was consummated in March 1418, in circumstances that left a juridical loophole for a later disavowal. Meanwhile fighting had broken out in Holland between Jacoba, aided by the Hook faction and by Brabançon forces, and her Bavarian uncle. Burgundy's mediation secured a settlement in 1419. A year later, John of Brabant practically surrendered Holland and Zeeland to John of Bavaria.

Disgusted with her feeble husband, Jacoba left for Hainaut in April 1420. In March 1421, after having repudiated her marriage, she sailed for England, where she was welcomed by Henry V. After Henry's death she married Humphrey, duke of Gloucester (*q.v.*), probably in Oct. 1423. This step had a disastrous effect on the Burgundian-English alliance, as an English intrusion in the Low Countries was not to be tolerated by Philip the Good, duke of Burgundy, another cousin of Jacoba. In autumn 1424 Humphrey and Jacoba landed in Hainaut, where they were opposed both by Burgundians and Brabançons. In April 1425 Humphrey returned to England, abandoning his wife, who had to submit to Philip the Good; she was interned at Ghent. John of Bavaria had died in Jan. 1425, leaving his possessions in Holland to Philip of Burgundy, who had now also become next heir to Jacoba. Moreover, Philip induced John of Brabant to transfer to himself the mortgage of Holland and Zeeland. Jacoba escaped to Holland in Sept. 1425 and for three years struggled gallantly to maintain herself, supported by the Hook faction. At first she had some success, but Philip, putting out his full strength, gradually broke down all opposition. The death of John of Brabant (April 17, 1427) was of no avail to the countess, for the pope pronounced her marriage with Gloucester invalid (Jan. 9, 1428), thus leaving her entirely without support.

By the treaty of Delft (July 3, 1428) Jacoba was allowed to keep the title of countess, but Philip was to administer the government of her three counties, and she promised not to marry again without his consent. Two years later Philip committed the government of Holland and Zeeland to three nobles of the Borselen family, from Zeeland. In 1432 Jacoba secretly married one of them, Francis, lord of Zuilen and St. Maartensdijk—a very mysterious affair. Philip intervened and compelled her to abdicate in his favour (April 12, 1433). As duchess in Bavaria and countess of Ostrevant, she henceforth lived in retirement, and died childless at Teilingen near Leiden on Oct. 9, 1436.

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(A. G. J.)

JACOBABAD, a municipal town and district in the Khairpur division of West Pakistan. Jacobabad town (pop. [1961] 35,278), the administrative headquarters of the district, lies 200 mi. N. of Hyderabad. It is noted for its consistently high temperatures, the maximum recorded being 52.2° C. (126° F.). The town has five parallel main streets lined with ornamental trees, and there are five public parks and a gymkhana. Gen. John Jacob's tomb, the Victoria clock tower (1887) and a big clock in the residency, made by the general himself, are of interest. A horse and cattle show with farm products and machinery is an annual feature. There is a municipal broadcasting station and a civil aerodrome. Jacobabad is a junction on the Pakistan Western railway and main roads radiate in all directions.

The town was founded on the site of the village of Khanghar in 1847 by Gen. John Jacob, for many years commandant of the Sind Horse Cavalry regiment and the first deputy commissioner of the district, who died there in 1858.

JACOBABAD DISTRICT, formerly known as Upper Sind Frontier district, has an area of 2,982 sq.mi. and a population (1961) of 528,709. It consists of a narrow strip of alluvial plain which

slopes away from the Indus in the east. It is protected from flood by the Kashmor embankment. The Bugti hills border the district in the north while the outliers of the Kirthar hills occur in the extreme southeast. Annual rainfall averages less than four inches. Agriculture is practised with the help of canal irrigation; millet, gram, wheat, rice and oilseeds being the chief crops and rice is milled locally. (K. S. Ad.)

JACOB BEN ASHER (1269–1340), codifier of Jewish law, was born in Germany (Cologne?) and died in Toledo, Spain. A son of Asher ben Yehiel (*q.v.*), Jacob is best known for his work *Arb'a'ah Turim*, or four rows or classes of law, from which he is called *Ba'al ha-Turim* ("Master of the Rows"). Jacob divided the entire Jewish law systematically into four classes: (1) *Orah Hayyim* ("Path of Life") contains laws dealing with the prescribed prayers and ritual observances of a Jew; (2) *Yoreh De'ah* ("Teacher of Knowledge") contains laws dealing with permitted and forbidden things, such as dietary laws; (3) *Eben ha-Ezer* ("Stone of Help") contains laws dealing with family relations; and (4) *Hoshen ha-Mishpat* ("Breastplate of Judgment") contains civil and criminal law. Jacob eliminated from his work all laws and customs which ceased to operate after the destruction of the Second Temple. He paid special attention to customs which originated in Germany. The systematically arranged work of Jacob superseded the codes of earlier times and served as a basis for the final edifice of codified Jewish law, the *Shulhan 'Arukh* by Joseph Qaro (*q.v.*).

See Meyer Waxman, *History of Jewish Literature*, vol. ii, p. 140 ff. (1933). (J. M. Rl.)

JACOBEAN STYLE, in architecture, is that style of early English Renaissance which followed the Elizabethan style (*q.v.*), and is generally contemporary with the reign of James I (1603–25). It is characterized by a combination of motives from the late Perpendicular period (*q.v.*), with a great use of crude and misunderstood classical detail, in which the influence of Flanders is strong. The Tudor pointed arch is common, and in interior work there is considerable simple, Tudor paneling and an occasional use of perpendicular vaulting forms. Doorways, fireplaces and the like are usually framed with classical forms, and both outside and inside there is a wide use of terms, pilasters, S-scrolls and the type of pierced, flat ornament known as strapwork. This style, despite its name, is found over a longer period of time than the strict limits above stated; thus Wollaton hall, Nottinghamshire (1580), can rightly be termed Jacobean, and traces of the same style are found in the colleges of Oxford and Cambridge that were constructed up to the beginning of the 18th century. *See* also Tudor Period.

JACOBI, ABRAHAM (1830–1919), German-U.S. physician, considered the founder of pediatrics in the United States, was born at Hartum, Westphalia (Germany), May 6, 1830, and was educated at the Universities of Greifswald, Göttingen and Bonn (M.D., 1851). Because he participated in the German revolutionary movement he was imprisoned, 1851–53, in Berlin and Cologne for "high treason."

Upon his release he went to the United States and began practice in New York city. In 1860 he became professor of children's diseases at the New York Medical college, holding the first chair in the subject founded in the United States. He was professor of children's diseases from 1865 to 1870 in the medical department of New York university and from 1870 to 1902 in the college of physicians and surgeons of Columbia university. He established the first special clinic for diseases of children in the country in New York city in 1862 and later established many others. He died at Bolton Landing, N.Y., July 10, 1919.

JACOBI, FRIEDRICH HEINRICH (1743–1819), German philosopher, a leading exponent of the *Gefühls-* or *Glaubensphilosophie* (philosophy of feeling or of belief), was born at Düsseldorf on Jan. 25, 1743. Having completed his education at Geneva (1759–62), where he came under the influence of contemporary French writers, he took his father's place as head of a sugar factory in 1764, but gave this up in 1772, when he became a member of the governing council of the duchies of Jülich and Berg. His house at Pempelfort then became a centre of literary activity. Associated with C. M. Wieland in the launching of the literary periodical *Der Teutsche Mercur* (1773), Jacobi published in it the second part of his philosophical novel *Eduard Allwills Briefsammlung* (1776; the first part had appeared in *Iris*, 1775) and the first part of another novel, *Woldemar: ein Seltenheit aus der Naturgeschichte* (1777; complete ed. 1779). In 1779 he was appointed privy councilor to the electoral court of Bavaria.

When Lessing, whom he met in 1780, told him that he knew no philosophy but Spinoza's, Jacobi took up the study of Spinozism. The rationalism of it repelled him; he denounced it in *Über die Lehre des Spinoza, in Briefen an den Herrn Moses Mendelssohn* (1785; 2nd ed. 1789). When Moses Mendelssohn and other partisans of the Enlightenment attacked his notion of "belief" as being obscurantist, he replied in *David Hume über den Glauben, oder Idealismus und Realismus* (1787), maintaining that his notion of belief as the only means of immediate cognition of individual facts was the same as that held by the most advanced philosophers.

Jacobi went to see Goethe at Weimar in 1784 and visited London in 1786. In 1794 he left his house at Pempelfort because of danger from the approach of the French Revolutionary armies and went to Hamburg. Eventually he settled for a time at Eutin. When Fichte was accused of atheism, Jacobi published an open letter, *Jacobi an Fichte* (1799), to make his own theistic position clear. His *Über das Unternehmen des Kriticismus, die Vernunft zu Verstande zu bringen*, against Kant, appeared in 1801.

In 1801 Jacobi began a round of travels which took him to Pempelfort, Aachen, Paris and Hanover. In 1804, however, financial losses obliged him to return to Eutin. He then received an invitation to Munich in connection with the establishment of an academy of sciences there. He arrived in Munich in 1805, and was president of the academy from 1807 to 1812. His treatise *Von den göttlichen Dingen und ihrer Offenbarung* (1811) was directed against Schelling, to whose philosophy he objected and whose presence in Munich was disagreeable to him. Jacobi died in Munich on March 10, 1819.

Jacobi's philosophy is closely related to that of his friend Johann Georg Hamann (*q.v.*). Belief for him meant an immediate conviction not only of the reality of sense-data but also of truths present in the heart or in the spirit of man, including his knowledge of God, all of which Jacobi felt to be endangered if they were to be submitted to the rationalizing processes of the mind. He specifically disclaimed any intention of constructing a system of philosophy. The collected edition of his works, which he began, was completed by F. Koppens, six volumes (1812–25).

Bibliography.—There are selections of Jacobi's letters ed. by F. von Roth (1825–27) and by R. Zoppritz (1869) and collections of his correspondence with Goethe (1846), with Herder (1856–57), with Hamann (1868) and with F. Bouterwek (1868). *See* E. Zirngiebl, *F. H. Jacobis Leben, Dichten und Denken* (1867); L. Lévy-Bruhl, *La Philosophie de Jacobi* (1894); A. W. Crawford, *The Philosophy of F. H. Jacobi* (1905); O. F. Bollnow, *Die Lebensphilosophie Jacobis* (1933).

JACOBI, JOHANN GEORG (1740–1814), one of the anacreontic group of German poets which included J. N. Götz and J. W. L. Gleim (*qq.v.*). Jacobi was born in Düsseldorf on Sept. 2, 1740, son of a wealthy businessman. He was the elder brother of F. H. Jacobi (*q.v.*). After studying at Göttingen and elsewhere he became in 1766 professor of philosophy at Halle. From 1768 to 1774 he lived in Halberstadt and then returned to Düsseldorf, where he published *Iris* (1774–76), a quarterly which numbered Goethe, Gleim, Hermann Lenz and J. J. W. Heinse among its contributors. In 1784 he became professor of aesthetics in Freiburg, where he issued a series of "pocket books" (1795–1813) to which Klopstock, M. Claudius, J. H. Voss, Jean Paul Richter and others contributed. This series was also, from 1803, called *Iris*.

Jacobi's poetry is largely lyric and his delicate, oversweet anacreontic verses are strongly influenced, in form and content, by contemporary French models. Later (and especially after his prose and verse *Winterreise* of 1769) the influence of Goethe and Laurence Sterne led him to develop more genuine traits of feeling and he ultimately wrote some distinctive poetry which combines intimate feeling for nature with melodiousness and an appealing simplicity. Some of his poems were attributed to Goethe. He died in Freiburg on Jan. 4, 1814.

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JACOBI, KARL GUSTAV JACOB (1804–1851), German mathematician, who was one of the great algorists, was born at Potsdam on Dec. 10, 1804. He studied at Berlin university, where he obtained the degree of doctor of philosophy in 1825, his thesis being an analytical discussion of the theory of partial fractions. He first became known through his work on the theory of numbers, which he communicated in letters to K. F. Gauss. In 1827 he became extraordinary and in 1829 ordinary professor of mathematics at Königsberg, which chair he filled until 1842. Together with Niels H. Abel, he was one of the founders of elliptic function theory; his principal work was *Fundamenta nova theoriae functionum ellipticarum* (1829). He made notable research on differential equations and applied his analysis to dynamical problems. He introduced the theory of the last multiplier, which is fully treated in his *Vorlesungen über Dynamik*, edited by R. F. A. Clebsch (1866).

Jacobi advanced the theory of configurations of rotating liquid masses by showing that the ellipsoids, which are now known as Jacobi's ellipsoids, should be figures of equilibrium. He was one of the early founders of the theory of determinants, and he invented the functional determinant formed of the n^2 differential coefficients of n given functions of n independent variables that bears his name (Jacobian) and which has played an important part in many analytical investigations.

Valuable also are his papers on Abelian transcendents and his investigations in the theory of numbers to which he applied elliptic functions. He left a vast store of manuscript, portions of which have been published at intervals in August L. Crelle's *Journal for Pure and Applied Mathematics*. He died in Berlin Feb. 18, 1851.

Jacobi's *Gesammelte Werke* were published by the Berlin Academy (1881–91).

See Leo Königsberger, *Carl Gustav Jacob Jacobi* (1904); E. T. Bell, *Men of Mathematics* (1937). (O. Oe.; X.)

JACOBINS, the name generally given to the most famous political club of the French Revolution (*q.v.*). Though it drew some inspiration from earlier 18th-century *sociétés de pensée* or debating societies its immediate forerunner was the Club Breton, established at Versailles soon after the estates-general met in May 1789, in which Breton deputies entertained "patriot" colleagues (including Mirabeau and Robespierre) at the Café Amaury. After the events of Oct. 5–6, 1789, had brought the National Assembly to Paris, a similar club was formed, probably in December. Officially called the Société des Amis de la Constitution, it soon became known as the Jacobin club because it met in a convent of the Dominicans or Jacobins in the Rue St. Honoré.

From the beginning the society was essentially a club for debate, and more than 200 deputies enrolled in it, meeting in the refectory. The admission of nondeputies—usually writers, scientists, sympathetic foreigners and prosperous bourgeois who paid a higher subscription—meant that from spring 1791 meetings had to be held in the library. The members, who were carefully selected, were brought together at first not so much by a doctrine as by a common preoccupation, the fear of an aristocratic conspiracy. Most of them favoured a constitutional monarchy, not a democracy. Their aim was emphasized by the rules drawn up by Antoine Barnave and accepted on Feb. 8, 1790: "to enlighten the people and to protect them from error." This was also the guiding principle of many clubs formed in the provinces and affiliated to the Jacobin club, which thus could issue instructions to them and so exert great influence throughout France. By July 1790 there were 152 such clubs, and the Paris club alone had nearly 1,200 members. Within the club, however, there were great differences of opinion: Robespierre, for instance, was confronted by Barnave, by the duc d'Aiguillon (Armand de Vignerot Du Plessis de Richelieu) and by Louis Marie de Noailles. The club met on Mondays, Wednesdays, Fridays and Sundays in the evening until about 11 P.M. From May 29, 1791, meetings were held in the former chapel.

At the time of Louis XVI's flight to Varennes (June 1791) several members, including J. P. Brissot, posted up republican manifestoes; and the "massacre" on the Champ de Mars (July 17) almost led to the dissolution of the club, as all the moderate deputies, led by the brothers Lameth, went to join the rival club of the Feuillants (*q.v.*), so that only six deputies were left. Robespierre and Jérome Petion de Villeneuve, however, were able to keep the most devoted Parisian members together and to rally the provinces. By September the club was not only larger (with about 130 deputies among its members and 1,000 societies acknowledging its supremacy) but endowed with a new spirit.

Jacobin influence in the elections to the Legislative Assembly and to the Paris municipal administration was most successful. From Oct. 14, 1791, meetings were public, and the "brothers and friends" came to think of themselves more and more as the whole nation. As the Legislative Assembly was composed of new men, the Jacobins became its mentors, drafting proposals for legislation, criticizing decrees, keeping watch over ministers and their agents, listening to petitions and forming public opinion through speeches and circulars. Robespierre's influence was undeniably great, but he did not at first always get his own way; when the question of war with Austria arose he was opposed to it, but Brissot persuaded the Jacobins that war was necessary, and it was declared in April 1792 (*see* FRENCH REVOLUTIONARY WARS). The defeats of the French armies, however, brought the club round to Robespierre's views again, and it supported him against La Fayette and the counter-revolutionary elements in the assembly. The Jacobins had little to do with the planning of the insurrection of Aug. 10, 1792, and were disturbed by the September massacres, when events seemed to be going too fast for them; yet once more the club was saved from dissolution by the entry of new members.

On Sept. 22, 1792, after the Convention had created the republic, the club changed its name to Société des Jacobins, Amis de la Liberté et de l'Égalité. It then set out to attract the deputies of the left in the Convention (that is, the Montagnards) and also the more prosperous *sans-culottes*, shopkeepers and artisans like Maurice Duplay. Dominated now by Robespierre, the club made its will prevail in the trial of the king and then set about the overthrow of the Girondins (*q.v.*). Though Brissot and his friends had been expelled from the club, they still had a majority in the Convention and so could threaten to overrule Parisian deputies and the Paris commune. Therefore the Jacobin extremists and the *sans-culottes* organized the risings of May 31–June 2, which led to the expulsion of the Girondins from the Convention.

The Jacobin club then became the loyal supporter of the revolutionary government. The affiliated societies worked with the *représentants en mission* to prevent the spread of "federalism," preserve national unity, maintain the food supply and speed the levy of troops. Carefully prepared debates in the club initiated most of the great measures of public safety before Jacobin deputies sponsored them in the Convention. It was the Jacobin club which launched the Terror and the attacks on journalists, on the clergy, on foreigners, on "timid" generals and on unpatriotic contractors. *Représentants en mission* reported to the Paris club, and in Oct. 1793 it sent delegates to the rebellious inhabitants of Bordeaux and Lyons to create "public spirit."

The Jacobins believed in equality among citizens, in the freedom of the individual and in the universal brotherhood of man. But what they spread was not so much a body of doctrine as a state of mind; their correspondence, proclamations and newspapers succeeded in setting up a "dictatorship of opinion" over the whole country. They extolled civism and virtue, comforted the doubtful and ruthlessly condemned their opponents as traitors. Possessed by quasi-religious enthusiasm, the Jacobin was ready to sacrifice himself as well as others for the public good and to promote the regime of "liberty" to the point of despotism. By the autumn of 1793 (by which time a number of women had joined the club), the Jacobins were applauding the anti-Christian movement; and because of the food shortage they began to demand a government-controlled economy, such as the club of the Cordeliers (*q.v.*) also wanted. To save the government's authority from the excesses

of the enthusiasts, Robespierre had to take action. The club began a purge of its members, refused affiliation to societies created after May 31, 1793 (Jan. 1794), and broke off relations with the Cordeliers (Feb. 1794), then with the Hébertists and finally with the Dantonists. By the end of April the club's fate was inextricably linked with Robespierre's.

Robespierre now controlled the Convention, the Paris commune and the local administrations, but his government became less and less popular as it came to rely more and more on officials. The revolutionary dictatorship, an essentially Jacobin creation, was incompatible with *sans-culotte* democracy because it subordinated the controlled economy to national defense and paid little attention to the needs of the masses, whose support it consequently lost. Obsessed with the idea of unity, Robespierre even wanted to dissolve the societies affiliated after Aug. 10, 1792, in order to bring *sans-culotte* organizations under Jacobin control. Yet when the opposition of *sans-culottes* in the sections had been put down, discontent with the high cost of living and the fixed wage level continued.

During the reaction of Thermidor (July 1794) the *sans-culottes* did not try to save the Jacobin leaders of the government. The club itself, it is true, did not appreciate its peril. It was closed on the night of 10 Thermidor (July 28), reopened the next day, then closed again. The survivors of the old factions and the *jeunesse dorée* deliberately set out to destroy it, and public opinion blamed the Jacobins for everything that had gone wrong. The Convention first got rid of the affiliated societies and then, on Nov. 12, approved the decree of Nov. 11 which suppressed the Paris club. Some members continued to meet under P. F. Tissot and F. E. Raisson in a ballroom in the Rue des Boucheries-St. Germain; but their old meeting place was demolished, to give way to the present Marché St. Honoré.

Jacobinism, linking as it did the *bourgeoisie* and the *sans-culottes*, could not be the voice of a single class, so that its internal contradictions limited its function in history. The Jacobin spirit, however, survived in François Babeuf's *Tribun du Peuple* and in the Panthéon club of 1795–96 under the Directory; in the Réunion des Amis de la Liberté et de l'Égalité or Club du Manège of 1799, with its *Journal des Hommes Libres;* and in the Carbonari (*q.v.*) and the republican societies under the Bourbon Restoration. Its role in the revolution of Feb. 1848 was negligible. The term Jacobin, however, is still used to denote a staunch democrat.

See also references under "Jacobins" in the Index.

Bibliography.—F. A. Aulard, *La Société des Jacobins,* 6 vol. (1889–97), an incomplete collection of documents; C. Brinton, *The Jacobins: an Essay in the New History* (1930); G. Martin, *Les Jacobins* (1945); G. Walter, *Histoire des Jacobins* (1946); J. Castelnau, *Le Club des Jacobins* (1947); A. Soboul, *Les Sans-Culottes parisiens en l'an II* (1958). *See* also articles by various authors in the *Annales historiques de la Révolution française* and *La Révolution française.* (Ma. Bo.)

JACOBITES, the name given in British history to the supporters of the exiled Stuart king James II (Lat. *Jacobus,* James) and his descendants after the revolution of 1688. On the death in 1807 of Henry Stuart, Cardinal York, the last Stuart in the male line, the rightful occupant of the British throne according to legitimist principles, was in the line of descent from Henrietta (1644–70), youngest daughter of Charles I. Since Salic law does not apply to the British throne, the claim was transmitted through Henrietta's daughter, Anne Marie (1669–1728), who married Victor Amadeus II of Sardinia. Her great-grandson, Victor Emmanuel I (1759–1824) thus inherited the claim in 1807, which passed to his daughter Maria Beatrice (*c.* 1780–1840) and through her granddaughter Marie Thérèse (1849–1919) wife of Louis III of Bavaria to his grandson Albrecht (1905–).

The political importance of the Jacobite movement extended mainly from 1688 to 1745. The Jacobites, especially under William III and Queen Anne, could offer a feasible alternative title to the crown and the exiled court at St. Germain was frequently contacted by disgruntled soldiers and politicians. After 1714 the Whigs' monopoly of power led some Tories into Jacobite intrigues and the Tories, especially after Lord Bolingbroke's schemings in 1714, were long accused of being potential if not actual Jacobites. The movement received support in Scotland and Wales where it was primarily dynastic, and in Ireland where it was mainly religious. Roman Catholics and Tory Anglicans often felt far more sympathy for the Stuarts than for their successors. The Tory Anglicans had doubts about the legality of the events of 1688–89, while the Catholics had more to hope for from James II and James the Old Pretender, who were firm Catholics, and Charles Edward the Young Pretender, who vacillated for political reasons but who was at least tolerant. After the failure of the rebellions of 1715 and 1745 (*see* English History and Scotland: *History*), Jacobitism declined as a serious political force but remained as a sentiment. "The king over the water" gained a certain sentimental appeal, especially in the Scottish Highlands and a whole body of Jacobite songs came into being. By the late 18th century the name had lost many of its political overtones and George III even gave Cardinal Henry a pension. The name persisted as a purely historical term and as a description of the supporters of legitimist Stuart claims.

See also references under "Jacobites" in the Index.

JACOBS, W. W. (William Wymark) (1863–1943), English author of short stories about seafaring men and dockyard workers, was born at Wapping, London, on Sept. 8, 1863. His books, speaking through their characters, display a gentle humour and economy of style. Though his seamen are rarely at sea, their adventures or misadventures ashore provide many thrilling tales. His first volume of short stories, *Many Cargoes* (1896), had an immediate success and was followed by two others, *The Skipper's Wooing* (1897) and *Sea Urchins* (1898). One of his most famous short stories, "The Monkey's Paw," came to be regarded as a "horror" classic and was dramatized many times. An omnibus, *Snug Harbour,* containing some 17 volumes of his work, was published in 1931. Jacobs died in London on Sept. 1, 1943.

JACOBSEN, JENS PETER (1847–1885), Danish novelist and poet, an outstanding exponent of late 19th-century literary naturalism, was born April 7, 1847 at Thisted, Jutland, the son of a prosperous merchant. As a student in Copenhagen his interests were divided between literature and the natural sciences, particularly botany; he wrote a number of important treatises and translated Darwin's *Origin of Species* (1872) and *The Descent of Man* (1875). The first Danish Darwinist, he preceded Georg Brandes in rejecting the Christian interpretation of life and, from 1871 onward, supported the new, naturalistic, anti-Romantic movement with articles in its journals and with *Mogens* (1872), a story written in an impressionistic style, describing a young man's progress from daydreams to reality. About this time appeared the first symptoms of the tuberculosis which cut short Jacobsen's life and overlaid his meagre literary output with melancholy. He died at Thisted, April 30, 1885.

Despite constant struggles against illness he managed to write two novels, *Marie Grubbe* (1876; Eng. trans., 1914) and *Niels Lyhne* (1880; Eng. trans., 1919). The first, set against a vividly depicted late 17th-century background, tells the story of a *grande dame* who, after several ill-starred marriages and liaisons, elopes with a groom and ends her life in poverty. The second novel develops a theme similar to that of *Mogens*—of the dreamer who through experience and disillusionment becomes a realist—with the additional element of the problem confronting the atheist in bearing the burden of his lack of belief. Both show Jacobsen's scientific training in that character is interpreted biologically and psychologically, but they also show his warm sympathy and emphasis on the human striving for moral unity, balance and individuality. It is this humanity which ensures his reputation, rather than the consciously picturesque and rhythmical, somewhat affected prose style which was revolutionary at the time and was much admired and imitated.

Jacobsen was a highly independent and original writer, self-conscious and self-critical. As a novelist of the naturalist school, he can be compared to Flaubert, but was probably most influenced by Turgenev and, among Scandinavians, by Hans Christian Andersen and Bjørnstjerne Bjørnson. Some of his best work appeared in *Mogens og andre Noveller* (1882; Eng. trans., 1921). He had written poetry all his life, posthumously collected in *Digte og Udkast* (1886; Eng. trans., 1920), which revealed his consider-

able original gifts as a lyric poet, using language with unusual boldness and anticipating in some ways the poetry of a later period. His *Samlede Skrifter* were published in a two-volume edition (1918; 11th ed., 1948) and in an annotated edition *Samlede Værker*, five volumes (1924–29). There are several editions of his interesting letters, many of which are included in *Georg og Edv. Brandes' Brevveksling*, volume 11 (1940).

See G. Christensen, *J. P. Jacobsen*, 2nd ed. (1924); A. Gustafson, *Six Scandinavian Novelists* (1940). (S. M. K.)

JACOBUS DE VORAGINE (1228/9–1298), archbishop of Genoa, chronicler and author of the *Golden Legend*, was born in Genoa and became a Dominican in 1244. After gaining a reputation throughout northern Italy as a preacher and theologian he was provincial of Lombardy (1267–78 and 1281–86) and archbishop of Genoa (1292) until his death there on July 13/14, 1298. He was beatified in 1816 for his work as a peacemaker between Guelphs and Ghibellines and his feast day in the Dominican order is July 13.

His works include sermons on gospel lections, saints' days and the Virgin Mary, a chronicle of Genoa and the *Legenda aurea*, (*Golden Legend*, also known as the *Lombardica historia*). This book is a collection of saints' lives, of accounts of events in the lives of Christ and of the Virgin Mary, and of information about holy days and seasons, the whole being arranged as readings (Lat. *legenda*) for the church year. Immensely popular in the middle ages, it was translated into all western European languages and gradually much enlarged. William Caxton's translation was one of the first books printed in English (1483). Medieval artists found the *Golden Legend* a storehouse of events and persons to be illustrated. But the miraculous stories it contains and its natural lack of historical perspective rendered the book unacceptable at the Reformation and after the rise of the new learning, so it then went completely out of fashion.

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JACOPO DELLA QUERCIA: *see* QUERCIA, JACOPO DELLA.

JACOPONE DA TODI (JACOPO DE' BENEDETTI) (*c.* 1230–1306), Italian religious poet whose work was based on a spiritual conception of poverty. He was born in Todi, Umbria, where he practised as a lawyer until his sudden conversion following the death of his wife, about 1268. He became a Franciscan tertiary and, ten years later, a lay brother. The importance he attached to the ideal of poverty made him sympathize with the Spirituals (*see* FRANCISCANS) and brought him into conflict with Pope Boniface VIII. In 1297 he signed the manifesto which declared Boniface's election invalid, and was excommunicated and imprisoned from 1298 to 1303, when Benedict XI released him. He died at Collazzone, Umbria, Dec. 25, 1306.

Jacopone wrote more than 100 *laudi spirituali*, varying greatly in tone and feeling. His art is unself-conscious, but he often writes with great power. Poverty is his theme. His realization of the "foolishness" of God's love for men overturns all worldly values: poverty of spirit, giving freedom from the desire to possess goods, honour, wisdom or even goodness, is for him the opening out of the human soul to be filled by God. Its other name is love.

Jacopone's *Laudi, Trattato e Detti*, were ed. by F. Ageno (1953). E. Underhill, *Jacopone da Todi, Poet and Mystic* (1919), includes some translations; *see* also M. Casella, "Jacopone da Todi," in *Archivum Romanicum*, vol. 4 (1920). (S. Rs.)

JACOTOT, JEAN JOSEPH (1770–1840), French educator and innovater of a "universal method" of education, was born at Dijon on March 4, 1770. In 1795 he became subdirector of the École Polytechnique in Dijon and shortly afterward professor of the method of sciences. His ideas were mainly a product of his extremely varied experience. He was successively soldier, politician, professor of languages, mathematics, Greek and Latin literature, French language and literature, military secretary and director of the military École Normale. In 1818 he left France for Louvain, Belg. He died in Paris on July 30, 1840.

In *Enseignement Universel* (1823) Jacotot asserted the equality of the mental capacities of all men and attributed existing differences to will. If the individual starts on the right lines he can educate himself. Newly acquired knowledge must be linked with existing knowledge, a process which is assisted by association of ideas. A course of study should begin by memorizing one section of subject matter until it has been thoroughly assimilated; then it can be associated with other sections. In the study of French, pupils were required to memorize six books of François Fénelon's *Télémaque* by concentrating in turn on the separate words, sentences and the grammar and finally linking up their knowledge through a number of varied exercises. (S. J. C.)

JACQUARD, JOSEPH MARIE (1752–1834), French inventor of a loom that included all the weaving movements, was born at Lyons on July 7, 1752. After fighting both against and for the Convention in the French Revolution, he worked in a Lyons factory, and in his spare time constructed his improved loom. In 1801 he exhibited it at the industrial exhibition at Paris; and in 1803 he was summoned to Paris and attached to the Conservatoire des Arts et Métiers. A loom by Jacques de Vaucanson (1709–82), deposited there, suggested various improvements in his own, which he gradually perfected to its final state. Although his invention was fiercely opposed by the silk weavers, who feared that its introduction, because of the saving of labour, would deprive them of their livelihood, its advantages secured its general adoption; by 1812 there were 11,000 Jacquard looms in use in France. The loom was declared public property in 1806, and Jacquard was rewarded with a pension and a royalty on each machine. He died at Oullins (Rhône) on Aug. 7, 1834; six years later a statue was erected to him at Lyons. *See* WEAVING: *Weaving Machinery.*

JACQUARD LOOM: *see* WEAVING.

JACQUELINE OF HAINAUT: *see* JACOBA.

JACQUERIE, the name—derived from the nobles' habit of referring contemptuously to any peasant as Jacques or Jacques Bonhomme—given originally to an insurrection of the lower classes in northeastern France against the nobles in 1358.

The original *Jacquerie* took place at a critical moment of the Hundred Years' War (*q.v.*). The battle of Poitiers (Sept. 1356), in which King John II was captured by the English, was the most recent of a series of defeats that had brought discredit on the military competence of the lords and knights. It had been followed by an Anglo-French truce which had released the "great companies" of mercenaries from the English forces to ravage and terrorize the French countryside. The Île-de-France, Champagne and Picardy were particularly afflicted, but the nobles, instead of protecting the peasants, sometimes compounded with the "companies" and even used the fact that the peasants had paid ransoms as a ground for demanding heavier payments of dues to themselves, which they spent on ostentatious luxury. From Nov. 1357, moreover, the dauphin Charles (*see* CHARLES V, of France) was preoccupied not only with the revolutionary activities of Étienne Marcel (*q.v.*) in Paris but also with the resuscitated hostility of Charles II (*q.v.*) the Bad, king of Navarre.

Having decided to blockade Marcel in Paris, the dauphin, at Compiègne on May 14, 1358, ordered the refortification of the castles surrounding Paris. The peasants were thus required to contribute to strengthening the seats of their oppressors: they could not bear this. On May 21 a rising began near Compiègne. It quickly spread southwestward over the country between the Oise and the Marne rivers and across the Seine; southeastward into Champagne; and northwestward to the area between Beauvais and Amiens. Appalling atrocities were committed against the nobles and numerous castles destroyed. In some towns the bourgeois and the tradesmen joined the peasants, who also had the support of some priests, regardless of attacks on the clergy as well as on the nobility. When Compiegne withstood the insurgents, their captain-general, Guillaume Cale or Carle, led his force to help Marcel's Parisians in an assault on Ermenonville. Cale, however, had left the Parisian contingent before it began its assault, together with

the bourgeois of Meaux, on the stronghold at Meaux in which the dauphin had left a party of royal ladies. Gaston Phoebus of Foix and Jean III de Grailly, captal de Buch, completely defeated this assault (June 9); then Charles the Bad captured Cale by treachery and annihilated his forces near Clermont-en-Beauvaisis (June 10), after which Charles went on to reduce Senlis, which had declared itself for the Jacques; and the dauphin led an expedition to reduce Champagne (June 15–24). Thenceforward repression continued until Aug. 1358, accompanied by sweeping massacres of peasants.

See S. Luce, *Histoire de la Jacquerie*, rev. ed. (1894).

JADE is a general term applied to the various types of minerals which are tough, hard, fine grained, and range in colour from almost pure white through clear emerald green to a dark black-green. Because of its pleasing colour and extreme toughness jade has been widely used, both by the ancients and moderns, as a lapidary stone and for small decorative carvings.

Most jades are made up of one or the other of two widely differing minerals, jadeite and nephrite. Jadeite is a pyroxene with the composition $Na_2O.Al_2O_3.4SiO_2$. It forms in nature at high pressure deep in the earth's crust at depths of 20 to 30 mi. It can be synthesized in the laboratory by subjecting the mineral analcite, $Na_2Al_2O_3.4SiO_2O$, to pressures of greater than 15,000 atm. in the temperature range of 400°–800° C. Jadeite plus water are the products. The common feldspar, albite, $Na_2O.Al_2O_3.6SiO_2$, can be converted to a mixture of jadeite plus quartz by pressures of 15,000–20,000 atm. in the temperature interval of 500°–800°. Jadeite is a rare mineral because rocks which have been subjected to this temperature and pressure are found only uncommonly on the surface of the earth. Its presence indicates great uplift of earlier deeply buried regions and great amounts of erosion. Many impurities may be present in the mineral. These are dominantly calcium, magnesium and iron oxides. The presence of these impurities accounts for the widely contrasting colour of different specimens of jadeite.

Nephrite, the other mineral of the jade family, although externally similar in appearance to jadeite, contrasts markedly in origin and in composition. Nephrite is an amphibole which may range in composition from the mineral tremolite to the mineral actinolite. The composition of tremolite is $2CaO.5MgO.8SiO_2.2H_2O$. Actinolite contains up to 50% of the molecule FeO substituting for MgO in the mineral tremolite. The colour of nephrite ranges from pure white, if it is made up solely of the tremolite molecule, to dark black-green, depending on the amount of iron in the mineral.

For discussion of hardness and other characters, occurrence and uses *see* JADE AND OTHER HARD STONE CARVINGS. (G. C. KY.)

JADE AND OTHER HARD STONE CARVINGS, in this article, refers to stones of jadeite, nephrite or similar minerals, that have been shaped for utilitarian, aesthetic or religious purposes, from earliest times to the present and in all parts of the world. For information about similar carvings in other materials, *see* GEM and JEWELRY; for information about the mineralogical properties of jade, *see* JADE.

The Material.—The name "jade" has been applied loosely to a variety of stones worked by lapidaries, but is now confined by common consent to two only—jadeite and nephrite. These stones differ from each other both in chemical composition and in crystalline structure. The first is a silicate of sodium and aluminum and is classed as a pyroxene. It is a cryptocrystalline mineral, the minute crystals being interlocked to form a compact aggregate. It ranks as 6½ or 7 on Mohs' scale of hardness, and has a remarkably constant specific gravity of 3.33 and a refractive index of 1.65–1.68. Nephrite, on the other hand, is a silicate of calcium and magnesium belonging to the amphibole group of minerals. It is properly regarded as a compact form of tremolite or, if iron is present in considerable quantity, of actinolite. In these minerals the crystals take the form of hairlike fibres of microscopic size, and in nephrite they are felted together to form a tough and closely integrated mass. The hardness is 6½, and the specific gravity is usually close to 3.0, with extreme limits of 2.9 and 3.1. The refractive index varies between 1.60 and 1.65. Both jadestones are too hard to be scratched by metal tools, but nephrite, though not quite so hard as jadeite, has sometimes proved even more resistant to the lapidary's abrasives. The name "nephrite" was introduced as a geological term in the 18th century, but it was not until 1863 that A. Damour showed that it had been applied indiscriminately to two minerals closely resembling each other but of quite different composition. Damour called the sodium-aluminum silicate jadeite, while the name nephrite was henceforth reserved for the silicate of calcium and magnesium.

Both stones may be white or colourless. The great range of shades of green, brown, mauve, blue, yellow, red, gray and black is mainly due to the presence, usually in very small quantities, of other elements such as iron, chromium and manganese. The two minerals, when worked and polished, can usually be distinguished by their appearance alone. The fine lustre of polished nephrite is oily rather than vitreous, and that of jadeite the reverse, while some colours are peculiar to one stone and some to the other. For example, the popular apple- and emerald-green jewelry jades are invariably jadeite. There are wide variations of translucency in both stones.

Confirmed occurrences of jadeite were rare prior to the 1940s, and the large deposits near Tawmaw in upper Burma are still the only important source of gem-quality material. The mineral has now, however, been located in Japan (Niigata prefecture), at several places in western California, in Celebes and New Guinea (traces) and most recently in the Motagua river valley of Guatemala. Occurrences of nephrite are more numerous. China's most important source throughout its history has been the region of Khotan (Hotien) and Yarkand in central Asia. In more recent times the Chinese have also imported nephrite from the neighbourhood of Lake Baikal in eastern Siberia. Other important sources are in the South Island of New Zealand from which the Maoris obtained their supplies; near Kotzebue in Alaska; and along the Sweetwater river in Wyoming. Great boulders of nephrite have been found near Jordanow Slaski (Jordansmühl) in the Silesia region, Pol., and in the valleys of the Turnagain and Fraser rivers in British Columbia. There are geological reports of nephrite from Brazil and of both nephrite and jadeite from the Ligurian Apennines.

From time to time the presence of jadestone has been reported or rumoured in several provinces of China and in many other countries, but these reports are at present unconfirmed and in most cases have been shown to be false. The frequency of misleading rumours is mainly due to inexact terminology and the fact that certain other minerals are easily mistaken for jade. Mexico, Tibet, Mongolia, Manchuria and Indochina have been repeatedly named as sources of jadestone, but it has not been proved to exist in any of them.

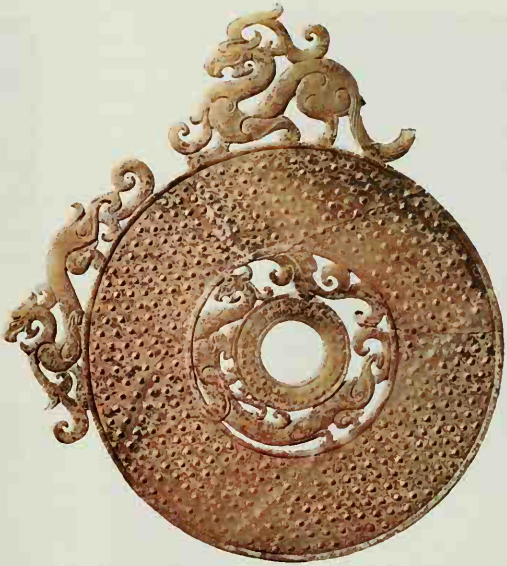
Jade in the Neolithic Age.—Both the jadestones, nephrite and jadeite, were worked into implements by Neolithic man in many parts of the world. The best-known finds are those from the lake dwellings of Switzerland, from western France and from China, but specimens have been reported from many countries of Europe, Asia and America. Jade is hard, tough and heavy; it takes and keeps a good edge, while its fine colours and warm polish must have been the delight of the Stone-Age craftsman. Unlike most stones it cannot be chipped or flaked, yet the laborious task of fashioning it with sandstone rubbers may well have seemed to be justified by the result. In more recent times too, primitive men to whom metals were unknown, like the Alaskan Indians and the Maoris of New Zealand before their discovery by Captain Cook, have made and treasured tools, weapons and simple ornaments of jade. When, however, the stone cultures were succeeded by those of bronze and iron, jade gradually lost its industrial value and fell from favour as a gem stone in all but a few regions. Evidence as to the possibility that the Greeks and Romans were acquainted with jade is inconclusive.

Mexico and Central America.—The first carved jades to reach Europe in historical times were brought back by the early Spanish navigators from their colonies in Mexico and Central America, where the natives wore them as ornaments, amulets and badges of rank. Among the Spaniards they acquired a reputation for the cure and prevention of diseases of the kidneys, whence the

Nephrite pendant (*hei-tiki*). New Zealand. Height 4¼ in.

Nephrite ritual object (*ts'ung*). Chinese, Chou dynasty (*c.* 1122–256 B.C.). Height 2⅝ in.

Jadeite plaque found at Teotihuacán, Mexico, but apparently of Mayan workmanship. A.D. 700–900. Height 5½ in.



Nephrite disk (or *Pi*) ornamented with feline figures. Chinese, Chou dynasty, period of the Warring States (*c.* 450–221 B.C.). Height 8½ in.

Nephrite carving of a cockatoo. Chinese, Shang dynasty (*c.* 1766–*c.* 1123 B.C.). Height 5⅛ in.

Nephrite cup. Chinese, Chou dynasty, period of the Warring States. Length 4½ in.

CARVINGS IN JADE

BY COURTESY OF (SECOND ROW RIGHT) NELSON-ATKINS GALLERY, KANSAS CITY (NELSON FUND), (BOTTOM RIGHT) THE SMITHSONIAN INSTITUTION, FREER GALLERY OF ART, WASHINGTON, D.C., (OTHERS) TRUSTEES OF THE BRITISH MUSEUM

JADE AND OTHER HARD STONE CARVINGS

Apple-green jadeite water vessel, for use with a scholar's ink-palette. Chinese, Ch'ing dynasty (1644–1912). Length 3 in.

Casket of seaweed-green nephrite, elaborately carved and reticulated. Chinese, Ch'ing dynasty. Width 7¼ in.

Jade bottle with rubies and emeralds in a gold setting. Mogul, 18th century. Height 10 in. Schreiber loan, formerly belonging to Lord Clive, now in the Victoria and Albert Museum

Nephrite belt hook. Chinese, Han dynasty (202 B.C.–A.D. 221). Length 2⅞ in.

Coral carving of Hsi Wang Mu, the fairy "Queen Mother of the West" riding above the clouds on a *feng-huang*. Chinese, Ch'ing dynasty. Height 13⅛ in.

Carving of a flowering lotus in white and pale green nephrite. Chinese, Ch'ing dynasty. Height 5¾ in.

CARVINGS IN JADE AND CORAL

BY GRACIOUS PERMISSION OF HER MAJESTY QUEEN ELIZABETH (TOP ROW); BY COURTESY OF (SECOND ROW RIGHT) FOGG ART MUSEUM, GRENVILLE L. WINTHROP BEQUEST, HARVARD UNIVERSITY, CAMBRIDGE, (BOTTOM LEFT) G. J. WINNER, ESQ., (BOTTOM RIGHT) MRS. A. F. DE BREYNE; PHOTOGRAPH (SECOND ROW LEFT) C. H. CANNINGS

stone became known as *piedra de los riñones* ("stone of the kidneys") or *piedra de ijada* ("stone of the flank" or "of the loins"). This name passed into French as *le jade* and into English as "jade." The name *piedra de los riñones* was rendered *lapis nephriticus* in Latin writings, and this in due course gave us our word "nephrite." But since jadeite was the material of the Aztec and Mayan jade carvers, and the great majority of their works in collections are of that material, it follows that the *lapis nephriticus* of 16th- and 17th-century writers was, in fact, what is now called jadeite.

Nearly all the Meso-American jades are of one or another shade of green, ranging from emerald through apple (sometimes mottled with white), pea and celadon to greenish-gray. There are also the peculiar bright green and the very dark green of the varieties known respectively as diopside-jadeite and chloromelanite. The Aztecs knew them all by the generic name of *chalchihuitl*, and had distinctive names for the various colours. The most highly prized was the emerald green, which they called *quetzalchalchihuitl*, after the brilliant plumage of the quetzal bird. The carvings comprise plaques, figurines, small masks, pendants and implements. Most of them have smoothly polished surfaces, and some follow the kidneylike conformation of the pebbles from which they were carved, so that notions of sympathetic magic may have given rise to the belief in their therapeutic value. The appreciation of jade and the art and craft of jade carving in Middle America died out soon after the Spanish conquest.

China.—Jade and jade carving are associated pre-eminently with China since in no other region of the world has this obdurate material, too hard to be cut by steel, been worked with such skill and in such a long and unbroken tradition. From the dawn of their civilization the Chinese have regarded jade as the fairest and most desirable of stones, a material supremely fit to be fashioned into religious ritual objects and the insignia of kings and princes. It was believed to be, in a special sense, a product of Heaven itself, and so to be highly charged with creative force. Mysterious powers of healing the body and even of conferring immortality were attributed to it. Jade amulets were buried with the dead for their supposed virtue as a preservative of the corpse. Others were kept in the home or carried on the person. But apart from this the mere possession and frequent contemplation of finely worked objects of jade, especially white jade, have been held to be conducive to the cultivation of virtue and the expulsion of evil thoughts from the mind. In the course of time the stone became a recognized medium of artistic expression, and the craft of the jade carver enjoyed a status comparable to that of the goldsmith in the west. The word *yü* 玉 ("jade") is employed in Chinese metaphor as a symbol of nobility, beauty and purity, much as "gold" and "golden" are used in English.

Jade in its natural state is not found within the 18 provinces of China proper, and there is at present no valid evidence that it was ever obtained from native sources. The belief that it was may be accounted for by the fact that in Chinese writings the name for jade, *yü*, was frequently applied to lapidary stones in general, especially those showing some resemblance to jade, such as the serpentines. The provinces of Kansu, Shensi and Yunnan, moreover, which have been credited with the production of jade, would have acquired such a reputation because the stone entered China by routes passing through those provinces, from which other parts of the country received their supplies.

It is probable that the Chinese always obtained their jadestone, as they certainly have done for more than 2,000 years, from the region of Khotan and Yarkand in what is now Sinkiang, where pebbles and boulders were collected from the beds of rivers, and where jade was later quarried from deposits in the western Kunlun mountains. The length and hazards of the journey were one reason for the high price it commanded in China.

From Neolithic sites have come not only tools, but what are believed to be simple cult objects in the form of flat disks with circular orifices at the centre. In the Bronze Age and throughout the formative period of their civilization, jade was the most precious substance known to the Chinese. It was conspicuous in court ceremonial, and it shared with bronze the function of providing the material, or the principal component, of ritual objects. The stone of the ancient Chinese jade carvers was nephrite. There are many allusions to *yü* in the classics. In the most ancient ritual text, the *Chou li*, dating from the 4th century B.C. but perhaps containing material from earlier times, certain jade insignia and ritual jades are named and their functions rather cryptically defined. The most notable are the *pi* 璧 and the *ts'ung* 琮. The disk with the circular perforation is identified with the first and regarded as the ancient symbol of the Supreme Deity, the Lord on High, or Heaven. It is the most sacred and venerable of Chinese religious symbols, occupying a place in the Chinese world comparable to that of the cross form in Christendom. The reason for its adoption as the divine symbol is uncertain. It may represent the solar disk, or perhaps the hole may depict the sun shining in the vault of heaven. Its form has been used as an ornamental device and as a base for decorative design, especially in jade, throughout the history of China. Another well-known form, the hollow cylinder or truncated cone enclosed in a rectangular body, is identified with the *ts'ung*, traditionally the symbol of the deity Earth, the complement and counterpart of Heaven. Here again the origin of the shape is obscure. The most acceptable explanation is that it derives from the plan of ancient royal tombs, such as those revealed by the excavations at Anyang, Honan province. Certainly a better symbol of Mother Earth could hardly be found than the portal by which her children returned to her bosom. Other ritual objects mentioned in the *Chou li* have been identified provisionally with various ancient jades in collections.

The earliest ornamental jades comprise small plaques and pendants, shaped from slabs of the stone a few millimetres thick, with surface decoration incised or in low relief. The majority represent animals—mammals, birds, fish and insects. The most common are dragons, tigers, deer, hares, pheasants, owls and parrots. The manner in which many of them were used is unknown since the clothing or other material to which they were attached has perished long ago. They are datable by the circumstances of excavation or by analogy with the decoration of ritual bronzes of the first stylistic phase; *i.e.*, to the Shang-Yin or early Chou dynasty. More accomplished carvings were executed in the middle and later reigns of the Chou dynasty, especially after the introduction of iron tools, perhaps about 500 B.C. From then onward the application of jade carving was extended from simple ritual objects and small slabs with decorated surfaces to many articles of use and luxury—belt hooks and ornaments, sword and scabbard furniture, hollow vessels, sculpture in the round and fittings with loosely linked parts contrived from the solid block or pebble. The best designs of this period are of unsurpassed excellence and breathtaking beauty to which the camera can hardly do justice. The craft attained maturity toward the close of the Chou dynasty in 256 B.C., and continued to show notable achievements of design and workmanship in the succeeding Han period (202 B.C.–A.D. 221).

Criteria for the dating of Chinese jade carvings, at least to within a few centuries, have been fairly well established up to this period by excavation or by analogy with works of art in other materials. By comparison very few sites dating from the 3rd century to the Ming dynasty (A.D. 1368–1644) have been excavated under control.

The artistic potentialities of this remarkable mineral were by this time fully appreciated, and though still laborious to work jade was found to be free from some of the limitations imposed by the material of other crafts. The subject matter and its treatment therefore tended to diverge from those of the others, so that recognizable analogies are fewer. The many delightful animal carvings in jade are particularly hard to date since their forms depend less upon the unfettered will of the designer than upon the peculiar shapes and markings of the pebbles or boulders from which they are fashioned. For the 18th century more evidence is available, especially in regard to the reign of the great Ch'ien-lung emperor (1736–95). Under his patronage and in those times of exceptional prosperity and luxury there was great interest in jade and jade carving. Many thousands of carved jades were added to the imperial collections, upon some of which poems composed by

their owner were incised in characters imitating the imperial calligraphy. Jade was applied to countless new uses in the Forbidden City and the stately homes of nobles and officials. Though the inspiration of the designers of 2,000 years earlier was rarely attained, the execution and finish left nothing to be desired. Greater quantities of the raw material were entering China than ever before, and designers, craftsmen and purchasers became more discriminating. Fabulous prices were paid for fine work in nephrite of choice colours and textures, like the famous *yang chih* 羊脂 ("congealed mutton fat"), the dark green *pi yü* 碧玉 and the rare *chi-tan huang* 雞蛋黃 ("egg-yolk yellow"). There was also renewed interest in ancient jades and in such curiosities as the burned and calcified carvings called *chi-ku pai* 雞骨白 ("chicken-bone white").

At this period too began the vogue for the vivid-green jadeite of Burma, later to become familiar to Europeans and Americans in the form of Chinese jewelry jade. Jadeite does not appear to have been worked in China before the 18th century A.D. when it was entering the country through Yunnan province from Burma. A contemporary Chinese writer regarded it as having merely "usurped the name of jade," but the brilliant emerald-green colour of some of the finer specimens soon earned it a place in public esteem as high as that of nephrite. An old name, *fei-ts'ui* 翡翠 ("plumage of the kingfisher"), which had been applied at least as early as the 11th century to certain fine green nephrites but had passed out of currency, was revived to distinguish the new material. This is the name by which it is still known throughout China. The belief that Burmese jadeite was carved in China in much earlier times appears to rest on a confusion of the two uses of the term, *fei-ts'ui*.

Jade carving, both of *yü*, nephrite, and *fei-ts'ui*, jadeite, has been practised with great skill and success, notably in Peking, in the 20th century. The best work is little inferior in design and quality to that of the Ch'ien-lung period. Most of the jadeite jewelry has been carved in Canton and Shanghai. *See* also CHINESE SCULPTURE.

India and Persia.—Jade carving in India is associated especially with the courts of the Mogul emperors. Prior to the end of the 16th century the Indians had no tradition of jade carving, though certain other hard stones, notably rock crystal, had been worked in the Islamic world, including India, for centuries. Within a few decades jade vessels of a quality and complexity of design unequaled anywhere but in China, but markedly different in style, were appearing in India. It has been surmised that the Moguls succeeded in attracting Chinese jade carvers to India, as they did craftsmen from other countries.

The material used for Indian carvings was nephrite, usually white or pale green, apparently imported from Khotan or Yarkand like the jade used by the Chinese themselves, since there is no known source of gem-quality nephrite in India. The most distinctive and un-Chinese of the Mogul jades are the hilts of swords and daggers of Persian design. These are usually plain but beautifully formed and finished, and since they would not require the more complicated equipment used for making and decorating the vessels, they may well have been worked by Persians or Afghans in their own countries or in India. The favourite technique of decoration of Mogul jades is insetting with gold and precious stones, diamonds, rubies or emeralds, an example of painting the lily that would hardly have commended itself to the Chinese jade carver, though the result is a fine glow of colour. In the 18th century some of these Indian jades reached Peking, perhaps as imperial gifts, and were there inscribed with eulogistic poems by order of the Chinese emperor. Other jades in the Mogul style appear to have been carved in China to satisfy the vogue there for wares in the "Indian taste," or possibly even for export to India. *See* also INDIAN ART; ISLAMIC ART.

New Zealand.—Until Capt. James Cook landed in New Zealand in 1769, the Maoris were entirely ignorant of metals. Their weapons, tools and ornaments were made of hard and tough woods, whalebone, shell and stone. The most highly prized of their industrial stones was the *pounamu*, or nephrite, known to the European settlers as "greenstone." From it they made axes, knives, chisels, adzes and the *mere*, or warclubs, of their chiefs. A *mere* is about 13 to 15 in. long, of flattened shape and tapered toward the edges. It has a hole drilled in the handle through which a thong was passed to secure it to the wrist. These jade clubs served not only as weapons, but as symbols of authority and muniments of title to land. They were usually worked from stone of specially fine colour or distinctive markings.

Jade jewelry of the Maoris consisted chiefly of earrings and pendants, of which the *hei-tiki* is the most characteristic. The name means "neck ornament in human form." The shape varies little, being that of a squat figure with a big head inclined to one side. These pendants were treasured as mementos of ancestors and greatly venerated, though not, it appears, as objects of religious worship.

Europe and the U.S.—Jade carving has not been practised extensively in the west in historical times. Some beautifully designed gems and trinkets incorporating jade, chiefly Siberian nephrite, were made in the ateliers of the St. Petersburg jeweler Peter Carl Fabergé (active 1870–1918). The sculptor Donal Hord, of San Diego, Calif., has carved some remarkable statues from Wyoming nephrite, using power-driven drills and carborundum sticks. He records that he and one assistant devoted 15 months' steady work to fashioning and polishing a figure weighing 161 lb. from a 300-lb. block. The stone is also worked into small ornaments on power lathes by amateur lapidaries, especially in the U.S.

Technique.—The means by which jade was worked in prehistoric times may be inferred from examination of artifacts and the records of methods employed by the Maoris within the 19th century. The stone was cut with laminae of sandstone or with "hard cutters" of slate, working in quartz sand and water, and then shaped with sandstone rubbers. Holes were made by drills of wood, hollow bone or bamboo carrying the wet sand. These perforations were usually conical in shape due to the rapid wearing away of the tool, or biconical if drilled from opposite sides of the jade. In the Bronze and Iron ages metal tools were used as vehicles for the abrasive. Most of the work of Chinese lapidaries in modern times is carried out, as it has been for centuries, on rough treadle-operated lathes fitted with tools of steel, wrought iron, wood and leather. This method avoids the dangers to the material attendant on high speeds, but leaves the craftsman's hands free to manipulate the jade and to apply the abrasive "sand" mixed with water to the rotating head of the tool. The natural abrasives formerly in use, such as crushed garnets and corundum (emery), have been superseded in the 20th century by carborundum. Perforations are drilled with the diamond point, and enlarged with a wire saw. A great variety of tools is employed, but there is much specialization, so that any important carving is almost certain to be the work of a team of specialists. The training is long and arduous, and the work makes great demands on the craftsman's patience.

Minerals and Imitations Mistaken for Jade.—Several minerals native to China have a superficial resemblance to nephrite and, because of the scarcity and high value of the latter, have been worked and applied to the same purposes through the ages. These stones were also called *yü* by the Chinese, who nevertheless recognized them as substitutes for *chen yü* 眞玉 ("true jade"; nephrite). They are sometimes designated *fu yü* 玞玉 ("false jades"). Though softer than nephrite, they are usually carved less skillfully, and in any case they do not take its characteristic polish. Fraudulent imitations of ancient jades are, of course, always made of true jade, though sometimes it is artificially stained. Most of the false jades prove to be one or other variety of serpentine. Apart from lacking the lustre of nephrite they are lower both in hardness and in specific gravity. The variety which approaches those of nephrite most closely is known as bowenite, which has a hardness ranging up to 6 and a specific gravity of 2.8. Bowenite carvings and other false jades are often "improved" by staining. Pyrophyllite, an aluminum silicate, is another mineral extensively carved in China and sometimes mistaken for nephrite, but it is still softer and lighter than bowenite. There are a few cryptocrystalline minerals of a weight and hardness near to those of jadeite, such as sillimanite, an aluminum

silicate, and saussurite, a silicate of calcium and aluminum (a mixture of zoisite or epidote and feldspar). Lacking the natural beauty of jade and being no easier to work, they have, however, rarely been used as substitutes. The most successful imitations of jadeite are artificial and made of a heavy lead glass, cleverly tinted to imitate the distinctive apple-green colour. Great numbers of bracelets, necklaces, earrings and pendants of this material are in circulation.

Other Hard Stones.—Many other ornamental stones have been carved and polished by methods similar to those of the jade carvers. The Chinese have also excelled in working these, though none have enjoyed the esteem that the Chinese have accorded to jade. The most numerous are members of the quartz group, the gem varieties of which fall into three categories—the transparent, the translucent and the opaque. The transparent varieties are found as single individual crystals, occasionally two feet or more in length. They comprise the clear, colourless rock crystal, the amethyst and citrine, the smoky quartz and the rose quartz (the last is not fully transparent). The translucent varieties consist of an aggregate of minute, needle-shaped crystals arranged in parallel layers and have the general designation of chalcedony. There is a wide range of colours. The yellow, orange and red are called carnelian, the brown is called sard and the bright green chrysoprase. There are also pale blue, violet and mauve chalcedonies. The natural colours have sometimes been changed or brightened by impregnating the heated stone with dyes, the presence of which is not easily detected by the naked eye. Agate is the well-known variety in which successive layers of the stone are brought into prominence by being differently coloured. Clever use has been made of this peculiarity by Chinese lapidaries to portray natural objects of contrasting colours. Aventurine quartz is a translucent stone containing small flakes of mica which give it an attractive spangled effect. In the opaque quartzes the finely granular aggregate is coloured with intermixed impurities, as in the many-hued jaspers with their attractive streaked and mottled effects. A number of other beautiful opaque stones have been worked by lapidaries through the centuries. Lapis lazuli is a crystalline limestone coloured with minute crystals of the deep-blue mineral lazurite, and speckled with brassy yellow iron-pyrites. Turquoise is a hydrous phosphate of aluminum with variable amounts of copper and iron, giving colours ranging from sky blue to pale sea green. Malachite is a hydrous carbonate of copper of rich warm green colour; it forms in rounded nodules which impart a marbled effect to the carved and polished surface. A relatively inexpensive translucent stone, with a hardness of only 4 on the scale, and also extensively worked by the Chinese, is fluorspar or fluorite. This is found in a wide range of delicate colours, the best known being the pale greens and the blues.

Two other gem materials, though not in fact minerals, have been worked by lapidary techniques, and with outstanding success both in Europe and China. They are amber, a fossil resin ranging in colour from "amber yellow" to reddish and dark brown; and coral, the closely compacted and petrified skeletons of colonies of the minute coral polyps. The most highly valued colour is the beautiful rose pink.

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For excellent illustrations *see* also: S. Jenyns, *Chinese Archaic Jades in the British Museum* (1951); A. Salmony, *Carved Jade of Ancient China* (1938), *Archaic Chinese Jades in the Edward and Louise B. Sonnenschein Collection* (1952). (S. H. HD.)

JADEBUSEN (JADE BAY), a broad, shallow inlet of the North sea, belonging to Oldenburg, Germany. The bay, which was for the most part made by storm floods in the 13th and 16th centuries, measures about 180 sq.km. (70 sq.mi.). It has communication with the open sea by a fairway, about 5 km. wide, which never freezes, and with the tide gives access to the largest vessels. On the northern shore of the bay is the port of Wilhelmshaven. The main harbour has several basins and dry docks. It was established in the 1860s by the Prussian government as a naval base. A stream, about 23 km. long, also known as the Jade, enters the head of the bay. (R. E. DI.)

JADOTVILLE, the second city of the province of East Katanga in the south of the Republic of the Congo, lies at an elevation of 4,166 ft. on the electrified railway between Tenke and Elisabethville, 86 mi. S.E. Pop. (1958) 74,478, including 4,664 Europeans. It is an important centre of the mining company, Union Minière du Haut-Katanga, and is named after Jean Jadot, a former company president. Founded in 1917 around the Likasi mine, the town developed rapidly after 1923 to become the seat of a great industrial complex. Jadotville treats the ore from the western part of the Haut-Katanga and produces chiefly copper and cobalt, being in the early 1960s one of the world's leading producers. It contains plants for ore concentration, copper-smelting works, electrolytic refining plants for copper and cobalt, a sulfuric acid factory utilizing zinc sulfide from Kipushi (near Elisabethville), and factories producing chemicals and glycerin. The principal workshops of the Union Minière are also situated there.

The nucleus of the city is Likasi and the two chief industrial parts are Panda (also residential), just to the south, and Shituru to the southeast. There are several African quarters. Kakontwe, 4 mi. W., is also an industrial site (flour milling, explosives manufacture) with residential quarters. Jadotville is linked by rail with the mines of Kambove (15 mi. N.W.) and Shinkolobwe (15 mi. S.W.); and by air services with Elisabethville and other towns in Katanga. Most of the Africans are Baluba immigrants from Kasai province. (HE. NI.)

JAEGER, the name used in America for three species of hawk-like, cosmopolitan sea birds of the genus *Stercorarius*, allied to the larger, heavier-built skua (*q.v.*; *Catharacta skua*) and with it constituting the family Stercorariidae, close to the gulls in the order Charadriiformes. In England all members of the family are placed in the genus *Stercorarius* and all are called skuas. The jaegers have a central pair of tail feathers extending 3 to 7 in. beyond the others, while the skua has the central tail feathers almost even with the next. They are characterized by variation in plumage colour from a light phase, with white underparts, to a uniformly dark phase; a hook-tipped bill; and large, strongly-hooked, sharp claws. They are strong, rapacious pirates of the high seas, harassing gulls and terns until they disgorge food. The three jaegers are the pomarine (*S. pomarinus*), the largest, with twisted tail-points; parasitic (*S. parasiticus*), the commonest; and the long-tailed (*S. longicaudus*), the rarest. (G. F. Ss.; X.)

JAÉN, capital of the Spanish province of the same name, region of Andalusia, is situated on the north side of the Sierra de Jabalcuz, 334 km. (208 mi.) S. of Madrid and 96 km. (60 mi.) N. of Granada by road. Pop. (1960) 64,917. The city underwent much modernization in the mid-20th century without, however, losing its traditional character. The history of Jaén goes back to the Roman occupation, with traces of earlier settlement. The most notable period was the Moorish domination and the Christian reconquest, and the most representative buildings from these periods are the castle of Santa Catalina and the cathedral. The castle was already known in the 12th century to Arab chroniclers. It owes its present form to Ferdinand III of Castile (*El Santo*) to

whom the town's Moorish ruler submitted in 1246. The cathedral of the Assumption was begun (on the site of a Gothic church which itself had replaced an Arab mosque) in 1540 by Andrés Vandelvira but was not completed until 1801. Jaén is connected to the main railway from Madrid to Andalusia. It also has good road connections. Local occupations are agriculture, olive oil production and metal working.

JAÉN PROVINCE is one of eight provinces in Andalusia (*q.v.*). It is bordered north by Ciudad Real and Albacete; east by Albacete and Granada; south by Granada; and west by Córdoba. Pop. (1960) 736,391. Area 5,211 sq.mi. There is considerable emigration to more industralized provinces. The Bético system, or Sierra Morena, crosses the north but has no notable summits, the highest in the province belonging to the Sierra Mágina (7,103 ft.). The most important river basin is that of the Guadalquivir, which rises in the Sierra de Cazorla. There are several irrigation dams and hydroelectric plants. The irregularity of the terrain gives rise to much variation of climate. Agriculture is flourishing; extensive olive-groves are followed in importance by vines and cereals. There are lead mines at Linares and others produce iron, copper, uranium and salt. Industries include the manufacture of automobiles, agricultural machinery, foodstuffs, chemicals and ceramics. Linares is on the Madrid-Cadiz railway with a branch southeast to Almeria. Besides Jaén, other chief towns are: Andújar (32,185), Baeza (15,461), Cazorla (12,232), Linares (60,068), Martos (23,990), Úbeda (28,956) and Villacarrillo (15,683). (Jo. A. L.)

JAFFA: *see* JOPPA; TEL AVIV-JAFFA.

JAFFNA, the second largest town in Ceylon, lies on the Jaffna peninsula, 190 mi. N. of Colombo. Pop. (1953) 77,181 (mun.). It is the commercial and administrative centre for the peninsula and the outlying islands, which form the northernmost parts of Ceylon. Jaffna was for many centuries the capital of a Tamil kingdom. It fell to the Portuguese in 1617, and later (1658), under the Dutch, was an administrative and commercial town of some importance. It had a considerable trade in elephants, pepper and other commodities. Jaffna is no longer a large port for the approaches to it are through very shallow water; but it has a brisk trade with south India in small ships. It is the railhead for traffic between its peninsula and other parts of Ceylon. Tobacco production is the chief industry.

Jaffna is a fascinating and highly distinctive town, bearing the stamp of its Tamil population with their south Indian cultural connections, and also carrying traces of the Portuguese and Dutch. It has a fine Dutch fort, and is the seat of American missions and a Roman Catholic bishop.

JAFFNA DISTRICT (pop. [1953] 491,849) includes not only the peninsula and islands but also a section of the mainland to the south. The peninsula and islands are densely peopled with industrious Tamils; the mainland area is more sparsely settled but is developing. (B. H. F.)

JAGERSFONTEIN, a diamond-mining and wool-farming centre in Orange Free State, Republic of South Africa, lies 72 mi. S.W. of Bloemfontein at an elevation of 4,618 ft. Pop. (1960) 3,885. A 50-carat diamond was found at a farm there in 1870. Famous stones from the mine include the Excelsior (1893) of 995.2 metric carats in the rough, and the Reitz or Jubilee (1895) of 650.8 metric carats in the rough (*see* DIAMOND). Just southeast is the township of Charlesville. (W. P. v. N.)

JAGGARD, WILLIAM (*c.* 1568–1623), English printer who published the First Folio of Shakespeare's plays, described as "the most important publication in English literature," was born *c.* 1568. He became a bookseller in London *c.* 1592 and a printer *c.* 1604. In 1610 he was appointed printer to the City of London, but soon after was stricken blind. He maintained, nevertheless, a flourishing business. About 1598 Jaggard published an anthology, *The Passionate Pilgrime*, supposedly by Shakespeare, although three-quarters of the poems were by others. Only a fragment of this edition exists. In 1599 he published a second edition, and in 1612 he "much offended" Shakespeare by issuing a third edition which included several poems of Thomas Heywood without authorization of either poet. In 1619 Jaggard traded further on the popularity of Shakespeare's name by surreptitiously printing ten plays, some by Shakespeare, some falsely ascribed to him. Two years later, however, he began printing for Shakespeare's fellow actor his collected plays, a financially hazardous venture. The First Folio of Shakespeare was published in 1623, shortly after Jaggard's death. In it appeared for the first time half of Shakespeare's plays. It contains the Droeshout portrait which has become conventionally accepted as the best likeness of Shakespeare.

See E. E. Willoughby, *A Printer of Shakespeare* (1934); J. Q. Adams' introduction, "The Printing of the First Folio of Shakespeare," to facsimile, *The Passionate Pilgrim* (1939). (E. E. WI.)

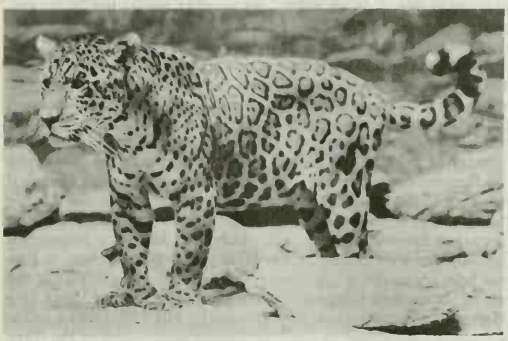
JAGIELLO DYNASTY, a princely house whose members ruled over much of eastern Europe in the 14th–16th centuries. Its founder was JOGAILA (*c.* 1351–1434), in Polish called Jagiello, grandson of the Lithuanian grand prince Gediminas and son of the grand prince Algirdas by his consort Yuliana of Tver. Grand prince himself from 1377, Jagiello was in 1386 baptized with the name Wladyslaw and married to the Angevin queen of Poland, Jadwiga, thus becoming king of Poland as Wladyslaw II. His realm included not only Poland and Lithuania proper but also large Russian territories belonging to Lithuania, so that it stretched from the Baltic to the Black sea. His eldest son, WLADYSLAW III (1424–44) of Poland, was also elected king of Hungary (as László I), thus extending his lands as far as the Adriatic sea, but was killed by the Turks at Varna. Wladyslaw III's younger brother CASIMIR IV (1427–92), grand prince of Lithuania, who was crowned king of Poland in 1447, had six sons and six daughters by his wife, Elizabeth of Habsburg. The eldest of the sons, WLADYSLAW (1456–1516), who was not very brilliant, was elected king of Bohemia, as Vladislav II, in 1471, forestalling his brother Casimir (1458–84), who was canonized in 1521; and Wladyslaw also became king of Hungary, as László II in 1490. His son LOUIS, however, was killed after the battle of Mohács in 1526, the last Jagiello king of Bohemia and Hungary.

The Polish throne was inherited by the third son of Casimir IV, JOHN ALBERT (1459–1501), who was succeeded in turn by his brothers ALEXANDER of Lithuania (1461–1506) and SIGISMUND I the Old (1467–1548), duke of Glogow since 1498. The youngest son of Casimir IV, the debauched Frederick (1468–1503), was archbishop of Gniezno and cardinal. Sigismund I and his second wife, Bona Sforza, princess of Milan, had a son, SIGISMUND II AUGUSTUS (1520–72), who succeeded his father on the throne. The dynastic policies of the Jagiello family were based on fomenting separatist tendencies of the nobles of their hereditary realm of Lithuania, in order to induce the Poles to elect successive grand princes to the Polish throne for fear of breaking up the personal union with Lithuania. When it became evident that Sigismund II Augustus would die without issue, a real union of the two countries became a fact in 1569. When Sigismund Augustus died, the male line of Jagiello became extinct, but after the short reign of the French prince Henry in Poland (*see* HENRY III, of France), Stephen Báthory, husband of Sigismund I's daughter Anne, was elected king in 1575; and after him Sigismund III Vasa, son of Sigismund I's daughter Catherine, who had married John III of Sweden, was elected in 1587. (ST. HE.)

JAGUAR (*Panthera onca*) is the largest species of the cat family (Felidae) in the western hemisphere, where it ranges from the U.S.-Mexican border to Patagonia. In the countries that bound its northern limit it is not frequently met with but in South America it is quite common. The jaguar is usually found singly and preys upon such animals as the horse, tapir, capybara, dogs or cattle. Occasionally the jaguar becomes a man-eater.

The cry of this great cat, which is heard at night and most frequently during the mating season, is deep and hoarse. Toward the close of the year the female brings forth two to four cubs that are able to follow their mother in about 35 days after birth.

The ground colour of the jaguar varies greatly, ranging from white to black, these extremes being, however, definite sports. The typical coloration is orange-tan upon the head, neck, body, outside of legs and tail near the root, marked with black spots arranged in rosettes with a black spot in the centre (unlike the leopard; *q.v.*); the tip of the tail has crowded, irregular black



BY COURTESY OF NEW YORK ZOOLOGICAL SOCIETY

JAGUAR (PANTHERA ONCA)

markings. The nose and upper lip are light reddish-brown. The average length is about 4 ft. from nose to root of tail. The jaguar is thickset; it does not stand high upon its legs and in comparison with the leopard is heavily built; but its movements are rapid and it is as agile as its more graceful relative. There are a number of local races in various parts of its range.

See also CAT; CARNIVORE.

JAHANGIR (JEHANGIR) (1569–1627), Mogul emperor of India. Born at Fatehpur-Sikri on Aug. 31, 1569, to the daughter of Raja Bihari Mal of Amber, as Prince Salim. Jahangir was early marked out for the succession by his father Akbar. In 1599, however, he impatiently revolted while Akbar was engaged in the Deccan. Akbar was loath to proceed to extremes as other possible successors were either too drunken or too young. In 1605, on his deathbed, he designated Jahangir as *padshah*. Since to act contrary to the main principles of Akbar's rule would have required a conviction and an energy which were not his, Jahangir continued his father's traditions. A desultory war with the Rajput principality of Mewar was ended in 1614 on generous terms. Akbar's campaigns against Ahmednagar were continued fitfully, with Mogul arms and diplomacy often thwarted by the able Habashi, Malik Ambar. In 1617 and 1621, however, Prince Khurram (Shah Jahan; *q.v.*) concluded apparently victorious peaces. Jahangir was not a strict Sunni Muslim; he allowed, for example, the Jesuits to dispute publicly with Muslim *ulama* and to make converts; he followed Akbar in the patronage of translations from Hindu sacred books.

After 1611 Jahangir accepted the influence of his Persian wife, Nur Jahan, her father Itimad ud-Daula and her brother Asaf Khan. Together with Prince Khurram, this clique dominated politics until 1622. Thereafter, Jahangir's declining years were darkened by a breach between Nur Jahan and Prince Khurram, who rebelled openly between 1622 and 1625. In 1626 Jahangir was temporarily placed under duress by Mahabat Khan, another rival of Nur Jahan's group. Jahangir died on Oct. 28, 1627, while traveling from his beloved Kashmir to Lahore.

A heavy drinker and opium eater (until excess taught him comparative moderation), Jahangir encouraged Persian culture in Mogul India. He possessed a sensitivity to nature, acute perception of human character and artistic sensibility which expressed itself in an unmatched patronage of painting.

See Beni Prasad, *History of Jahangir* (1923); H. Beveridge (ed.), *Tuzuk-i-Jahangir*, Eng. trans. by A. Rogers, *The Memoirs of Jahangir*, 2 vol. (1909–14). (P. H.)

JAHIZ, AL- ("the goggle-eyed"; ABU OTHMAN AMR IBN BAHR AL-JAHIZ) (d. 869), the most original and many-sided of the early Arabic prose writers, spent his life in Basra, devoting himself to theology, law and the study of literature. In religion he was a rationalist, or Mo'tazilite, and in law he founded a system of his own, which, however, barely survived him. His works include *Kitab al-Bayan wa-al-Tabyin* (edited by Muhibb al-Din al-Khatib, 1914), a discursive treatise on rhetoric; *Kitab al-Bukhala* (edited by Taha al-Hajiri, 1948; French translation by C. Pellat, *Le Livre des avares*, 1951). *Kitab al-Hayawan* ("The Book of Animals," edited by 'Abd-al Salam Mohammed Harun, 1938–47) is, despite its title, more a philological than a zoological work. Many of his shorter treatises have been edited; others remain in manuscript.

See C. Pellat, *Le milieu basrien et la formation de Gahiz* (1953).

JAHN, FRIEDRICH LUDWIG (1778–1852), German pedagogue and patriot, commonly called the "father of gymnastics" and founder of the *Turnverein* (*q.v.*), was born in Lanz on Aug. 11, 1778. He studied theology and philology, joined the Prussian army after Jena (1806), and in 1809 went to Berlin, where he became a secondary-school teacher. Brooding upon the humiliation of his native land by Napoleon, he conceived the idea of restoring the morale of his countrymen by the development of their physical and moral powers through gymnastics. The first *Turnverein*, or open-air gymnasium, was opened by him at Berlin in 1811, the young gymnasts being taught to regard themselves as members of a kind of guild for the emancipation of their fatherland. In 1813 he took an active part at Breslau in the formation of the famous corps of Lützow, a battalion of which he commanded, though during the same period he was often employed in secret service. After the end of the Napoleonic Wars he returned to Berlin, where he was appointed state teacher of gymnastics.

A man of democratic nature, rugged, honest, eccentric and outspoken, Jahn often came into collision with the reactionary spirit of the time, and in 1819 the gymnasium was closed and Jahn was arrested and imprisoned for six years. After his release he settled at Freiburg, where he died on Oct. 15, 1852. He received the iron cross in 1840, and in the spring of 1848 was elected to the German national parliament.

A complete edition of Jahn's works was published at Hof in 1884–87.

JAHN, OTTO (1813–1869), German archaeologist, philologist, and writer on art and music, was born at Kiel on June 16, 1813. He was professor of archaeology at Griefswald, and then at Leipzig, but was dismissed (1851) from the Leipzig chair for political reasons. He was then director of the art museum at Bonn, and in 1867 was appointed to a chair in Berlin. He died at Göttingen, Sept. 9, 1869. He wrote many books on Greek art, and prepared editions of classical authors. Of his works on musical history the most important is *Wolfgang Amadeus Mozart*, 4 vol. (1856–59; Eng. trans. by P. D. Townsend, 3 vol.; 1882).

JAI ALAI is the name used in the western hemisphere for the Spanish-Basque game known as pelota vasca. *Jai alai*, from the Basque language, means "merry festival" and was adopted by the Cubans when they imported the game in 1900.

The origins of the sport are obscure, but it is generally agreed that *jai alai* evolved from handball in the 17th century. After the introduction of rubber for ball making, which created the first lively ball, athletes in the Basque provinces of Spain changed one-wall handball so that it would be faster and more interesting to watch. The first piece of equipment used after the rubber ball became popular was a *guante*, or bowl-shaped leather glove, to protect the hand. Since little speed could be obtained by hitting the ball with the *guante*, a flat wooden bat about two feet long was devised and the game of *pala* was born. It is still popular in Spain, but has not spread to other lands.

Later the *guante* took other forms and its purpose changed from a means of batting the ball to a catching and throwing device. A hand pocket was added and the basic shape was changed to a concave rigid pocket made out of heavy leather about 5 × 8

BLACK STAR

JAI-ALAI PLAYER LEAPS IN THE AIR TO TAKE RICOCHETING PELOTA OFF FRONTÓN WALL IN HIS CESTA

in. long. Using the improved *guante*, players could catch and throw the ball instead of batting it. With this modification, a side wall was added at right angles to the stone front wall and by the mid-18th century, a back wall was also used as at present.

The desire for power and more efficient catching area led to the development of the *cesta*, or wicker basket. The frame of the modern *cesta* is steam-bent chestnut with ribs, which form the shape, planed down to $\frac{1}{16}$ in. thick and 1 in. wide. A durable Spanish reed is woven over the frame and ribs. The hand is inserted into a leather glove which is sewn to the outside of the *cesta* and tape is wound around the glove so that the hand cannot come out. *Cestas* vary in dimension and are tailor-made for each player.

The pelota (Spanish for "ball") used in modern *jai alai* is about three-fourths the size of a baseball, but much harder and more lively. It is constructed of hand-wound virgin de Pará rubber from Brazil. A layer of linen thread and two coats of especially hardened goatskin complete the pelota. In play, speeds of more than 150 m.p.h., or 220 ft. per second, are not uncommon and the outer cover must be replaced frequently.

In a *frontón*, as the *jai alai* auditoriums are called, the front wall is to the spectators' right, the side wall or *ble* is directly in front and the back wall or *rebote* is at the left. The front wall is constructed of huge granite blocks, since ordinary poured concrete will deteriorate under the constant hammering of the rock-hard ball. The side and back walls are made of gunite, a pressure-applied cement which is hard enough to take the secondary force of the ball, since it is always thrown to the front wall first, after which it may rebound off the back wall and ricochet off the side wall.

The rules of the game are simple. The ball is served and the opposing player in the case of singles, or his partner in doubles games, must catch and return the ball after it hits the front wall. He can still make the catch off the back wall if the ball has hit the floor only once. This shot is one of the most spectacular since it often causes the player to hurl himself on the concrete floor to give power to his forward throw. The action during a game is virtually continuous since players must catch and throw without stopping the motion of their arms. The skill of the game lies in placing the ball out of reach of the opposition, throwing it at tremendous speed, or imparting an incredible amount of spin on the ball so that even if the opposition catch it, they will not be able to return it.

There are two types of *jai alai* games, *partidos* and *quinielas*. The former is a match singles or doubles game which lasts from 10 to 40 points and is popular in Spain, France, Cuba and Mexico. The *quiniela* version has from six to eight one- or two-man teams competing for five to seven points to establish a win; a play-off is conducted to determine place (second) and show (third) positions if teams are tied. This system is popular in Mexico and Cuba and has been used in the United States, Italy, China and the Philippines since the second decade of the 20th century. In 1935, a law was passed in the Florida state legislature permitting parimutuel wagering on the sport. At that time the only *frontón* in the United States was located in Miami, Fla.; by the second half of the 20th century three more *frontones* had been built in that state and the original *frontón*, the largest, reported attendance figures of over 330,000 persons who wagered more than $9,000,000 in 100 nights of play. (L. S. Bn.)

JAINISM, a religion of India whose ideal is the realization of the highest perfection of the nature of man, which, it holds, was in its original purity free from all pain and the bondage of life and death. The term Jain is derived from Sanskrit *jina* ("victor" or "conqueror") and implies conquest over this bondage, which is imposed by the phenomenal world. Jainism does not consider it necessary to recognize any higher being other than the perfect man, and for this reason it is usually said to be atheistic. It can also be called a heretical sect of the Vedic faith, which had its origin in revolt from the tradition and the authority of the Vedas (*see* Hinduism); its earliest founders may have belonged to the sect that rebelled from the idea and practice of taking life prevalent in the Vedic animal sacrifice (*see* Vedic Religion). Jainism as a religion has predominantly monastic leanings, though its teachings are enjoined on all alike. Its peculiar genius lies in its emphasis on equal kindness toward all life, even toward the meanest; it is par excellence a religion of love and kindness.

According to the Jains their faith is eternal and has been revealed through the successive ages of the world by the *tirthankaras*, a line of saints or prophets, 24 in number, each of whom attained perfection and absolute freedom and then preached Jainism to the world. The first *tirthankara*, Risabha, is thus traditionally the founder of Jainism, but though his name occurs in the Vedas and the Puranas very little else is known of him; nor is there historical evidence of the other *tirthankaras* until Parshvanatha, the 23rd in the line, who is known to have founded the Nirgranth sect and to have died around 776 B.C. The actual and historical founder of Jainism was Vardhamana, called Mahavira ("Great Hero"), who was born about 600 B.C. in the republic of Vaishali (Bihar) at the site of the modern village of Basarh about 27 mi. N. of Patna (*see* Mahavira, Vardhamana Jnatriputra). His father was a ruling Kshatriya (the second of the four Hindu castes), chief of the Naya clan. He was an elder contemporary of Gautama Buddha and is referred to in Buddhist writings as Nataputra (son of the Nata). When he was about 28 years of age he took up the life of an ascetic, at first as a member of the Nirgranth sect. After years of hardship and meditation he attained enlightenment; thereafter he preached Jainism for about 30 years and died at Pavapuri (also in Bihar) in 527 B.C. Pavapuri has been, since then, one of the chief places of Jain pilgrimage; a number of temples have grown up, and Diwali, the Hindu New Year festival, is a day of great pilgrimage for the Lord Mahavira.

Jainism has never been torn by philosophic dispute, but in the 4th or 3rd century B.C. the Jains began to split into two sects on points of rules and regulations for monks, a rift which was complete at least by the end of the 1st century A.D.

The Digambara (or "sky-clad," "naked") hold that a saint should own nothing, not even clothes; hence the practice of going naked. They also believe that salvation is not possible for women. The Shvetambara (or "white-clad") differ from them on all these points.

Literature.—According to the Shvetambara, the sacred literature preserved orally since Mahavira was systematized and written down by the council at Pataliputra (Patna) about the end of the 4th century B.C., but it is generally agreed that it was not given its present shape until some 800 years later (about A.D. 454). It consists of 12 *angas* ("sections"), the last of which is subdivided into 14 *purvas* ("former texts") and 5 *prakaranas*, along with other *sutra* (aphoristic) literature. Among later works, mention may be made of Lokaprakasha, an encyclopaedia of Jainism compiled by Vinaya-Vijai in A.D. 1652.

The Digambaras hold that the entire literature was destroyed about A.D. 789. Some of the books, however, were saved in Nepal and in Sravana Belgola (in Mysore), the Jain headquarters of south India (and the second most important place of Jain pilgrimage, where a colossal statue of Lord Gommateshvara exists). The language of their canonical literature was originally Ardha-Magadhi, a blend dialect of the province of Magadha (modern Bihar), but as the texts are largely rewritten it would be better to call it Apabhramsha or Jain-Prakrit, a corrupt form of Sanskrit. From at least the 9th century, Jain texts were also written in Kanarese (*see* Prakrit Literature; Kanarese Literature).

Philosophy.—Jain metaphysics is a dualistic system dividing the universe into two ultimate and independent categories: living beings or souls (*jivas*), which permeate natural forces such as wind and fire as well as plants, animals and human beings; and non-living entities (*ajivas*), which include space, time and matter.

The next most important concept is that of *karma*, a subtle invisible substance composed from one of the types of matter, which flows into and clogs the *jiva*, causing the bondage of life and transmigration (*see* Metempsychosis). This inflow can be stopped by many lives of penance and disciplined conduct, resulting in the final *moksha*, or liberation, the ultimate goal of human endeavour. Karmic matter is elaborately classified according to its effect: for instance, one type is that which prevents true knowledge; another, that which causes pleasure or pain. Since no god

has a place in Jainism, *karma* comes to occupy a very central position, for most of the functions of a god are appropriated by the soul and its potential power. Souls are divided into those that have attained perfection and those still in bondage. Of the former there are five classes in order of merit, the five Lords of Jainism.

Ethics.—The Jain ethic is a direct consequence of the philosophy of soul and *karma*. Since the primary duty of man is the evolution and perfection of his soul and that of his fellow creatures, *ahimsa*, or "nonhurting" of life, irrespective of its distinction into higher and lower, is the cardinal principle. "Hurt no one" is a positive injunction enjoining love and compassion toward all creatures; Jains alone build asylums and rest houses for old and diseased animals, where they are kept and fed until they die a natural death. The three ideals of *Samyag-Darsha* or right faith, *Samyag-Jyana* or right knowledge, and *Samyag-Charitra* or right conduct are known as the "three jewels," or the *triratna*.

Jainism also prescribes most elaborate rules for everyday conduct; for example, for guidance in the practice of *ahimsa*, cruelty is analyzed into as many as nine kinds, each subtler than the last.

Logic.—A distinctive contribution of Jainism lies in its doctrine of *naya*, which means "point of view." According to Jainism, the Buddhist doctrine of change and of nothingness, which postulates that all things are transitory, was contrary to facts, and so was the Advaitic theory of absolute identity (*see* INDIAN PHILOSOPHY). Their foremost logical position is what is called *Anekantavada*, or the theory of many-sidedness of reality and truth.

Art and Architecture.—Not believing in a god or *avataras* (incarnations of a god) the Jains are necessarily not an idol-worshiping sect, but this has not prevented them from erecting and carving statues in honour of their *siddhas* or perfect souls. They have erected monumental *stupas* (hemispherical domes of solid masonry, surrounded by railings with ceremonial gateways and surmounted by an "umbrella") in honour of their saints, and the richness and quality of their architecture and carving in stone have few equals. Excellent examples exist in Junagadh, Osmanabad and Girnar (just east of Junagadh, Saurashtra), while Mt. Abu (*q.v.*) in Rajasthan represents in its highest perfection the Indian genius for graceful masonry decoration. Satrunjaya (near Palitana, Saurashtra) is one of the world's most beautiful temple cities. (*See* also INDIAN ARCHITECTURE.)

Position in the 20th Century.—Jainism preaches universal tolerance, and its attitude toward other forms of religion is that of noncriticism; it is not competitive and has never cared for the spread of its faith. Its followers totaled just over 1,600,000 in the early 1960s, with the Digambara majority in the south and the Shvetambaras in the north. Among its followers are found the rich traders and merchants of Gujarat and Maharastra, forming about 0.45% of the total population of India.

See INDIAN PHILOSOPHY: *Epic Period: Jainism; see* also references under "Jainism" in the Index.

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JAINTIA HILLS: *see* KHASI AND JAINTIA HILLS.

JAIPUR, the capital city of Rajasthan state, India, and headquarters of Jaipur district, lies 1,414 ft. above sea level, 191 mi. S.W. of Delhi and 696 mi. N.E. of Bombay by rail. It is known as the "pink city" because of the prevailing colour of its buildings, and is one of the most beautiful cities in India. Pop. (1961) 403,444. Jaipur is named after Maharaja Sawai Jai Singh II who founded it in Nov. 1727. It is surrounded by a wall, 20 ft. by 9 ft., pierced by eight gateways. The city has been built in six rectangular blocks separated by streets 111-ft. wide. The chief buildings are the city palace, a remarkable open-air observatory (Jantar Mantar), Hawa Mahal (Hall of the Winds), Amber (ancient capital), Ram Bagh palace, a museum and public library, and Nahargarh or Tiger fort. There is also a hospital and a fine park. The city is the seat of the University of Rajasthan (founded in 1947), which has faculties of arts, science, commerce and medicine. It is also a busy and prosperous commercial centre, famous for its arts and crafts: stone, marble and ivory carving, brass and enamel work, jewelry, and "tie and dye" work. It lies on the Delhi-Ahmedabad line of the Western railway and has an airport at Sanganer, about 8 mi. S. Hard-surface roads connect the city with different parts of the state.

J. ALLAN CASH—RAPHO GUILLUMETTE

OBSERVATORY WITHIN THE WALLS OF THE OLD CITY OF JAIPUR, CONSTRUCTED BETWEEN 1718 AND 1734.

JAIPUR DISTRICT (area 5,393 sq.mi.; pop. [1961] 1,901,756) is one of eight which together form the east Rajasthan plain region. The soil round Jaipur city and to the west and north is generally sandy and barren; to the east and south there is black cotton soil (formed by disintegration of black lava) and a rich alluvial loam. On the north and west the district is bounded by a broken chain of hills, an offshoot of the Aravalli range, beyond which lies the Rajputana desert. The hills are more or less covered with jungle trees, of no value except for fuel. Salt is largely manufactured from the Sambhar lake in the west.

Jaipur belonged to a Rajput dynasty of the Kachwaha clan. During the mutiny the maharaja assisted the British and was rewarded by an extension of territory. Maharaja Sawai Man Singh, who was given full ruling powers in 1931, merged his state in the union of Rajasthan on March 30, 1949, and was made *rajpramukh*. After the reorganization of states in India (1956), the office of *rajpramukh* was abolished, and a governor was appointed to administer the state. (S. M. T. R.)

JAISALMER, a town and district (former princely state) in the Jodhpur division of Rajasthan state, India. The town, headquarters of the district, lies on the Thar desert, 140 mi. W.N.W. of Jodhpur. Pop. (1961) 8,362. It is famous for its fort built in A.D. 1156 in which is the Gyana Bhandar ("store of knowledge") which contains very old manuscripts written in Sanskrit. There are also Jain temples whose stone carvings are unique. All the buildings are of yellow stone which, in the yellow desert, gives the city a languorous charm. There is an emergency landing field at Jaisalmer and a regular bus service operates between the town and Pokaran, 70 mi. to the east. Pokaran is the terminus of the Jodhpur line on the Northern railway.

JAISALMER DISTRICT (pop. [1961] 140,338; area 14,847 sq.mi.) is almost entirely a sandy waste, forming a part of the great Thar desert. There are no permanent streams and only one small river, the Kakni, which after 28 mi. spreads over a large area, forming a jhil (lake) called the Bhuj jhil. The climate is dry and healthful and the average annual rainfall is 11 in. Only the poorer grain crops are grown. Large herds of camels, cattle, sheep and goats are kept. The principal trade is in wool and ghee (clarified butter).

History.—Most of the inhabitants are Bhatti Rajputs, who take their name from an ancestor named Bhatti, renowned as a warrior before the tribe was driven from the Punjab into this oasis in the

desert. Deoraj, a famous Bhatti prince, assumed the title of rawal and founded a dynasty. In 1156 Jaisal, the sixth in succession, built the city of Jaisalmer and made it his capital. It was sacked by the sultan Ala-ud-Din in the late 13th century. After that, the princely state gradually weakened and in 1818 Mulraj entered into political relations with the British and thereby regained some of his lost territory. In 1949 the state was absorbed into the new union of Rajasthan. (S. M. T. R.)

JAJCE (YAYTSE), a Yugoslav town and *srez* (district) in Bosnia-Hercegovina, situated 30 mi. S. of Banja Luka. The town occupies a hill overlooking a waterfall where the Pliva river rushes down to the Vrbas river, about 100 ft. below. Pop. (1961) 6,839. It is the site of a large electric power station and electrochemical and electrometallurgical factories.

Under the walls of Jajce, the Turkish sultan, Mohammed II, defeated and beheaded the last Bosnian king, Stephen Tomasevic, in 1463. The Hungarians, under King Matthias I, reconquered Jajce and a part of Bosnia, but after the battle of Mohács in 1526 Jajce surrendered and remained Turkish until the Austrian occupation in 1878. At the end of World War I Bosnia was incorporated in the kingdom of Yugoslavia. During World War II Jajce changed hands several times between the Germans and the Partisans. The forces of Marshal Tito captured it for the first time in Sept. 1942 and for several months it was the headquarters of the Partisan supreme command. On Nov. 29, 1943, the A.V.N.O.J. (Anti Fascist Council of National Liberation) proclaimed there the first constitution of the Federal People's Republic of Yugoslavia. (V. DE.)

JAKARTA (DJAKARTA, formerly BATAVIA), the capital of the Republic of Indonesia, coextensive with the metropolitan district of Jakarta-Raya (area 223 sq.mi.), lies at the mouth of the Tjiliwung (Chiliwong) river on the northwestern coast of Java. Pop. (1961) 2,973,052.

The City.—The foreign influences on Jakarta's history can easily be detected in the modern city. Colonized and ruled by the Dutch from the early 17th century until 1945, Dutch colonial influence is naturally strong. Much of the original city has disappeared in the course of rapid modern development, but fragments remain. Historic buildings include the fine old house (1708) of Governor General van Riebeeck and the remains of the Portuguese church (1695). The mixture of western and oriental styles is everywhere apparent in the life of the city. In the wide streets horse-drawn carriages and handcarts circulate alongside automobiles; but the traffic is dominated by the *betjak*—a two-passenger tricycle taxi. Large modern stores contrast with colourful markets and open-air shops that line the pavements. The canalized Tjiliwung flows through the city—among 17th-century houses in downtown Jakarta and beside wide business thoroughfares. Gardens abound and the streets are tree lined. The main canal, which connects Jakarta's fish market with the Java sea, is used by the local fishing boats (*prahus*) which have high, curved prows and enormous single sails.

This prosperous rapidly expanding city has absorbed the suburbs, and a new satellite town, Kebajoran, has grown up. In Jakarta are a Roman Catholic cathedral, 17th-century Protestant churches and many mosques. The main part of the University of Indonesia (founded 1950) is at Jakarta (other faculties are at Bandung and Bogor) and the city also has several private universities and academies and a teachers' training college. The museum is an impressive white building with a pillared portico and there is a modern reference library together with one in the Balai Pustaka, a government institute. At the meteorological bureau (built 1858) measurements of temperature and humidity have been recorded since 1864; records are also kept of seismic movements. The headquarters of Radio Republik Indonesia are in Jakarta. Manufacturing industries include several iron foundries and repair shops, margarine and soap factories, breweries and printing works. There are also tanneries, sawmills and textile mills.

Jakarta has a good transport system; it is connected by road and rail with every city of importance in Java. Between the harbour and town is Kemajoran airport, an important link between Europe and the east and a stop on the England-Australia flight. Jakarta is connected by air with the capitals of southeast Asia. The city is the centre of the island's wireless communications and of Indonesia's postal, telegraph and telephone systems.

The Port.—Along the coast east of the city, at Tandjungpriok, a modern harbour has replaced the original one (1877–83). The outer harbour, enclosed by two long stone breakwaters, is 525 ft. wide at the entrance. The outer harbour channel, which has a depth of 30 ft. at low water, leads to three inner harbours suitable for ships drawing up to 27 ft., 30 ft. and 40 ft. respectively. There are fully equipped quays with warehouses, two dry docks and a coal storage wharf, and facilities are being expanded.

The port is connected with Jakarta by road, rail and canal and serves not only the hinterland of western Java but is also a clearinghouse for the whole archipelago. It exports, besides rubber, tea, quinine and tapioca, a great variety of other tropical produce; imports consist mainly of manufactured goods, oil and coal which are in turn distributed throughout Indonesia.

History.—The 16th-century settlement, Sunda Kelapa, was the chief port of the Sundanese kingdom of Padjadjaran, being renamed Djajakerta in 1527 by the sultan of Bantam. At the end of the 16th century the Dutch landed in the sultan's territories, and after a struggle in which the town was razed to the ground they established a trading post on the site. The earliest European buildings were erected by the Dutch East India company in 1614 on the eastern bank of the Tjiliwung. The modern city owes its origin principally, however, to Jan Pieterszoon Coen, who built a walled township protected by a fortress. The Dutch renamed the town Batavia. The original Dutch town is largely the sector known today as Jakarta Kota or downtown Jakarta. The Chinese population lived within the walls of the city until 1740 when they were segregated, and Jakarta's Chinatown is now the centre of commerce.

During the 17th century Batavia was the trade centre for the east; in the 18th century its prosperity declined, partly due to epidemics of malaria and partly to unrest under Dutch rule. Batavia was briefly under British rule during the Napoleonic Wars but was returned to the Netherlands in 1814. During the 19th century Batavia's prosperity grew, when large-scale cultivation of imported plants such as coffee, cinchona (quinine) and rubber developed. The population increased rapidly and included settlers from Malaya and foreign trading nations.

With the international recognition of the Republic of Indonesia on Dec. 27, 1949, the city was renamed Jakarta (Djakarta) and proclaimed the capital of Indonesia.

JAKOBSON, ROMAN (1896–), Russian-U.S. linguist and Slavicist, one of the leading exponents of the European structural movement, known as the Prague school, was born in Moscow on Oct. 11, 1896. Jakobson's work, based on an assumption of a pervading binary structure in the phonological material of language, extended this dichotomization to grammatical structure as well. His linguistic studies included poetic language, child language, and loss of speech in aphasia. After 1941 he was active in the U.S. at Columbia university, and after 1948, Harvard.

For a list of his publications *see* the bibliography in M. Halle *et al.* (comp.), *For Roman Jakobson* (1956). (J. Lz.)

JAKUN, an aboriginal, pagan Malayan people found in the interior eastern portions of the Malay peninsula. The major Jakun subgroups include the Biduanda, Mantera, Orang Laut, Orang Kanak and Orang Ulu. Combined population was estimated at less than 5,000 in the 1960s. Later invaders from the highly developed states of Sumatra occupied the coasts of Malaya and often amalgamated with the Jakun. Those natives who resisted the newcomers finally retired to the interior where in the 1960s they still retained much of early Malayan culture. In physical type they are basically southern Mongoloids as distinguished from neighbouring peoples, the Senoi and Semang (*qq.v.*); their language is archaic Malay.

Jakun houses of bamboo and thatch stand in jungle clearings where dry-land rice, sweet potatoes, millet and other crops are raised; these are supplemented by jungle products and game hunted with blowgun and poison darts. Several family clearings make up a settlement, each settlement with a headman who is the leader in raids and in the search for game.

In common with other pagan Malayan peoples the Jakun believe in multiple souls for man, other animals, plants and even inanimate objects. It is held that souls may leave their hosts and that they may be enticed or coerced by magic. It is thought that the souls of the right-hand side of an individual go to an afterworld at death, but that those of the left side wander on earth. Religion is centred around many superior beings and family ancestors for whom ceremonies are conducted by mediums.

See also F.-C. Cole, *Peoples of Malaysia* (1945); W. W. Skeat and C. O. Blagden, *Pagan Races of the Malay Peninsula* (1906).

(F.-C. Ce.)

JALALABAD (Jellalabad), the capital town of Nangrahar (or Eastern) province in Afghanistan, lies at a height of 2,000 ft. on the south bank of the Kabul river, which is there wide and fast-flowing. A plain stretches to its south. Pop. (1960 est.) 25,000, mostly Pathans from the surrounding tribes, many of them Mohmands. The town is 70 mi. from Peshawar, via the Khyber pass, and 110 mi. from Kabul. The old road to Kabul ran via Gandamak and the Jagdalak and Khurd Kabul passes. The new road follows the river to Sarobi and then traverses the high Lataband pass. Seven miles west of Jalalabad the Kabul river is crossed by the Darunta bridge leading north to the Kunar valley. The town thus holds an important strategic position, dominating the entrances to the Laghman and Kunar valleys and so commanding routes to Chitral and Pakistan north of the Khyber, as well as the Kabul-Peshawar road. It has an airfield and is a military centre.

The bazaars and walls of the old city have disappeared and the modern town stands farther west near spacious parks once used by Afghan kings, who moved their court there in winter to profit from the pleasant climate. Wealthy people of Kabul still have winter houses there. The surrounding country is fertile with small, remunerative landholdings. Oranges, rice and sugar cane are the principal products. A factory in the town processes the cane. Jalalabad is an important centre for trade with India and Pakistan. In the early 1960s, with U.S. and Soviet aid, the roads were being rebuilt and a dam was being constructed in the Darunta gorge, with an associated system of irrigation.

The site of Jalalabad has been occupied since the 2nd century B.C. At Hadda (5 mi. S.) are remains of an early centre of the Gandhara school of art. This site, excavated by the French, yielded some fine Buddhist sculptures, and Buddhist stupas are to be seen in the plains around. Babur, founder of the Mogul dynasty, chose the site for the modern town, and his grandson Akbar built it in 1560. A relic of the Mogul period is the garden at Nimla (26 mi. W.), with its magnificent cypress trees. A notable episode in the town's history was its defense by British troops under Sir Robert Sale during the First Afghan War, when it was held from Nov. 1841 to April 1842; after a severe siege a successful counterattack was then made on the Afghans. At that time the town was surrounded by a high wall with bastions and loopholes. The amir Habibullah of Afghanistan was assassinated near Jalalabad in 1919, and he and his son and successor Amanullah are buried there.

(X.)

JALAL-UD-DIN RUMI (Mohammed ibn Mohammed Moulavi Balkhi) (1207–1273), one of Persia's greatest mystical poets, was born on Sept. 30, 1207, in Balkh. His father, a prominent professor of theology and philosophy, moved a few years later because of a quarrel with the ruler, the Khwarizm-shah Mohammed. After spending several years in Syria, the family settled at Konya (Iconium) in Asia Minor, then known as Rum, whence the poet's title. There his father resumed his professorship, in which Jalal-ud-din succeeded him on his death in 1231. He continued in his orthodox teaching and study, until the whole tenor of his life was changed under the influence of a Socrates-like figure, Shamsuddin Mohammed of Tabriz. This mysterious wanderer appeared in Konya in 1244, and disappeared (probably violently) about two years later. Under the inspiration of his teaching, however, Jalal-ud-din abandoned formal theology and devoted himself to the pursuit of Sufi mysticism, in which field he is justly regarded as a supreme master. He was the spiritual founder of the Mevlevi order of "dancing" dervishes. His most important work, composed during the last ten years of his life, was the *Mathnawi-i Ma'nawi* (ed. with Eng. trans. and commentary by R. A. Nicholson, 1925–40). This comprises about 30,000 couplets in six books, a vast compendium of Sufi lore and doctrine, interspersed with fables and anecdotes, which has been described as "the Koran in the Persian language"; it is especially remarkable for its insight into the laws of physics and psychology. Second to this, but perhaps higher in poetical quality, is the *Diwan-i Shams-i Tabriz* (pub. 1959; selected poems trans. by R. A. Nicholson [1898] and by Sir Colin Garbett [1956]), a collection of lyrics (*ghazals*) dedicated to his spiritual guide. Their deep emotional content and mystical power have made them widely known. Jalal-ud-din died at Konya on Dec. 17, 1273.

Bibliography.—For Jalal-ud-din's life and work *see* R. A. Nicholson's *Selected Poems from the Divani Shamsi Tabriz* (1898); *Encyclopaedia of Islam*, vol. i, pp. 1004–1006 (1913); and E. G. Browne, *Literary History of Persia*, vol. ii, pp. 515–525 (1928). (L. P. E.-S.)

JALAP, a cathartic drug consisting of the dried tuberous roots of *Exogonium purga*, a plant of the morning-glory family growing on the eastern slopes of the Mexican Sierra Madres at elevations of 5,000 to 8,000 ft. Jalap has been cultivated for many years in India, chiefly at Ootacamund, and grows there as easily as a yam, often producing clusters of tubers weighing more than nine pounds; they are rich in resin, containing 18%. The plant has also been grown in Jamaica, at first among the cinchona trees but later in new ground, as it was found to exhaust the soil. Jalap is a typical water-expelling purgative, causing the excretion of more fluid than does scammony but producing less stimulation of the muscular wall of the bowel. The use of water-expelling purgatives for removing water from the body in such conditions as dropsy has been generally abandoned in favour of less irritating and dangerous substances. *See* Cathartic.

JALAPA, a department and a city in east-central Guatemala. Area: 796 sq.mi.; pop. (1960 est.) 105,538. This isolated and mountainous department is occupied largely by Indians who grow maize, wheat, beans, tobacco and rice. Dairy cattle (for cheese production) are raised. The dense forests yield supplies of lumber.

Jalapa, the departmental capital (pop. [1957 est.] 8,312), can be reached by highway from the Motagua valley where connection is made with the road and railroad from Guatemala to the Caribbean coast. (P. E. J.)

JALAPA (Jalapa Enríquez), capital city of the state of Veracruz in Mexico. Pop. (1960) 66,269. Picturesquely situated at an elevation of 4,300 ft. on the slopes of the sierra separating the cool central plateau from the hot Gulf coast, Jalapa has a moderate and healthful climate. A thriving Indian village when Cortés marched through it in 1519, Jalapa is known for its climate, its abundant flowers, and as a market for the rich coffee produced nearby. Heavily populated by the Spanish after the Conquest because of its convenient location, Jalapa was famous in colonial days for its great annual fair held to dispose of the goods brought from Cádiz by the returning Spanish "silver fleet." The massive Spanish-Moorish architecture of Jalapa is reminiscent of viceregal days. Most impressive of the mountain peaks which surround Jalapa is Nauhcampatépetl rising to a height of 14,045 ft.

(H. R. Hy.)

JALAUN, a town and district in the Jhansi division of Uttar Pradesh, India. The town (pop. [1961] 14,101) is not connected with any railway but a 13-mi. metaled road links it to the south-east with Orai, the district headquarters. Orai (pop. 29,587) lies on the main railway and road from Kanpur to Jhansi.

Jalaun District (area 1,764 sq.mi.; pop. [1961] 663,168) is roughly triangular in shape and lies entirely within the level plain of Bundelkhand. It is almost surrounded by the Jumna (Yamuna) river and its tributaries Betwa and Pahuj. The central region thus enclosed is a level cultivated land, largely covered with black cotton soil and almost treeless. The Non river flows through the centre. The district is susceptible to drought and only a small part of the area to the west is watered by the Betwa canal. The climate, though hot and dry, is healthful, and the average annual rainfall is 32 in. Agriculture is the main occupation and the main crops are millets, oilseeds and cotton. (M. N. K.)

JALGAON and **DHULIA,** districts of Maharashtra, India, which were formerly known as East and West Khandesh respectively. The chief natural feature of both districts is the Tapti river which divides each into two unequal parts, a larger to the south and a smaller to the north. The two districts are here treated as one topographically. The southern part is drained by the Girna, Bori and Panjhra rivers and there lies the long central fertile plain of Khandesh, where the fields produce a variety of crops. Northward beyond the alluvial plain the land rises toward the Satpura range. In the centre and east the country is level and is mostly arid and unfertile. Toward the north and west the plain rises into a difficult and rugged country, thickly forested and inhabited by Bhil tribes. Drainage centres in the Tapti, which receives 13 principal tributaries in the districts. On the whole the districts are fairly well supplied with surface water and are well wooded; in places there are dense forests but most of the valuable timber has been cut. The soils are of all grades, and the principal crops are cotton, millets, pulses, wheat and oilseeds. The cotton-spinning, pressing and ginning industries are important in the industrial economy, the chief articles of export being cotton, food grains, oilseeds, butter, indigo, wax and honey. Stone-built temples, reservoirs and wells are found all over the region. There are also remains of Muslim architecture, ruined chaityas and viharas.

Jalgaon District (area 4,573 sq.mi.; pop. [1961] 1,765,047) is a prosperous cotton-growing area and has cotton-ginning factories in all the chief towns. The district headquarters are at Jalgaon (pop. 80,351) on the Central railway, 230 mi. N.E. of Bombay city. There are six municipal towns with more than 20,000 people: Amalner, Bhusawal, Chalisgaon, Chopda, Dharangaon and Jalgaon. At Jalgaon and at Amalner are arts and science colleges affiliated to the University of Poona. Bhusawal, 16 mi. E. of Jalgaon, is an important railway junction with connections to Bombay and other towns in northern, eastern and central India.

Dhulia District (area 5,022 sq.mi.; pop. [1961] 1,351,236) is much less developed than the eastern district. There are only two municipal towns with a population of over 20,000: Dhulia (98,893) and Nandurbar (41,055). Dhulia (*q.v.*), the headquarters, 185 mi. N.E. of Bombay, is an important cotton centre. The most striking natural feature of the district is the bold outline of the towering Satpura range with a belt of thick forest, the habitat of a variety of wild animals. There are large tracts of uncultivable land used for grazing cattle. The supply of surface water is scanty. Cotton ginning, spinning and weaving are the main industries. (M. R. P.)

JALISCO, a Pacific coast state of Mexico. Pop. (1960) 2,443,261. Area 30,941 sq.mi. Jalisco is traversed from north-northwest to south-southeast by the Sierra Madre, locally known as the Sierra de Nayarit and Sierra de Jalisco, which divides the state into a narrow, heavily forested coastal plain and a high plateau region, part of the great Anáhuac tableland, with an average elevation of about 5,000 ft., broken by spurs and flanking ranges of moderate height. The sierra region is largely volcanic and earthquakes are frequent; in the south are the active volcanoes of Colima (13,110 ft.) and Nevado de Colima (14,219 ft.). The *tierra caliente* zone of the coast is tropical and humid, while the inland plateaus vary from subtropical to temperate and are generally more dry and healthful. Lakes are numerous, the largest in the country being Chapala, about 51 mi. long by 19 mi. wide, which is considered one of the most beautiful in Mexico. It is a popular resort and also an important fishing area.

The agricultural products of Jalisco include Indian corn, wheat and beans on the uplands, and sugar cane, cotton, rice, indigo and tobacco in the warmer districts. Rubber and palm oil are natural forest products of the coastal zone. Stock raising is an important occupation of the more elevated districts. The mineral resources include silver, gold, cinnabar, copper, bismuth and various precious stones. There are reduction works and many industries, including cotton and woolen goods, pottery, cement plants, foodstuffs, electric power plants, refined sugar and leather. Railway outlets reach Mexico City, Manzanillo, and Nogales, Ariz.

There is a large percentage of Indians and mestizos in the population. The capital is Guadalajara (*q.v.*), an industrial and ecclesiastical centre of great colonial charm. Other important towns with their populations (1960) are: Ciudad Guzmán (30,941); Lagos de Moreno (23,636), a mining town 100 mi. E.N.E. of Guadalajara, on the Mexican National railways; Autlán (17,017); Ameca (17,588), in a fertile agricultural region on the western slopes of the sierras.

Jalisco was first invaded by the Spaniards about 1526 and was soon afterward conquered by Gonzalo Nuño de Guzmán. It once formed part of the *reyno* of Nueva Galicia, which also included Aguascalientes and Zacatecas. Jalisco was taken by French troops during the period of intervention, but was recaptured in 1866. In 1889 its area was much reduced by a subdivision of its coastal zone, which was set apart as the territory of Tepic (now the state of Nayarit). (J. A. Cw.)

JALNA, a town previously in the former state of Hyderabad, and now in the Aurangabad district in Maharashtra, India. Pop. (1961) 67,158. It lies on the right bank of the Kundlika river, 210 mi. E.N.E. of Bombay. It is a trading town and has several cotton ginning and pressing factories. Jalna has many fruit gardens and is noted for its fine oranges. The town lies on the Kacheguda-Manmad line of the Central railway, and is also linked by roads with the rest of the state. It is gaining in importance as a centre of commerce and of science education. (S. Ah.)

JALORE, a town and district in the Jodhpur division of Rajasthan, India. The town, headquarters of the district, is situated on the Jawai river, a tributary of the Luni, 75 mi. S.S.W. of Jodhpur city. Pop. (1961) 12,882. On a hill to the south and commanding the town stands one of the most famous forts in Rajasthan. Built by the Paramara Rajputs, it is about 800 by 400 yd. in extent and is accessible only by a steep stone path. The principal manufactures are cotton cloth, camel saddles and beautifully engraved drinking vessels.

Jalore was held by the Paramaras until the end of the 12th century, when the chauhan, Rao Kirthi Pal of Nadol, took it and made it his capital. His grandson Udai Singh surrendered it to Shamsuddin Altamsh about 1210, but it was immediately restored to him. About a century later the sultan Ala-ud-Din captured it from Kanardeo Chauhan. A three-domed mosque, said to have been built by him, still stands. In about 1540 the fort and the district passed to Raja Maldeo of Jodhpur.

Jalore District has an area of 4,916 sq.mi. and a population (1961) of 547,072. The soil is generally sandy except in the north where it is loamy. Average annual rainfall is about 10 in. The main crops are bajra, wheat, gram, mung beans and sesame. Less than 5% of the cultivated area is under irrigation. Important towns are Jaswantpura, Jalore, Sanchore and Ahore. (S. M. T. R.)

JALPAIGURI, a town and district of West Bengal, India. The town is on the right bank of the Tista river, 50 mi. S.E. of Darjeeling. Pop. (1961) 48,738. It is a picturesque market town with shady trees lining its broad streets and offers a fine view of the snowy peaks of the Himalayas to the north. There are three colleges, including the new teachers' training college, all affiliated to Calcutta university. Jalpaiguri lies on the Eastern railway.

Jalpaiguri District (area 2,407 sq.mi.; pop. [1961] 1,359,292) is bounded east by Assam, west by Bihar, north by Bhutan and south by the Cooch-Behar district and East Pakistan. It comprises two distinctive regions, separated by the Tista river. The region to the west of the Tista is densely populated and grows rice, jute and sugar cane; to the east are rolling plains dotted with low hills. This region is known as the Western Duars as it has five duars or passes to Bhutan. Its dense forests and reed jungle have been cleared for tea gardens, and in its lowlands jute and tobacco are grown. Annual rainfall is heavy, the average being 129 in. Forests occupy 662 sq.mi. and contain valuable timber trees and big game. There are a number of game sanctuaries in the district, the largest of which is that of Garumara, which preserves rhinoceros and bison. Anthracite is extracted at Bagrakot. An annual fair is held at Jalpes, 9 mi. to the east. There is one college, affiliated to Calcutta university, in Alipur Duar. The most important industry in the district is the production of tea. (S. P. C.)

JAMAICA, an island in the West Indies, lies about 90 mi. south of the eastern extremity of Cuba. It is 146 mi. from east

to west and 51 mi. in extreme breadth and has an area of 4,413 sq.mi. Jamaica comprises, in addition to the island of that name, the Morant and Pedro Cays, islets which lie to the south and are used only for collecting guano and sea birds' eggs.

PHYSICAL GEOGRAPHY

Geology.—The greater part of Jamaica is bedded with Tertiary deposits, but in the Blue mountains and some of the other ranges older rocks emerge. The foundation of the island is composed of stratified shales and conglomerates, with tuffs and other volcanic rocks and occasional bands of marine limestone. The limestones contain Upper Cretaceous fossils, and the whole series has been heavily folded. Upon this foundation rests unconformably a series of marls and limestones of Eocene and Oligocene age. Some of the limestones are composed of Foraminifera, together with Radiolaria, and indicate a subsidence to great depths, while the higher peaks of the island still remained above the sea. Toward the middle of the Oligocene period, when the folding pressure took place, the island was lifted far above its present level and was probably connected with the rest of the Greater Antilles and perhaps with the American mainland also. In the same period plutonic rocks of various kinds were intruded into the deposits already formed, and in some cases produced considerable metamorphism. During the Miocene and Pliocene periods the island again sank, but never to the depths which it reached in the Eocene period. The deposits formed in this period were shallow-water conglomerates, marls and limestones, with Mollusca, Brachiopoda, corals, etc. Finally, a series of successive small upliftings, less than 500 ft. in the aggregate, raised the island to its present level.

The island produces a great variety of marbles, porphyrites, granite and ochres. Traces of gold have been found associated with some of the oxidized copper ores (blue and green carbonates) in the Clarendon mines. Copper ores are widely diffused, and lead, cobalt, manganese iron ores and a form of arsenic occur. In 1942 deposits of bauxite were located in the parish of St. Ann, 50 mi. from Kingston, and Jamaica has since become the largest bauxite-producing country in the world.

Relief and Drainage.—A mountainous backbone extends through the island from east to west, rising in the east to the Blue mountains where Blue Mountain peak reaches 7,402 ft. East of these lie the John Crow or Blake mountains, a rugged limestone plateau reaching a height of about 3,800 ft. Altitudes of the five mountain passes are from 3,000 to 4,000 ft. Two thirds of the island is occupied by a plateau of deep-sea white limestone, forming a region of great beauty broken by innumerable hills, valleys, "cockpits" and sinkholes, and covered with luxuriant vegetation. These uplands usually terminate in steep slopes or bluffs, separated from the sea, in most cases, by a strip of level land. On the south coast, especially, these plains are often extensive, the Liguanea plain, on which Kingston and Spanish Town stand, having an area of about 132 sq.mi. More than 100 rivers and streams find their way to the sea, with numerous tributaries which issue from every ravine in the mountains—hence the name "Isle of Springs" (see *History* below). These streams are mostly not navigable, and in times of flood become violent torrents. Some of the larger rivers have laid down alluvial plains in their lower valleys and considerable deltas at their mouths. The Black river flows through a vast morass, once the sea bed, and is navigable by small craft for about 25 mi. Vestiges of intermittent volcanic action occur and there are several radioactive hot springs. Jamaica has 16 harbours, the chief of which are Port Morant, Kingston, Old Harbour, Lucea, Montego Bay, Falmouth, St. Anns Bay, Port Maria and Port Antonio.

Climate.—Jamaica has a tropical maritime climate and lies in the path of the northeast trade winds. The mountain ranges lend variety in temperature and rainfall to the climate, which is one of the island's chief attractions. At Kingston, near sea level, the temperature ranges between 26.7° and 30° C. (80° and 86° F.); in the north, sea level temperature is slightly lower; while at Hill Gardens, in the Blue mountains at 4,907 ft. it varies from 4.4° to 7.2° C. (40° to 45° F.). The uplands are thus pleasantly cool.

The rainfall varies greatly; while the annual average for the island varies between 74 and 77 in., on the northeastern slopes of the Blue mountains, which receive the full force of the moisture-laden trade winds, it is 200 in., and in the John Crow mountains it reaches nearly 300 in. At Kingston it is 30 to 35 in., while in the western parishes it is 85 in. The wettest months are May and June, and October and November, although, as a rule, no month is entirely without rain. Hurricanes usually pass to the northeast or southwest of Jamaica, but occasionally pass over it, causing severe damage. (R. To.)

Vegetation.—The abundant indigenous plant life is characterized by great diversity and local endemism. The vegetation, largely tropical, contains temperate varieties in higher mountain areas. Forests of several types occur, as well as extensive swamps and limited areas of natural savanna. Over 3,000 species of flowering plants, about 200 of which are orchids, and more than 530 species of pteridophytes, 300 species of mosses and many fungi have been recorded.

Sheltered coasts are occupied by large tracts of mangroves (four species); these trees help to protect the coasts from erosion. The south coast is very dry and supports semi-desert vegetation dominated by cacti and other xerophytic plants; the most conspicuous cactus is the dildo (*Lemaireocereus hystrix*). Most of the lowlands and lower mountain slopes have been cleared of their natural forests, but small pockets and larger tracts of these still persist in the Cockpit country, the John Crow mountains and the higher slopes of the Blue mountains; forests on watersheds and crown lands are now protected by law. Reforestation of some areas is being carried out, the principal planted trees being mahoe (*Hibiscus elatus*), Caribbean pine (*Pinus caribaea*) and species of *Eucalyptus*. The northeastern sector of the island is very wet and originally supported a luxuriant rain forest, now largely destroyed except on the higher mountains.

Native trees notable for their beautiful flowers include the lignum vitae (*Guaiacum officinale*), two species of mountain pride (*Spathelia*) and the West Indian ebony (*Brya ebenus*). Most of the conspicuous flowering trees of roadsides and towns have been introduced from other countries. The largest tree is the silk-cotton (*Ceiba*), the buttressed trunks of which sometimes reach a girth of 50 ft.; the wood of these trees is soft, and dugout canoes are frequently made from the smaller ones. Among the 12 native species of palms, the macca-fat (*Acrocomia spinosa*), the mountain cabbage (*Roystonea altissima*) and the bull thatch (*Sabal jamaicensis*) are particularly striking.

Animal Life.—Except for about 20 species of bats, the only indigenous land mammal is the cony (*Geocapromys*); the manatee, though rare, occurs in coastal waters. Rats and mice came in with the earliest European settlers and are now abundant, as is also the Indian mongoose, introduced in 1872 to help control the rats. Tanagers, hummingbirds, parrots and pigeons are among the 57 resident species of birds, 42 of which are said to be peculiar to the island and 6 of which belong to genera unknown elsewhere but closely allied to other American forms. Nine other species are now extinct. In the winter 52 species of warblers, ducks and waders arrive from North America. Among the 55 species of amphibians and reptiles are a crocodile, a fresh-water turtle, 8 snakes (none poisonous), lizards, an introduced toad (*Bufo marinus*) and small frogs. The chief fresh-water fish is the mountain mullet, and there are also at least four species of crayfish. Insects of all groups are numerous, including fireflies, moths and butterflies (14 endemic of which the giant butterfly *Papilio homerus* is especially distinctive); several species of Peripatus occur. Extensive coral reefs contain more than 40 species of coral and numerous brilliantly coloured reef animals. The island is celebrated for its approximately 500 species of very rare land mollusks. (G. R. Pr.)

HISTORY

Jamaica was discovered by Columbus on May 3, 1494. He was subsequently stranded for 12 months on the north coast, in 1503–04. In 1509 Don Juan de Esquivel was appointed by Diego, Columbus' son, as governor, and from that date till 1655 the island remained under Spanish rule. The Spaniards named it Sant' Jago.

Its native Arawak name was Xaymaca, "Isle of Springs." St. Iago de la Vega (later Spanish Town), was founded in 1523 and was the capital till 1872. During the Spanish occupation the Arawaks were exterminated and Negro slaves were imported in small numbers to take their place. When Jamaica was taken by the British the total population was about 3,000. Oliver Cromwell attacked the Spanish West Indies and Adm. William Penn and his military colleague Robert Venables succeeded in capturing and holding Jamaica in 1655. The Spaniards were completely expelled in 1660. Their slaves took to the mountains, and till the end of the 18th century the efforts of these Maroons, as they were called, to maintain their independence gave rise to repeated fighting.

Jamaica was governed by military authority until 1661 when Edward D'Oyley was appointed captain general and governor in chief with an executive council. Under his successor a legislative assembly was established, with power to make laws subject to disallowance by the crown. Jamaica soon became a chief resort of buccaneers, who frequently united the profession of merchant or planter with that of pirate or privateer. By the treaty of Madrid, 1670, the British title to the island was recognized, and the buccaneers were suppressed. The Royal African company was formed in 1672 with a monopoly of the English slave trade, and from this time Jamaica became one of the greatest slave marts in the world, with a thriving smuggling trade to Spanish America. At this date there were in Jamaica 70 sugar works, 60 indigo works and 60 cacao works. An attempt was made in 1678 to impose royal taxes and to supersede the powers of the legislature. The privileges were restored in 1682; but not till 46 years later was the question of revenue settled, by a compromise by which Jamaica undertook to pay £8,000 (later reduced to £6,000) per annum to the crown, provided that the laws of England were made binding in Jamaica; all additional taxes had to be voted annually by the assembly. In 1692 a severe earthquake destroyed the greater part of the town of Port Royal and led to the foundation of Kingston.

A threatened invasion by the French and Spanish in 1782 was averted by the victory of the admirals George Rodney and Samuel Hood off Dominica. The last attempt at invasion was made in 1806, when the French were defeated by Adm. Sir John Duckworth.

During the French war Jamaica was at the zenith of its prosperity, with coffee rivaling sugar as an export crop and with more than 3,000,000 slaves at work. The abolition of the slave trade in 1807, however, raised the planters' costs, and the end of the war brought a steady drop in sugar prices. Most of the planters, always improvident, and usually indebted to their London factors, became hopelessly involved.

Emancipation struck a further blow at the planters' prosperity and security. All slaves were emancipated by an act of the imperial parliament in 1833. They became free in fact, after a period of so-called apprenticeship, in 1838. Many of the more enterprising among them left the plantations and moved to the hills, where their descendants live as small farmers today. The planters received compensation at the rate of £19 per slave, but most of it went to their creditors. They were left financially exhausted and with a scarcity of labour. The abolition in 1846 of the tariff protection of colonial produce in the British market reduced the price of sugar still further and in many cases destroyed the profits of the already impoverished planter.

Dissensions between the executive, the legislature representing propertied interests, and the home government, as to the means of retrenching public expenditure, created much bitterness. Although some slight improvement marked the administration of Sir Charles Metcalfe and the earl of Elgin, when Indian immigration was introduced to redress the scarcity and irregularity of labour and the railway was opened, the improvement was not permanent. Poverty, increased taxation, land hunger and maladministration of justice combined to cause widespread discontent. An outbreak occurred at Morant Bay in Oct. 1865, in which the chief magistrate of the parish and 18 other white persons were killed. The rising was ruthlessly suppressed under martial law, and the principal instigator, G. W. Gordon, was hanged. These severities were widely applauded in the West Indies, but indignation in England led to the recall of the governor, Edward John Eyre, and to a drastic change in the government of the island.

Before his recall, Eyre had induced the Jamaican assembly, frightened by the riots, to vote its own extinction. Crown colony government was established by act of parliament in 1866. The new governor, Sir John Peter Grant, achieved a remarkable reorganization of the affairs of the colony. He established a constabulary on the lines of that of Ireland, reconstructed the judicial establishment, substituting stipendiary magistrates for the planter-justices, established a public medical service, a public works department and government savings bank, improved education and irrigated the fertile but drought-stricken plain between Spanish Town and Kingston. During his government the lucrative trade in bananas was started by Capt. A. W. Baker, founder of the organization which later became the United Fruit company. Bananas soon became a principal crop, grown for export by small farmers as well as by large estates. Many Jamaicans also found employment in the early years of the 20th century on banana plantations in Central America; others worked on the construction of the Panama canal and on sugar plantations in Cuba.

On Jan. 14, 1907, a violent earthquake struck Kingston. Almost every building in the capital and in Port Royal, and many in St. Andrew, were destroyed or seriously damaged. About 800 persons were killed and a large part of the city was burned. These disasters offered an opportunity of improving Kingston, and under the government of Sir Sydney (Lord) Olivier the scattered public offices were reconstructed in two blocks flanking a planted square on the finest street of the city.

Representative government was restored by stages from 1884, when nine elected members were added to the legislature. Their number was increased to 14 in 1895. Further changes were discussed from 1922 to 1926, and more vigorously after 1938, partly as a result of riots in that year. In 1944 a new constitution established a house of representatives elected by universal suffrage, in which a two-party pattern soon emerged. A modification of this constitution in 1953 gave departmental responsibilities to elected ministers, but retained a nominated legislative council as an upper house with limited powers and an executive council including both officials and ministers, with the governor presiding. In 1957 the official members left the executive council, which then became a cabinet under the chairmanship of the premier.

Jamaica was relatively little affected by World Wars I and II, though many Jamaicans served in the British armed forces overseas. A U.S. air base was established on the island during World War II, but was dismantled in 1950. After the war the island profited greatly from help under the Colonial Development and Welfare act, and from outside sources of private capital. Many new industrial undertakings were started, including a sugar refinery, citrus factories, a coconut product factory and a cement factory. Development was checked in Aug. 1951 by a severe hurricane, which devastated crops throughout the island and killed about 150 people; but energetic reconstruction, assisted by gifts and loans from the United Kingdom, made possible a remarkably rapid recovery. The expansion of the tourist trade and the development of bauxite mining more than offset the loss of openings for employment in Cuba and Central America.

On Jan. 3, 1958, Jamaica entered the federation of the West Indies, a group of islands in the Caribbean that formed a unit within the Commonwealth of Nations. (*See* WEST INDIES [FEDERATION], THE.) Norman Manley, leader of the People's Nationalist party, became prime minister after the elections held in July 1959, but in 1960 the Labour party under Sir Alexander Bustamante pressed for secession from the federation. Widespread support was given to their views in a general referendum (Sept. 19, 1961). At the general election in April 1962 the Labour party was returned to power and Bustamante became prime minister. In May, after negotiations in London, the federation was dissolved; on Aug. 6 Jamaica became independent and a member of the commonwealth. (J. H. Py.)

POPULATION

Jamaica is rich in traces of its now extinct former inhabitants, the Arawaks (*q.v.*). Aboriginal petaloid celts and other imple-

ments, flattened skulls and vessels are common. The population of the island was 1,613,880 in 1960. About three-quarters are Negroes of African origin, and 15% are mulattoes of mixed descent. There are large groups of Asian Indians and Chinese, and about 18,000 Europeans. Migration to the United Kingdom became a feature of Jamaican life after 1953. A total of 78,782 Jamaicans emigrated in the years 1954–59, and the numbers in 1960 and 1961 increased prior to the control act of 1962 which restricted commonwealth immigration into the U.K. The average density of population is 366 per square mile, the greatest concentration being along the coasts and in the valleys. The population is predominantly Christian in faith.

The capital, Kingston (*q.v.*; pop. [1960] 123,495), on the southeast coast, is the largest port of the island. Spanish Town (St. Iago de la Vega; 14,424), the former capital, lies 12 mi. W. of Kingston; after the transfer of the seat of government to Kingston in 1872 it sank rapidly in importance but has revived as the centre of valuable sugar and banana cultivation in the irrigated Liguanea plain. Montego Bay (23,822) on the northwest coast is the second largest town of Jamaica, a preferred tourist centre and the site of an international airport. Port Antonio (7,745) on the northwest coast, with two of the finest harbours, is concerned mainly with the fruit trade.

ADMINISTRATION AND SOCIAL CONDITIONS

Constitution.—The constitution of 1944, as amended in 1953, gave Jamaica a substantial measure of self-government and on Nov. 11, 1957, it became virtually independent in the conduct of its home affairs—the first British West Indies colony to attain home rule.

Proposals for constitutional reform, made by a bipartisan committee appointed in 1956, were presented to the house of representatives on April 1, 1958. These proposals were largely embodied in the Jamaica (constitution) Order in Council, 1959, which extended the constitution of 1957 and came into operation on July 4, 1959, on which date Jamaica became completely self-governing in internal affairs while remaining a member of the federation of the West Indies. On Aug. 6, 1962, Jamaica became a fully independent nation and a member of the commonwealth.

The constitution provides for: (1) a governor general appointed by the queen; (2) a privy council of six members appointed by the governor general after consultation with the prime minister; (3) a cabinet consisting of the prime minister and not fewer than 11 other ministers appointed by the governor general on the prime minister's advice; and (4) a bicameral legislature, consisting of a senate and a house of representatives. The senate has 21 members appointed by the governor general: 13 on the advice of the prime minister and 8 on the advice of the leader of the opposition. The lower house has 45 elected members, though this number may be increased to 60. The governor general appoints as prime minister the member who can best command the support of the majority, and as leader of the opposition the member who commands the support of the remainder of the house. The normal life of parliament is five years.

The constitution may be amended by a majority of all members of each house except in the case of certain "ordinarily entrenched" and "specially entrenched" provisions; the latter include monarchical and parliamentary forms of government. The government of Jamaica specifically assumed all treaty rights and obligations entered into by Great Britain and the federal government.

Local Administration.—For administrative purposes, Jamaica is divided into 14 parishes: Kingston (pop. 123,495); St. Andrew (300,448); St. Thomas (68,829); Portland (63,825); St. Mary (95,006), St. Ann (115,158); Trelawny (56,536); Westmoreland (108,656); St. James (82,954); Hanover (53,888); St. Elizabeth (115,700); Manchester (112,603); Clarendon (163,810); and St. Catherine (152,972).

Taxation.—The main direct taxes are income tax, land and property tax, estate duties and motor vehicle licence duties. Indirect taxation includes custom and excise duties, entertainment duties and various fees and licences.

Land Policy.—Large areas of government lands, with the exception of forest reserves, have been disposed of under the land settlement plan which was originally a freehold system of tenure; however, a leasehold plan later became the subject of experiment. Foreigners are allowed to buy or lease land, which may not be held by any person in trust for, or for the benefit of, a foreign government without licence from the governor general.

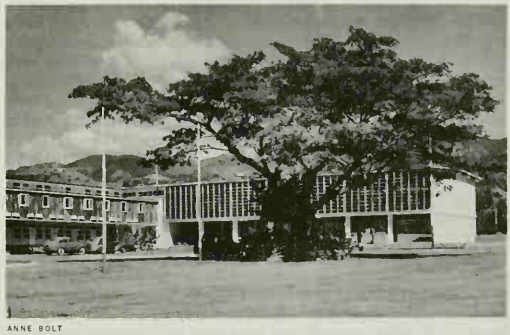
Living Conditions.—Housing projects in Jamaica are limited by risks from earthquakes and hurricanes, though emergency rehousing measures are well organized to deal with these. Much house building is prefabricated.

The ministry of labour is responsible for industrial relations, factories and apprenticeship, and employment services. It also arbitrates in industrial disputes and resolves representational issues by the taking of polls in order to establish representational claims. There are about 20 trade unions, about half of which have fewer than 250 members. The ministry recruits workers for the U.S. farm workers program and operates a migratory advisory service to inform and advise those seeking employment in Great Britain.

Health.—Disease rates in Jamaica compare favourably with those in the most advanced neighbouring countries, the U.S. and Canada. Each of the island's 14 parishes has a medical officer in charge of health services with a staff of inspectors and nurses. There are 21 general hospitals and 5 specialist hospitals. The U.C.W.I. hospital has accommodations for more than 300 patients along with large casualty and outpatient clinics. A four-year program to eradicate malaria was begun in 1958.

Justice.—The law of Jamaica is based on the common law of England, modified by legislation covering the island, mostly enactments of the Jamaican legislature. There is a supreme court, which consists of a court of appeal and a high court of justice; there are also resident magistrates' courts, petty sessional courts, coroners' courts and a traffic court. For police purposes the island is divided into four areas administered from Kingston. The force totaled about 4,500 in the early 1960s.

Education.—Jamaica is the home of the University of the West Indies, situated at Mona near Kingston. It was founded in 1946 and has faculties of medicine, natural sciences and arts, and a department of education. Technical education is available at the Kingston technical school and at the College of Arts, Science and Technology. In the early 1960s there were about 40 secondary schools and more than 700 primary schools. Primary education is compulsory and free, though in remote areas this policy cannot always be fully implemented.



ANNE BOLT

ADMINISTRATIVE BUILDINGS OF THE UNIVERSITY OF THE WEST INDIES, SITUATED NEAR KINGSTON

THE ECONOMY

Production.—Agriculture is the basis of Jamaica's economy. Almost every tropical crop can be grown on the island. Before World War II bananas were the most valuable product, and made up more than half of the colony's exports by value. By 1943 the industry was brought to a standstill through lack of transport and Panama disease, but it has gradually recovered and bananas are the second crop in value. Sugar cane is the principal crop in value

although the absence of large areas of level land where the crop can be brought to a central factory make it less important than in some other islands. Much of the sugar is used for the distillation of rum, for which Jamaica is famous. Other products include cocoa, coffee, spices, citrus and tobacco. Coconuts are grown along the north coast; sugar cane in the drier and flatter parts of the northwest and southeast; citrus fruit and tobacco in the south; coffee in the uplands; and bananas in almost every part of the island. Forest covers about 480,000 ac., or less than 20% of the total land area.

The most important development in Jamaica's economy at mid-20th century was the exploitation of the bauxite deposits, which are the largest known deposits in the world. Three companies are engaged in mining operations, extracting bauxite at an annual average rate of 6,000,000 tons. Gypsum is mined and processed locally, but there has been a decrease in production since the peak year of 1958 when 600,000 tons were quarried. A cement factory with a capacity of at least 100,000 tons a year came into operation in 1952. Because of continued expansion in the building industry, the demand for cement has increased substantially. Other manufactures include cigars and cigarettes, matches, condensed milk, textiles, shoes, margarine and beer.

Tourism.—The tourist trade is playing an increasingly important part in the economy of Jamaica. A government-sponsored £1,000,000 development of the Negril area as a tourist resort began in July 1959. Jamaica's situation, size, variety and climate contribute to its great attraction for the tourist.

Trade.—Exports in order of importance are sugar, bauxite, alumina, bananas, rum, pimentos and fruit juices. Imports include food, drink, tobacco, cotton and artificial silk piece goods, fuel oil, automobiles, chemical fertilizers and footwear.

Finance.—Public revenue is derived from direct taxation; the remainder comes from indirect taxation, including customs and excise tariffs. The government has raised loans in London, New York and locally.

In Nov. 1959 a development finance corporation was established by the government to provide medium- and long-term finance for industrial development, housing and tourism. The industrial and agricultural development corporations have increased promotional activities in their respective spheres: new industries established include pharmaceuticals, typewriters and automobile accessories; in agriculture the quality of beef and dairy cattle was improved, and the poultry industry became the second largest livestock activity. In addition to £1,250,000 carried over from previous allocations under the Colonial and Development Welfare act, Jamaica received £3,000,000 for the period 1955–60 and a further £250,000 in 1960. A revised development program for the years 1960–64 was prepared, based on the ten-year plan already published, called "A Plan for Jamaica 1957–67."

The monetary unit of Jamaica is the Jamaican pound. One Jamaican pound = B.W.I. $4.80 = £1 sterling.

Transport and Communications.—Jamaica's central position in the Caribbean has greatly favoured the development of air transport, and there are international airports at Palisadoes, near Kingston, and at Montego Bay. Both are able to accommodate the largest commercial aircraft, and are linked by direct flight services with the Americas and with other West Indies islands. British, United States, Canadian and Dutch airlines maintain regular air services. There are internal airstrips at Boscobel and Braco and there are also 15 private airstrips. Principal seaports are Kingston, Montego Bay and Port Antonio, and regular passenger and cargo services are maintained with Great Britain, Canada, and the U.S. There are also shipping lines to all parts of Europe, South America, South Africa, India, Australia and New Zealand.

Internal communications are facilitated by an extensive system of metaled and unsurfaced roads, and a railway which operates from Kingston to Montego Bay and to Port Antonio. There are two radio broadcasting stations, one of which is government-controlled. The post office maintains surface and airmail services, and the island is linked by telecommunications with Europe and the Americas. Meteorological services are provided by the West Indies Meteorological service.

See also references under "Jamaica" in the Index.

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JAMAL AL-DIN AL-AFGHANI (1838–1897), Muslim philosopher, politician and journalist, one of the most important figures of the Muslim world in the 19th century, who exerted great influence on the widespread liberationist and constitutional movements which arose in the last decades of the century, is said to have been born at Asadabad in Persia, although, possibly for political reasons, he claimed as his birthplace As'adabad in Afghanistan. At any rate, his youth was spent in Afghanistan. He left the country in 1870 after involvement in dynastic civil wars and the death of his patron, the amir Dost Mohammed Khan, and went to Constantinople, where he was well received because of his reputation as a scholar and was at first permitted to lecture at the university; he soon became known as a freethinker, however, and was deported.

Jamal al-Din next took up residence in Cairo, where he lectured and worked actively for nationalist revival and for liberation from European hegemony. (*See* EGYPT: *History: Modern Period.*) He was exiled to India but in 1883 moved to Paris where he and Mohammed 'Abduh (*q.v.*) published for a short time an influential newspaper, *al-'Urwat al-Wuthqa* ("The Unbreakable Bond") in which he severely criticized British policy in the Muslim countries. In 1886 he was invited to Teheran by Nasir ad-Din Shah, but his growing influence there caused him personal difficulties, particularly after he opposed the Persian government's granting of a tobacco concession to an English group in 1890. Under his active leadership the reform party in Persia became increasingly bold, and the shah was assassinated in 1896 by one of Jamal al-Din's disciples. In 1892 he accepted the invitation of the sultan to settle in Constantinople, where he lived until his death on March 9, 1897, alternately praised and suspected by the authorities.

Jamal al-Din worked for liberation from European domination, for the internal development of the Muslim countries through the introduction of liberal institutions and for the union of all Muslim countries under a single caliphate. *See* also PAN-ISLAMISM.

See C. C. Adams, *Islam and Modernism in Egypt* (1933).
(H. B. PA.)

JAMBI (DJAMBI) is the name of a town and province of Sumatra in the Republic of Indonesia. The province is on the east coast of Sumatra separated from the islands of Singkep and Lingga by the strait of Berhala. Area 17,345 sq.mi.; pop. (1961) 744,381. It is a long narrow strip of territory extending to the west coast mountain ranges, and includes the peaks of Kerintji (12,483 ft.) and Masurai (9,629 ft.). Except for a hilly range in the mid-north region, with Merban (2,503 ft.), the country slopes gradually to the sea, becoming flat and swampy, while near the coast it is intersected by numerous small rivers. The rivers flowing down from the mountains unite to form the Batang Hari, which is navigable for ocean-going ships from Jambi to the sea (50 mi.). There is much navigation of the rivers by small craft. The people are farmers and fishermen; rice and rubber are grown, and copra and cotton are produced. Petroleum is worked southwest of Jambi town.

JAMBI TOWN, the provincial capital, lies on both banks of the Batang Hari. Pop. (1961) 113,080. It twice suffered severe damage by fire in the mid-20th century and there are few buildings of note. There is a public park. The town is a rubber manufacturing centre and also exports rubber, rattan, indigo and timber. There are shipping connections with ports of Java and Sumatra and with Singapore. Roads lead southward to Palembang and westward to the west coast, and there are internal air services to Jakarta and other centres.

Jambi was capital of the Malay kingdom from about A.D. 1100. It passed into Dutch control in 1916 after long resistance. During World War II it was in Japanese hands and in 1946 became part of the Indonesian Republic.

JAMES, SAINT, "the Lord's brother" according to Gal. i, 19. The Gospels mention brothers of Jesus along with Joseph and Mary, or Mary alone, and the contexts suggest a blood relationship (Matt. xii, 46; xiii, 55; Mark vi, 3; John ii, 12; Acts i, 14). Tertullian (*Against Marcion,* iv, 9) and Clement of Alexandria (*Stromateis,* vii, 93 ff.) imply that this was the interpretation during the first two centuries, but by the 3rd century the nature of the relationship was being debated. Origen and others claimed that James was a stepbrother of Jesus through a previous marriage of Joseph. Another hypothesis maintained by Jerome was that the two were cousins, James being identified with James the son of Alphaeus (*see* JAMES, SAINT, the Less), assuming the latter to be a nephew of Mary. These interpretations emerged simultaneously with the increasing emphasis on the perpetual virginity of Mary.

James was lukewarm, if not opposed, to Jesus' ministry (Mark vi, 4; iii, 31 ff.; John vii, 15). His later conversion Paul connects with an appearance of the risen Christ (I Cor. xv, 7). Three years after Paul's conversion James was an important leader in the Jerusalem church (Gal. i, 18–19), where he assumed even more significance after Herod Agrippa I put the apostle James to death and Peter fled from Jerusalem (Acts xii, 1–17; A.D. 44). He was the chief spokesman for the Jerusalem church during the "council" regarding Paul's mission to the gentiles (Acts xv, 13) and Paul's final visit to Jerusalem (Acts xxi, 18 ff.). He was not one of the original 12 apostles but Paul seems to have regarded him as an apostle (Gal. i, 19).

Later tradition records that James was called "the Just" and was noted for his pious fulfillment of Jewish Law. He opposed those Jewish Christians who would require that gentile Christians submit to the Law, including circumcision, proposing instead adherence to limited practices (Gal. ii, 9 ff.; Acts xv, 13 ff.). On the other hand he believed Jewish Christians should continue in their loyalty to Jewish practice and piety, as he did himself (Gal. ii, 11 ff.; Acts xxi, 17 ff.). The latter point explains later traditions emphasizing his piety and also his popularity with Jews as well as Jewish Christians. Evidence for this popularity is the Jews' resentment when Ananus, the high priest, during the absence of the Roman procurator, had James put to death (A.D. 62). Variant accounts are recorded by Josephus (*Antiquities,* xx, 9, 1 ff.) and Hegesippus (in Eusebius' *Church History,* ii, 23 ff.). Josephus' report that James was stoned at the instigation of the aristocratic party of Sadducees against the will of the Pharisees is more plausible than the more legendary account of Hegesippus that he was thrown from a Temple tower by the Pharisees.

James's ability to maintain a living relationship between Jewish Christians and Jews raises many questions, such as the degree to which Jewish Christians in Jerusalem shared in Jewish nationalistic expectations. In the later Jewish-Christian Clementine *Homilies* and *Recognitions* James assumes the proportions of a legendary hero. In the early church he was designated the first bishop of Jerusalem (though the title is not used in the New Testament) and the author of the Epistle of James (*see* JAMES, EPISTLE OF).

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JAMES, SAINT, THE GREAT, the apostle of Jesus, so called to distinguish him from James the Less (*i.e.,* the Younger; Mark xv, 40) (*see* JAMES, SAINT, the Less). He was one of Jesus' 12 intimate disciples, mentioned second (Mark iii, 17) or third (Matt. x, 2; Luke vi, 14; Acts i, 13) in the apostolic lists. He and his younger brother John, the sons of Zebedee, are designated "Boanerges" or "sons of thunder" (Mark iii, 17), perhaps because they were zealots for national independence or were of a violent disposition (*see* JOHN, SAINT). The first four disciples called by Jesus were Peter, Andrew, James and John (Mark i, 16–19), and these four are those whose question introduces the great discourse on the end of the age (Mark xiii, 3 ff.). Peter, James and John witness the Transfiguration (Mark ix, 2) and are with Jesus in Gethsemane (Mark xiv, 32–33); James thus belongs to the innermost circle. He and his brother ask for special positions of honour in the future when Jesus is to be glorified (Mark x, 35–40; in Matt. xx, 20–23 it is their mother who makes the request) but are promised only a share in Jesus' sufferings. James is the only apostle whose martyrdom is recorded in the New Testament; he was put to death by the sword at the order of Herod Agrippa I (A.D. 44; Acts xii, 2). According to Spanish tradition his body was translated to Santiago (*q.v.*) de Compostela, and his shrine there attracts pilgrims from all over the world. His feast is celebrated July 25. *See* also APOSTLE. (SH. E. J.)

JAMES, SAINT, THE LESS, the apostle of Jesus, identified in the lists of apostles as the son of Alphaeus, may well be the James the Less (or Younger, or Little) whose mother, Mary, is mentioned among the women at the cross and the tomb (Mark xv, 40; xvi, 1; Matt. xxvii, 56). Nothing further is known of him unless one accepts the improbable identification with James "the Lord's brother" (*see* JAMES, SAINT). A late legend of martyrdom in Persia has no authority. The Orthodox Church commemorates the son of Alphaeus on Oct. 9, the Lord's brother on Oct. 23. In the Western Church the identity of the two Jameses is assumed in the feast of SS. Philip and James on May 1, originally the dedication of the church of the Holy Apostles at Rome where supposed relics of these saints were brought about A.D. 560 (in the Roman rite the feast was moved to May 11, in 1955, to make room for St. Joseph the Worker on May day). *See* also APOSTLE.

(E. R. HY.)

JAMES I THE CONQUEROR (1208–1276), king of Aragon from 1213 to 1276, son of Peter II and of Mary of Montpellier, was born at Montpellier on Feb. 2, 1208. Peter, whose interests in Provence and Languedoc entangled him in the Albigensian troubles, arranged an alliance between James and Simon de Montfort's daughter, and in 1211 he entrusted the boy to Montfort's care. After Peter's death (Sept. 12, 1213) the Aragonese and Catalans appealed to the pope for the surrender of the child, and he was put in the care of the Templars, who educated him at Monzón. He married Leonor, daughter of Alfonso VIII of Castile, in 1221 but divorced her in 1229 on the ground of consanguinity and married Yolande, daughter of Andrew II of Hungary, in 1234 (wedding ceremony 1235). James was astute and patient, of gigantic stature and immense strength, and by 1229 he had so far reduced his unruly vassals that he was able to undertake the conquest of the Balearic Islands, achieved in six years. He then turned to the Moorish kingdom of Valencia, conquering the town on Sept. 28, 1238, after a three-year campaign. By the treaty of Almizra (1244) James agreed that all further conquests in the south should be reserved to Castile. On May 11, 1258, he signed the treaty of Corbeil with Louis IX of France, which ended Aragonese attempts to expand beyond the Cerdaña and Roussillon. During the last 20 years of his life James carried on war with the Moors in Murcia on behalf of his son-in-law, Alfonso X, "the Wise," of Castile.

As a legislator and organizer he occupies a high place among the Spanish kings. Though orthodox and pious, he had an ample share of moral laxity, and the favour that he showed his bastards led to protest from the nobles and to conflicts among his sons, legitimate and illegitimate. He divided his states between his sons Peter and James, leaving Aragon, Valencia and Catalonia to Peter and the Balearic Islands, Roussillon, the Cerdaña and Montpellier to James—a division which inevitably produced conflict. James died at Valencia on July 27, 1276.

JAMES II (1264–1327), king of Aragon, son of Peter III, was left king of Sicily (1285) by his father. Having inherited Aragon on the death of his brother Alfonso III (1291), he resigned Sicily (1295) and married Blanche, daughter of Charles II of Naples, in an endeavour to make peace with the Angevins. Sardinia and Corsica were both assigned to him in compensation for Sicily, but he was able to occupy Sardinia only (1324).

JAMES I (1566–1625), king of Great Britain and Ireland from 1603 to 1625, and James VI of Scotland from 1567 to 1625, was the son of Mary Stuart and her second husband Henry Stewart, Lord Darnley. James was born in Edinburgh castle on June 19, 1566. After his father's murder and the enforced abdication of

his mother, he was proclaimed king of Scotland on July 24, 1567. During the troubled times of his minority he was kept for safety's sake in Stirling castle, while a succession of regents struggled to assert his authority. His tutors, among them George Buchanan, gave him a sound education, especially in languages and theology, which developed in him literary ambitions rarely found in princes, but which also tended to make him a pedant. His first published work, *The Essayes of a Prentise in the Divine Art of Poesie* (1584), contained, besides verses, a tract upon the rules to be observed in Scottish poetry.

By then he had already begun to play his part in public affairs. Before he was 12 he had taken the government nominally into his own hands when the earl of Morton was driven from the regency (1578); but for several years more he remained the puppet of contending intriguers and faction leaders. Morton, after a brief return to power, lost influence to the duke of Lennox, the nephew of James's grandfather, who had been brought up as a Catholic in France and now schemed to win Scotland back for Mary and for Rome. The Protestant party defeated these plans by kidnapping James in the Ruthven raid (1582) and forcing Lennox into exile; but next year James escaped from his captors and began to pursue policies of his own.

His chief purposes were to escape from subservience to Scottish factions and to establish his claim to succeed Elizabeth I upon the throne of England. For these ends he was ready to use whatever means looked most promising. He intrigued with Spain and the Guises for an understanding with his mother and in a letter to the pope (Feb. 1584) virtually promised to turn Catholic if given recognition and effective support by the Catholic powers. At the same time he took steps to curb the pretensions of the Presbyterian party, which had been alarmed by Lennox' intrigues and his own vacillations into claiming an independent authority for their church that would have left the king, in Andrew Melville's famous phrase, no more than one of "God's silly vassals." The "black acts" of 1584 accordingly declared the king head of the church, gave him power to appoint bishops to govern it and forbade its ministers to hold assemblies without his consent or to express opinions on public affairs. All this did not, however, mean that James was committing himself to the Catholic side. On the contrary, realizing that more was to be gained by cultivating Elizabeth's good will than by seeking the support of her enemies, in 1585–86 he concluded an alliance with England. Thenceforward, in his own unsteady fashion, he remained true to this policy and even Elizabeth's execution of his mother in 1587 drew from him only formal protests.

Yet his Catholic flirtations continued. Like his marriage (1589) to Anne of Denmark, they were a means of showing a measure of independence toward Elizabeth, who steadfastly avoided recognizing him as her successor. They also raised hopes at Rome and among the English Catholics which were to help smooth his path to the English throne, even if they did not convince Philip II of Spain, to whom Mary had bequeathed her claims. Moreover, in Scotland the monarchy was too weak, after his mother's follies and his own long minority, for James to be able to take strong measures against the Catholics without falling into unwelcome dependence upon the Protestant lords and the Presbyterian ministers. And, since Mary's execution and the defeat of the Spanish Armada (1588), he could almost regard such dependence as a worse danger to monarchy than the often disappointed plottings of the Catholic lords. For several years, therefore, he continued to connive at, and even to share in, Catholic plottings, showing, for example, remarkable lenience toward the earls of Huntly and Erroll when they were detected in treasonable correspondence with Spain (1589). Nevertheless, their increasing boldness gradually drove him into their enemies' arms. Protestant opinion, outraged by Huntly's murder of the popular earl of Moray, compelled him in 1592 to allow the statutory establishment of a full presbyterian system of church government and the repeal of the "black acts" of 1584. After the exposure of the intrigue with Spain known as the affair of the Spanish blanks (1592–93), the combination of the turbulent earl of Bothwell with Huntly and Erroll compelled the king to take drastic measures against them.

Once the earls' defeat (1594) had broken the power of the Catholic faction, James began to assert himself against the Presbyterians. He was able to divide the more moderate ministers from the extremists. Thanks to an act of 1587 vesting in the crown the extensive property of the ancient church, he also had the means to tempt away their noble allies. His finances were brought into rather better order by the eight commissioners known as the Octavians (1596–97). Thus he was now able to rule Scotland through his privy council almost as absolutely as Elizabeth ruled England through hers. How completely he had established his ascendancy was shown by the mysterious Gowrie conspiracy (1600; *see* GOWRIE, JOHN RUTHVEN, 3RD EARL OF). In this it is not clear whether James was the intended victim or the successful villain, but he was strong enough to extort, even from the ministers, declarations of their belief in his own version of the affair. A year or two earlier he had expounded his exalted views of the nature of royal authority, and the divine right upon which he believed it to be based, in two considerable books—*The True Lawe of Free Monarchies* (published anonymously, 1598) and the *Basilikon Doron* (completed 1598; published 1599).

So, when James at length succeeded to the English throne on the death of Elizabeth I (March 24, 1603), he was already, as he told his English parliament, "an old and experienced king" and one with a clearly defined theory of kingship. Unfortunately neither experience nor theory equipped him to solve the new problems that faced him; and he lacked the qualities of mind and character to supply their defect. The remaining 22 years of his life proved therefore almost as unfortunate for his dynasty as the years before 1603 had been fortunate. There was still much that was sensible in his policies and the opening years of his reign as king of Great Britain were a time of material prosperity for both realms. For he brought them peace. He speedily ended the English war with Spain (1604). He seized the chance to establish law and order on the border. He asserted his authority over the Scottish islands, an easier task now that Elizabeth had tamed their Irish neighbours. He strengthened his control of Scottish local government by introducing justices of the peace. He encouraged Scottish trade and, if his plans for Nova Scotia did not flourish, he planted Scottish colonists firmly in Ulster. The test of his statesmanship north of the border was, however, his ecclesiastical policy and here he pressed his hardly won advantage too far. He succeeded by 1612 in grafting on to the Scottish church a royally appointed episcopacy, complete with courts of high commission on the English pattern. But it was only after much management and browbeating that he persuaded a general assembly (1618) and parliament (1621) to authorize rites such as confirmation by bishops and kneeling at communion. The new ceremonies, so far as they could be enforced, provoked even greater opposition than the new bishops and, if outwardly James had done much to assimilate the independent Scottish church to the more obedient Anglican model, beneath the surface he had stoked up the smouldering hostility that his son was to fan into a consuming fire.

In England, too, James had done more to exacerbate his problems than to solve them. There the test of his statesmanship lay in his handling of parliament. In parliament the English monarchy had a junior partner that was rapidly coming of age and claiming ever wider rights to criticize and shape public policy. Moreover, its established monopoly of granting taxes made its assent necessary for the improvement of the crown's financial position, which had been seriously undermined by the general rise in prices, the rising costs of government and the expense of the long war with Spain. James, who had so successfully divided and corrupted Scottish assemblies, never mastered the subtler art of managing an English parliament. He kept few privy councilors in the house of commons and so allowed independent members to seize the initiative there, while his lavish creations of new peers and, later in his reign, his subservience to upstart favourites loosened the crown's hold upon the house of lords. His fondness for lecturing the houses about his prerogative rights and about the dependence of their privileges upon his grace and favour at once put them on their guard and drew from them counterclaims such as the Apology of the commons (1604). His shambling gait,

restless garrulity and dribbling mouth sorted ill, in the eyes of men used to Tudor dignity, with his exalted claims; and his actions and policy did little to redeem his physical shortcomings. His favour to impecunious Scots was partly responsible for the English parliament's rejection of his sensible plan for a closer union of the two kingdoms. By getting the law courts thereupon, in Calvin's case (1608; *see* ENGLISH HISTORY), to proclaim as law part of what parliament had just refused to enact, he struck at the houses' legislative supremacy. By using the judges' decision in Bates's case (1606) to justify a new scale of customs duties, he seemed to threaten their control of the purse strings.

Finally his ecclesiastical policy was bound to displease them. "No bishop, no king" might be a sensible maxim for a king of Scotland, but English Puritans were not Scottish Presbyterians. By threatening at the Hampton Court conference (1604) to harry them out of the land if they would not conform, James threw away the chance of a comprehensive settlement offered by the moderation of their Millenary petition. By abetting the bishops' efforts to enforce his threat, he gave new life to the Puritan alliance with the house of commons which had caused so much trouble for Elizabeth. The growing breach was widened by the slowness of James, coming from the poverty of Scotland, to appreciate the financial difficulties of the English crown. In four years of peace he practically doubled the debt left by Elizabeth after 17 years of war and his lack of economy blurred parliament's appreciation of his real necessities. It is therefore hardly surprising that when in 1610–11 the Great Contract (*see* ENGLISH HISTORY) offered a chance for a new start with consent of parliament, the project failed through faults on both sides.

That failure, and the death of Robert Cecil, earl of Salisbury, the next year, marked the turning point of the reign. During the ensuing ten years James summoned only the brief Addled parliament of 1614. Deprived of parliamentary grants, his government was forced to adopt unpopular expedients, such as the sale of monopolies, of which at least one—Sir William Cockayne's project—had disastrous effects on English trade. Driven to rely even more upon the judges to declare the law in his favour, James fell into a quarrel with the independent and self-willed chief justice Edward Coke and took the unusual course of dismissing him in 1616. Moreover, during these years the king succumbed to the influence of the upstart and incompetent Scot, Robert Carr, earl of Somerset, whose ascendancy culminated in the scandals of the countess of Essex' divorce and Sir Thomas Overbury's murder. Somerset was then succeeded by the young George Villiers (*see* BUCKINGHAM, GEORGE VILLIERS, 1ST DUKE OF), who was less unworthy but even more hated for his arrogance and monopoly of royal favour. With the help of Lionel Cranfield (later earl of Middlesex), however, he did something to restore efficiency and solvency to the administration.

On top of all this James embarked upon a foreign policy that fused discontent into a formidable opposition. Earlier, he had earned some popularity by helping France and the Dutch to resist Spanish designs in the Cleves-Jülich question and by marrying his daughter Elizabeth to Frederick V, elector palatine, the leading Calvinist prince of Germany. But by the time that the Thirty Years' War began to embroil Germany and Europe (1618), James had fallen under the spell of the Spanish ambassador Count Gondomar (*q.v.*). At Gondomar's demand he sent Sir Walter Raleigh to the block (1618). With Gondomar's encouragement he developed a plan for marrying his son and heir Charles to a Spanish infanta and of joining with Spain to mediate peace in Germany. The plan, though plausible in the abstract, showed an astonishing disregard for English opinion. Moreover, if England were to have the strength to impress Spain, it required money; money meant a parliament; and when a parliament was at last summoned in 1621, its alarm and anger led it into a general attack upon the king's government and into a quite novel claim to dictate his foreign policy. James in fury tore the record of the offending Protestation from the commons' journals and dissolved the parliament.

He had now less means than ever either to impress Spain or rescue his son-in-law. Yet still he persisted and even, though reluctantly, allowed Charles and Buckingham to make a reckless journey to Madrid in the vain hope of winning the infanta by personal entreaty (1623). For the abrupt reversal of policy which followed their disillusioned return, and for the capitulation to parliament in 1624, James was hardly responsible. Never a very hard worker, he was now aging rapidly and leaving decisions largely to his son and his favourite. On March 27, 1625, he died at his favourite residence, Theobalds.

Besides the political problems that he thus bequeathed to his son, James left a body of writings which, though of mediocre quality as literature, entitle him to a unique place among English kings since Alfred. In addition to the works already mentioned, he was the author of *Demonology* (1597), a treatise advocating severe measures against witchcraft; of the *Counterblast to Tobacco* (published anonymously, 1604); and a number of other volumes of prose and verse. His prose works and speeches were collected and published in 1616 by James Montagu, bishop of Winchester, who also translated them into Latin (1619). *See* also references under "James I" in the Index.

See D. H. Willson, *James VI and I* (1956); *The Political Works of James I*, with an introduction by C. H. McIlwain (1918).

(R. B. WM.)

JAMES II (1633–1701), king of Great Britain from 1685 to 1688, was born at St. James's palace, London, on Oct. 14, 1633, the second surviving son of Charles I and Henrietta Maria. He was created duke of York in Jan. 1634. During the Civil War he lived at Oxford, from Oct. 1642 until the city surrendered in June 1646. He was then removed by order of the Long parliament to St. James's palace, but he escaped to the Netherlands on April 20, 1648, and rejoined his mother in France early in 1649. After a long visit to Jersey (Sept. 1649–Sept. 1650) and another to the Netherlands, he joined the French army in April 1652, and served in four campaigns under Turenne, who commended his courage and ability. When his brother, Charles II, concluded an alliance with Spain against France in 1656 he very reluctantly changed sides, and he commanded the right wing of the Spanish army at the battle of the Dunes (June 14 [new style; June 4, old style], 1658).

Heir Presumptive.—At the Restoration James was lord high admiral (a post to which he had first been appointed in 1638) and by his intelligent and loyal support of able subordinates, such as Samuel Pepys and Matthew Wren, did much to maintain the efficiency and improve the organization of the navy. He also showed considerable interest in colonial ventures; it was on his initiative that New Amsterdam was seized from the Dutch in 1664, and it was renamed New York in his honour. He commanded the fleet in the opening campaigns of the Second and Third Dutch Wars and again showed marked courage at the battle off Lowestoft (1665), in which the Dutch admiral Opdam was killed, and in an indecisive encounter with Admiral de Ruyter off Sole (Southwold) bay (1672). This was his last taste of active military command until 1688. In politics he was a strong supporter of the earl of Clarendon, whose daughter Anne (*see* HYDE) he married in Sept. 1660. Both before and after marriage he had the reputation of being as great a libertine as his brother. But in 1668 or 1669 he was admitted to the Roman Catholic Church, though he continued, on his brother's insistence, to take the Anglican sacraments until 1672, and he attended Anglican services until 1676. Charles II also insisted that James's daughters, Mary and Anne, be raised in the Protestant faith.

James's conversion had little effect on his political views, which were already formed by his reverence for his dead father, his close association with Lord Clarendon and his friendship with Clarendon's sons, Henry (afterward 2nd earl of Clarendon) and Lawrence (afterward 1st earl of Rochester). James, in fact, was always more favourable to the Anglican Church than was his brother, who remained nominally a Protestant. Thus he had no difficulty in supporting the earl of Danby's high church policy; he welcomed the prospect of England's re-entering the European war on the side of the Dutch; and he even consented to the marriage of his elder daughter, Mary, to William of Orange in 1677. For the rest of the reign, in fact, James was the spokesman of the conservative Anglican courtiers, who believed that his views on monarchy

and parliament coincided with theirs, who found his formal, humourless, unbending nature more congenial than Charles's slippery geniality, and who respected him for his frank acknowledgment of his religious beliefs.

However, in view of the queen's childlessness, the conversion of the heir presumptive to the throne roused great alarm in the general public. James's decision to resign all his offices in 1673 rather than take the anti-Catholic oath imposed by the Test act made his position clear, and later that year, his first wife having died, he gave further offense by marrying a Roman Catholic princess, Mary of Modena. By 1678 this had created a climate of opinion in which the fabricated tale of a "popish plot" to assassinate Charles and put his brother on the throne was generally believed, and from 1679 to 1681 three successive parliaments, with a large measure of public support, strove to exclude James from the succession by statute. During the exclusion crisis James spent long periods in exile, at Brussels, March–Aug. 1679, and Edinburgh, Nov. 1679–Feb. 1680 and Oct. 1680–March 1682. The lead he gave to the conservative elements in court and parliament, his unremitting pressure on his weaker brother and his obdurate defense of his rights even at the risk of civil war contributed to the defeat of the exclusionist opposition in 1681. In 1682 he returned to England and resumed the leadership of the Anglican Tories, whose power in the localities was re-established and increased by the "remodeling" of the borough corporations and the government of the counties in their favour. By 1684 James's influence on state policy was paramount, and when he finally came to the throne on Feb. 6, 1685, with very little overt opposition or even criticism, it seemed likely that the strong support of the Anglicans, lay and cleric, would make him one of the most powerful of 17th-century British kings.

Accession.—This trend was confirmed by the new parliament that assembled in May 1685. Firmly Anglican and devotedly royalist, it voted James a larger income than any of his predecessors had enjoyed in time of peace, and there seemed no reason why he should not in time secure adequate toleration for his co-religionists. But the unsuccessful rebellions of the duke of Monmouth in England and the duke of Argyll in Scotland, in the summer of 1685, marked a turning point in the reign. James's distrust of his subjects, conceived in the turbulent 1670s, if not earlier, was at once sharpened. The rebellions were put down with great ferocity, the army was considerably increased and stationed every summer on Hounslow heath to overawe London, and the new regiments were granted to Roman Catholic officers, who had had military experience abroad and whose loyalty was undoubted. This last act of policy provoked a quarrel between king and parliament, which was prorogued in Nov. 1685, never to meet again. In 1686 the division between the king and his former allies, the Anglican Tories, deepened. After many of them had been replaced, the judges of king's bench in the collusive action *Godden* v. *Hales* found in favour of the king's power to dispense individuals from the Test oath; and Roman Catholics were admitted to the privy council and later to the high offices of state. A commission for ecclesiastical causes was set up to administer James's powers as supreme governor of the Anglican Church, and its first act was to suspend Henry Compton, bishop of London, one of the most outspoken critics of royal policy.

Religious Policy.—The year 1687 saw the intensification of James's Roman Catholic policy, and the dismissal of the king's brothers-in-law, Clarendon and Rochester, signalized his complete and final break with the Anglican party. The ecclesiastical commission was used to take over Magdalen college, Oxford, for the use of Roman Catholics, and a papal nuncio was officially accredited to St. James's. In April James issued a proclamation (commonly known as the Declaration of Indulgence) suspending the laws against Roman Catholics and Protestant dissenters alike; in July he dissolved parliament, and in September he launched an intensive campaign to win over the Protestant dissenters and with their aid secure a new parliament more amenable to his wishes.

What those wishes were is still not clear: some of his utterances suggest a genuine belief in religious toleration as a matter of principle; others point to the establishment of Roman Catholicism as the dominant if not the exclusive religion of the state. This confusion may well reflect the state of James's own mind, which undoubtedly deteriorated in the years 1687–88, and some of his assertions, accusations and threats at this time verge on the insane. However this may be, the unexpected news that the queen was pregnant (Nov. 1687), establishing the prospect of a Roman Catholic succession, had great effect on most Protestants; while the wholesale "remodeling" of borough corporations, lord lieutenancies, deputy lieutenancies and magistracies that winter inflamed the majority of the nobility and gentry, whose political and social power suffered by it. Ever since the spring of 1687 many Englishmen of diverse political views had been in touch with William of Orange, the husband of the heiress presumptive, and some had gone over to join him, while in the first half of 1688 relations between England and the Netherlands deteriorated alarmingly and there was extensive rearmament on both sides. The spark was touched off by James himself, when he re-issued his Declaration of Indulgence on April 27, 1688, and on May 4 ordered it to be read in the churches. The passive disobedience of a majority of the clergy was underlined by the archbishop of Canterbury and six of his bishops, who petitioned James to withdraw the order. The petition was subsequently published, and James made the mistake of prosecuting its authors for seditious libel. Meanwhile, on June 10, in slightly mysterious circumstances, the queen gave birth to a son.

The "Glorious Revolution."—On June 30, 1688, the seven bishops were acquitted—a tremendous defeat for the government—and that same day a letter was signed by seven leading Englishmen, inviting William of Orange to bring over an army and call a free parliament, which could (among other things) arbitrate on the legitimacy of the prince of Wales. By September William's intentions were obvious, but James felt obliged to decline Louis XIV's offer of assistance for fear of the reaction in England; in any case he was understandably confident in the ability of his own army and navy to repel invasion. But William sailed in late October, under cover of the general war which had now broken out in Europe, evaded the English fleet, and landed at Torbay on Nov. 5, 1688. In the subsequent "campaign," James's Protestant officers deserted to the enemy in such large numbers that he dared not commit the army to a pitched battle, and this treachery, together with the defection of his daughter Anne, finally shattered his nerve. He ordered the queen and the baby prince to France and followed them on Dec. 11. His flight was intercepted in Kent, but on Dec. 23 he was allowed to escape again and this time he found refuge in France. On Feb. 12, 1689, the convention parliament declared that James had abdicated, and next day offered the crown to William and Mary. The Scots parliament followed suit in May.

In March 1689 James landed in Ireland, and a parliament summoned to Dublin acknowledged him as king. But his Irish-French army was defeated by William at the Boyne (July 1, 1690), and he returned to France. William's generals reconquered Ireland the following year. In Ireland James had shown none of his former military ability and he now aged rapidly, falling increasingly under the influence of his pietistic wife. He became daily more absorbed in his devotions, and his more aggressive supporters soon came to regard him as something of a liability. The peace of Rijswijk between England and France (1697) removed his last hopes of restoration, and he died at St. Germain on Sept. 5, 1701.

See ENGLISH HISTORY; *see* also references under "James II" in the Index.

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JAMES I (1394–1437), king of Scots from 1406 to 1437, was the third son of Robert III and Annabella Drummond, and was born at Dunfermline in July 1394. After the death of his mother in 1401 and that of his surviving brother, David, duke of Rothesay, at the following Easter in suspicious circumstances, his father determined to send him for safety to France. Captured, however, off Flamborough head in March 1406, he was kept the prisoner

of successive English kings for 18 years. Robert III died on hearing of the capture and James became king but the regent Albany showed no desire for his nephew's release. Growing to manhood in England, James received an excellent education by order of Henry IV. In 1420 Henry V summoned him to confront the Scots serving with the French armies and he took part in the sieges of Melun, Dreux and Meaux. He was knighted at Windsor in 1421 by Henry, at whose funeral he was a principal mourner the next year. The minority of Henry VI in England and the death of Albany in Scotland provided the opportunity for negotiating his release in 1424 with his marriage to Joan Beaufort. A ransom of £40,000, less 10,000 marks as Joan's dowry, was to be paid within six years and a truce was concluded for seven.

Returning to a kingdom which had had no strong ruler for 100 years, James resolved to "make the key keep the castle and the bracken bush the cow." His first parliament enacted that "ferme and sikker pece be kepit throu all the realme." To curb the nobles he had Duke Murdoch (regent, 1420–24) executed with his two sons and the earl of Lennox. The lord of the Isles was imprisoned and the earls of Strathearn and March dispossessed. Several Highland chiefs were arrested and some put to death. More constructively, James improved the machinery of government. He transferred the chamberlain's financial duties to a treasurer and a controller, is thought to have introduced the quarter seal and was the first Scottish king to use a sign manual. An act of 1428 provided for shire representation in parliament with a speaker and marked off prelates and nobles as lords of parliament, but only the last part was effective. The committee of articles, which was to dominate parliament till 1689, can be first seen in this reign. He instituted a court of justice which is the real origin of the court of session and introduced the tradition of counsel for the poor.

James vacillated between friendship with England and the old French alliance. Only 9,500 marks of the ransom were paid altogether and in 1428 he made with France a treaty for sending military help and for marrying his daughter, Margaret, to the dauphin, Louis; but the English truce was renewed in 1431 for five years more. In 1436, however, after the raid of Piperden, James came down on the French side, sending Margaret to her unhappy marriage and besieging Roxburgh with ignominious failure. In ecclesiastical policy James protected church property, required integrity of religious houses and hospitals, founded at Perth the only Scottish charterhouse and approved the burning of a Hussite, Paul Crawar. But he endeavoured to stop the traffic at Rome in Scottish benefices, passing statutes which antagonized successive popes and supporting the Council of Basel against Eugenius IV. The dispute brought Aeneas Silvius to Scotland in 1435 and Antonio Altani as nuncio in 1436. Much of his legislation bore on economic and social life. Export of precious metals was restricted, shipping fostered, archery encouraged and football forbidden. Precautions were prescribed against fire and leprosy. A close time was enacted for game and salmon and the destruction ordered of wolves and rooks. The yield of the crown lands was trebled and that of the customs doubled.

Thirteen years of vigorous central government antagonized the nobles. Therefore Walter, earl of Atholl (who as the son of Robert II by his second marriage claimed a better right to the throne than those of the first, legitimated only *per subsequens matrimonium*), incited Sir Robert Stewart and Sir Robert Graham to murder James at Perth on the night of Feb. 20, 1437. The tale of Catherine Douglas barring the door with her arm is without contemporary support. James was buried in the charterhouse he had founded, as was Queen Joan, who, after marrying Sir James Stewart of Lorne, died in 1445.

Although thickset and fat, James was strong and vigorous. Walter Bower describes his athletic prowess, musical skill, artistic talent and interest in "moral sciences and mechanical arts." Of the poems once attributed to him only *The Kingis Quair* (ed. by W. M. Mackenzie, 1939) is now thought to be his and even that is disputed by some. He had twin sons, Alexander, who died in infancy, and James (afterward James II), and six daughters: Margaret, who married Louis the dauphin; Isabella, who married Duke Francis I of Brittany; Joan, who married James, earl of Morton; Eleanor, who married Archduke Sigismund of Austria; Mary, who married Count Wolfert of Grandpré; and Annabella, who married George, earl of Huntly.

See E. W. M. Balfour-Melville, *James I, King of Scots, 1406–1437* (1936). (E. W. M. B.-M.)

JAMES II (1430–1460), king of Scots from 1437 to 1460, was the only surviving son of James I and Joan or Jane Beaufort. He was born at Holyrood on Oct. 16, 1430, and succeeded to the throne on Feb. 21, 1437. During his minority, schism in the church intensified the strife between the Douglas-Livingstone (antipapal) party and that of the Crichtons who were supported by the papalist bishop of St. Andrews, James Kennedy. The situation changed, however, with the healing of the schism and the king's coming of age; and from the date of his marriage to Mary of Guelders (Gelderland), niece of Philip of Burgundy (July 3, 1449), James was his own master. He continued his father's policy of strengthening the crown against the barons and of securing control over the national church; and he also sought to profit from the international situation to pursue an imperialistic policy against England. The first of these aims involved a struggle with the overgrown house of Douglas, which maintained a treasonable intercourse with the Yorkists in England and with the disaffected Crawford and lord of the Isles at home. The final contest was precipitated by the king's rash act in murdering William, 8th earl of Douglas, while his guest under safe-conduct at Stirling castle, on Feb. 22, 1452. The new earl procrastinated, and James on the advice of Kennedy won over some of his supporters. The Black Douglases were overthrown in 1455 and their estates annexed to the crown. Thereafter James sought to aggrandize the royal house by forming a semiroyal peerage and a nobility of service and by securing the earldoms of Mar and Moray and the lordship of Man for his sons.

James maintained the French alliance and sought French support for an attack on England. He plotted with both Lancaster and York, although ostensibly his quarrel was with the Yorkists, who harboured the renegade Douglas and revived claims to the overlordship of Scotland. He raided Northumberland in 1456 and in 1460 laid siege to Roxburgh castle, where he was killed by the bursting of a cannon. A soldier's king, James was impulsive and masterful, with the charm and versatility of the Stewarts.

See Sir A. H. Dunbar, *Scottish Kings*, 2nd ed. (1906); A. I. Dunlop, *Life and Times of James Kennedy, Bishop of St. Andrews* (1950). (A. I. D.)

JAMES III (1452–1488), king of Scots from 1460 to 1488, was the eldest son of James II and was born in May 1452. He was crowned in Kelso abbey in 1460. The control of the kingdom, at first exercised by the sagacious Bishop Kennedy (d. 1465), was in 1466 usurped by Sir Alexander Boyd and his brother, Lord Boyd. Their downfall came soon after the marriage (1469) of James to Margaret, daughter of Christian I of Denmark, a marriage which resulted in the annexation of the Orkneys and Shetlands to Scotland (1472). In 1476 an expedition against the lord of the Isles resulted in his submission and the forfeiture of his earldom of Ross.

James, however, incurred the hostility of his nobles, who did not share in his passion for music and architecture, and blamed him and his low-born familiars for the poverty and lawlessness which afflicted the country. In 1479 he arrested his brothers, Alexander, duke of Albany, and John, earl of Mar. Mar's mysterious death and Albany's daring escape from Edinburgh castle further diminished James's popularity. When threatened by an invasion from England in 1482, he led a small army to the border; he was overtaken by his disaffected nobles, who hanged his favourites over Lauder bridge and brought him back captive to Edinburgh. Albany, summoned from exile by Edward IV, now advanced, with the duke of Gloucester, against Berwick, captured the town and proceeded to Edinburgh, where he liberated the king and ruled the country as his lieutenant general till, in March 1483, the discovery that he had made a treasonable compact with Edward forced him to flee. James strove to render his position less precarious by entering into friendly relations with Henry VII and by negotiating with Innocent VIII a concordat (1487) which

gave him extensive rights of patronage within the Scottish church; but in 1488 his nobles again rose in rebellion, proclaiming his eldest son, James, duke of Rothesay, as their leader, and, on June 11, defeated him at Sauchieburn near Stirling. James escaped from the battlefield to meet his death at the hands of some person unknown. He left three sons—his successor, James IV; James Stewart, duke of Ross (d. 1504); and John Stewart, earl of Mar (d. 1503). (R. L. Me.)

JAMES IV (1473–1513), king of Scotland from 1488 to 1513, eldest son of James III, was born on March 17, 1473. He was in the hands of the rebels who defeated the troops of James III at the battle of Sauchieburn near Stirling on June 11, 1488, and became king when his father was killed a few hours afterward. Few if any of the kings of Scotland have won such general popularity, or passed a reign so little troubled by internecine strife. Crowned at Scone a fortnight after his accession, James began at once to take an active part in the business of government. A slight insurrection (1489) was easily suppressed, and a plot (1491) formed by some nobles to hand him over to the English king, Henry VII, came to nothing. In spite of this proceeding Henry wished to live at peace with his northern neighbour; a five years' truce was concluded on Dec. 21, 1491. When, in 1495, Perkin Warbeck, pretending to be Richard, duke of York, Edward IV's younger son, came to Scotland, James prepared to invade England in his interests, but the war was confined to a few border forays, and a seven years' peace was negotiated in Sept. 1497. A marriage was arranged (1502) between James and Henry's eldest daughter Margaret which took place at Holyrood in Aug. 1503. This union led to the accession to the English throne of the Stuart dynasty.

James had already humbled the last lord of the Isles (1493) and he had little difficulty in suppressing revolts; indeed, he was responsible for the unification of the country. James also began to treat as an equal with the powerful princes of Europe, the emperor Maximilian I, Louis XII of France and others; he sent assistance (1501–02, 1507–08) to his uncle John, king of Denmark, and received special marks of favour (1507) from Pope Julius II. But his position was weakened when Henry VIII succeeded to the English throne in 1509. Causes of friction already existed, and Henry's attitude was not conciliatory; sea fights took place between ships of the two monarchs, while war was brought nearer by the treaty of alliance which James concluded with Louis XII in 1512. Urged on by his French ally, James eventually embarked on war, in spite of the counsels of his advisers. Gathering a large and well-armed force, he took Norham, Ford and other castles in Aug. 1513. He met the advancing English army under Thomas Howard, earl of Surrey, at Flodden, or, more correctly, at the foot of Branxton hill. The battle, which took place on Friday, Sept. 9, 1513, is among the most famous and disastrous, if not among the most momentous, in the history of Scotland (*see* Flodden, Battle of). Having led his troops from their position of vantage, the king himself was killed while fighting on foot, together with nearly all his nobles. He left one legitimate child, his successor James V, but he had many illegitimate children, among them (by Margaret Boyd) Alexander Stewart, archbishop of St. Andrews and chancellor of Scotland, who was killed at Flodden, and (by Janet Kennedy) James Stewart, earl of Moray (d. 1544).

James appears to have been a brave and generous man, and a wise and energetic king. He was possessed of considerable learning; during his reign the Scottish court attained some degree of refinement, and Scotland began to count in European politics. Literature flourished under his patronage, education was encouraged, and the material condition of the country improved enormously. The king was specially interested in his navy, in medicine and in printing, as well as in chivalry and pageantry. He is said to have worn an iron belt as penance for his share in his father's death; and by his frequent visits to shrines, and his benefactions to religious foundations, he won a reputation for piety.

See R. L. Mackie, *King James IV of Scotland* (1958) and (ed.) *The Letters of James IV, 1505–13* (1953). (G. S. P.)

JAMES V (1512–1542), king of Scots from 1513 to 1542, was the only legitimate son of James IV. He was born at Linlithgow on April 10, 1512, and succeeded his father in 1513. The regency was first assumed by his mother, but after Queen Margaret's second marriage, with Archibald Douglas, 6th earl of Angus, in Aug. 1514, it was vested by the estates in John Stewart, duke of Albany, the heir presumptive. The minority was disturbed by constant quarrels between a faction, generally favourable to England, under Angus, and the partisans of France, under Albany. At the same time the queen mother and the nobles struggled for possession of the king's person. The English had not followed up their victory at Flodden but Henry VIII and Francis I of France were watching affairs in Scotland closely. When Albany had retired to France, the parliament in 1524 declared James fit to govern with the advice of his mother and a council. Angus obtained control of the king in 1526 and he kept him in close confinement until 1528, when James, escaping from Edinburgh to Stirling, compelled Angus to flee to England. The king made a strong effort to suppress his turbulent vassals in the south of Scotland during 1529 and 1530. Negotiations for peace with England were begun and a treaty was signed in May 1534. Henry VIII wished James to marry his daughter Mary, but the Scottish king married Madeleine, elder daughter of Francis I, in Paris (Jan. 1537). Madeleine died on July 7, 1537, and James made a much more important marriage in 1538—to Mary (1515–60), daughter of Claude, duc de Guise, and widow of Louis d'Orléans, duc de Longueville. This connection helped to induce James to adopt a firm foreign policy and to range himself definitely among the enemies of England. He had refused to meet Henry VIII at York in 1536, and had received the gift of a cap and sword from Pope Paul III in 1537, thus renouncing the friendship of Henry VIII. Although in 1540 the English king made another attempt to win the support of James for his religious policy, the relations between the two countries became very unfriendly. In 1542 Henry sent an army to invade Scotland. James's forces, because of the lack of support from the nobles, were easily scattered at the rout of Solway Moss on Nov. 24, 1542. This blow preyed upon the king's mind and on Dec. 14 he died at Falkland, having just heard of the birth of his daughter. His two sons had died in infancy and his successor was his only legitimate child, Mary. He left several illegitimate children, including James (*c.* 1531–70), earl of Moray (the regent Moray).

James V showed vigour and independence as a sovereign, although his steadfast opposition to his uncle, Henry VIII, cost him the support of some of the nobles, while his habit of mingling with the peasantry gained him wide popularity. The persecution of heretics during this reign was largely the work of the ecclesiastics, especially David Beaton, archbishop of St. Andrews.

See Denys Hay (ed.), *The Letters of James V* (1955). (G. S. P.)

JAMES, The Old Pretender (1688–1766), styled James III of England and VIII of Scotland by the Jacobites and known also as the chevalier de St. George, the son of James II and Mary of Modena, was born at St. James's palace, London, on June 10, 1688. The unwelcome arrival of an heir to the Roman Catholic monarch encouraged belief in the entirely false story that the child was supposititious, having been introduced into the queen's bed in a warming pan. The arrival of William of Orange in England later in 1688 resulted in the flight of the queen and her child to France where they were joined later by James II. A refuge was offered to the exiled royal family at St. Germain and here the prince spent his early years. When James II died in 1701, Louis XIV acknowledged the prince as King James III and VIII. Just before the succession of his half sister Anne in 1702, a bill of attainder was passed against him by the English parliament. Though Anne succeeded to the throne with little opposition she was never quite settled in her conscience about the claim of the "king over the water," whom she very probably wished to succeed her, but James's adamant adhesion to the Catholic faith made this quite impossible.

The Pretender first attempted to regain the throne in 1708 when he embarked for Scotland. His ship managed to reach the Firth of Forth but the arrival of an English fleet meant that James never actually set foot on land. Returning to the continent he fought with the French army, distinguishing himself in the

battles of Oudenarde (1708) and Malplaquet (1709). Under the terms of the treaty of Utrecht (1713) he was compelled to leave France, but before the treaty was signed James had already left Paris and settled at Bar-le-Duc in Lorraine. Before leaving France James wrote to Queen Anne to suggest that she should name him as her heir on the grounds that she would "readily comply with so just and fair a proposal as to prefer your own brother, the last male of our name, to the duchess of Hanover, the remotest relation we have." To this appeal the queen made no answer

When the earl of Mar precipitated the rebellion in Scotland in 1715 James again set out for the northern kingdom. He landed at Peterhead on Dec. 22 and went to Scone where preparations were made for a coronation, but no ceremony in fact took place. The advance of government troops under the duke of Argyll caused James to retreat to Montrose and shortly after, seeing the total lack of readiness on the part of his own supporters, he returned to France. Thus the Jacobite rebellion collapsed. James continued to scheme for his return, hoping to enlist the help of Charles XII of Sweden, but Charles's death in 1718 brought these plans to an end. In 1719 the Spanish minister Giulio Alberoni offered support to James and he went to Madrid. An expedition was prepared at Cadiz under the duke of Ormonde but after setting sail the ships were driven back into port by storms. A smaller force under Lord Marischal reached Stornoway but surrendered at Glenshiel in June.

James passed the remainder of his life in or near Rome. On Sept. 1, 1719, he married Maria Clementina Sobieska, a granddaughter of John III of Poland. She bore him two sons, Charles Edward (1720–88), the Young Pretender, and Henry (1725–1807), later the cardinal duke of York. In Rome James and his wife were openly acknowledged as king and queen and the Muti palace was placed at their disposal by Pope Clement XI. James's marriage was not happy; shortly after the birth of her second son Clementina retired to a convent for two years. She died in 1735 and was buried with royal state in St. Peter's.

During his later years James suffered much from ill-health and allowed most of the direction of Jacobite affairs to pass into the hands of his elder son to whom he gave a commission as regent when the prince left Rome in 1744 (*see* CHARLES EDWARD). Throughout the rebellion of 1745 James remained in Rome supporting his son from a distance but never very confident of success. Henry's acceptance of a cardinal's hat in 1747 had the full support of James though it caused a long-lasting rift between the brothers. James died at Rome on Jan. 1, 1766, and was buried in St. Peter's with the ceremonies usually accorded to a reigning sovereign. He was a dignified and high-principled man who might have made a conscientious monarch but lacked the drive and initiative to regain a throne once lost. He professed a liberal religious policy, maintaining a Protestant chaplain for his non-Catholic followers, while remaining himself devoted to the Roman Catholic faith.

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JAMES, HENRY (1843–1916), U.S. novelist and critic and one of the most influential theorists of fiction in the English-speaking world, was born in New York city on April 15, 1843, and died in London in 1916. Although he wrote for more than half a century as an American, he became a British citizen a few months before his death. A creator of the cosmopolitan novel, James also laid the foundations for the modern psychological novel, experimented with narrative techniques and sought, in his critical papers, to arrive at a "codification" of the art of fiction. His influence was pervasive. Joseph Conrad, James Joyce, Virginia Woolf, Dorothy Richardson and Graham Greene are among many novelists who derived technique or aesthetic ideas from James. Much of the contemporary terminology used in discussion of fiction stems from the critical prefaces written by the novelist to his own novels late in life. Assembled, they amount to a major treatise on the art.

The novelist was the second son of Henry James (1811–1882), an idiosyncratic and voluble Swedenborgian with a pungent wit and vigorous style; his elder brother was William James (1842–1910), the psychologist and philosopher of pragmatism. Both sons derived from their father his vivid sense of words and adapted it to their own needs. In early childhood Henry James lived in Albany, N.Y., where his grandfather, an Irish immigrant, had amassed one of the largest fortunes in the state. He passed his boyhood in New York city; during his adolescent years he was schooled by tutors and governesses in Europe. A shy boy, he resisted formal education and was described by his father as a "devourer of libraries." Most of his reading was in fiction. On the eve of the Civil War the family returned from one of their European sojourns and settled at Newport, R.I. There the 17-year-old Henry formed a friendship with John LaFarge, the painter, who encouraged him to begin writing. In the early weeks of the war the future novelist suffered a strained back while helping to put out a fire, and this "obscure hurt," as he called it in his memoirs, kept him from military service. In 1862 he briefly attended the Harvard law school; he was already writing short stories and book reviews. The first identified piece of fiction by him is an unsigned tale, "A Tragedy of Error," published in a New York magazine, the *Continental Monthly*, Feb. 1864. By this time the James family had established itself in Cambridge, Mass., opposite the Harvard yard, and here Henry James met Charles Eliot Norton and certain of the Boston Brahmins. Norton accepted his precocious book notices in the *North American Review* and in 1865, when Henry James was 22, his first acknowledged short story was published in the *Atlantic Monthly*. By the time he was 25 he was called by the *Nation* "the best writer of short stories in America." William Dean Howells, who became an editor of the *Atlantic* in 1866, promptly recognized the gifts of the young contributor and from that time on the pages of this journal were open to him. Young James and Howells, between them, inaugurated the era of realism in American fiction.

James's first tales are placed in the American scene; they show a careful study of his principal models: Balzac, Merimée, George Eliot and George Sand. Of American writers, the principal influence was Hawthorne. From the first James showed a close awareness of certain fictional problems which few storytellers had recognized or studied: the value of "point of view" in fiction; the need to maneuver the reader so as to involve him in the story; the need for careful identification of narrators in first person stories. In general James created his fiction out of an acute observation of patterns of human behaviour; his early stories dealt largely with American manners and human relationships.

In 1869–70 James paid his first adult visit to Europe and gained his first experience of Italy, where many of his later stories were set. While he was abroad, his cousin, Minny Temple, to whom he was deeply attracted, died. Later he wove her into *The Portrait of a Lady*, his first major novel, and *The Wings of the Dove*, one of his last works, as well as into certain of his tales. The fruit of his year of wandering in Europe was his first important story, "A Passionate Pilgrim." This was followed by a short novel, *Watch and Ward*, serialized in the *Atlantic*, but later virtually disowned by its author. For two years (1870–72) James tried to make his way in Boston by writing book reviews and stories as well as art criticism. A renewed stay in Europe for two years (1872–74), largely in Italy, yielded his first full-length work, *Roderick Hudson*, the story of an American sculptor's brief success and disintegration in the art studios of Rome. In this book James posed the problem of the American artist: was he to try to create at home, in a country busy with material expansion, or to expatriate himself into the complexities and dark corruptions of Europe? He implied that not the artist's country so much as his creative personality was the determining force in his life. In 1875, after trying once again to make his way in America, this time in New York—by writing theatre and art criticism as well as fiction—he decided Europe would yield him more material, including the opportunity to write travel papers for American journals. Late in that year he settled in Paris.

In the French capital he sought out the Russian novelist, Ivan Turgenev, whose work had attracted him, and was introduced by him in turn to Flaubert and the group of French realists: Zola,

Edmond de Goncourt, Daudet and Maupassant. James admired the art discussions of the French writers; deplored their Parisian parochialism and "unclean" subjects; and learned from Turgenev the lesson that character, rather than story, was important: indeed, that once the artist discovers a character the latter will supply his own story. While in Paris, James wrote letters on current affairs and Parisian art events for the *New York Tribune*, and completed his novel *The American* which won him a wider public. But he felt himself too much an outsider in France, and in 1876 transferred to London. There, in small rooms in Bolton Street off Piccadilly, James wrote the major fiction of his middle life. When he withdrew from London, it was to the British seaside, there to continue his writing; or for periodic trips to France and Italy, where he collected materials for his travel and his literary papers written on the margin of his fictions. In 1878, with the publication of "Daisy Miller," he became internationally known. The story, dealing with an American flirt whose behaviour is misunderstood by the international set in Rome, was central to James's first phase. In this period most of his stories were "international." They presented the contrast of American and European manners, and they inaugurated a series of studies of the American girl against the European background, of which *The Portrait of a Lady* (1881) established James as a major figure in world literature. In several years of rapid writing, with no falling off in quality or style, James produced *The Europeans* (1878); *Washington Square* (1881), one of the best known of his American subjects (posthumously dramatized as *The Heiress*); and such shorter tales as "An International Episode," "A Bundle of Letters" and "The Point of View," in which he balanced American innocence against European sophistication. During James's lifetime many of his American readers felt that the contrast was weighted in favor of the Europeans, but later critics recognized that all of James's "international" stories give his American protagonists a moral victory over the more cultivated, but also more corrupt, Europeans, and that Europe in reality is pictured often as a museum-world which James believed must not be exalted above human values.

In 1881 James revisited America. His parents died during the following year; thereafter the novelist ceased his crossings of the Atlantic and for 20 years remained uninterruptedly abroad, largely in England. He inherited a small income from his father, but turned it over to his sister, since his literary earnings were sufficient to support him. In England and France he formed friendships with a group of notable writers, critics and painters, among them Robert Browning, Robert Louis Stevenson, Edmund Gosse, Paul Bourget, George du Maurier, John Singer Sargent, Jules Jusserand, Mrs. Humphry Ward and later Joseph Conrad, H. G. Wells, Rudyard Kipling and Edith Wharton.

The second phase of his writings began with *The Bostonians* (1886), a novel with a wholly American subject; and *The Princess Casamassima* (1886), his first novel dealing exclusively with European life. Both novels were concerned with reformers, *The Bostonians* with the earliest phase of the suffragette question, *The Princess* with anarchism. *The Tragic Muse* (1889) is a novel of the art studios and the stage. It ushered in the novelist's "dramatic years," five years (1890–95) devoted assiduously to playwriting. A dramatization of *The American* in 1891 had a modest run; but an original play, *Guy Domville*, produced Jan. 5, 1895, was booed out of the theatre. James reluctantly accepted this verdict and returned to the novel. He now wrote a series of short fictions, *The Other House* (1896), *The Spoils of Poynton* (1897), *What Maisie Knew* (1897), *In the Cage* (1898) and *The Awkward Age* (1899), which are set in England and show the influence of the scenic methods he had studied in the theatre. The novelist had never married, and in 1898 he purchased historic Lamb house in Rye, Sussex, where during the next dozen years he divided his time between long periods of solitary work and the practice of genial bachelor hospitality. He had written all his earlier works in longhand, but now he dictated the long, inflected and parentheses-studded sentences of his late style. With unabated power and increasingly subtle narrative skill he wrote his famous ghostly tale, *The Turn of the Screw*, and after the turn of the century, *The Ambassadors* (written in 1901 but published in 1903), *The Wings of the Dove* (1902) and *The Golden Bowl* (1904). In their tragic vision and technical virtuosity—innovations in "point of view" and manipulation of scene and subjectivity—these massive novels marked James's last phase and have come to be regarded as the summit of his work.

In 1904–05 James revisited the United States after his two-decade absence and wrote *The American Scene* (1907), remarkable for its prose pictures and its brooding concern with the materialistic drift of American life. During his remaining years James revised his novels and tales for the "New York edition" of his works, rigidly selected and arranged in 24 volumes and published between 1907 and 1909. It was for this edition that he wrote his famous prefaces on the art of fiction. Between 1910 and 1914 he wrote his two volumes of autobiography, *A Small Boy and Others* and *Notes of a Son and Brother*. A fragment of a third volume, *The Middle Years*, was published posthumously, as were two unfinished novels, *The Ivory Tower* and *The Sense of the Past*, the latter becoming the successful play *Berkeley Square*.

He wrote in all 20 full-length novels, a dozen novelettes, more than 100 short stories; he collected his travel writings in *Transatlantic Sketches* (1875), *Portraits of Places* (1883), *A Little Tour in France* (1885), *English Hours* (1905) and *Italian Hours* (1909). His essays are grouped in *French Poets and Novelists* (1878), *Partial Portraits* (1888), *Essays in London* (1893), *Picture and Text* (1893) and *Notes on Novelists* (1914).

Henry James was elected to the American Academy of Arts and Letters in 1905, and on becoming a British subject in 1915 received the Order of Merit from George V. He died on Feb. 28, 1916, and his ashes were taken to America and buried in the James family plot in Cambridge cemetery.

Although he was a remarkable innovator and widely known in the literary world, James's public was comparatively small during his lifetime. With the revival of interest in his work following centenary observances in 1943, and the growing comprehension of the extent of his fictional explorations, he has reached an ever-widening audience. His rendering of subjective states places him as a forerunner of the "stream of consciousness" method in fiction. In his originality, distinction of style and inventiveness, he has been regarded as the prototype of the American artist and is often spoken of as a "novelists' novelist."

BIBLIOGRAPHY.—Posthumous publication of James has been extensive. His notebooks, constituting a remarkable document on the creative process, were edited by F. O. Matthiessen and K. B. Murdock in 1947; his 12 plays, edited by Leon Edel, appeared in 1949. Miscellaneous essays have been collected in *The Scenic Art*, ed. by A. Wade (1947); *The American Essays of Henry James*, ed. by Edel (1956); *The Painter's Eye*, ed. by J. L. Sweeney (1956); *The House of Fiction*, ed. by Edel (1957); *Parisian Sketches*, ed. by Edel and I. D. Lind (1957). In 1920 Percy Lubbock edited a selection from his vast correspondence in *The Letters of Henry James* in two large volumes. Further letters appeared in *The Selected Letters of Henry James*, ed. by Edel (1955). A complete bibliography of James's writings, compiled by Leon Edel and Dan H. Laurence, was published in 1957. In addition to earlier critical works by Rebecca West, Joseph Warren Beach, Ford Madox Hueffer, Van Wyck Brooks and Pelham Edgar, the late F. O. Matthiessen edited an anthology of James family writings and wrote a study of the later novels; F. W. Dupee wrote a short critical biography (1952); and Edel completed the first part of a full-length biography, *Henry James: The Untried Years* (1953). (LN. E.)

JAMES, JESSE WOODSON (1847–1882), U.S. outlaw, was born Sept. 5, 1847, in Clay county, Mo. In the early months of the American Civil War the family favoured the Southern cause, and as a result suffered greatly at the hands of the Union forces. By way of retaliation, Jesse turned informer and later, when only 15 years of age, joined the Confederate guerrilla forces led by W. C. Quantrill (*see* BANDITRY). There he soon established a reputation for marksmanship and daring. At the conclusion of the war Jesse and other members of the band surrendered, but soon afterward he was treacherously shot and severely wounded. In the following year he was declared an outlaw, and thereafter until his death he was a fugitive from the law. In 1867 he became the leader of the "James band" of bank and train robbers, and during the following years attained notoriety for crimes of the most daring and cold-blooded type. Attracted by a reward of

$10,000 offered by Governor Crittenden of Missouri for the capture of Jesse James, dead or alive, two members of his own band, Robert and Charles Ford, turned against him. They shot and instantly killed him in his home at St. Joseph, Mo., April 3, 1882.

Jesse's brother Frank (1843–1915) took part in most of the exploits of the James band. He surrendered and was twice brought to trial soon after the death of his brother, but was acquitted both times. The closing years of his life were spent quietly on a farm in Missouri.

See Robertus Love, *The Rise and Fall of Jesse James* (1926); C. W. Breihan, *The Complete and Authentic Life of Jesse James* (1953).

JAMES, WILLIAM (1842–1910), U.S. psychologist, philosopher, leader of the movement known as pragmatism, and most renowned and representative of the thinkers of the United States, was born in New York city on Jan. 11, 1842. He was the eldest of the five children of Henry and Lucy (Walsh) James; the second of the five, William's brother Henry (*q.v.*), became the distinguished author of novels proclaimed for their psychological subtlety and their refinement of style. The other brothers and sisters do not figure notably, nor do the ancestors of William and Henry James. There is no indication in the American line of Irish, Scotch and English forbears, whose bloods mingled in their veins, of that deep and urgent concern with the ultimates of nature and human nature which moved the two brothers and their father. The grandfathers were "farmers, traders and merchants," prosperous and Presbyterian, with hardly even a doctor or a lawyer among them. There is a probable connection between the father's philosophic interests and an accidental burning during his boyhood that required the amputation of one leg above the knee. Both the physical and the spiritual life of Henry James the elder were marked by restlessness and wanderings, largely in Europe, which affected the training of his children at school and their education at home. He had himself graduated from Union college, in Schenectady, N.Y., and then gone to the Princeton theological seminary, to prepare himself for the Presbyterian ministry, but had developed while there "antipathy to all ecclesiasticisms which he expressed with abounding scorn and irony throughout all his later years." In 1844, when William was two years old, a friend introduced to his father the works of Swedenborg. In these he seems to have found something of the consolation and security that he was seeking, and upon them he built a system of his own which seems to have served as a vision of spiritual life adequate to compensate for his bodily misfortune. The best of it William James conserved in *The Literary Remains of Henry James*, published in 1886. It provided the permanent intellectual atmosphere of William James's home life. Its perduration made up for the disciplineless irregularity of his schooling, which ranged from New York in the United States to Boulogne in France, Geneva in Switzerland, and back. The habits acquired in dealing with the father's views at dinner and at tea carried over into the extraordinarily sympathetic yet critical manner of dealing with anybody's views on any occasion.

When James was 18 years of age and the family was living in Newport, R.I., he tried his hand at studying art, with William M. Hunt for a teacher and John LaFarge for a fellow pupil. But he soon tired of it, and the following year entered the Lawrence scientific school of Harvard university. From courses in chemistry, anatomy and similar subjects there, he went to the study of medicine in the Harvard medical school, but interrupted this study in order to accompany Louis Agassiz, in the capacity of assistant, on an exploring expedition to the Amazon. There his health failed and his duties irked him. He returned to the medical school for a term, and then during 1867–68 went to Germany for courses with Helmholtz, Virchow and Bernard, among others. At the same time he read widely in the psychology and philosophy then current, especially Renouvier.

The acquaintance with Renouvier is a focal point in James's personal and intellectual history. He seems from adolescence to have been a delicate boy, always ailing, and at this period of his stay in Germany to have suffered a breakdown, with thoughts of suicide. When he returned home, in Nov. 1868, after 18 months in Germany, he was still ill. Though he took the degree of M.D. at the Harvard medical school in June 1869, he was unable to begin practice. Between that date and 1872 he lived in a state of semi-invalidism in his father's house, doing nothing but reading, and writing a very occasional review. Early in this period he experienced a sort of phobic panic which persisted until the end of April 1870. It was relieved, according to his own statement, by the reading of Renouvier on free will and the decision that "my first act of free will shall be to believe in free will." The decision carried with it the abandonment of all determinisms—both the scientific kind which his training had established for him and which seems to have had some relation to his neurosis, and the theological, metaphysical kind that he kept combating in the notion of "the block universe." His revolutionary discoveries in psychology and philosophy, his views concerning the methods of science, the qualities of men and the nature of reality, seem all to have received a definite propulsion from this resolution of his poignant personal problem.

In 1872 James was appointed instructor in physiology in Harvard college. He served in this capacity until 1876. But he could not be diverted from his ruling passion, and the step from teaching physiology to teaching psychology—not the traditional "mental science" but physiological psychology—was as inevitable as it was revolutionary. It meant a challenge to the vested interests of the mind, mainly theological, which were entrenched in the colleges and universities of the United States. It meant a definite break with what Santayana called "the genteel tradition." Psychology ceased to be mental philosophy and became a laboratory science. Philosophy ceased to be an exercise in the grammar of assent and became an adventure in methodological invention and metaphysical discovery.

With his marriage in 1878, to Alice H. Gibbens of Cambridge, Mass., a new life began for James. The old neurasthenia practically disappeared. He went at his tasks with a zest and an energy his earlier record had given no hint of. It was as if some deeper level of his being had been tapped: his life as an originative thinker began in earnest. He signed a contract with Henry Holt and Company to produce a textbook of psychology by 1880. But the work grew under his hand and did not appear until 1890. When it did appear, as *The Principles of Psychology*, it was not a textbook but a monumental work in two great volumes from which the textbook was condensed two years later. The *Principles* was at once recognized as both definitive and innovating in its field. It established the functional point of view in psychology. It assimilated mental science to the biological disciplines and treated also thinking and knowledge in the aspect of instruments in the struggle to live. It made at one and the same time the fullest use of principles of psychophysics and defended, without embracing, free will.

The *Psychology* completed, James seems to have lost interest in the subject. Creator of the first U.S. demonstrational psychological laboratory, he disliked laboratory work and did not feel himself fitted for it. He liked best the adventure of free observation and reflection. Compared with the problems of philosophy and religion, psychology seemed to him "a nasty little subject" that he was glad to have done with. His studies were now of the nature and existence of God, the immortality of the soul, free will and determinism, the values of life. They differed from the usual thing in method: they were empirical, not dialectical. James went directly to religious experience for the nature of God, to psychical research for survival after death, to the fields of belief and action for free will and determinism. He was searching out these things, not arguing foregone conclusions. He had begun to teach ethics and religion in the late 1880s, and his collaboration with the psychical researchers dated even earlier. Survival after death he found at the end to be unproved; but the existence of divinity he held to be established by the record of the religious experience, but as a plurality of saving powers, "a more of the same quality" as oneself, that in a crisis one's personality can make contact with and be saved. Freedom he found to be a certain looseness in the conjunction of things, so that what the future shall be is not made inevitable by past history and present form; freedom or chance corresponds to Darwin's "spontaneous

variations"; it is what saves history from being mere repetition. These views were set forth in the period between 1893 and 1903 in various essays and lectures, afterward collected into works: *The Will to Believe and Other Essays in Popular Philosophy* (1897); *Human Immortality* (1898); *Talks to Teachers on Psychology and to Students on Some of Life's Ideals* (1899); *The Varieties of Religious Experience* (1902). The decade may be correctly described as James's religious period. All his studies are concerned with one aspect or another of the religious question. His natural interest in the subject was reinforced by the practical stimulus of an invitation to give the Gifford lectures on natural religion at the University of Edinburgh. He was not able to give them until 1901–02, and their preparation focused his labours for a number of years.

His disability, involving his heart, was due to prolonged effort and exposure during a holiday in the Adirondacks in June 1899. A trip to Europe which was to have taken up a sabbatical year away from university duties turned into two years of invalidism. The Gifford lectures were prepared during this distressful period. Published as *The Varieties of Religious Experience*, they had an even greater acclaim as a book than as articles. Cautious and tentative though it was, the rich concreteness of the material, the final summary of the evidence that the varieties of religious experience point to the existence of specific and various reservoirs of consciousnesslike energies with which we can make specific contact in times of trouble, touched something fundamental in the minds of religionists and at least provided them with apologetic material not in conflict with science and scientific method.

The book also topped off James's interest in the psychology of religion. He now explicitly turned his attention to the ultimate philosophic problems that were at least marginally present with his other interests. Already in 1898, in a lecture at the University of California on philosophical conceptions and practical results, he had formulated the theory of method known as pragmatism. Having its roots in the strict analysis of the real logic of the sciences made in the middle 1870s by that extraordinary eccentric genius Charles S. Peirce, it underwent in James's hands a transforming generalization. He showed how the meaning of any idea whatsoever—scientific, religious, philosophical, political, social, personal—can be found ultimately in nothing save the succession of experiential consequences it leads through and to; that truth and error are identical with these consequences or else nothing within reach of the mind at all. He had made use of the pragmatic rule in his study of religious experience. He now turned it upon the ideas of change and chance, of freedom, variety, pluralism, novelty, which from the time he had read Renouvier it had been his preoccupation to establish. He used the pragmatic rule in his polemic against monism and the "block universe," against internal relations (*i.e.*, the notion that you can't have one thing without having everything), against all finalities, staticisms and completenesses. His classes rang with the polemic against absolutes, and a new vitality crept into the veins of American philosophers. The historic controversy over pragmatism saved the profession from iteration and dullness.

Meantime (1906) James had been asked to lecture at Stanford university, in California, and experienced there the earthquake which destroyed San Francisco. The same year he delivered the Lowell lectures, in Boston, Mass., afterward published as *Pragmatism: A New Name for Old Ways of Thinking*. Various studies—"Does Consciousness Exist," "The Thing and its Relations," "The Experience of Activity," etc.—appeared, chiefly in the *Journal of Philosophy;* they were essays in the extension of the empirical and pragmatic method to everything that has a name. These studies were collected after James's death and published as *Essays in Radical Empiricism* (1912). The fundamental point of these essays is that the relations between things, holding them together or separating them, are at least as real as the things themselves, that their function is real and that no hidden substrata are necessary to account for the clashes and coherences of the world. The empiricism was radical, because until this time even empiricists believed in a hidden turtle on whose back the cosmic elephant rode.

James was now the centre of a new life for philosophy in the English-speaking world; the continentals did not "get" pragmatism; if its German opponents altogether misunderstood it, its Italian adherents—Papini, of all people—travestied it. In England it was championed by Schiller; in the United States there were Dewey and his school. The pragmatists were by no means unanimous among themselves, but that added to the interest of the situation. In 1907 James gave his last course—an introduction to philosophy—in Harvard, and the students surprised him and broke an academic precedent by presenting him with a loving cup. In the spring he went to Columbia university in New York city to repeat the lectures on "Pragmatism." It was as if a new prophet had come: the lecture halls were crowded on the last day as on the first, with people standing outside the door. He was fêted and photographed; he himself describes the visit as the "high tide of my existence." His hope was, when the thing was over, to settle down at last to a free consideration of the philosophical questions that obsessed him. But there came an invitation to give the Hibbert lectures at Manchester college in Oxford, England, that constituted, he felt, a challenge which, in view of the status of pragmatism in England at that time, he might not disregard. These lectures, published in 1909 as *A Pluralistic Universe*, state in a more systematic and less technical way than the *Essays in Radical Empiricism*, the same essential positions. They present in addition certain religious overbeliefs of James's which further thinking, if the implications of the posthumous *Some Problems in Philosophy* may be trusted, seemed to be mitigating. These overbeliefs involve a pan-psychistic interpretation of experience which goes beyond radical empiricism and the pragmatic rule into conventional metaphysics.

Home again, James found himself working, against growing physical trouble, upon the material of which some was published after his death (1911) as the *Some Problems, etc.* referred to above. He also collected the occasional pieces in the controversy over pragmatism and published them as *The Meaning of Truth* (1909). He remained available to students and good causes, and he wrote various other pieces—the last one about B. P. Blood, the "pluralistic mystic." Finally his physical discomfort exceeded even his remarkable voluntary endurance. It was decided to try again a cure at Nauheim and he sailed with Mrs. James in the spring of 1910 for Europe. But in Europe he gave himself too freely to people and Nauheim did not help him. They came back, in the company of his brother Henry, in midsummer, going straight to the country home in Chocorua, N.H. There he died on Aug. 26, 1910. He was survived by his widow, three sons and one daughter.

It is still too early to estimate James's significance and influence. In psychology, his work is of course dated, but it is dated as Galileo's is in physics or Darwin's in biology, because it is the originative matrix of the great variety of new developments which are the current vogue. In philosophy, his positive work still is prophetic. The world he argued for is that which the new physics, the physics of Einstein and Russell and Bohr, definitely points to—a world of events connected with one another by kinds of next to next relations, a world various, manifold, changeful, originating in chance, perpetuated by habits (we call such habit laws) and transformed by breaks, spontaneities and freedoms. In human nature, James thinks, these visible traits of the world are equally manifest. The real specific event is the individual; his character, his beliefs, his endeavour are an adventure in autobiography of which the conclusion is not established in advance. He integrates societies as he lives, and he breaks them. He validates beliefs by living them out or he makes them false. He is the primary event from which history dates, and whose intervention gives it in each case a new and unexpected turn. But in history as in nature, the flux of change and chance transforms every being, invalidates every law and alters every ideal. "What," he asks, "has concluded, that we should conclude about it"? Let us therefore, he urged, allow the claim of everything that makes a claim before us, let us give it an opportunity to make good its claim. The world of thought and the world of things are alike to be treated in the spirit of sportsmanlike fair play; the new, the untried, the doubtful are to have their chance whenever and however they arise.

James lived his philosophy. It enters into the texture and rhythms of his rich and vivid literary style. It determined his attitude toward scientifically unaccepted therapies, such as Christian Science or mind cure, and repugnant ideals, such as militarism. It made him an anti-imperialist, a defender of the small, the variant, the unprecedented, the weak, wherever and whenever they appeared. His philosophy is too viable and subtle, too hedged, experiential and tentative to have become the dogma of a school. It has functioned rather as a germinative of new thought in others than as a standard old system for others to repeat. (H. M. K.)

For James's functional psychology, *see* PSYCHOLOGY, HISTORY OF: *Rise of Experimental Psychology: Functional Psychology;* for the James-Lange theory of emotions, *see* EMOTION; for his philosophy, *see* PRAGMATISM.

See also references under "James, William" in the Index.

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JAMES, EPISTLE OF, a book of the New Testament, classified among the "General" or "Catholic" Epistles, believed to have been written for Christians in general rather than for one specific church. The address "To the 12 tribes in the dispersion" (i, 1) designates the Christian church; from an early period Christians considered themselves the "true Israel" of God (*cf.* I Pet. i, 1; Gal. vi, 16).

Contents.—The book may be outlined as follows:

i, 1:	greeting
2–4:	trials as test of faith
5–8:	answers to prayer without faith
9–11:	curse of riches
12–15:	trials *v.* temptations
16–18:	all good is from God
19–26:	on self-control, and hearing and doing
27:	definition of religion
ii, 1–13:	partiality toward the rich is sin
14–26:	on faith and works: faith apart from works is barren
iii, 1–12:	sins of the tongue
13–18:	definition of true wisdom
iv, 1–10:	evil desires
11–17:	sins of speech, arrogance and omission
v, 1–6:	condemnation of the rich
7–11:	steadfastness of the righteous
12:	against swearing: "let your yes be yes and your no be no"
13–18:	efficacy of prayer in suffering and sickness
19–20:	bringing back the sinner from "the error of his ways"

Author.—The author calls himself James (i, 1). While the question of identity of this James has been debated from early times, consensus has favoured James "the brother of the Lord," (*q.v.*) though this agreement has in no sense solved the problem of authenticity. In the 4th century Jerome said some believed the Epistle was written by another person under the name of James the brother of Jesus. Doubt concerning its authenticity is reflected in its exclusion from the canonical list of the Roman Church called the Muratorian fragment (*c.* 200; *see* BIBLE: *Canon and Text: Canon of the New Testament*). Both Origen and Eusebius of Caesarea imply that the writing was disputed. It enjoyed increasing acceptance in the Eastern Church during the 4th century; in the Western and Syrian churches its authenticity was disputed as late as the 5th century.

Modern scholarship is divided over its authenticity. In addition to the early church's uncertainty the two major arguments against authenticity are: (1) The Greek literary form and style are of such a quality as to raise grave doubts that the Aramaic-speaking James could have composed it. (2) Though the writing strongly emphasizes the importance of the Law it makes no reference to ritual requirements; this is strange if James was the author, since from the New Testament and other sources (Josephus, Hegesippus) it is known that James was remembered for his strict adherence to the ritual demands of the Law even after becoming a Christian.

Form and Subject Matter.—The literary form of James has always presented a problem. Its opening verse suggests a letter. However, the body of the writing is notable for its lack of personal allusions and references which characterize a genuine letter and it has no final salutation. More enigmatic is its content. Except for two references (i, 1; ii, 1) and a probable allusion (v, 8) to Christ, distinctively Christian teachings are sparse. A few scholars have suggested that the writing was originally a Jewish document later adapted for Christian use. While few would agree, most would affirm the author's dependence on Jewish sources. The sections of the writing hang together loosely even where the same subject matter is repeated. There is no basic pattern of development in the argument.

This enigma has been solved by the recognition of James as a type of writing popularized in the Greco-Roman world by the Stoics and known as *paraenesis,* a compilation of moral rules and instructions intended to guide people in various human relationships. This mode of instruction had its influence on Hellenistic Judaism, as is known from Philo of Alexandria. It is generally agreed that James utilizes this popular form, probably under the influence of Hellenistic Judaism, and his content is determined largely by his paraenetic purposes and style. Similar paraenetic passages are found elsewhere in the New Testament (*e.g.,* I Thess. iv, 1–12; v, 1–22; Gal. v, 1–vi, 10; Rom. xii–xiii). The author thus makes use of a type of teaching already known in the church.

In the central section (ii, 14–26) James introduces another literary mode, the diatribe (also ch. iii–iv), also popularized by the Cynic-Stoic preachers and already exerting influence on Hellenistic Judaism. The subject matter of this section is more distinctly Christian, reflecting a continuing debate over the relation of faith and works which had been prompted by Paul's preaching (Romans and Galatians). The position attacked is not that of Paul himself but of later followers who misinterpreted his message. In Paul's time the argument over faith and works involved the question of whether or not a Christian must be circumcised and keep the ritual laws, all of which Paul denied. He went even further, saying that the moral commands were not the grounds of salvation. In James there is no evidence of the earlier battle over ritual requirements. The author takes for granted that the Christian must obey the moral injunctions of the Old Testament. That the author understood Paul is unlikely but debatable; it is reasonable to assume that for him Christ was understood as the new lawgiver, as in the position maintained in the Shepherd of Hermas, I Clement and the Didache (*see* APOSTOLIC FATHERS). His opponents are those who disparage the importance of either the Law or works on the ground that belief in God is sufficient. The author is insistent that Christian conduct is rigorously subject to the "royal Law."

Time and Place of Writing.—The moral instructions of James are intended for general application and consequently reveal nothing that would assist in specifically locating the writing in time and place. Scholars range widely in dating James from before A.D. 62 (traditional date of James's death) to A.D. 130. The place of origin is even more uncertain, with suggestions ranging from Caesarea (Palestine) and Antioch (Syria) to Rome. Those who deny its authenticity believe it was composed by an early Christian teacher who sought to gain authority by writing under the name of James the brother of Jesus. By the late 1st century James was revered by many as the leader of the early Jerusalem church, and his piety and zeal for the Law had become a basis for extensive legends. The author wrote at a time when the rapidly expanding church was faced with the problem of instructing converted gentile Christians whose background, unlike that of the early Jewish Christians, did not include the rigorous ethical tradition of Judaism.

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JAMES BAY, a shallow southern extension of Hudson bay, was discovered in 1610 by Henry Hudson and named after Thomas James who explored it in 1631. It was the site of some of the first settlements of the Hudson's Bay company. *See* HUDSON BAY.

JAMESON, SIR LEANDER STARR (1853–1917), British colonial statesman, leader of the famous Jameson raid at the end of Dec. 1895, was a loyal friend and collaborator of Cecil Rhodes and played a vital part in Rhodesian and South African history. Though impulsive, and sometimes overconfident, "Dr. Jim" was extremely popular for his charm, intelligence and selflessness.

Jameson was born in Edinburgh in 1853, the son of R. W. Jameson, lawyer and journalist. He studied medicine at University college, London, and was then elected resident medical officer in charge of University College hospital. This presaged a brilliant career in England, but in 1878 Jameson took a medical partnership at Kimberley, Cape Colony, where he met Cecil Rhodes. Acquaintance ripened into close friendship, and Jameson came to share Rhodes's dream of a British South Africa from the Cape to Cairo. On Rhodes's behalf, Jameson undertook several journeys to Lobengula, the Matabele king with whom he became very friendly. He persuaded the king to abide by the Rudd concession, the basis of the charter of the British South Africa company, and to allow the Pioneer expedition into Mashonaland in 1890. Jameson accompanied the expedition to Salisbury, then explored a route to Beira and negotiated, in March 1891, a concession with Chief Gungunhana of Gazaland, securing the area east of Mashonaland for the company. The Portuguese claimed suzerainty there and arrested Jameson. The dispute was finally settled by the Anglo-Portuguese agreement of 1891. In 1891, Jameson, who had abandoned medical practice, was appointed administrator of Mashonaland and established a settled government there. After the Matabele war (1893) his authority was extended over Matabeleland in 1894, thus covering Southern Rhodesia. He visited London early in 1895, a popular hero.

Since about Oct. 1894, Rhodes and Jameson had discussed with Uitlander leaders in Johannesburg a rising against the Transvaal government, the main obstacle to Rhodes's plans for South African federation under the British flag. The rising was fixed for Dec. 28, 1895, and Jameson was to move in to support it with a body of the company's police from Pitsani on the Transvaal-Bechuanaland border. Hearing that the rising would be indefinitely postponed due to internal dissension in Johannesburg, Jameson decided, without Rhodes's consent, to force the issue by invading the Transvaal with his force of about 500 men on Dec. 29—the famous raid. However, his force was surrounded and compelled to surrender to the Boers at Doornkop on Jan. 2, 1896. Jameson and five officers were tried in England under the Foreign Enlistment act. Jameson was sentenced to 15 months' imprisonment in July 1896, but was released in December after a severe illness. Early in 1897 he gave evidence to the select committee inquiring into the raid.

Besides inflicting untold damage on the British cause in South Africa, the raid ruined Rhodes's career as a Cape politician, but he and Jameson remained firm friends and constant companions until Rhodes's death in 1902. Thereafter Jameson continued the struggle for South African federation under the British flag. In 1900 he had been elected member of parliament for Kimberley; in 1902 he succeeded Rhodes as leader of the Cape Progressive party; and from Feb. 1904 to March 1908 Jameson was prime minister of the Cape. In 1907 he attended the colonial conference in London and pressed, unsuccessfully, for reciprocal imperial preferences.

Jameson's request in 1906 that the disputes between South African colonies be reviewed by a higher authority led to the Selborne memorandum recommending closer union and the calling of the national convention (Oct. 1908) which Jameson attended as a Cape delegate, becoming acknowledged leader of the British section. After union, his suggestion of a non-party "best man government" under Louis Botha was rejected, so he founded the Unionist party (May 1910) and became leader of the opposition until 1912 when ill-health forced him to retire to England. In 1913 he became president of the British South Africa company. He was knighted in 1909 and was made a baronet in 1911. He died on Nov. 26, 1917. In 1920 his body was taken to the Matoppo hills, Southern Rhodesia, and buried near Rhodes. *See* also SOUTH AFRICA, REPUBLIC OF: *History*.

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(M. F. K.)

JAMES RIVER (DAKOTA RIVER), a nonnavigable stream of North and South Dakota, U.S., named Dakota by the Dakota Territorial legislature, although better known as the James river or, in the vernacular, Jim river. Its alternate name is presumably derived from a French-Indian fur trapper who attached his own name to the river: Rivière de Jacques. The river has a length of 710 mi.

The river rises in Wells county, central North Dakota, and from there flows in a generally south-southeasterly direction across the entire state of South Dakota to its junction with the Missouri river about five miles below Yankton. In its sinuous course across the Dakota prairies the river falls only 460 ft. Its stream flow is subject to the rainfall variability in this subhumid region; consequently, it may fluctuate between flood stage and a mere trickle. A number of low-head dams have been constructed for recreation and water supply purposes, but there is no hydroelectric power development. A dam near Jamestown, N.D., provides flood protection and water for irrigation. The drainage basin of the river encompasses 22,100 sq.mi. and contains some of the most productive agricultural land in North and South Dakota, a region dominated by wheat, corn and livestock farming. Major cities along the river are Jamestown, N.D., and Huron, S.D. Its chief tributaries are Elm river and Turtle creek. (E. HG.)

JAMESTOWN, a city of Chautauqua county, N.Y., U.S., at the southern outlet of Lake Chautauqua, 68 mi. S.W. of Buffalo, is an industrial centre providing wood and metal furniture, automobile and airplane parts, washing machines, voting machines, office equipment, woolen textiles and tools. It was named for James Prendergast, who, while searching for his runaway horses, came upon the rapids of the Chadakoin at the outlet of Chautauqua lake and selected the site for his mill, around which grew the community. Settled in 1810, Jamestown was incorporated as a village in 1827 and chartered as a city in 1886. Water power was abundant and the migration of Swedes to Jamestown provided excellent skilled labour; their progeny continued to form a major portion of the population in the latter part of the 20th century. A significant number of Italians and English also enrich the heritage of the area.

A community college, opened in 1950, offers liberal arts, business and engineering degrees; the well-known Chautauqua institution is nearby. There are many recreational facilities: ski tows are within easy access, Lake Erie and Chautauqua lake provide boating and fishing, and large and small game make interesting hunting. For comparative population figures *see* table in NEW YORK: *Population*. *See* also CHAUTAUQUA. (A. W. B.)

JAMESTOWN, a former village in what is now James City county, Va., U.S., on Jamestown Island, in the James river, about 40 mi. above Norfolk. There the English made their first permanent settlement in America on May 14, 1607, began the cultivation of tobacco, established the first representative government on the American continent in 1619, bought the first Negro slaves to be introduced into the original 13 colonies, and built the first Anglican church in America. The settlement was named in honour of King James I of England.

The little colony suffered many misfortunes from the start and was about to be abandoned when Lord Delaware arrived with aid in 1610. It lay in a marshy district that proved unhealthful, and many of the early settlers died of disease. Jamestown was accidentally burned in Jan. 1608 and was almost completely destroyed on Sept. 19, 1676, during the rebellion led by Nathaniel Bacon. The state house and other buildings were again accidently burned in 1698, and after the removal of the seat of government of Virginia from Jamestown to the Middle Plantations (later Williamsburg) in 1699 the village fell into decay. Its population had never been large—in 1624 it was only 183—and the mortality was always heavy.

By the middle of the 19th century the peninsula on which the original settlement had been made had become an island; by 1900 the river had worn away the shore but had hardly touched the area

of the "New Towne" (1619) immediately east of the first settlement. The only visible remains, however, were the brick church tower and some gravestones. In 1893 the Association for the Preservation of Virginia Antiquities began its work of conservation, and in 1900 persuaded the U.S. government to build a wall to halt erosion along the river bank. A brick church modeled after that of 1639 and statues of Capt. John Smith and Pocahontas were erected to mark the tercentenary in 1907. All of Jamestown Island's 1,560 ac. became part of the Colonial National monument in 1930, and six years later were incorporated into the Colonial National Historical park. Since 1934 systematic excavation by the national park service has uncovered surprising quantities of old artifacts, foundations, wells, kilns and other objects that clarify the location and nature of old Jamestown. When the 350th anniversary was celebrated in 1957, the commonwealth of Virginia built Jamestown Festival park, which included replicas of 17th-century buildings and of the three ships that brought the first settlers from England. Ancient crafts were also demonstrated, a museum was opened and Queen Elizabeth II visited the festival.

See also VIRGINIA: *History;* SMITH, JOHN; and references under "Jamestown" in the Index.

See National Park Service Handbook no. 2, *Jamestown, Virginia* (1957); the series of 23 *Jamestown 350th Anniversary Historical Booklets*, ed. by E. G. Swem (1957); George F. Willison, *Behold Virginia: the Fifth Crown* (1951); Bradford Smith, *Captain John Smith, His Life and Legend* (1953). (B. SM.)

JAMI (NUR UD-DIN 'ABD-UR-RAHMAN IBN AHMAD) (1414–1492) is sometimes regarded as the last great Sufi poet of Persia. Born on Nov. 7, 1414, at Jam in Khurasan, he spent most of his life in Samarkand and Herat, where he died on Nov. 9, 1492. It was perhaps his mystical authority that brought him his widest contemporary fame, not only in Khurasan and the rest of Persia, but also in India and the Ottoman empire.

His major poetical work, the *Hajt Aurang*, a collection of seven romantic, philosophical and ethical poems, owes an admitted debt to Nizami (*q.v.*). Included in the collection are *Salaman va Absal* (Eng. trans. by Edward FitzGerald, *Salaman and Absal*, 1856); *Yusef va Zulaikha* (Eng. trans. by R. T. H. Griffith, *Yusuf and Zulaikha*, 1882) and *Laila va Majnun*. His prose and verse work *Baharistan* (Eng. trans. by E. Rehatsek, *The Beharistan: Abode of Spring*, 1887) is similarly modeled on the *Gulistan* ("Rose Garden") of Sa'di (*q.v.*), and his lyrics on the *ghazals* of Hafiz (*q.v.*). Nevertheless they all have a freshness and originality of their own. His many prose works, ranging from mystical writings and Koranic studies to biography, grammar and music, include *Lawa'ih*, a treatise on Sufism (Eng. trans. by E. H. Whinfield, 1906).

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JAMMES, FRANCIS (1868–1938), one of the most original French poets and short-story writers, whose work infused new life into French poetry when it was becoming atrophied after the decline of Symbolism. Born at Tournay (Hautes-Pyrénées), Dec. 2, 1868, he was educated at *lycées* in Pau and Bordeaux, became a lawyer's clerk in Orthez and spent the latter part of his life in Hasparren (Basses-Pyrénées) in the Basque country. He began writing when he was a very young man and in 1898 published his first major work, *De l'Angélus de l'aube a l'Angélus du soir*. He wrote much, both in prose and verse, which has kept its freshness. A poet of ordinary life, he devised a kind of free verse, composed of lines of varying length, which gave his work an irresistible charm. In his poems he celebrated the earth, the simple countrymen of the Pyrenees, animals, pure young girls, the Virgin Mary and the saints, using ordinary everyday language. Converted to Catholicism in 1906, he married in 1907 and had many children. He died in Hasparren, Nov. 1, 1938.

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JAMMU, winter capital of the Indian state of Jammu and Kashmir and capital of its province of Jammu, India, lies on the Tawi river, a tributary of the Chenab, 95 mi. S. of Srinagar. Pop. (1961) 102,738. The town and palace stand upon the right bank of the river; the fort overhangs the left bank at a height of 150 ft. above the stream. The city was the seat of a Rajput dynasty. After conquest by Sikhs, it formed part of Ranjit Singh's dominions. After his death it was acquired by Gulab Singh as the nucleus of his dominions, to which the British added Kashmir in 1846. There is a railway, no longer used, to Sialkot in Pakistan. Since the *de facto* partition of the original state of Jammu and Kashmir by India and Pakistan, and because of the interruption at the frontier, a road has been built from Jammu to Pathankot, about 60 mi. distant.

JAMMU PROVINCE consists of a submontane tract, the upper basin of the Chenab. *See* also JAMMU AND KASHMIR.

JAMMU AND KASHMIR. From 1846 to 1947 Jammu and Kashmir was one of the largest princely states of India. Since 1947, when India was divided into the dominions (afterward republics) of India and Pakistan, possession of the state has been disputed between the two countries, each controlling part of it. Except in Jammu, where there are many Dogras and Sikhs, and in Ladakh, which is predominantly Buddhist, the great majority of the people are Muslim. On this account as well as on economic grounds the state was claimed by Pakistan in Oct. 1947; very soon after this claim, however, the hereditary Hindu maharaja declared the accession of the state to India and fighting followed. A "cease-fire" line was arranged in 1948, leaving between one-third and one-half of the state, where the Muslim population comprised about 90% of the whole, in Pakistani hands. The dispute was referred to the United Nations which called for a plebiscite; by the mid-1960s this had not been held, and the problem, complicated by Chinese incursion from the north, remained unsettled. (See *History* below.) This article relates to the area of the original princely state but the *Administration* section explains how it is divided and how the Indian and Pakistani sections are administered.

The territory of the original state (86,024 sq.mi.) is bounded on the west by Afghanistan, on the north by the Sinkiang-Uigur Autonomous Region of China, on the northeast by Tibet. Though formally acknowledged by agreements, none of these boundaries has ever been demarcated. With Afghanistan and China they are natural and follow defined watersheds; with Tibet the boundary does not, and there is little impediment to native caravans passing between the two countries except the physical severity of climate, the altitude and the dearth of supplies and water. In 1961 the population of the Indian state was 3,560,976.

Kashmir, with its open vale, or "happy valley," famed for its beauty since Mogul times, and with its surrounding hills and valleys (the Liddar and the Sind), is a tourist and pleasure resort. Srinagar (*q.v.*), the summer capital of the Indian state (altitude 5,200 ft.) is in the vale; Jammu (*q.v.*), its winter capital (1,030 ft.), is at the southern foot of the Himalayas at the edge of the Punjab plain.

Physiography.—This is best described in regions from southwest to north: the Lesser Himalayas, the vale of Kashmir, the Great Himalayas and the trans-Himalayas (including the Karakoram). The Lesser Himalayas are there composed of the outer ranges, their wooded spurs and foothills, bordering a narrow piedmont strip, rarely 10 mi. wide. The two chief ranges, Dhaoladhar and Pir Panjal, enter from the mountain state of Chamba in the southeast and are cut through by the Chenab (*q.v.*) in Jammu. The Pir Panjal continues northwest to form the high southern rim of the vale, with peaks up to 16,830 ft., deep wooded valleys and torrents on its southern flanks, and fine alpine pastures (*margs*) on its northern rim. Gulmarg (8,700 ft.), the sporting and holiday centre, is typical of these. West of Baramulla, at the western end of the vale, the Pir Panjal is pierced by the Jhelum (*q.v.*) in a deep gorge.

The open vale of Kashmir is formed by the basin of the upper Jhelum, which flows through its middle. About 25 mi. below Srinagar the river forms the Wular lake which varies in extent from 50 to 60 sq.mi. according to the season. Its outlet is near

Sopor, about 14 mi. above Baramulla, below which it enters its gorge. From its junction with the Liddar near Anantnag (Islamabad; 5,240 ft.), 30 mi. up river of Srinagar, its fall is only 80 ft. in 80 mi. From Baramulla (5,160 ft.) to Muzaffarabad (2,100 ft.), on the western border of the state, where it is joined by the Kishanganga and turns sharply south, the river falls more than 3,000 ft. in 75 mi., or 40 ft. per mile. North and northeast of the vale is a broad mountain tract, eroded and drained northwestward by the Kishanganga and culminating in the axial zone of the Great Himalayas. On the Kashmir side of the range few peaks reach a great altitude. Kolahoi (17,799 ft.), between the Liddar and the Sind, and Haramukh (16,872 ft.) overlooking the entrance to the Sind valley being the best known. The Great Himalayas themselves in Kashmir are less rugged and carry fewer high peaks than in Kumaun and Nepal. There are but two great groups: Nun Kun in the southeast (Nun, 23,410 ft.; Kun, 23,250 ft.), and Nanga Parbat (26,660 ft.) in the northwest. The Zoji La (11,578 ft.), at the head of the Sind valley, is the lowest pass across the whole of the Great Himalayas' axis (excluding the river gorges) from end to end.

Beyond the great range, the subsidiary Zaskar and Ladakh ranges separate it from the trough of the Indus (*q.v.*) and its tributary the Shyok. These rivers have their distant sources on the desolate plateaus of western Tibet and traverse Ladakh and Baltistan. The Indus then carves a passage through the Ladakh and Great Himalayas' ranges, north and west of Nanga Parbat at an altitude of less than 4,000 ft. North of the Indus valley is the Karakoram Range (*q.v.*) with its giant peaks, such as K2, and glaciers (Baltoro, Biafo and Siachen), a natural barrier against encroachment from the north.

The strike of the beds and the general trend of the axes of all these mountains are from southeast to northwest as they approach the northwest syntaxial bend beyond the southward course of the Indus. At one time during the process of mountain building, the vale of Kashmir was an archipelago of volcanic islands, but the sequence of sedimentary and intrusive rocks follows much the same pattern as in the rest of the Himalayas, though in places complicated by recumbent folds of older rocks lying on younger. The vale of Kashmir is covered with Pleistocene and later alluvium, a process still in being. The country is subject to mild earthquakes.

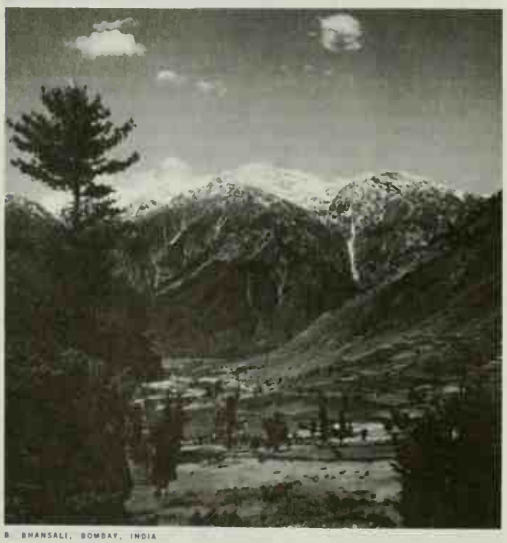
Climate.—There is wide climatic variation, ranging from the semitropical submontane areas in the southwest to the alpine zones of the high mountains. While Jammu, Poonch and the southern ranges have a considerable rainfall from June to September—in August more than 12.5 in. in both places—the greater part of the Kashmir vale is sheltered from the monsoon by the Pir Panjal (Srinagar, 2.3 in.). Not infrequently the currents pass over the vale and bring heavy rain to the ranges north of it. On the other hand, the vale and these ranges are much more affected by western disturbances from December to May, the maximum precipitation—in the form of heavy snowfalls on the ranges—being in March (Sonamarg, near the Zoji La, 14.5 in.). It is these spring falls and the rising temperatures in April and May that periodically close the passes and make them dangerous from avalanches. The valleys of Ladakh and Baltistan are largely shielded from both monsoon and western disturbances, and have usually less than 10 in. of annual precipitation (Leh, 3.2 in.), but the higher ranges of Baltistan and the Karakoram get considerably more. The temperature of the vale varies between a January minimum of −12° C. (11° F.) and a July maximum of 37° C. (99° F.); its climate is ideal in early summer and autumn but in July and August the air becomes oppressive and mosquitoes are troublesome.

Vegetation and Animal Life.—Rhododendron and juniper thrive at about 12,000 ft. Scrub and bamboo occur below 5,000 ft. Planes (*chenars*) are common in the vale and poplars line many of the main roads. Wild animals include ibex, markhor, urial, the Kashmir stag, black and brown bears and many game birds including vast numbers of duck on migration in winter.

The People.—South of the Pir Panjal, in Poonch and Jammu, the people, mainly Muslim in the west and Dogras (who are Hindus) in the east, live in well-watered, wooded and fertile valleys. In the vale of Kashmir the population, predominantly Muslim, is the densest in the whole of Jammu and Kashmir. Beyond the Great Himalayas from Dras and Kargil eastward, in Ladakh, Suru, Zaskar and Rupshu, the culture is Buddhist and the race Mongoloid; the people squat, sturdy and tough, simple and honest, often polyandrous. They merge westward into the Muslims of Baltistan, polygamous and of mixed race and culture. These are replaced in Hunza, Nagar and the Agency principalities by races loosely grouped as Dards, speaking a number of Shin and other dialects, quite different from Kashmiri, Balti or Ladakhi. Moreover they belong to a variety of Islamic sects: Baltis are mainly Sunni, Nagiris are strict Shi'ites, while on the opposite side of the Hunza river, the Hunzakuts belong to the Mulai sect, followers of the Aga Khan.

Large areas of eastern Ladakh, especially north of the upper Indus, are uninhabited. Elsewhere in Ladakh and Baltistan where there are permanent settlements in the valleys, the villages are often oases on alluvial fans, splashes of green in an otherwise stony mountain desert, irrigated by rough water channels fed by glacier streams or permanent snow, and lined with poplars. Scattered along the tracks are Buddhist *mani* walls and in occasional villages there are large monasteries (*gompas*) served by lamas, the best known being Lamayuru, Pitok near Leh, and Himis. High in the mountains summer huts and grazing grounds are often abandoned when winter cold and snow drive herdsmen to lower altitudes. For languages and dialects *see* KASHMIRI LANGUAGE; DARDIC LANGUAGES; BURUSHASKI LANGUAGE. For Kashmiri architecture and art *see* INDIAN ARCHITECTURE; INDIAN ART. (K. M.)

History.—The history of Kashmir is enshrined in four Sanskrit books. The *Rajatarangini*, commencing with traditional history of very early times, comes down to the reign of Sangrama Deva which began in 1006; the second work, by Jonaraja, takes up the history in continuation and, entering the Muslim period, gives an account of the reigns down to that of Zain-ul-ab-ad-din who came to the throne in 1420. P. Srivara carried on the record to the accession of Fath Shah in 1489. The fourth work, called *Rajavalipataka*, by Prajnia Bhatta, completes the history to the year 1586 when Kashmir was incorporated in the dominions of the Mogul emperor Akbar. In the *Rajatarangini* it is stated that the valley of Kashmir was formerly a lake and that it was drained by the great *rishi* or sage, Kasyapa, son of Marichi, son of Brahma, by cutting the gap in the hills at Baramulla (Varaha-mula). When Kashmir had been drained, he brought in the Brahmans to occupy it. In the



B. BHANSALI, BOMBAY, INDIA

THE LIDDAR VALLEY TO THE EAST OF SRINAGAR

7th century Kashmir is said by the Chinese traveler Hsuan Tsang to have included Kabul and the Punjab and the hill region of Gandhara. At an early date the Sanskrit name of the country became Kasmir.

In the time of Asoka one of the Indian Buddhist missions was sent to Kashmir and Gandhara. After his death Brahmanism revived. While Kashmir was under Kushan rule, Buddhism was to a great extent restored, though for several centuries the two religions existed together in Kashmir, Hinduism predominating. In this Hindu-Buddhist period, and chiefly between the 5th and 10th centuries of the Christian era, the Hindu temples in Kashmir were erected. In the 6th and 7th centuries Kashmir was visited by some of the Chinese Buddhist pilgrims to India. The country is called Shiemi in the narrative of To Yeng and Sung Yun (578). Hsuan Tsang spent two years (631–633) in Kashmir (*Kia-chi-mi-lo*). In the following century the kings of Kashmir appear to have paid homage and tribute to China, though this is not alluded to in the Kashmir chronicle. Hindu kings continued to reign till about 1338, when Udiana Deva was put to death by his Muslim vizier, Amir Shah, who ascended the throne under the name of Shams-ud-din.

The country fell into the hands of the Moguls in 1586. In the time of Alamgir II it passed to Ahmad Shah Durrani, and thereafter it remained in the hands of Afghans till it was wrested from them by Ranjit Singh, the Sikh monarch of the Punjab, in 1819. Eight Hindu and Sikh governors under Ranjit Singh and his successors were followed by two Muslims similarly appointed, the second of whom, Sheikh Imam-ud-din, was in charge when the battles of the first Sikh war (1845–46) brought about new relations between the British government and the Sikhs.

It was after the Sikh conquest of Kashmir that the small principality of Jammu came into prominence under its ruler Gulab Singh, a Dogra Rajput, who extended his power over Kashmir thus laying the foundations of the state of Jammu and Kashmir. Gulab Singh was descended from Raja Ranjit Deo who ruled over Jammu in the mid-18th century. Obliging genealogists however trace his descent back to Gonanda, a famous Kashmiri king mentioned in the *Rajatarangini*. Before the time of Gulab Singh the state of Jammu had merely a local importance. After 1780 the rulers of Jammu had become tributary to the Sikhs of Lahore. Entering the service of the Sikhs, Gulab Singh rose to high office under Ranjit Singh who created him raja of Jammu in 1820. He found his small kingdom a troublesome charge but after ten years of constant struggles he and his two brothers became masters of most of the country between Kashmir and the Punjab, including Bhadarwah and Kishtwar.

On the final defeat of the Sikhs near Sobraon (Feb. 1846), Gulab Singh was called to take a leading part in arranging conditions of peace. The treaty of Lahore (March 9, 1846) set forth that, the British government having demanded, in addition to a certain assignment of territory, a payment of a crore and a half of rupees (Rs. 15,000,000), and the Sikh government being unable to pay the whole, the maharaja (Dhulip Singh) should cede, as equivalent for one crore, the hill country belonging to the Punjab between the Beas and the Indus, including Kashmir and Hazara. The governor general, Sir Henry Hardinge, considered it expedient to assign Kashmir to the Jammu chief, securing his friendship while the British government was administering the Punjab on behalf of the young maharaja. Gulab Singh was well prepared to make up the payment in default of which Kashmir was ceded to the British; and so, in consideration of his services in restoring peace, his independent sovereignty of the country assigned to him was recognized, and he was admitted to a separate treaty. Thus by the treaty of Amritsar (March 16, 1846) the state of Jammu and Kashmir was created by the British with Gulab Singh (1846–57) as its first maharaja. Gulab Singh had already, after several extensions of territory east and west of Jammu, conquered Ladakh (a Buddhist country, and till then subject to Lhasa), and had then annexed Skardu, which was under independent Muslim rulers. Gulab Singh died in 1857 and was succeeded by his son, Ranbir Singh (1857–85), who because of his loyalty during the Indian mutiny (*q.v.*) was granted the right of adoption in lieu of natural heirs. It was under the next ruler, Maharaja Partab Singh (1885–1925) that a British resident was appointed for the first time. This was followed by certain administrative reforms and the first regular land revenue settlement. His rule was remarkable for the reassertion of the Kashmir sovereignty over Gilgit (*q.v.*). In 1925 Maharaja Sir Hari Singh (1895–1961) succeeded to the title of maharaja of Jammu and Kashmir. He went into exile in 1949 and his son, Yuvaraj Karan Singh, became regent. In 1952 the hereditary monarchy was abolished and the regent was elected head of state.

After the partition of the Indian subcontinent in Aug. 1947, Kashmir became a bone of contention between India and Pakistan. On Oct. 20, 1947, tribesmen from the northwest frontier of Pakistan invaded Kashmir and advanced on its capital Srinagar, but they failed to capture the city because of the intervention of Indian air-borne troops. In the same month the ruler of Kashmir executed an instrument of accession to the Indian union although 77% of his subjects were Muslims. On Jan. 6, 1948, India brought the case before the United Nations Security council on the ground that Pakistan was assisting the invaders. It was agreed that the future of Kashmir should be settled by a plebiscite. A cease-fire came into force in Jan. 1949, partitioning the state along a cease-fire line but all efforts of the Security council and its representatives in Kashmir, Adm. Chester Nimitz, Gen. A. G. L. McNaughton, Sir Owen Dixon and Frank P. Graham, between March 1949 and October 1952, failed to bring about a permanent solution. India's refusal to withdraw rendered an impartial plebiscite impossible and Indian troops remained in control of the vale of Kashmir and the greater part of Jammu and Ladakh. In 1953 and 1954 the prime ministers of India and Pakistan made an unsuccessful attempt to reach a solution by direct negotiations. On Jan. 16, 1957, the question was once more referred to the Security council but further mediation by Gunnar V. Jarring and Graham proved fruitless. In Feb. 1962 Jawaharlal Nehru, the Indian prime minister, rejected a suggestion that Eugene Black, president of the International Bank for Reconstruction and Development, should mediate in the dispute, stating that in the matter of sovereignty India had declared long ago there could be neither a mediator nor an arbitrator.

In 1959 it became known that Chinese forces had seized a portion of Ladakh in northeast Kashmir and had built a road across the occupied territory to connect Sinkiang with Tibet. An Indian reconnaissance patrol was attacked by Chinese troops and suffered casualties. In reply to Indian protests the Chinese government claimed the area in dispute as Chinese territory and refused to withdraw their forces. With the eruption of the border conflict in Oct. 1962, Chinese troops forced the evacuation of key Indian military posts guarding the Karakoram pass and overran defense positions in the Pangong lake area 100 mi. to the southeast. On Nov. 21 the Chinese suddenly announced a unilateral cease-fire which by implication suggested that while they were prepared to withdraw to the McMahon line at the eastern (North East Frontier Agency) end of the Himalaya frontier they intended to hold their gains (about 14,000 sq.mi. of territory) in the northern Ladakh area. Shortly afterward China and Pakistan signed an agreement (March 2, 1963) defining the 300-mi.-long border along a northern segment of Pakistan's side of the cease-fire line. There were further discussions between India and Pakistan but the Kashmir problem, by 1963, seemed no nearer solution.

(C. C. D.)

Administration.—The complete territory of the original state is comprised of the provinces of Jammu, Kashmir and the border states. Jammu, with Poonch, is divided into the districts of Jammu, Kathua, Udhampur, Mirpur and Reasi. Kashmir is divided into the districts of Anantnag, Baramulla, Astor, Muzaffarabad and Srinagar. The border states are Ladakh (*q.v.*); Baltistan; and the Gilgit agency which consists of the Gilgit and Astor subdivisions, the political districts of Ghizar, Punyal (Punial), Ashkuman and Yasin, the states of Hunza and Nagar and the subagency of Chilas. Muzaffarabad and part of Mirpur and Poonch comprise the state of Azad ("free") Kashmir, which is under the protection of Pakistan, while Baltistan and the Gilgit agency are administered directly by Pakistan. Ladakh, Jammu, Srinagar, Kathua, Udhampur, Reasi, Anantnag, Baramulla, and part of Mir-

pur and Poonch form the Indian state and are represented in the Indian *Lok Sabha* as the state of Jammu and Kashmir.

The Indian State.—The constitution of Jammu and Kashmir (the same name as that of the original state was adopted) under the Union of India came into effect on Jan. 26, 1957. The head of state (*sadr-i-riyasat*) has to be re-elected every five years by a majority of the legislative assembly. The legislature consists of two houses: the legislative assembly of 100 members representing constituencies, and the legislative council, of 36 members. In the legislative assembly there are 25 vacant seats, intended for representatives from the areas under Pakistani suzerainty.

The high court consists of a chief justice and two or more other judges, appointed by the president of the union.

Education is free and there are more than 2,000 educational institutions. The university at Srinagar was founded in 1948. There is an efficient medical service with dispensaries scattered throughout the state. In spite of its height the vale of Kashmir is not particularly healthful and in the past there have been considerable outbreaks of cholera and other infectious diseases, though the incidence of these has been considerably reduced.

Azad Kashmir.—The government, with headquarters at Muzaffarabad, was first set up in Oct. 1947. It is under a president (K. H. Khurshid, elected in Oct. 1961) who is assisted by a state council of 12 members. The state has its own high court.

In its land reforms the government has abolished all types of jagir (assignment of land and its revenues to privileged individuals) and conferred proprietary rights on occupancy tenants. Education at its lower stages is free and fee concessions are made at the higher stages. As well as primary and middle schools and 19 high schools, the state has one college at which students follow degree courses and 5 other colleges. In the mid-1960s there were 7 hospitals and more than 70 dispensaries (including one mobile) and first-aid posts.

Gilgit Agency and Baltistan.—Although both are administered by the government of Pakistan, through political agents, these two areas are governed as separate units because of the difficult mountain terrain and the lack of communications between them. Gilgit town is the headquarters of the Gilgit agency and Skardu that of Baltistan. In the two areas there are 90 primary schools, 11 middle schools (including one for girls at Skardu) and 5 high schools (one for girls at Gilgit). There are 7 hospitals (those at Gilgit and Skardu being particularly well equipped), and more than 30 dispensaries and first-aid posts.

The Economy.—Outside the province of Kashmir there are no major industries. The province has well-developed forest resources (spruce, blue pine, deodar) in the mountains, conserved by an efficient forestry department; fruit includes apples, pears, quinces, apricots, peaches, strawberries, raspberries and mulberries; but the basic occupation is the cultivation of rice, maize (corn), barley, rape, mustard and linseed. There is some animal husbandry, large flocks of sheep, goats, yaks and ponies being taken to upland pastures in summer by nomad Gujar and others. Good quality wool is woven into cloth (*puttoo*), the finest being pashmina from which shawls are made (*see* CASHMERE). Carpets are also hand produced using indigenous products. Sericulture dates back four centuries to Mogul times, mulberry trees being widely grown. The cultivation of saffron (*Crocus sativus*), noted for its yellow dye and its use as a food flavouring, is an ancient industry. Hydroelectricity was introduced about 1910, generated in a power station near Rampur in the Jhelum gorge, water from the river being channeled for 6 mi. in a flume to give a head of 400 ft. to the turbines. The power was first used to dredge the river above Baramulla and so assist outflow from the valley; it is also used in the large silk factory near Ram Bagh, for rice and flour mills, for the timber industry and for lighting in Srinagar and other towns. The project included the export of power to the northern Punjab. Another important source of revenue has for long been the tourist industry. Houseboats are hired to visitors for use on rivers, canals and lakes; huts are let at Gulmarg, the summer centre; camp equipment suppliers and travel agencies cater for longer trips; a small, efficient game department draws revenue from game and fishing licences. Leather and silver workers, carpenters, woodcarvers and other craftsmen depend on this trade.

Communications.—The disruption caused by the troubles of 1947 has been a tragedy for the territory. The cease-fire line cuts right across the country, and the Balti village of Skardu on the Indus is a Pakistani frontier post. Pakistani permits are required for the Shigar tributary, the Baltoro glacier and K2; Indian permits for Ladakh and the Karakoram trade route. The old Gilgit road is severed by the cease-fire line at the Burzil and Kamri passes and is no longer used. The lower Kishanganga is occupied by Pakistan, the upper by India. Baramulla also is a frontier town. The Jhelum valley road is no longer a road to Srinagar, which is now approached direct from Jammu by the Banihal route, greatly improved by a tunnel through the Pir Panjal near the summit (opened in 1956). Gilgit is reached from Pakistan either by air or by an improved motor road through Khagan and by the Babusar pass (13,690 ft.) and Chilas.

For three centuries the Mogul route into Kashmir was through Poonch and over the Pir Panjal pass (11,462 ft.) which gives its name to the range. François Bernier (1620–88), a jewel merchant, vividly described the passage of the imperial elephants on this narrow track. Only in the 1880s was the Jhelum valley road constructed through the gorge between Muzaffarabad and Baramulla, later to be metaled, widened and made fit for motor vehicles. It became the direct road between Rawalpindi through Murree to Srinagar, though liable to be blocked by snow and landslides in winter and spring. In 1922 another metaled road was opened over the Banihal pass (8,985 ft.) to link Srinagar directly with Jammu and the railhead at Sialkot. From Srinagar two main routes lead to central Asia: the Gilgit road, via the Burzil pass (13,775 ft.) and Astor, constructed in 1890–91 and continued on through Hunza and over the Pamirs to Kashgar, or Su-fu, in Sinkiang; and the route, via the Sind valley and the Zoji La (11,578 ft.), to Leh and on northward by the upper Shyok and Karakoram pass (18,290 ft.) to Yarkand. By 1960 the section between Srinagar and Leh, the capital of Ladakh, had been converted from a caravan track into a motorable road. As far as Leh it is also the main line of access of Zaskar and Rupshu, though these two districts are also reached from Kulu over the Rohtang (13,050 ft.) and Bara Lacha La (16,047 ft.) passes. The region of Suru, west of Zaskar, can also be reached from Jammu and the Warwan tributary of the Chenab by the Bat Kol pass (14,370 ft.); this pass was taken by the Dogra general Zorawar Singh and his army in 1834 when Ladakh was annexed to Jammu. *See* also references under "Jammu and Kashmir" in the Index. (K. M.)

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JAMNAGAR, a city and district of Gujarat, India. The city lies near the Gulf of Cutch, 45 mi. W.N.W. of Rajkot. Pop. (1961) 148,572. It was the capital of the former Nawanagar state. It is well laid out with wide roads and parks and owes a great deal to the famous cricketer Kumar Shri Ranjitsinhji (*q.v.*), its ruler from 1907 to 1933. The old city, founded by Jam Raval in 1540 and surrounded by a fort built in 1788, has narrow streets. The Lakhotha (museum) and Kotha Bastion, in the middle of a lake and approached by a bridge, the Jain temples and Darbargadh are the historic buildings. The various palaces, the Dhanvantri Mandir, the medical college, the Irwin hospital and the solarium for radium treatment are the modern constructions.

Jamnagar is famous for its *bandhani* (tie and dye) work, gold embroidery and metalware. Cement, pottery, textiles, oil crushing and the manufacture of salt are the main industries. The city is on the metre gauge of the Western railway and is also linked by air with the chief centres of India. It is connected to the ports of Bedi, Rozi, Sikka and Okka, which are in the district.

JAMNAGAR DISTRICT, formerly known as Halar district, is the westernmost of the six districts which form most of the Kathiawar peninsula in Gujarat state. It is chiefly composed of the former princely states of Nawanagar and Dhol Devani and has a population (1961) of 828,419 and an area of 3,944 sq mi. The

district is generally flat except for about two-thirds of the Bardo hills which lie within its boundaries. To the north mangrove swamps line its shores on the Gulf of Kutch providing large supplies of firewood and pasture. The principal products are grain, cotton, jowar, bajra, wheat, gram and potatoes. Handloom cloth and silk are the chief manufactures, and fishing is an important industry. Bullock carts, horses and camels are the chief means of conveyance in the district. Dwarka (*q.v.*), with its famous temples, and Okha port were included in Jamnagar district at its reorganization in Aug. 1959. (V. A. M. J.)

JAMNIA, Greek form of Hebrew JABNEH, JABNEEL ("God builds"), a Philistine city on the border of Judah (Josh. xv, 11) the site of which is now occupied by the Jewish village of Yavne, in Israel. It stands on a hill in a fertile district 13 mi. S. of Tel Aviv-Jaffa and 4 mi. from the sea. Its harbour, Minet ar Rubin, at the mouth of the Rubin river, is a survival from ancient times.

Jamnia's walls were destroyed by Uzziah (II Chron. xxvi, 6). In the Maccabaean period a non-Jewish town, it became Jewish again after the time of Alexander Jannaeus and was reckoned to Judah (Josephus, *Antiquitates,* xiii, 15, 4). Pompey detached it from Judah and Gabinius rebuilt it (57 B.C.). Through Herod and Salome it became a possession of that royal house, was presented to Livia and ultimately passed to Tiberius. After the destruction of Jerusalem by the Romans (A.D. 70) Jamnia became the home of the Great Sanhedrin. A meeting of rabbis held there *c.* A.D. 100 discussed and settled the final canon of the Old Testament (*see* BIBLE: *Canon and Text*). It was erected into a bishopric at the time of Eusebius (4th century) and its bishop was present at the Council of Nicaea (325). The crusaders, who called it Ibelin (a corruption of Jabneel), built a fortress there in the 12th century. There was a Jabneel 8 mi. S. of Tiberias in lower Galilee, Israel, and Josephus (*Vita,* 37) mentions a fortress in upper Galilee named Jamnia. *See* also YESHIBA. (E. RO.; X.)

JAMS AND JELLIES: *see* FOOD PRESERVATION (IN THE HOME): *Jams and Jellies.*

JAMSHEDPUR (also known as TATANAGAR) is a steel-manufacturing city in the Singhbhum district of Bihar, India. Pop. (1961) 328,044. The city lies near the southeastern edge of the mineralized Chota Nagpur plateau, 156 mi. W.N.W. of Calcutta on the Bombay-Nagpur-Calcutta railway line. It is a modern, open, well-planned and extensively built industrial city occupying an area of approximately 29 sq.mi. in an angle of the Subarnarekha and Kharkai rivers. It is noted for its beautiful park. The city rose on a rural site with the construction of the Tata iron and steel factory in 1907–11. Since then it grew rapidly with the expansion of the iron and steel works and allied industries, which include manufacture of locomotives, tin plate, agricultural implements, cable and steel wire and enameled ironware. (E. AH.)

JÄMTLAND, a *län* (county) of the southern part of Swedish Norrland, is centred on Storsjön and controls the Storlien gap to Trondheim (Norway). Pop. (1960) 139,800. Area 19,903 sq.mi. The county extends for 160 mi. east to west and 190 mi. north to south. It is drained by headwaters of the Ljungan, Indal and Ångerman rivers. Relief is high in the west, rising to 5,780 ft. at Sylarna, south of the Storlien gap, and 4,659 ft. at Åreskutan to the north of the railway through the gap. In the east of the county the hilltops fall to below about 1,500 ft. Of the rivers the Indal is the greatest. Östersund is the county town and with a population of (1960) 24,777 is the only town with more than 20,000 persons. The core of Jämtland is a relatively fertile lowland eroded out of Silurian sandstones and limestones. The presence of the limestone has sweetened the local drifts. Because of the low col to the west, Atlantic influences penetrate and so the average temperature in winter is appreciably higher there than in places farther south in Sweden. The favourable soils and the existence of alluvial terraces encourage agriculture, but there is still some transhumance to summer upland pastures.

The existence of the gap to Trondheim meant that many links were established with Norway. Jämtland passed to Sweden in 1645 but until the railway was opened in 1882 to Stockholm trade tended to be with Trondheim. Östersund (founded 1786) is an agricultural and tourist centre but has not developed as a major commercial centre although it is the largest town in Norrland apart from Luleå, Sundsvall and Kiruna. Åre, at the foot of Åreskutan, 50 mi. W.N.W. of Östersund, is a popular summer and winter sports resort. (A. C. O'D.)

JANACEK, LEOS (1854–1928), the leading Czech composer of the early 20th century, was born on July 3, 1854, at Hukvaldy, then in northern Moravia. He studied at Brno, Prague and later at Leipzig, St. Petersburg (1878) and Vienna (1879–80), where he was a pupil of Franz Krenn. From 1881 to 1919 he was director of the college of organists at Brno. He early devoted himself to criticism and research on folk music, which he undertook with Frantisek Bartos, and between 1884 and 1888 published the journal *Hudebni Listy.* His first opera, *Sarka* (1887–88; produced in Brno, 1925), was a romantic work in the spirit of Wagner and Smetana. In 1896 he again visited Russia, influences of the music he heard then being evident in his opera *Kata Kabanova* (Brno, 1921) and his orchestral rhapsody *Taras Bulba* (Prague, 1924).

Earlier he created a distinctive Czech style in his opera *Jeji pastorkyna,* later called *Jenufa* (Brno, 1904). The production of *Jenufa* in Prague in 1916 finally established the reputation of this retiring and idealistic composer, then over 60. His later operas, produced in Brno and Prague in 1926, include *Vec Makropulos* ("The Makropulos Affair," 1926), *Z mrtveho domu* ("From the House of the Dead," 1930), the satire *Vylet Pana Broucka* ("Mr. Broucek's Excursion," 1920) and the comic opera *Prihody Lisky Bystrousky* ("The Cunning Little Vixen," 1924), which achieved much success in Germany and England.

His instrumental works include a sinfonietta, a concertino for piano and chamber orchestra, the capriccio for piano (left hand) and chamber ensemble, the sextet *Mladi* ("Youth") for wind instruments, three string quartets and piano pieces. His vocal works, sacred and secular, show his manner of modeling the writing for voices on the inflection of his native language. They include *Glagolska Mse* ("Glagolitic Mass," 1926), *Zapisnik Zmizeleho* ("Diary of a Vanished Man," 1917–19) and *Rikadla* ("Nursery Rhymes," 1925–27) for nine voices and chamber ensemble. He died on Aug. 12, 1928, at Ostrava.

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JANE (JANE SEYMOUR) (1509?–1537), third queen consort of Henry VIII of England, was the eldest child of Sir John Seymour of Wolf hall, Savernake, Wiltshire, and Margaret, daughter of Sir John Wentworth of Nettlestead, Suffolk. She became lady in waiting first to Catherine of Aragon, then to Anne Boleyn. On Sept. 10, 1535, Henry VIII visited her father at Wolf hall and thenceforth became sufficiently attentive to her to arouse Anne Boleyn's jealousy. Jane was apparently not beautiful, even by Henry VIII's unexacting standards, but she was intelligent and her quiet reserve may well have gained an added charm from the contrast with Anne's more highly strung temperament. Like Anne earlier, however, though willing to be the king's wife, she refused to become his mistress, and this determination, coupled with Henry's growing affection, undoubtedly hastened Anne's downfall and execution (May 19, 1536). On May 30 Henry and Jane were married privately. As queen she was generally popular. She treated Catherine's daughter Mary with kindness and restored her to the king's favour. In the great religious controversies of the time she played little part, although it was said that Luther regarded her as "an enemy of the gospel." Her great achievement was to give Henry the legitimate son that he had so long desired, the future Edward VI, born on Oct. 12, 1537. That achievement cost her her life, and on Oct. 24, to the king's genuine sorrow, she died. Her family continued to enjoy his favour to the end of his reign. When her son succeeded to the throne in Jan. 1547, her brother Edward made himself protector, with the title of duke of Somerset, and another brother, Thomas Seymour of Sudeley, became lord admiral. (R. B. WM.)

JANEQUIN, CLÉMENT (*c.* 1473–*c.* 1560), famous French composer of polyphonic chansons, was born in Châtellerault. He worked in Bordeaux and Anjou before settling in Paris in 1549.

From 1555 he was in the service of Henry II, but he died a pauper. Though he was a priest and set religious texts, Janequin's fame lies in his 256 chansons. His well-known onomatopoeic pieces such as the early *Chant des Oiseaux* are not entirely typical of his style, which is distinguished by elegant restraint, subtle prosody and perfect formal balance.

See *Clément Janequin: Trente chansons*, ed. by M. Cauchie (1928); J. Levron, *Clément Janequin* (1948); F. Lesure, "Clément Janequin," *Musica Disciplina*, vol. v (1951). (B. L. Tr.)

JANESVILLE, a city of southern Wisconsin, U.S., the seat of Rock county, 32 mi. S.E. of Madison on the Rock river. Janesville was settled in 1835 and named for its pioneer settler Henry F. Janes; it was incorporated in 1853. A centre for trade in a dairy farming, grain and tobacco-growing region, the city had a rapid early growth. In 1919 General Motors opened a tractor plant which in 1922 became the Fisher Body and Chevrolet plant. Another industry is the Parker Pen company, incorporated in 1892. Other industries include the manufacture of church furniture, electrical and electronic equipment, punch presses, woolen and cotton goods, shades and awnings. The Wisconsin School for the Visually Handicapped is located in Janesville. The city is the site of the Lincoln-Tallman homestead museum and the birthplace of Carrie Jacobs Bond, composer, and the home of Frances Willard, feminist and a founder of the Women's Christian Temperance union. For comparative population figures *see* table in WISCONSIN: *Population*. (R. H. I.)

JANET, PIERRE MARIE FÉLIX (1859–1947), French psychologist and neurologist, chiefly distinguished for his work in the field of disordered personality, was born in Paris on May 30, 1859, and educated there. He qualified at the École de Médecine and then became, like Freud, a pupil of J. M. Charcot. Throughout most of his life Janet practised as a specialist in nervous and mental diseases. After a few years as part-time lecturer in philosophy at several of the larger Parisian *lycées*, he became director of the psychological laboratory of the Salpêtrière. In 1898 he was appointed lecturer on psychology at the Sorbonne, and in 1902 professor at the Collège de France. He died in Paris on Feb. 24, 1947.

Janet's chief work lay in the investigation of disorganized, alternating or split personality, as observed in certain of his hysterical patients. These conditions he interpreted in terms of a modified associationist theory. His studies led to a conception of normal personality as an integration of conscious and unconscious ideas and tendencies, and of hysteria as due to a lowered psychic tension, resulting in varying degrees of dissociation. The specific symptoms he interpreted as arising from subconscious thoughts. But his theories, unlike those of Freud, were formulated in terms of ideas rather than of emotions, and were intellectualistic and static rather than emotional and dynamic. Encyclopaedic in his learning, versatile in his interests, Janet published numerous papers and books. Of these the more important were *L'Automatisme psychologique* (1889); *The Mental State of Hystericals* (1892; Eng. trans., 1901); *Névroses et idées fixes* (1898); *Les Obsessions et la psychasthénie* (1903); *The Major Symptoms of Hysteria* (1907; Eng. trans., 1920); and *Les Débuts de l'intelligence* (1933). (Cy. B.)

JANG BAHADUR: *see* JUNG BAHADUR.

JANIN, JULES GABRIEL (1804–1874), French writer, who enjoyed considerable success as a dramatic and literary critic, was born at St. Étienne (Loire), Feb. 16, 1804. Beginning as a journalist on *La Lorgnette* he went on to *Figaro* and *La Quotidienne*. In 1829 he published a novel, *L'Âne mort et la femme guillotinée*, and the same year joined the *Journal des Débats* on which he worked for 44 years as dramatic critic. His authority was quickly recognized, but his judgments have not stood the test of time and his *Histoire de la littérature dramatique en France*, six volumes (1853–58), a collection of his articles, is rarely consulted. He was a facile writer on many subjects. His other works include *Barnave* (1831), a semihistorical novel; *Rachel et la tragédie* (1859); and *La Fin d'un monde et du neveu de Rameau* (1861). He died in Paris, June 19, 1874.

See A. Piédagnel, *Jules-Gabriel Janin*, 3rd ed. (1884). (D. Ks.)

JANIZARIES formed, until their dissolution in 1826, the core of the standing army in the Ottoman empire; while most of the other forces were disbanded in peacetime, they were kept on a permanent basis, ready for any emergency. During the reigns of the first two sultans feudal cavalry and unorganized levies of infantry had been sufficient, and the traditional story of the raising of the corps of janizaries in 1330 and of its being blessed by Haji Bektash has now been discounted. The janizaries were not established until late in the 14th century (exact date unknown) when, with Murad I's conquests in the Balkans, disciplined regular forces were needed to defend and expand the new possessions, while at the same time the numerous captives taken provided the raw material from which to recruit the new forces (the word "janizary" is derived from the Turkish *yenicheri*, meaning "new troops"). They represented a stage in military development far in advance of anything to be found in contemporary Europe; for 200 years their disciplined strength was more than a match for the enemies of the sultan. It was probably in this early stage that they came under the influence of the mystical religious movement of the *Ahi*, an influence which prepared the way for the later close connection between the corps and the Bektashi dervishes, a sect with distinctly heterodox ideas (*see* BALKAN PENINSULA: *Ethnology: Turks*).

Under Murad II, in the first half of the 15th century, came the organization of the *devshirme* (tribute of Christian children), and from then on this became the main source of recruitment for the janizaries, though some were still drawn from the ranks of boy prisoners. In any case, whatever their origin, all were considered to be slaves (*kul*) of the sultan, completely subject to his will. These recruits (*ajemoglan*), being all young, were first assigned to various official households in the provinces, where they underwent training in the Turkish language and Muslim religion; later they were transferred to the capital, where they were instructed in military discipline and the arts of war.

The janizaries were organized as a corps (*ojak*, "hearth"), which was composed of three unequal divisions (*Jema'at*, *Böluk* and *Segban*); at the period of its greatest extent these were divided into 196 companies (*orta*), of between 100 and 300 men. At the head of the corps was the agha of the janizaries, with a well-organized hierarchy of officers, many of whom were remarkable in that their titles were drawn from the kitchen: "Soup-man," "Cook," "Scullion," "Water-carrier," etc. In this connection it is noteworthy that the great cauldrons (*kazan*), in which their food was cooked, were as symbolically sacred as their banners and were kept under special guard; the overthrow of these cooking pots was the sign of dissatisfaction with the government. Until the late 16th century recruitment to the janizaries was severely limited so as to maintain a "corps d'élite"; at this stage, when the rule of celibacy had been relaxed, the sons of members were admitted alongside the tribute children and captives. However, the privileges enjoyed by janizaries were immensely attractive and under pressure from his other subjects Murad III greatly relaxed these restrictions; from then on the corps grew steadily until its numbers had swelled to over 100,000. More particularly, Muslim Turks were allowed to enter, to the gradual exclusion of Christian children, so that the *devshirme* had come to an end by 1700.

Originally the rules governing the janizaries were extremely strict; they were sworn to absolute obedience, abstinence from luxury, religious observance, celibacy, confinement to barracks and nonparticipation in trade. All their energies were to be devoted to military training. From the earliest times, however, these rules were often infringed, more particularly so when the numbers admitted to the corps were disproportionately increased. Apart from military duties in wartime, the janizaries were used in peacetime to garrison the frontier towns and also to police the capital, Istanbul. For this latter duty they were armed only with clubs, as a curb to their natural ferocity; in wartime, strangely enough, they were expected to choose and provide their own weapons—and a motley selection it was, though certainly not ineffective.

While the janizaries were the mainstay of the imperial armies during the heyday of the Ottoman empire, they were also the main

source of internal discontent, overthrowing viziers and sultans alike, at their pleasure; not for nothing have they been likened to the praetorian guards of the Roman period. They revolted first against Mohammed II, when he was brought to the throne as a boy in 1446; on his accession Bayazid II was obliged to yield to their demands for extra pay—a precedent for all succeeding sultans, which on more than one occasion almost bankrupted the empire. They were also largely responsible for the overthrow and subsequent execution of Osman II in 1622 and Ibrahim I in 1648, and for the downfall of Mustafa II in 1703 and Ahmed III in 1730. It was they, too, who formed the main opposition to the reforms of Selim III; they were able to depose him in 1807 and eventually to encompass his death. When Mahmud II came to the throne a year later, he realized that the future stability of the empire depended on the destruction of the janizaries, but it was not until 1826 that he was strong enough to achieve this. In June of that year the corps rose in revolt against the formation of new, westernized troops; the sacred flag of the prophet was unfurled and war was declared against the rebels. On their refusal to surrender, cannon opened fire on their barracks and most of the janizaries were killed; those taken prisoner were executed. So the corps, which for over four centuries had been the terror of Europe —and of its own masters—ceased to exist. *See* also TURKEY: *History*.

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JANJERO, a small Sidama kingdom situated between the Omo and the Gibbe rivers, southeast of Jimma in Kaffa province, southwest Ethiopia. It was independent until conquered by the Ethiopians in 1894; only one European is known to have visited it before this—Father Fernandez in 1613. The people, who are mainly agricultural, call themselves Yamma; the name Janjero is derived from the Amharic *zenjaro*, "baboon." Manoel de Almeida (who described Fernandez' journey) says they had "many barbarous and strange customs." The king was a magician; he was autocratic and had a large entourage of officials. *See* also AFRICA: *Ethnography (Anthropology): Northeast Africa;* AMHARIC.

See C. F. Beckingham and G. W. B. Huntingford, *Some Records of Ethiopia, 1593–1646* (1954); G. W. B. Huntingford, "The Kingdoms of Kafa and Janjero," *Ethnographic Survey of Africa: North-Eastern Africa*, part ii, with bib. (1955). (G. W. B. H.)

JAN MAYEN ISLAND, a bleak and desolate arctic island between Greenland and the north of Norway, about 71° N., 8° W. It is 33 mi. long and 10 mi. in greatest breadth, and is divided into two parts by a low, narrow isthmus. The island is of volcanic formation and mountainous, the highest summit being the extinct volcano of Beerenberg (7,470 ft.). Eruptions of ashes and steam have been observed. Glaciers are fully developed. The climate is cold and foggy. There is a little tundra and a few foxes exist on the island. Henry Hudson is said to have discovered the island in 1607 and called it Hudson's Tutches (Touches). Thereafter it was several times observed by navigators who successively claimed its discovery and renamed it. Thus, in 1611 or 1612 Hull whalers named it Trinity Island. Its present name is derived from Jan Jacobsz May, captain of a Dutch whaler, who claimed his company's territorial right to the island in 1614. Whaling stations were built but the whales were exterminated from the waters of the island by 1642, and the expeditions ceased. Since 1840, however, the island has been frequently visited by explorers, sealers, trappers and whalers. An Austrian observatory was maintained there for a year in 1882–83 and 1932–33. A Norwegian meteorological observatory, with wireless communication, has been working since 1921. Jan Mayen Island was annexed to Norway on May 8, 1929. In 1958–59 a radio and navigation station and an airstrip were erected by the NATO allies.

See E. von Wohlgemuth, *Osterreichische Polarstation Jan Mayen* (1886); J. M. Wordie, *Geog. J.* (March 1912), and *Trans. Royal Soc. Edin.*, 54 (1926). (L. H. HG.)

JANNINGS, EMIL (1886–1950), German actor known for his tragic roles in motion pictures, was born in Brooklyn, N.Y., on July 26, 1886, and taken as an infant to Germany, where he was reared by his grandparents. At 14 he ran away to sea and two years later joined a traveling stock company. By 1906 he was acting for Max Reinhardt in Berlin. Early film roles were Louis XV, opposite Pola Negri, in *DuBarry*, and Henry VIII in *Anne Boleyn*. In 1924, under F. W. Murnau's direction, *The Last Laugh* brought him his best-remembered role as a hotel doorman who lost his job; and in *Variety* (1925) he was a sideshow operator deceived by a woman. In *The Blue Angel* (1929), which introduced Marlene Dietrich, he was an aging professor married to a young night club singer. Moving to the U.S., Jannings was the first actor to win an award from the Academy of Motion Picture Arts and Sciences for *The Way of All Flesh* (1927). He won further critical approval for *The Patriot* and *The Last Command* (1928). Howard Barnes of the *New York World* declared that he had "taken a place in motion-picture tragedy only comparable to Chaplin's eminence in comedy." Returning to Germany and the stage, Jannings continued to work during the Nazi regime. He became an Austrian citizen in 1948 and died in Austria on Jan. 2, 1950. (R. D. MACC.)

JANSEN, CORNELIUS OTTO (1585–1638), bishop of Ypres and one of the fathers of the religious movement known as Jansenism, was born of humble Catholic parentage at Leerdam, Holland, on Nov. 3, 1585. In 1602 he entered the University of Louvain, then in the throes of a violent conflict between the Jesuit, or scholastic, party and the Augustinians, followers of Michael Baius (*q.v.*). Jansen joined the latter party. He made a momentous friendship with a like-minded fellow student, J. Duvergier de Hauranne (*q.v.*), later abbé of St. Cyran.

In 1604 Jansen went to Paris, partly to recover his health by a change of scene, partly to study Greek and Hebrew. In 1611 he joined Duvergier at his country home near Bayonne, where he spent several years teaching at the bishop's college. His spare time was spent in studying the early Fathers with Duvergier and laying plans for a reformation of the church from within, on principles radically different from the Counter-Reformation then in being.

Jansen returned to Louvain in 1617 to take charge of a new college for Dutch students of theology. Pupils found him a somewhat choleric and exacting master; academic society found him a recluse. He took part in the university's resistance to the Jesuits, who had established in Louvain a theological school that was a formidable rival to the official faculty of divinity. Jansen was sent twice to Madrid, in 1624 and 1626; the second time he narrowly escaped the Inquisition.

Antipathy to the Jesuits brought Jansen no nearer Protestantism; he wanted to prove to them that Catholics could interpret the Bible in a manner quite as mystical and pietistic as theirs. This became the great object of his lectures when he was appointed regius professor of scriptural interpretation at Louvain in 1630. Still more was it the object of his *Augustinus*, a treatise on the theology of St. Augustine, published posthumously in 1640. Its preparation had been his chief occupation since his return to Louvain. But Jansen, as he said, did not mean to be a school pedant all his life, and there were moments when he dreamed political dreams. He looked forward to a time when Belgium should throw off the Spanish yoke and become an independent Catholic republic on the model of Protestant Holland. These ideas became known to his Spanish rulers, and to assuage them he wrote a philippic called the *Mars gallicus* (1635), a violent attack on French ambitions generally and on Richelieu's indifference to international Catholic interests in particular. The *Mars gallicus* did not help Jansen's friends in France, but it appeased the wrath of Madrid against Jansen. In 1636 he was appointed bishop of Ypres, where he died on May 6, 1638. *See* also JANSENISM.

See J. Orcibals' edition of Jansen's letters (1947) and N. J. Abercrombie, *The Origins of Jansenism* (1936), which includes an analysis of the *Augustinus*. (N. J. A.)

JANSENISM, a reform movement in the Roman Catholic Church during the 17th and 18th centuries. It was launched by the posthumous publication at Louvain in 1640 of a huge work entitled *Augustinus*, based on the anti-Pelagian works of St. Augus-

tine and composed by the bishop of Ypres, Cornelius Jansen (*see* JANSEN, CORNELIUS OTTO).

Jansen's Teaching.—In Jansen's opinion the church was suffering from a number of evils. The official scholastic theology, having set out to embody the mysteries of faith in human language, had fallen a victim to the excellence of its own methods; language proved too strong for mystery. Theology sank into a branch of dialectic; whatever would not fit in with a logical formula was cast aside as useless. But average human nature does not take kindly to a syllogism, and theology had ceased to have any appreciable influence on popular religion. Simple souls found their spiritual pasture in little mincing "devotions," while more robust minds built up for themselves a natural moralistic religion quite as close to Epictetus as to Christianity. All these evils were attacked by Jansen. As against the theologians, he urged that in a spiritual religion experience, not reason, must be our guide. As against the stoical self-sufficiency of the moralists, he dwelt on the helplessness of man and his dependence on his Maker. As against the ceremonialists, he maintained that no amount of churchgoing will save a man unless the love of God is in him. But this capacity for love no one can give himself. If he is born without the religious instinct, he can only receive it by going through a process of "conversion." And whether God converts this man or that depends on his good pleasure. Thus Jansen's theories of conversion melt into predestination, although, in doing so, they somewhat modify its grimness. Even for the worst miscreant there is hope—God may yet think fit to convert him.

Such doctrines have a marked analogy to those of Calvin, but in many ways Jansen differed widely from the Protestants. He vehemently rejected the doctrine of justification by faith; conversion might be instantaneous, but it was only the beginning of a long and gradual process of justification. Second, although the one thing necessary in religion was a personal relation of the human soul to its Maker, Jansen held that the relation was possible only in and through the Roman Church. Jansen explicitly submitted his teaching to the judgment of the church, but his volumes were published by some of his followers without waiting for Roman approval. They created a stir in France, Belgium and Holland and were soon out of print. A second edition, fortified by the approval of ten theologians of the Sorbonne, followed. In 1641, however, the Roman authorities banned the work, and Pope Urban VIII in 1642 renewed the condemnation on the grounds that the *Augustinus* had appeared despite an earlier papal order forbidding publications on grace (divine aid to man) without previous approval and that it contained the errors of Michael Baius (*q.v.*), condemned in 1567 and 1580.

St. Cyran and Arnauld.—The condemnation of the *Augustinus* had little effect. The struggle that followed centred in France, where Jansen's friend Jean Duvergier de Hauranne (*q.v.*), abbé of St. Cyran, led his followers to support the doctrines of the *Augustinus*. St. Cyran, who was spiritual director of the nuns of Port Royal where Mère Angélique Arnauld was abbess, won the support of her powerful family (*see* ARNAULD), and after his death in 1643 Antoine Arnauld ("the "Great Arnauld"), priest and theologian, became leader of the movement. Arnauld gave it impetus by a number of works, especially by *De la fréquente communion* (1643), which aimed at restoring the ancient discipline in the preparation for and administration of the sacrament of penance; he believed that absolution was given hastily, almost automatically, by many of his contemporaries (particularly the Jesuits), even to hardened sinners and without due consideration of their dispositions. This work was not condemned by Rome.

In 1653 Pope Innocent X condemned five propositions which had been drawn from the *Augustinus* by a French theologian:

1. There are some of God's commandments that just men cannot observe with the powers they have in their present state, even if they wish and strive to observe them; nor do men have the grace that would make their observance possible.

2. In the state of fallen nature internal grace is never resisted.

3. To merit or demerit in the state of fallen nature it is not necessary for a man to have freedom from necessity but only from constraint.

4. The Semipelagians admitted the necessity of internal, preparatory grace for individual acts even for the beginning of faith; they were heretics for this reason, that they wished this grace to be such that the human will could resist it or obey it.

5. It is Semipelagian to say that Christ died or shed his blood for all men without exception.

Innocent condemned the first four propositions as heretical; the fifth error was also condemned if understood to mean that Christ died for the salvation of the elect alone.

On the publication of this condemnation, the French Jansenists hesitated for a time, but then Arnauld took up a position against the papal decision. He admitted that the propositions merited condemnation but denied that they were to be found in the *Augustinus*, at least in the sense in which they had been condemned. In 1654, 38 bishops rejected this interpretation and were congratulated by Innocent X on their stand. The Jansenists persisted, however, proposing a distinction between right (law) and fact: The church, they maintained, has the right (*droit*) to decide the truth or falsity of a doctrine, but doubt as to the presence of this doctrine in a book raises a question of purely human fact (*foit*) which as such does not fall within the teaching power of the church. A pronouncement by the church on such a fact does not require an interior assent, only respectful silence.

Pascal and Port Royal.—Blaise Pascal won wide support for Jansenism through his *Lettres écrites par Louis de Montalte à un provincial* (better known as the *Provincial Letters*, or *Les Provinciales*), which, because of their matchless style, enjoyed a success rarely equaled. The *Provinciales* are devoted to ridiculing the moral theology of the Jesuits as well as to attacks on the doctrine on grace of the Jesuit Luis de Molina (*see* MOLINISM). Although possessed of little competence in these difficult fields and guilty of alteration and incompleteness in citation, Pascal caused a reversal of public opinion in favour of Jansenism. (*See* also PASCAL, BLAISE: *Les Provinciales*.)

In 1656 Pope Alexander VII confirmed the condemnation of the *Augustinus*, but when, during the following year, the general assembly of the French clergy issued a formula against Jansenism, four bishops, among them a brother of Antoine Arnauld, refused to accept it. In the resistance that developed, the name of Port Royal was prominent. Port Royal de Paris, the convent of Cistercian nuns referred to above, had an establishment outside the city, Port Royal des Champs, which became a centre for Jansenist priests and laymen (*see* also PORT ROYAL). Some of these solitaries of Port Royal conducted schools for boys and exerted a considerable influence on religion and culture, as well by their novel educational methods as by their own exceptional character and gifts. But Port Royal was also a centre of resistance to ecclesiastical authority.

In 1665 Pope Alexander VII, supported by Louis XIV, demanded written submission to the condemnation of the five propositions as expressed in the *Augustinus*. Most of the Jansenists refused to sign. The pope also condemned the theory of right and fact, affirming that the church has the right and power to decide whether an author in fact teaches heresy. When the attitude of the king toward Rome cooled because of the struggle over Gallican rights, Alexander's successor, Pope Clement IX, in 1669 accepted a submission from Jansenist leaders, whose sincerity in the instance, however, has been questioned. This ended the first and more serious crisis in the long struggle.

The peace was exploited as an approbation of the Jansenist position while the troubles that pitted the French throne against the papacy won new adherents—this despite the fact that two Jansenist bishops took the lead in defending the rights of the church. The disputes on quietism (*q.v.*) and adaptation in the missions (*i.e.*, the tendency of the Jesuit missionaries, for the sake of prudence, to permit converts to adapt certain pre-Christian practices to Christian worship and doctrine) were also turned to Jansenist advantage.

18th Century.—At the beginning of the 18th century Jansenism again attained the centre of interest in France. The new crisis was precipitated by the statement of 40 theologians of the Sorbonne that sacramental absolution need not be refused to a cleric

who held the distinction between right and fact or other Jansenist doctrines, provided he maintained respectful silence. Pope Clement XI in 1705 condemned this view. All but one of the 40 professors and all but one of the French bishops accepted the decision. Port Royal, however, remained inflexible and as a result was suppressed, the buildings being razed in 1710 and the nuns distributed among other convents.

Meanwhile the Jansenists had found a new leader in the former Oratorian Pasquier Quesnel (*q.v.*), whose *Réflexions morales* (1668–99) was repeatedly banned; in 1713, 101 propositions drawn from it were condemned in the bull *Unigenitus*. Since some of these propositions, apart from their context, seemed capable of an orthodox explanation, the cardinal archbishop of Paris and some other bishops asked Rome for an explanation; later they appealed to a future general council. In 1718 the pope rejected the appeal and excommunicated the appellants. In 1720 the French *parlements* accepted the bull *Unigenitus* and the royal court turned against the appellants. The archbishop of Paris submitted in 1728. Quesnel and other leaders in the meantime had fled to Holland, where the Dutch Jansenists had gone into schism in 1723.

In France, where a schism was apprehended, the crisis subsided, due in part to a change in public opinion caused by extremists of the Jansenist movement. French Jansenism, henceforth, tended to lose its identity and to merge into Gallicanism and anti-Jesuitism. The 18th-century crisis involved far fewer people than that of the 17th. The schismatic church in Holland was long faithful to its Catholic heritage but eventually fell away from it; after 1870 it merged with the Old Catholics (*q.v.*).

In Italy in the 17th century the *Provinciales* united various groups such as the adversaries of Probabilism (*q.v.*) and the adherents of Augustinianism into a kind of Jansenist party. It was only in the 18th century, however, that a true Jansenism appeared in Italy under the leadership of the bishop of Pistoia, Scipione de' Ricci (1741–1810). This led to the clearest condemnation of the system by Pope Pius VI in 1794. The French Revolution practically eliminated Jansenism as a danger for the Roman Catholic Church, and the first Vatican council (1869–70) put an end to Gallicanism.

Aims and Achievements.—If, as has been stated, Jansenism was an effort to win back the Protestants on the basis of St. Augustine's doctrine, it failed signally. The prolonged discussion merely led Rome to reaffirm the doctrinal positions of the Council of Trent on grace and predestination. The campaign for a stricter moral theology had more success, since lax opinions were condemned by Rome in 1665, 1666 and 1679. Probabilism, too, at one time, seemed doomed but has survived in its original form as well as in Equiprobabilism, a slightly modified form proposed by St. Alfonso Liguori.

If the Jansenists, following the lead of Erasmus, hoped to introduce, instead of the intellectualism of the schoolmen, a vague theology in which the heart and the feelings would have a leading role, they must also be judged a failure on this point. Scholasticism was not displaced and as hairsplitters the Jansenist theologians hold a high rank.

Some have detected in this long and bitter controversy evidence of a profound disagreement within Roman Catholicism between the Jansenists, who maintained an absolute immobility in matters of dogma, morals, rites, customs and discipline, and those who thought that the church, if it was to win back those alienated by the Renaissance in the west and the cultured nations of the east, would have to submit its doctrine and practice to a profound reinterpretation. On a still deeper level it pitted those who wanted a coherent theology, satisfying the exigencies of reason, against the Jansenists, who in religion felt the need of a field from which the rational was excluded. Others have seen in it primarily a reaction to the success of the Jesuits. There is little doubt finally that the French genius for debate and the circumstances of the times contributed not a little to the proportions the conflict took on.

The term Jansenism survives in French literary criticism, the pessimistic writings of existentialist and neorealist authors often being so referred to.

See also references under "Jansenism" in the Index.

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JANSSEN, JOHANNES (1829–1891), German Roman Catholic historian. His *Geschichte des deutschen Volkes seit dem Ausgang des Mittelalters* (volumes 1–6, 1876–88; volumes 7–8 completed by L. Pastor, 1893–94; English translation 1896 *et seq.*) was the first large-scale modern attempt in Germany to present a defense of the Catholic Church at the close of the middle ages. His work, inspired by a romantic view of the middle ages, was extensively documented but his documents were partially selected and the book was violently attacked by Protestant historians.

Janssen was born at Xanten, on the lower Rhine, on April 10, 1829, studied in Münster, Louvain, Bonn and Berlin, became *Privatdozent* in Münster in 1854 and in the same year professor of history at a Frankfurt am Main Gymnasium. He was ordained priest in 1860 (but without leaving his teaching post) and in 1880 was made domestic prelate to the pope and apostolic pronotary. Wishing to devote himself to his historical work, he rejected the suggestion of a cardinalate. In 1875 he became a member of the Prussian legislature. He died in Frankfurt on Dec. 24, 1891. His most important follower was Ludwig Pastor (*q.v.*).

His other works include *Schiller als Historiker* (1863); a life of his friend J. F. Böhmer (1868); *Zeit- und Lebensbilder* (1875) and *Frankfurts Reichskorrespondenz, 1376–1519* (1863–72).

Bibliography.—L. Pastor, *J. Janssen* (1893); M. Schwann, *J. Janssen und die Geschichte der deutschen Reformation* (1892); H. Bornkamm, *Luther im Spiegel der deutschen Geistesgeschichte* (1955).

JANSSEN, PIERRE JULES CÉSAR (1824–1907), French astronomer notable for his early observation of the sun by means of spectroscopy and photography, was born on Feb. 22, 1824, in Paris. He studied chemistry, mathematics and physics at the university there, and in 1865 he became professor of general science in the school of architecture, thus showing his interest in the profession of his maternal grandfather, the architect Pierre Hippolyte Lemoyne. Janssen carried out some studies on terrestrial magnetism, but he is remembered for his astronomical work. This really began in 1864 when, sent by the French Academy of Sciences to Italy and Switzerland, Janssen observed the solar spectrum, paying particular attention to those lines due to absorption by the earth's atmosphere. Later, in 1893, in observations from the meteorological observatory which he had established on Mt. Blanc and of which he was the director, he conclusively proved that the strong oxygen lines in the solar spectrum were due to atmospheric oxygen. He also made a host of other important spectroscopic observations, especially on the planets and on the sun, and discovered how to use a spectroscope to observe solar prominences in daylight whereas, hitherto, they had been observable only for the few minutes' duration of solar eclipses. This discovery, also independently arrived at by Sir Joseph Norman Lockyer, was of very great practical importance. Janssen was also the first regularly to use photography for studying the sun, and while at the Meudon observatory, Paris, of which he was in 1876 appointed the first director, he published his great *Atlas des photographies solaires* (1904), which contained 6,000 pictures of the solar disk. He died at Meudon, on Dec. 23, 1907.

See H. Macpherson, *Astronomers of To-Day* (1905). (Cn. A. R.)

JANSSENS, ABRAHAM (Janssens van Nuyssen) (*c.* 1575–1632), Flemish historical painter, was born at Antwerp, studied under Jan Snellinck and was in Rome between 1598 and 1601. In 1601 he appears as a master of the Antwerp painters' guild, of which he was dean in 1607. His stylistic development indicates that he revisited Rome between 1601 and 1610, though there is no certain evidence of this. His earliest pictures are characteristic of the northern mannerist tradition, but from about 1610 his work shows the marked influence of Caravaggio. Until

eclipsed by Rubens, Janssens was the most successful of the Flemish historical painters. (R. E. W. J.)

JANSSEN (JONSON, JANSON) **VAN CEULEN, CORNELIUS** (CORNELIS) (1593–1662), Flemish portrait painter, was apparently born in London and baptized on Oct. 14, 1593. His family derived originally from Cologne and emigrated from Antwerp to England about 1568. He worked in England from 1618 to 1643, and afterward retired to Holland, working at Middelburg, Amsterdam, The Hague and Utrecht. In England he was patronized by James I and the court, and under Charles I he continued to paint the numerous portraits which adorn many English mansions and collections. Janssen's pictures, chiefly portraits, are distinguished by clear colouring, delicate touch, good taste and careful finish. He generally painted upon panel and often worked on a small scale, sometimes producing replicas of his larger works. In all probability his earliest portrait (1618) was that of John Milton as a boy of ten.

JANUARIUS (GENNARO), **SAINT** (*c.* 304?), a bishop of Benevento said to have been martyred at Pozzuoli under Diocletian, whose present fame rests on the relic alleged to be of his blood, kept in a glass phial in the cathedral at Naples. The solid substance in the phial often becomes liquid when the phial is exposed; this phenomenon has been frequently tested and seems certainly to be genuine. No wholly satisfactory natural explanation of it has been found. The feast day of St. Januarius is Sept. 19.

See H. Thurston in *The Month*, vol. 149 (1927) and 155 (1930); H. Thurston and D. Attwater (eds.), *Butler's Lives of the Saints*, vol. iii, pp. 594–596 (1956). (D. AR.)

JANUARY (Lat. IANUARIUS), the first month of the modern calendar, with 31 days. Though named for Janus, the two-faced Roman god of "beginnings," January was regarded as the 11th month, not the 1st, until at least 153 B.C. In later antiquity New Year's day, Jan. 1, became a popular festival, celebrated with masquerades and the giving of gifts. Partly to avoid the pagan associations of that day various other dates were widely used in the middle ages to begin the year, and in England the legal and ecclesiastical calendar still began with March 25 (Feast of the Annunciation) until the Gregorian calendar was finally adopted in 1752. (F. R. WN.)

JANUS, in Roman cult, the animistic spirit of doorways (*ianuae*) and archways (*iani*). His worship traditionally went back to Romulus and a period even before the actual founding of the city. There were many *iani* (*i.e.*, ceremonial gateways) in Rome, usually not part of a wall but freestanding structures symbolic of auspicious entrance (or exit). These were used ceremonially on the setting out of any party, but particular superstition was attached to the departure of the army, for which there were lucky and unlucky ways to march through a gate. The most famous of these *iani* was the Ianus Geminus, actually a shrine of Janus at the north side of the Forum where the Argiletum entered. It was a simple rectangular bronze structure with double doors at each end. Tradition recorded that it was erected by Numa to indicate, when the doors were open, that Rome was at war; and when closed, that it was at peace (which occurred only twice between the reigns of Numa and Augustus! *Cf.* Livy i, 19, 2).

Some scholars regard Janus as a god of all beginnings and believe that his association with doorways is derivative. He was invoked as the first of any gods (including Jupiter) in regular liturgies. The beginning of the day (*cf.* his epithet Matutinus), month and year, both calendar and agricultural (*cf.* his epithet Consivius, "the sower"), were sacred to him. January is of course named for him, and his festival took place on Jan. 9, the Agonium. His priest was no less than the rex sacrorum, the representative of the ancient king in his capacity as religious head of the state; and the offering of a ram on Jan. 9 took place at the Regia, the old royal household, later symbolic of the state household. In the hymn of the Salii (*q.v.*) he is referred to as *divom deus*, "god of gods."

This exalted aspect of his worship set later Romans speculating as to the true nature of the divinity, and they came forth with various explanations of a cosmic deity; *e.g.*, a sun-god, a sky-god or the universe itself. Modern interpretations have also been varied. Some regard him as a god of water crossings and others, finding in Janus the same root as in Diana, believe him to be a moon deity.

There was a temple of Janus in the Forum Holitorium dedicated from the booty of the defeat of the Carthaginian fleet off Mylae (260 B.C.) by G. Duilius. It has been identified with the ruins of one of the three temples under the present church of S. Nicola in Carcere. It is assumed also that Janus had an early cult on the Janiculum, which the ancients took to mean "the city of Janus."

In addition to the gate, his symbol is a double-faced head, and thus he is seen represented, both bearded and unbearded, in art. Occasionally he was even four-faced as the spirit of the four-way arch. There was a temple to Janus Quadrifrons erected by Domitian in the Forum Transitorium which contained such a statue. A four-way arch of the 3rd or 4th century A.D. still stands in the Velabrum. *See* also ROMAN RELIGION.

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JAPAN (NIPPON, NIHON). The island country of Japan lies off the east coast of Asia and entirely within the temperate zone. Its land area of 142,727 sq.mi. supports more than 93,000,000 people. The over-all density of 654.5 persons to the square mile is remarkable considering that over 80% of Japan is composed of uninhabitable rugged mountains. Although located adjacent to eastern Asia and in the Chinese culture realm, Japan has been protected by relatively wide intervening seas and straits and so has developed strong indigenous characteristics. There is considerable parallelism between Japan and western Europe in the historical development of social and economic patterns. When Japan was opened to world trade and intercourse in the mid-19th century it had reached the stage of late maturity in feudalism. Consequently, it was able to adopt modern industrial civilization much faster than other Asian countries.

The territorial limits of Japan, following World War II, remained unsettled in the second half of the 20th century. The area under direct control comprises the four main islands of Honshu, Shikoku, Kyushu and Hokkaido and many adjacent smaller islands.

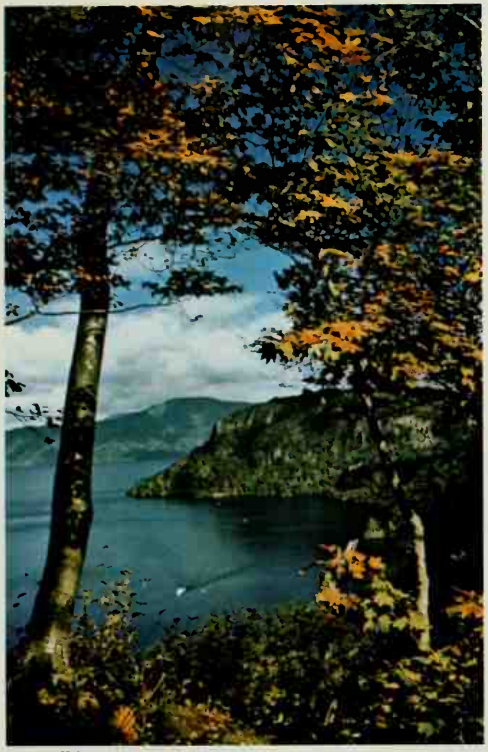
The island arcs of Japan are subject to intense crustal movements and violent earthquakes and volcanic activity. The islands are exceedingly mountainous and have only narrow littoral plains and limited intermontane basins. Their latitudinal range (27° N.–45° N.) and location between Eurasia and the Pacific ocean are the chief controlling factors of climate and vegetation. The climate ranges from warm temperate to cold temperate and the frequent occurrence of typhoons and cyclones and the moisture-bearing monsoons ensure an abundant precipitation, with frequent floods and no marked dry season.

In spite of the paucity of arable land about 36.5% of the population is rural. Rice is the dominant crop, supplemented by commercial crops, fruit, vegetables and sericulture. Japan is the world's first fishing nation measured both by catch and by people employed. It has a variety of minerals, both metallic and nonmetallic, but except for coal, limestone and sulfur, production is not significant.

Japan entered the modern industrial period in the beginning of the 20th century and the phenomenal development achieved made possible large population and urban growth. The manufacturing industries encompass a wide range from light to heavy, chemical and iron and steel. Industrial plants are concentrated largely in the core belt of great cities and conurbations extending from Tokyo westward through Nagoya and Osaka and on to include northern Kyushu.

This article is divided into the following main sections and subsections:

I. Physical Geography
  1. Geology
  2. Relief and Drainage



JOSEPH NETTIS
Lake Towada, one of several large lakes in northern Honshu, largest and most populous of the Japanese islands

BOB & IRA SPRING
Mt. Fujiyama, the highest peak in Japan, and Lake Kawaguchi, central Honshu

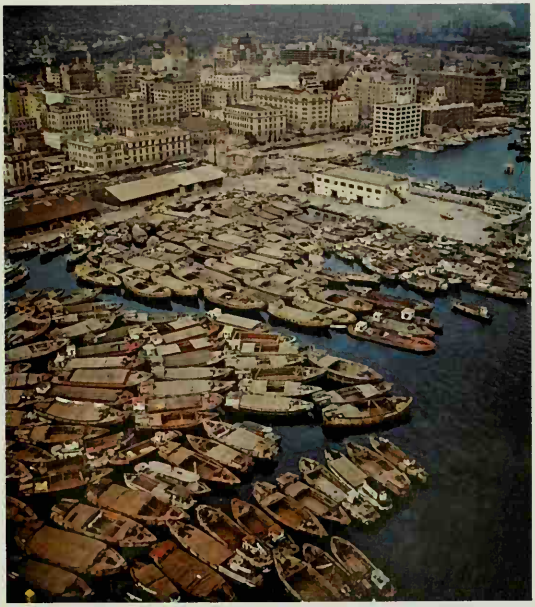
SCENES IN JAPAN

Street scene in the neon-lit amusement district of Tokyo, capital of Japan

RONNY JAQUES—PHOTO RESEARCHERS, INC

WALTER M. LANGSDORF—RAPHO GUILLUMETTE
Strip-farming of grain and vegetables near Hakone, central Honshu

BOB & IRA SPRING
Islands in the Inland sea near Okayama, southwestern Honshu



BOB & IRA SPRING
The harbour at Kōbe, an ancient city which has become a major trading and industrial centre

JAPAN

BOB & IRA SPRING

Kegon falls in the Nikko National park, a popular sightseeing area in central Honshu

BRADLEY SMITH—PHOTO RESEARCHERS, INC.

Schoolchildren posing for a class picture in front of the great 13th-century bronze Amida (Great Buddha) at Kamakura

JOSEPH NETTIS

Farm woman and her child on the island of Shikoku

ABOVE FOUR PHOTOGRAPHS BY BOB & IRA SPRING

Contrasts in Japanese life result from the blending of the ancient traditions of the orient with the modern technology of the west. The ancient crafts of printmaking and the preparation of seafood (like the drying of squid above, right) continue to thrive alongside newer occupations such as welding and the cultivation of pearls

MINORU AOKI—RAPHO GUILLUMETTE

Men dressed in medieval warrior's garb at the Age festival held annually at Kyōto to commemorate the long history of the country's former capital

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Further geographic, historic, political and economic aspects can be found in articles on individual islands and groups, the prefectures and main cities. (R. B. H.)

I. PHYSICAL GEOGRAPHY

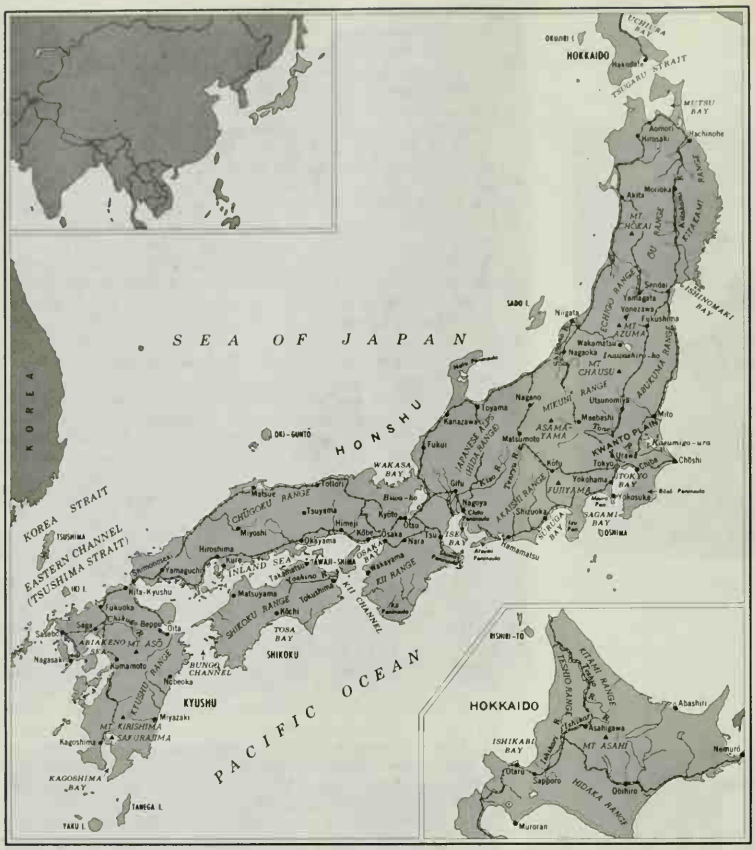
1. Geology.—The Japanese archipelago is one of several island arcs that stretch north and south in the western Pacific between the southern tip of Kamchatka (*q.v.*) peninsula in Siberia and southeast Asia. The Russian island of Sakhalin (*q.v.*), which lies due north of Hokkaido, has shared a common geologic history with Japan and can be considered geologically an integral part of the Japanese arc. Between northeastern Hokkaido and southern Kamchatka is the Kuril Islands (*q.v.*) arc; between southern Kyushu and northeastern Formosa (Taiwan) is the Ryukyu Islands (*q.v.*) arc; and southward from the vicinity of Tokyo bay stretches the Bonin Islands (*q.v.*) arc, which also incorporates the seven Isles of Izu (Izu-shichitō [*q.v.*]). The contact points of these three arcs with Japan have been great centres of volcanic activity through long periods of geologic time. The Japanese archipelago bends perceptibly eastward in a convex arc, separated from the Asian mainland by a shallow depression occupied by the Sea of Japan. Despite this pronounced eastward bulge, the two extremities of Japan are near the mainland. Northwestern Hokkaido is only about 150 mi. from the Russian coast, and Sakhalin, separated from Hokkaido by La Pérouse (Sōya) strait, comes to within a scant 10 mi. of the coast across Tatar strait (Gulf of Tatary). To the southwest, a 125-mi. expanse of ocean, Korea strait (the section nearest Japan called Tsushima strait), stands between Japan and the southeastern tip of the Korean peninsula.

The Japanese arc had its origin in mid-Paleozoic time, when marine sediments derived from the continent were piling up in a great downwarped oceanic trough. Paleontological evidence indicates the existence of a fairly complete sequence of marine sedimentation and periodic volcanism from Silurian to Permian time. Large sections of Japan began to appear from beneath the sea during Middle and Late Triassic time, during what the Japanese call the Akiyoshi orogenic movements. By Early Jurassic time, most of present Japan was above sea level. However, partial submergence took place during the Jurassic and Early Cretaceous, when some of the most remarkable diastrophic movements of Japan's geological history took place. Large-scale igneous intrusions were a feature of the Cretaceous. The Tertiary was marked by extremely complex orogenic movements, and many parts of Japan were flooded, especially during the Miocene. The Miocene and Pliocene brought strong folding movements and widespread volcanic extrusion. In more recent geologic times, terraces and shore lines of emergence are indicative of coastal movement during the Pleistocene. The frequency of earthquakes, volcanic activity and minor crustal movements in contemporary Japan is eloquent testimony to the instability that still prevails in the earth's crust beneath the Japanese islands.

The rocks that make up the Japanese islands can be grouped into five broad classifications. (1) The oldest, Pre-Cambrian rocks, mostly gneisses and crystalline schists, have a limited occurrence. The largest exposures are in central Shikoku, the Kii peninsula in Honshu and the Abukuma mountains of northeastern Honshu. (2) The oldest unmetamorphosed rocks are sandstone, slate, limestone and chert of marine origin from the Paleozoic (called the Chichibu complex by the Japanese) and both marine and nonmarine sedimentary rocks from the Mesozoic. Both classes are widespread; they are most conspicuous in central Hokkaido and central Honshu, central Kyushu, southern Shikoku, the southern Kii peninsula and the Kitakami mountains of northeastern Honshu. They are typically folded and faulted into some of Japan's highest relief. (3) Cenozoic sedimentary rocks, chiefly sandstone and shale, are of both marine and nonmarine origin and are often interbedded with volcanic materials. Weak and poorly consolidated, they form hills and low mountains in central western and northwestern Honshu and western and eastern Hokkaido. Most of Japan's coal and oil is derived from rocks of this age. (4) Granitic rocks are widespread, reaching their best development in central and western Honshu and northern Kyushu. The age of some of the western Honshu granite has been established as Late Cretaceous. Many minerals are associated with the granitic rocks. (5) Volcanic rocks—lava, tuff and breccia—of Cenozoic Age cover about one-fourth of Japan's surface, more than any of the other four rock categories.

Broadly generalized, the oldest rocks in Japan occur east of a main line of dislocation that passes through central Kyushu, north central Shikoku, the central Kii peninsula, east central and northeastern Honshu and central Hokkaido. This is labeled the outer zone by Japanese geologists to differentiate it from the inner zone of younger rocks that lie west of the line. Both zones are interrupted dramatically in central Honshu by the Fossa Magna, a massive fault depression, now occupied by younger strata and volcanic deposits, that cuts across Honshu between longitude 138° and 139° E. Thus Japan can be divided into five major geomorphic regions: the northern (northeastern) inner and outer zones, the Fossa Magna and the southeastern inner and outer zones.

2. Relief and Drainage.—For such a small country, Japan exhibits exceptional regional diversity in its surface features. Seascapes, mountains, volcanic peaks, rivers, plains and lakes are interblended in a natural tableau that changes in detail swiftly over short distances. This variety has won Japan's landscape (*sansui*) acclaim as one of the world's loveliest. Land forms, along with climate and other natural elements, have been important in shaping the geographic patterns of the Japanese population and its activities.



PRINCIPAL PHYSICAL FEATURES AND CITIES IN JAPAN

Coast Line.—The Japanese coast line is noted for its length and variety, and for its role in the emergence of Japan as a leading fishing and maritime power. For each square mile of land surface there are nine miles of coast line. No place in Japan is more than 75 mi. from the sea.

Adjacent seas (*naikai*) and their coasts are of sharply different character. Although the East China sea has a maximum depth of 9,126 ft. the average depth is only 617 ft., while the Japan sea, with a maximum depth of 12,276 ft., has an average depth of 4,429 ft. Japan's Sea of Japan coast line is only one-fourth as long as the Pacific coast line because of its general lack of indentations. The fingerlike Noto peninsula and deeply incised Wakasa bay are its main irregularities. Sado and Oki-Guntō (*qq.v.*) are noteworthy offshore islands. Coastal sand bars, often with shallow lagoons on their lee sides, and sand dunes are common features. There are few natural harbours along the smooth coast line, and the entire Sea of Japan coast is exposed to strong winds and wave action generated by the winter monsoon. However, southern and western Kyushu, which face on the Korea strait and the East China sea, have remarkably indented coast lines and a profusion of offshore islands, among which the Amakusa-rettō, Tsushima, Iki and Gotōrettō (*qq.v.*) groups are largest. Ōmura bay and the Ariakeno sea, the latter bordered by the volcanic Shimabara peninsula west of its mouth, are prominent coastal indentations.

Immediately east of Japan, the waters of the Pacific ocean plunge abruptly into one of the world's most profound submarine trenches, where soundings have located depths in excess of 26,000 ft. The Pacific coast line of Japan, although smooth for long stretches, has a number of large indentations. Natural harbours free from river silting are rare, yet Pacific ports are among Japan's best. North of Tokyo bay, the coast is relatively smooth except for one irregular section north of Ishinomaki bay in northeastern Honshu. Between Tokyo bay and the eastern entrance of the Inland sea, three great bays (Sagami, Suruga and Ise) and intervening peninsulas (Miura, Izu, Atsumi, Chita, Shima and Kii) are striking coastal features. Kagoshima bay is cut deeply into southern Kyushu. The Inland sea is noted for its irregular coast line and hundreds of small islands, qualities that place it among the leading beauty spots in Japan. Its calm, easily navigated waters extend east to west for more than 250 mi. The Inland sea is formed by five distinct basins, each caused by faulting and subsidence. The Kii strait (or channel) and Bungo channel (or strait) link the Inland sea with the Pacific, whereas access to the East China sea is by the narrow Shimonoseki strait.

Japanese offshore waters are the meeting ground of warm currents moving northward from equatorial areas and cold currents bearing southward from the polar area. The Kuroshio (also called the Japan current or Black stream), a warm current equivalent to the Gulf stream of the North Atlantic ocean, passes close to the southeastern coasts of Japan. At about 35° N. it veers eastward into the North Pacific. An offshoot, the Tsushima current, makes its way through Tsushima strait into the Sea of Japan, where it parallels the Japanese coast. Cold waters of the Oyashio (its northern portions known as the Bering current or Kamchatka current) and others from the Sea of Okhotsk wash the coasts of Hokkaido and northeastern Honshu. The convergence points of these waters can be identified by oppressive fog banks, especially off eastern Hokkaido.

Mountains.—Mountains (*yama, san* or *zan, take* or *dake, sammyaku*) dominate the Japanese landscape. Only about 15% of the land surface is level or of modest enough slope to permit agricultural settlement. Although the extensive hill and mountain tracts impose strict limitations on the amount of easily habitable space and hinder communications, they also have a positive function. Many of the mountainous areas have valuable forest stands, serve as watersheds to the many swift rivers and streams and offer recreational and tourist facilities. Of mixed blessing is the function of the mountains as climatic modifiers; some areas are protected from weather extremes, while others receive heavier rainfall and snowfall because of their presence.

Japan's rocky spine is formed mostly by folded mountains upthrust from the floor of the Pacific ocean. However, there is great diversity of land forms resulting from block faulting, crustal movements, intense volcanism and vigorous erosive forces. The typical Japanese mountain landscape is one of deep-cut valleys, sharp

contours and other evidence of relatively recent uplift. Only in areas of easily weathered granite or sedimentary rocks are contours softer and more rounded. Highest elevations are in the Japanese Alps or the Hida range, now a national park, in central Honshu, where peaks over 10,000 ft. are not uncommon. Elevation decreases in general northward and southward from this area. Despite the complexity of Japan's physiography, a fairly regular arrangement of a number of mountain systems in the form of arcs can be discerned. In general, these systems parallel the long axis of the islands and are strung between three irregular mountain knots in central Honshu (Gifu node), central Hokkaido and central Kyushu. In few places is movement easy between the Pacific and Sea of Japan coasts.

The two major mountain systems of western Japan, which parallel each other between central Kyushu and central Honshu, are of different character. The Chūgoku range, which forms the backbone of the long peninsular extension of western Honshu, has rounded contours and elevations seldom above 3,000 ft. The range is sufficiently high, however, to block most weather extremes from the Sea of Japan. South of the Inland sea a forbidding range having a steep northern face and three interruptions by arms of the sea runs from central Kyushu (Kyushu mountains) through Shikoku (Shikoku mountains) and the Kii peninsula (Kii mountains) into central Honshu (Akaishi mountains) to terminate at the Fossa Magna. Highest elevations, exceeding 10,000 ft., are at its eastern extremity, with elevations decreasing to the west.

The Honshu knot is remarkable for its intricate pattern of fault lines, as shown in the presence of uplifted block mountains and waste-filled depressions, and a rich variety of volcanic forms. It is an area of over-all high relief and superb mountain landscapes. Northward from the knot three mountain systems trend through northern Honshu in echelon. The central Ōu range is continuous, but the westernmost (Echigo mountains in its southern part) and easternmost (Abukuma and Kitakami mountains) are interrupted by alluvial plains and fault basins.

Elevations generally decrease to the north, where Tsugaru strait stands between the land masses of Honshu and Hokkaido. The lower elevations and discontinuity of these ranges keep their modifying effect on climate less than that of higher ranges elsewhere. The relief of Hokkaido is compounded of subdued mountains and volcanic masses, the latter including the highest peaks of more than 6,000 ft. The arrangement of the mountains is in the form of an irregular knot, although two short ranges in the north central (Kitami mountains) and south central (Hidaka mountains) parts of the island can be singled out as the chief components of the mountainous core.

Volcanism.—The Japanese islands lie within a continuous zone of crustal instability that extends through the Pacific rim lands in the form of a horseshoe, from southeast Asia northward to the Aleutian Islands, then southward to the southern tip of South America. This zone is noted for its numerous earthquakes and volcanoes, giving rise to its popular name, the circum-Pacific ring of fire. Volcanism in Japan has produced more than 150 major volcanoes, about 40 of which are active but dormant, and widespread lava and ash plateaus. During recorded history many disastrous eruptions have occurred. Volcanic cones are among the highest elevations in Japan.

Japan is traversed by seven principal volcanic chains, most of which parallel and blend with the mountain ranges. The westernmost chain passes through the Ryukyu Islands and southern Kyushu. The terminal cone of Mt. Kirishima (5,577 ft.) is still active. On-take (3,668 ft.) in Kagoshima bay erupted violently in 1914 and is constantly discharging fumes. The Asō chain extends from central Kyushu eastward through northern Shikoku. Its chief feature is Mt. Asō (5,223 ft.), in Kyushu, which has one of the largest *calderas* in the world, measuring 71 mi. in circumference, 17 mi. from south to north and 10 mi. from east to west. A third chain passes through western Honshu and converges in central Honshu with the Fuji chain, which comes from the Bonin Islands, in a splendid rash of volcanic peaks. Towering above this largest collection of volcanic peaks in Japan is the lovely conical form of Fujiyama (*q.v.*) (Fuji-san; 12,388 ft.), the highest elevation in Japan. Also in the central Honshu group is Asama-yama (8,340 ft.), which ranks after Mt. Asō as the largest active Japanese volcano. Its cone is constantly emitting smoke and ash. Extending northward from central Honshu are two parallel volcanic chains. The easternmost has the highest and most numerous peaks: Mt. Chausu (6,289 ft.), Mt. Azuma (7,654 ft.) and Mt. Bandai (5,968 ft.) are best known. Mt. Chōkai (7,316 ft.) is the highest volcano in the westernmost chain. The northernmost volcanic chain passes through central Hokkaido, the Kuril Islands and Kamchatka. It gives rise to several important volcanic masses in Hokkaido found in the Akan National park to the east and the centrally located Daisetsuzan National park.

Another feature of the volcanic zone is the thousands of natural hot springs to which tourists flock for relaxation and medical treatment. Earthquakes are of disturbing frequency. There is an average of four seismic disturbances daily, not counting many so slight that they can be detected only by delicate measuring instruments. The typical tremor is a matter of momentary agitation that may cause wooden houses to sway. Severe shocks, which occur at the average rate of once every six years, cause fearful destruction of life and property. The southern shores of Honshu and Shikoku were formerly most subject to earthquakes, but the centre of seismic disturbance seems to have shifted to central and northeastern Honshu and Hokkaido.

Rivers and Lakes.—Abundant precipitation gives birth to more than 100 main Japanese river systems whose waters run from the mountainous interior to the sea. It is the vigorous erosive force of runoff, streams and rivers that modifies mountain topography and builds the alluvial plains and mountain basin floors on which Japanese life centres. Japanese rivers (*kawa* or *gawa*) all have short courses and small drainage basins. Only three rivers exceed 200 mi. in length: the Shinano (229 mi.) of northwestern Honshu, the Ishikari (227 mi.) of western Hokkaido and the Tone (200 mi.) of the eastern Kwanto (Kantō) plain. The Tone river also has the largest drainage basin (6,085 sq.mi.). River beds are commonly higher than the level of the lowlands through which they pass in their lower courses, because of heavy stream sedimentation and confining natural or artificial levees. As a result, a rapid build-up of stream volume, such as often occurs during the typhoon season, results in dramatic and destructive floods. Rivers furnish two-thirds of the irrigation water used in agriculture, most of the water for industrial and household use, and are an important source of hydroelectric power. (See *The Economy: Production*, below.)

Numerous lakes (*ko, numa* or *ike*) are scattered among the mountains and plains, but they are mostly small and of limited utility. Some lakes support small-scale fishing and have scenic and recreational value. The largest lake is Biwa (Biwa-ko, *q.v.*) in central western Honshu. Other well-known lakes are Imba (Kwanto plain), Suwa and Nojiri (central Honshu), Chūzenji (Chūzenji-ko, *q.v.*), Inawashiro, Tazawa and Towada (northern Honshu) and Tōya, Shikotsu and Akan (Hokkaido).

Plains.—The bulk of the Japanese population lives in many small, dispersed coastal lowlands (*heiya*) and interior basins whose combined size is only one-fifth of the land surface. The largest single expanse of relatively level land, the Kwanto plain of the Pacific coast of central Honshu, is only about 5,000 sq.mi. in extent. The largest, most productive and most populated plains are found along the seacoasts. Most of them have been formed by the deposition of earth materials transported seaward from the mountainous interior by swiftly moving streams and rivers. Conspicuous exceptions are surfaces of marine-abrasion origin, to be found in northeastern Honshu and southeastern and northern Hokkaido. In the interior there are only a few small, scattered basins, mostly in central and northern Honshu. Recent uplift has created terraces in many places. In the Kwanto plain, where terraces abound, older alluvial surfaces have been uplifted, reworked by erosive forces and their sediments redeposited by stream action in a new location as alluvium. Natural terraces have limited fertility for agriculture and few supplies of surface water. At the other extreme, low-lying portions of many coastal plains are poorly drained, have high water tables and pose problems to suc-

cessful human occupancy unless drainage works can be instituted.

The most important plains, from the standpoint of size and economic function, are located along the Pacific coast of central Honshu, north and west of the Kwanto plain. The key lowland of northeastern Honshu is the Sendai plain and its northern continuation, the Kitakami river valley, which knifes through the interior between the Ōu and Kitakami mountains. Westward from the Kwanto plain many small plains hug the coast as far as the large Nōbi plain, just east of the Kii peninsula. The Nōbi lowlands continue along the western shores of Ise bay. The shores of the Inland sea are also dotted by small plains in Honshu, northeastern Kyushu and northern Shikoku. The largest of these, the Settsu (Ōsaka) plain, is at the Inland sea's eastern extremity. Only slight topographic irregularities separate it from the interior Kyōto basin to the northeast.

In Shikoku the lowlands bordering the Inland sea are supplemented by the Yoshino river valley in the northeast and the Kōchi plain in the extreme south central portion. Kyushu's plains are best developed in the island's western (Tsukushi plain) and northern sectors. Southern Kyushu is overlain by thick volcanic-ash plateaus. Among the many small plains that line the Sea of Japan coast line of Honshu, centrally located Echigo plain, the largest, and Toyama plain are outstanding. In Hokkaido the Ishikari plain, in the west, is the largest plain; other level expanses are found in the southeastern (Tokachi and Kushiro-Nemuro plains) part of the island.

3. Climate.—Japan has a latitudinal span of 15°, hence it is not surprising that there are significant regional differences in temperature and precipitation between the two extremes of humid, subtropical Kyushu and humid, continental Hokkaido. Surrounding oceanic bodies exert a modifying influence on seasonal temperatures, and countless variations in climatic pattern are produced by relief differences. The broad outlines of the Japanese climate are set by the summer and winter monsoons. During the winter the intense cold of the Asian interior creates a vast high-pressure area over eastern Siberia. The presence of a low-pressure area over the western Pacific accentuates the flow of dry, cold air eastward. Air masses pick up moisture as they cross the Sea of Japan and deposit it as rain or snow over the Japanese islands. During the summer the pressure gradient is reversed and moist, cool Pacific air moves from the south and east across Japan toward the Asian low-pressure area. The summer monsoon brings early summer rains. The monsoon pattern results in colder winters and wetter summers than might be expected in Japan's latitudinal and marine location. Frequent weather changes are brought by the passage of mid-latitude cyclonic storms, and during late summer and early fall Japan is visited by destructive typhoons, violent rotary storms of tropical origin. Southwestern Japan suffers the worst typhoon damage.

Temperature.—Low winter temperatures in Japan are accentuated by penetrating northwest winds. From December through February the temperature is below freezing in many localities, especially in Hokkaido and northern Honshu. At Asahigawa (central western Hokkaido), the January mean temperature is 14° F., and the mean minimum temperature, 3°. Temperature rises gradually to the south, with little difference between the Pacific and Sea of Japan coasts. During January, the coldest month, Tokyo has a mean temperature of 37°; Ōsaka, to the southwest, with a winter climate typical of the Inland sea basin, is two degrees warmer. Southern Kyushu is the warmest part of Japan during the winter, with a January mean temperature of 45°.

Japan's long latitudinal stretch has little bearing on summer air temperatures, although marked differences occur with elevation. Everywhere temperatures on the plains are high and are accompanied by high relative humidity. Relief comes with the cooler nights. Hokkaido is cooler than areas to the south. Some examples of mean temperatures for August, the hottest month, for scattered localities are: Kagoshima 79°; Ōsaka 81°; Tokyo 77°; and Sapporo 69°. In northern Japan spring and autumn, transitional periods between the two extreme seasons, are of shorter duration than in southern Japan. The frost-free period ranges from 120 days in Hokkaido to twice that number in southern Kyushu.

Precipitation.—No part of Japan is deficient in its total supply of atmospheric water received in the form of rain or snow. Maximum precipitation generally occurs during the early summer and minimum precipitation during winter in keeping with the monsoon pattern. The major exception is the Sea of Japan coast, where winter precipitation, mostly in the form of snow, exceeds that of summer. It has the largest snow accumulation in Japan. The summer rainy period, known as the *baiu* or "plum rain" because it commences when plums are ripening, continues for much of June and July. Torrential rains accompany late summer and early fall typhoons. Rainfall patterns on a national scale are very irregular because of topography, but most of Japan receives precipitation in excess of 40 in. annually. Western Hokkaido, eastern Honshu and the Inland sea region receive 40–60 in. annually. Heavier amounts occur in central Honshu and along the Sea of Japan coast. In these localities, 100–120 in. annually is not uncommon.

Snow falls on most parts of Japan in winter, but the amount and duration vary greatly. Snow blankets Hokkaido, northern Honshu, the Sea of Japan coast and the mountainous interior of Honshu from November to April. Winter weather in areas of heavy snowfall is marked by successive overcast or cloudy days. However, brighter weather is more the rule in such favoured areas as the Inland sea borderland, where the entry of moisture-bearing winds is blocked by mountain ranges.

4. Vegetation.—Japan's latitudinal extent and climatic and topographic diversity are reflected in the composition and geographic arrangement of its flora. A distinct feature of the flora is the great variety of forms; approximately 9,000 species of vascular plants alone have been identified. The flora can be described as essentially a temperate-zone type with boreal forms present in northern Japan and at higher elevations to the south and subtropical forms present in the southern extremes. The temperate forms are closely related to those of the Yangtze valley of central China. Long centuries of landscape modification by the Japanese has upset the natural order on a vast scale. In the plains and cultivable hills, native species have been eradicated or reduced in number and new, sometimes imported, species have taken their place. In similar fashion, continuous cutting of native trees and shrubs and purposeful reforestation with favourite commercial species have changed the complexion of the mountain flora. For purposes of simplicity, the following discussion of Japan's floral zones is limited to the dominant vegetation, trees. More than 1,100 species of trees and shrubs are involved; they can be grouped into three broad geographic classifications: subtropical, temperate and boreal zones.

The subtropical zone, which includes most of Kyushu, Shikoku and Honshu as far north as the Kwanto plain, has an evergreen vegetation. This flora requires an average annual temperature of 55° to 70° F., so at elevations above 2,500 ft. within the zone it is replaced by a more northern type of deciduous and mixed forest stand. Oaks, represented by several species, and members of the laurel and tea families are most prevalent. Banyan (*Ficus benghalensis*), palms (*Trachycarpus* and *Rhapis*), cycads, camphor (*Cinnamomum camphora*) and other tropical elements are found in southern Shikoku and Kyushu. Small groves of tall bamboo add a graceful note to the landscape. Such tropical food crops as banana, citrus fruits and sugar cane are grown.

The temperate zone includes central Honshu except for elevations over 5,400 ft., northern Honshu and the western one-third of Hokkaido. Included are areas whose average annual temperature is between 43° and 55° F. Primary floristic components of the predominantly mixed forest are maples, ash, birch, beech, poplar, chestnut, horse chestnut and other deciduous trees. The empress tree (*Paulownia*) is a common deciduous tree of the cultivated lowlands. Among the zone's many valuable conifers are Japanese cedar (*Cryptomeria japonica*), cypress, hemlock, umbrella pine (*Sciadopitys verticillata*), false arborvitae, yew and white pine (*Pinus pentaphylla*). Black pine (*P. thunbergi*) and red pine (*P. densiflora*) occur in dense stands in the hills, low mountains and along sandy shores.

The boreal zone is best developed in central and eastern Hokkaido and at elevations between 5,400 and 8,400 ft. as far south

as central Honshu, where the average annual temperature is below 43° F. Forest stands are dominated by such conifers as fir, spruce, larch, hemlock and Japanese cedar. These, together with such broadleaf trees as birch, alder and dogwood, generally occur at elevations over 1,000 ft. There is a great variety of broadleaf trees, mostly at lower elevations: oaks, maples, linden, ash, elm, walnut, cherry and magnolias. Above timber line in the high mountains of central Honshu and points farther north, azalea, dwarf species of birch and bamboo and alpine plants make an appearance. The Manchurian dwarf pine (*P. pumila*) forms dense carpets on high ridges. In southeastern Hokkaido large bogs in the lower reaches of several rivers have a distinctive flora.

The luxuriant and diversified forests, whether the cool green of the conifers or the resplendent fall colours of the deciduous trees, are one of Japan's most famed natural sights. The Japanese have used native and imported flowering plants, trees and shrubs to advance the art of gardening to a high degree of perfection, stressing maximum effect in minimum space through judicious plant arrangement. Japanese success in the cultivation of chrysanthemum, flowering cherry, wisteria, camellia, azalea, iris and a host of other domesticated plants is unsurpassed. The cultivation of dwarf trees in pots, *bon-sai* (*q.v.*), is another Japanese gardening art. Private and public gardens are high lights of town and city. (*See* JAPANESE GARDEN.)

Marine flora can also be subdivided into tropical, temperate and boreal classifications. The tropical zone, as a result of the presence of warm currents, extends as far northward on the Pacific coast as Tokyo bay, but it barely penetrates into the Sea of Japan.

5. Animal Life.—Japan has a rich fauna that, like the islands' climate and vegetation, shows strong regional variations with latitude and altitude. Most Japanese land animals are temperate-zone species, blending with subarctic types in Hokkaido and tropical types in Kyushu and southern Shikoku. Hokkaido fauna, in general, is most distinctly different in detail from that of the rest of Japan. Close resemblances to species in China, Korea, Siberia and southeast Asia suggest that many Japanese animals may have originally reached Japan from the continent. Marine fauna can also be subdivided into northern, central and tropical classifications, although the tropical zone extends much farther north than on the land. Warm-water species commonly accompany the Japan current as far north as the Bōsō peninsula outside Tokyo bay.

About 140 mammals have been identified in Japan and adjacent waters. The orders best represented are the rodents, carnivores and cetaceans (whales, dolphins and porpoises). There are numerous species of shrews, moles and bats and one primate, the Japanese macaque (*Macaca fuscata*). The carnivores include bears, badgers, otters, ermines, mink, martens, raccoon dogs, foxes, wolves, eared seals and walrus. Wild pigs, deer and deer antelopes are also found. Japanese seas are inhabited by more than 30 different cetaceans.

Japan has about 450 species of birds, of which more than one-third are water birds. Shore birds, gulls and auks are most fully represented among these with 95 species. Also numerous are grebes, albatrosses, shearwaters, tropic birds, cormorants (sometimes trained by fishermen to catch smelt or ayu), herons, storks, glossy ibises, ducks, geese, swans and cranes. Other species include vultures, hawks, falcons, grouse, pheasants, quail, ptarmigan, pigeons and doves, cuckoos, owls and woodpeckers. There are about 150 songbirds.

Thirty species of reptiles have been identified, including sea turtles, fresh-water tortoises, sea snakes and a large number of lizards. Among the snakes, only two rarely encountered species are poisonous. The largest snake, the Japanese rat snake (*Elaphe climacophora*), attains a length of five feet but is harmless. A colony of albino snakes of this species is found in Yamaguchi prefecture. Amphibians are well represented by many toad, frog and newt species. In the mountain streams of Kyushu and western Honshu lives a species of giant salamander (*Megalobatrachus japonicus*), which is one of the largest living amphibians, attaining a length of five feet.

The seas around Japan swarm with fish, some strictly native and others migratory species from as far away as the cold waters of the Sea of Okhotsk and the equatorial waters of the Indian ocean. The chief fish of commercial value taken from the sea include salmon, sardine, sea bream, yellowtail, horse mackerel, tuna, trout, herring, shark, flying fish, gray mullet, smelt and cod. There are also many species of fresh-water fish; carp, goldfish and eels are raised commercially. (*See* also *The Economy: Production: Fisheries*, below.)

Trout are fairly common in Japanese rivers and lakes which are also the home of fresh-water crabs and crayfish. However, most crustaceans, such as shrimps and prawns, are found in the sea. A giant crab (*Macrocheirus kaempferi*) with a limb spread of ten feet visits Japan from southeast Asian waters. There is no lobster along the coasts of Japan, but there are various species of lobster-like crustaceans (*Palinurus* and *Scyllarus*) that are highly prized as food. Nearly 1,200 marine mollusks and many echinoderms, such as sea urchins and starfish, are also found in Japanese coastal waters. A remarkable number of species of clams, oysters, abalone and sea snails are used for food; both mussels and oysters are raised commercially for food, and the pearl oyster is raised for the production of cultured pearls. Japan is not rich in coral or sponges, although extensive coral beds are found off the western coast of Kyushu and the southern coast of Shikoku.

Among the worms, the most notable and troublesome representatives are the all too numerous parasites that prey on man and domesticated animals: roundworms, tapeworms, liver fluke and distomes. Japan has a good cross section of the insect orders; some of their more striking members are tropical butterflies and beetles. The showy destructive beetle known as the Japanese beetle (*q.v.*) in the United States is an undistinguished dull colour in its native land and is kept in check by insect parasites. In addition to the true silkworm, Japan has many large, colourful moths. Wasps, bees, hornets, flies, mosquitoes, ants and cockroaches are much in evidence. Fireflies, dragonflies, grasshoppers, crickets, mantes and cicadas abound during the summer. Japanese spiders range from a giant species to one of minute dimensions.

II. GEOGRAPHIC REGIONS

Based upon political subdivisions (prefectures), Japan is conventionally divided into the eight following districts or regions, each having an over-all similarity in its physical and human geographic conditions.

1. Hokkaido.—A land of severe continental climates, rugged mountains and volcanic masses, Hokkaido was not colonized for the most part until the 1870s and still has a pioneer-era atmosphere. Agriculture, based on U.S. models, is highly commercialized and specialized. Hokkaido is Japan's most important stock grazing and dairying area, is a leader in forestry and ocean fishing and has the second largest coal production. Most natural resources move southward to Japan's industrial belt, giving Hokkaido's economy a semicolonial flavour. Industry is restricted to Muroran (mainly iron and steel) and a few other centres. Sapporo (*q.v.*), in the large and heavily settled Ishikari plain, is the island's urban centre.

2. Tohoku or Ōu.—A region of northern Honshu, consisting of Aomori, Akita, Yamagata, Iwate, Miyagi and Fukushima prefectures. Climatically transitional between Hokkaido and subtropical Japan, and topographically dominated by three parallel mountain systems, Tohoku is a predominantly rural region. Some sections are among the poorest and most primitive in Japan. Its large farming population occupies the coastal plains and several large interior basins. Tohoku agriculture is limited to one (summer) crop because of deep snow accumulation, poor drainage and low winter temperatures. It produces large rice surpluses and much silk. Forestry, fishing and mining (petroleum, coal, iron ore and copper) flourish, but production moves to cities and industries outside the region. Sendai is the regional centre.

3. Kwanto.—Consists of Ibaraki, Tochigi, Gumma, Saitama, Chiba and Kanagawa prefectures, and the metropolis of Tokyo. Formed by the Kwanto plain and its mountainous borderlands, the Kwanto (Kantō) region has a split personality. Its eastern half, which suffers from poor drainage, contains the many water bodies of the Tone river system, Kasumiga lake and marshes and lagoons

in abundance. It remains essentially agricultural with the exception of such industrial centres as Mito (*q.v.*) and Utsunomiya. The western half of the region is elevated and terraced, and is among Japan's most urbanized and advanced industrial-commercial areas. Tokyo-Yokohama constitute the nucleus of Japan's largest population cluster, around Tokyo bay and spreading into the interior. Interior sections are noted for their intensive, city-market-oriented agriculture and silk production.

4. Chūbu.—This large region of central Honshu has three distinct geographic personalities. First, the Sea of Japan coastal portion (Niigata, Toyama, Ishikawa and Fukui prefectures) is one of Japan's most highly specialized rice-growing areas, producing great rice surpluses. Some industry based on petroleum, natural gas and hydroelectricity has developed. Niigata and Kanazawa are outstanding cities. Second, in the mountainous interior (Nagano, Yamanashi and Gifu prefectures) life centres in a series of elevated mountain basins set amid the formidable terrain. There is the heart of the silk-producing and silk-reeling industry. Fruits and other agricultural specialties are grown, rich forests are worked and rivers have been dammed to produce Japan's largest supply of hydroelectric power. Third, the Pacific coastal strip (Shizuoka and Aichi prefectures) is highly developed industrially, centring on Nagoya and smaller industrial cities. It has superb rail transportation and is noted for its citrus-fruit, tea and vegetable growing. Shizuoka ranks after Nagoya as the regional service centre.

5. Kinki.—In central western Honshu, consisting of Shiga, Kyōto, Ōsaka, Hyōgo, Nara, Wakayama and Mie prefectures, Kinki is one of Japan's most historic and densely settled districts. Regional life centres on the great urban clusters of Ōsaka and Kyōto. Greater Ōsaka ranks as one of Japan's two largest industrial-commercial nuclei and is second only to greater Tokyo in size. Elsewhere, agriculture of an intensive, multiple-crop type is the prevalent economic mainstay, with forestry in the mountains and fishing along the coasts. Japan's largest lake, Biwa-ko, the rugged Kii mountains and the heavily indented Fukui coast line are outstanding physical features.

6. Chūgoku.—The Sea of Japan coastal portion (Shimane and Tottori prefectures) of this region of western Honshu are its "shady side," so called because of its typically cold, snowy winter weather. It is relatively remote from the large centres of western Japan and has a simple farming-forestry-fishing economic base. The Inland sea side, or "sunny side" (Okayama, Hiroshima and Yamaguchi prefectures), has Japan's most pleasant winter weather and is a progressive, prosperous and densely settled region. It is part of the historical "cradle of Japanese civilization," the Inland sea borderlands, and has a modern economy based upon a thriving, diversified agriculture and industry that is dispersed among many of the region's cities. Hiroshima (*q.v.*) is the regional centre.

7. Shikoku.—Composed of four prefectures (Kagawa, Ehime, Tokushima and Kōchi), Shikoku is divided physically and culturally by the east-west Shikoku mountains. The northern plains resemble their Chūgoku counterparts across the Inland sea in physical and economic qualities. Takamatsu (*q.v.*), in the northeast, is the leading Shikoku city. Southern Shikoku is isolated and dependent upon farming, forestry and fishing.

8. Kyushu.—Consists of Fukuoka, Saga, Nagasaki, Ōita, Kumamoto (*q.v.*), Miyazaki and Kagoshima prefectures. Like neighbouring Shikoku, Kyushu has two contrasting faces. Northern Kyushu is one of the most highly industrialized parts of Japan, specializing in heavy industry, has the nation's largest coal production and is very urbanized. Fukuoka and the old port city of Nagasaki (*qq.v.*) are its chief cities. Plains in central western Kyushu, noted for their large rice surpluses and general agricultural output, are important as food suppliers to the northern cities. Kumamoto is the main service centre for this central agricultural zone. Tropical southern Kyushu, dominated by extensive ash plateaus and volcanic peaks, is one of Japan's most isolated, poorest and most tradition-bound regions. It rests on a primitive farming, fishing and forestry economic base. Kagoshima provides urban leadership for the area. (J. D. Ee.)

III. THE PEOPLE

The following discussion of the physical characteristics, language and writing, and religions of the Japanese people provides an introduction and a background for the analysis of social, cultural and institutional changes and developments considered in their historical context under *History*, below.

1. Physical Characteristics.—Japan was populated primarily from the mainland, and the majority of the people belong to the Mongoloid (*q.v.*) stock and exhibit few traits by which they can easily be distinguished from various other Mongoloid groups. There are minority elements in the population that represent mixtures with the aboriginal Ainu of northern Japan and with strains from southeast Asia, Korea, Europe, etc.; but there has been relatively little admixture for 1,000 years and considerable homogeneity has been attained. It has been estimated that the majority are genetically closest to Koreans, the Tungus tribes and groups in northern China. (*See* Races of Mankind.)

Most Japanese tend to have more body and facial hair than other Mongoloid groups, and skin colour is more often brown than yellowish. Body build tends to be sturdy. While the Japanese are classed among short-statured peoples, rather remarkable changes in physique occurred after 1900. Studies made by the government revealed that by the early 1950s the average stature of the male population had risen to nearly 5 ft. 4 in. (163 cm.), an increase of almost 3 in. over the conscript of 1900. The change has been attributed to improved diet and medical care, exercise and freer circulation resulting from the decrease in the habit of sitting on the floor with the legs buckled under. Paralleling tendencies in other industrialized nations, the urban population is, on the average, taller than the rural. Japanese wrestlers have exceptional physiques. Selected in early youth for size and proficiency, they are often at least 6 ft. tall and weigh more than 300 lb. Most of their size is attributed to selection and specialized physical training, although some cases reputedly show traces of acromegaly.

Of minority ethnic groups in Japan, the Ainu constitute the most notable. They are distinctive in physical type as well as culture and language. Although their origin is unknown, they show traits suggesting Caucasoid affiliation, and have sometimes been referred to as the "hairy Ainu" because of their abundant body hair (*see* Ainu).

2. Language and Writing.—The Japanese language has not been conclusively related to any other, although some scholars believe it may show affinities to Korean and, possibly, to the Altaic group (Mongolian, Manchu and Turkic families). Others suggest Polynesian or Malaysian affinities. It is quite different from Chinese, from which, however, many words have been borrowed (*see* Japanese Language). The Ainu tongue has not been related to Japanese or any other language. Writing originally was borrowed from China in the form of the Chinese idcographs, and for centuries a scholarly prestige value was attached to the ability to write in classical Chinese. Gradually, however, a Japanese system of writing was developed in which Chinese characters were abbreviated and used for phonetic value only—not for meaning. These syllabaries or *kana*, originally consisting of about 50 syllables, greatly stimulated the development of literature from the 9th century on (*see* Japanese Literature). Two such systems, the *hiragana* and *katakana*, are used in modern times, but are employed in association with the many *kanji*, or Chinese characters, which can be pronounced several different ways; *e.g.*, as pure Japanese or in modified Chinese. Traditional-style Japanese is written in columns from right to left. (R. F. Sr.)

3. Religion.—There is no single dominant religion in Japan; several religious and quasi-religious systems exist side by side. National and communal cults have been traditionally regarded as the domain of Shintō, a public and private morality has been based on Confucianism and spiritual and metaphysical problems have been the concern of Buddhism. The Code of Warriors (Bushidō; *q.v.*) was the guiding principle of the warriors during the feudal period, and the masses have always been influenced by an unorganized "folk" Shintō, related to but not altogether compatible with the institutionalized form.

While these systems have never lost their identities, each has been deeply influenced by the others. To complicate the matter further, in the 19th century the Japanese government recognized 13 Sect Shintō denominations outside traditional Shintō, and after World War II numerous "New Religious Cults" emerged.

According to department of education reports, in the second half of the 20th century Shintō, Buddhism, Christianity and New Religious Cults claimed memberships totaling more than the total population of Japan. This reflects the accepted pattern of plurality of religious affiliation among the Japanese, who find no contradiction in paying homage to Buddhist and Shintō deities alike. Traditionally, a person conforms to the beliefs and practices of his family. The average home has both the Shintō family shrine (*kami-dana*) and the Buddhist family altar (*butsu-dan*). In addition to family rites, pious Japanese visit their tutelary Shintō shrines twice a month; others do so only on special festive occasions. On holy days many Japanese also visit the Buddhist temples to which their families belong. As the family cemetery is usually taken care of by the Buddhist temple, and funerals and memorial services are performed according to Buddhist rites, members of the family visit the cemetery and temples, as well as ask a Buddhist priest to read passages from a sacred scripture (sutra) at the family altar, on the anniversaries of deceased relatives. When a child is born, the infant is taken to the Shintō shrine to receive the blessing and protection of the tutelary deity. In the modern period, the observance of the traditional religious practices has broken down considerably, especially among the urban populations, but the pattern of plural belonging has persisted.

Early Period.—Very little is known about the religious beliefs and practices of the inhabitants of the Japanese islands in the prehistoric period, but the earliest Japanese religion had much in common with the shamanism (*q.v.*) of northeastern Asia. A Chinese chronicle of the 3rd century A.D., not altogether reliable, mentions that a female shaman ruler, Pimiku (in Japanese Himiko, meaning "sun daughter"), reigned over one of the kingdoms in Japan; she "was old and unmarried, and had devoted herself to magic." Also according to the Chinese records, when Queen Himiko died a great mound was raised over her, and more than 1,000 of her male and female attendants followed her in death. She was succeeded by a young female relative named Iyo or Ichiyo. Scholars have not agreed as to where Himiko's kingdom was situated.

The religion of the early Yamato clans was a simple polytheistic nature worship, in which each clan (*uji*) also venerated its own special deity (*uji-gami*). Among all the clan deities, the sun-goddess, the deity of the imperial clan, held a special position of honour. Gradually, simple shrines were constructed for the performance of religious rites consisting of obeisance, offerings and prayer. While the early Japanese were not concerned with moral sins, they were preoccupied with ceremonial defilement; thus the most important feature of the early Japanese religion was purification, which was achieved by exorcism, cleansing and abstention. This religion was later called Shintō or "the way of the gods," and most of the characteristics of the early Shintō have been preserved to a significant degree in the present-day religion.

Beginning in the 4th and 5th centuries, when Japan came under Chinese influence, Japanese society, based on primitive communal rules and authorities, accepted Confucian ethical principles and Confucian social and political theories (*see* Confucianism). Thus, although the traditional paternalistic authoritarianism was retained, interpersonal relationships came to be regulated in terms of such concepts as filial piety, the veneration of ancestors and reciprocal rights and obligations between superiors and inferiors. Also, Japanese indifference to metaphysical speculations gave way to the acceptance of many philosophical concepts from Taoism (*q.v.*) and the yin-yang system. Numerous kinds of divination and witchcraft, palmistry and fortunetelling, too, were introduced from China, and the influence of astrologers and sorcerers was strongly felt, even in court life.

Introduction of Buddhism.—In 538 or 552 one of the Korean kings presented to the Japanese court a Buddhist image, copies of Buddhist scriptures and liturgical ornaments, and from this date Buddhism in Japan is usually said to have begun. The Chinese form of Buddhism that reached Japan was the bearer of civilization, blending within it the spiritual wisdom and learning of India and China, with well-organized ecclesiastical institutions and highly developed arts and architecture. (*See* Buddhism.)

After an initial period of resistance on the part of Shintō priestly families and conservative aristocrats, Buddhism gradually captured the Japanese. Many scholars, priests, nuns and ecclesiastical artists were welcomed from China and Korea. While the majority of the people did not understand or appreciate the subtleties of Buddhist doctrine, they were dazzled by the arts, ceremonies and architecture of Buddhism, and they hoped to accumulate merit in the life to come by contributing money, land and buildings to the monastic orders. The relatively rapid expansion of Buddhism in Japan was due in large part to the support it received from the court.

By far the most famous patron of Buddhism was Prince Shōtoku Taishi (see *History*, below), whose religious policy left lasting marks on Japanese Buddhism. The second of his Seventeen Articles reads: "Revere the Three Treasures—Buddha, the Law and the Holy Community—for these are . . . the supreme object of faith in all countries." Shōtoku was also fully aware of the political significance of Buddhism as a stabilizing and unifying force for the nation. With active encouragement and support from the government, Buddhism prospered, and Buddhist temples served as religious, educational and philanthropic institutions. The government went so far as to issue an official decree in 685 ordering the establishment of Buddhist family altars in all households.

Nara Period.—During this period, the *Records of Ancient Matters* (*Kojiki; q.v.*) and the *Chronicles of Japan* (*Nihongi; q.v.*) were compiled from oral traditions; these chronicles have remained the semisacred scriptures of Shintō. Both Shintō and Buddhism were regarded as important departments of the state, and the government controlled the appointment of ecclesiastics. There were six schools of Buddhism during this period: the Jōjitsu (Sautrantika), Kusha (Sarvastivada), Sanron (Madhyamika), Hossō (Yogacara), Kegon (Avatamsaka) and Ritsu (Vinaya). The first two are Theravadin and were studied only as intellectual disciplines; the last was a nondoctrinal study of monastic rules and ordination rites. Doctrinally important were the three Mahayana schools, Sanron, Hossō and Kegon. Although lofty philosophical systems intrigued some studious monks, these were ignored by pious followers. Many people were interested in the reading of certain scriptures and in charitable works that they believed would bring rewards both in this world and in the next life, and they were undiscriminating in their attitudes toward Buddhism, Shintō and Confucianism. Confucianism was often characterized as the "Outer Gate," a steppingstone toward the "Inner Gate" of Buddhism. Shintō deities were enshrined within the compounds of many Buddhist temples. Also during the Nara period, under the leadership of En-no-Gyōja (d. 701?), whose religion combined folk Shintō, Buddhism and Taoism, emerged the order of Mountain Priests (Shugen-dō), destined to play an important role in the subsequent history of Japanese religions.

In the capital, however, Buddhism exerted a decisive influence. The close affiliation of Buddhism and the court resulted in the involvement in political intrigues of rich and powerful monks. The daring attempt of the priest chancellor Dōkyō to usurp the throne failed, but the incident illustrates the power of the Buddhist hierarchy of 8th-century Japan.

Heian or Fujiwara Period.—Two schools of Buddhism prospered in this period, the Tendai school, founded by Saichō or Dengyō Daishi (767–822), and the Shingon school, founded by Kūkai or Kōbō Daishi (d. 835). Saichō tried to synthesize the doctrines of the Tendai (*T'ien-t'ai* in Chinese), Zen (*Ch'an* in Chinese) and the esoteric school of Buddhism within the doctrinal framework of the Lotus *sutra*. He envisaged the monastic centre at Mt. Hiei, not far from Kyōto, as the religious capital of the nation. Kūkai dedicated his life to the establishment of the esoteric Shingon (*Ch'en-yen* in Chinese) school of Buddhism in Japan. He was a great synthesizer, and his school, embracing both lofty philosophy and magical incantations, influenced the courtiers in Kyōto, as well

as the masses in remote areas. Even the Tendai school, shortly after the death of Saichō, came under the influence of the Shingon and became *de facto* another esoteric school.

Kūkai is credited with the theoretical formulation of Ryōbu ("Two Aspects") Shintō, a pattern of coexistence or amalgamation of Shintō with Buddhism. A similar attempt, called Ichi-jitsu ("One Reality") or Sannō Ichi-jitsu Shintō, was made by the Tendai school. Both of them interpret Shintō deities as Japanese manifestations of Buddha, finding no contradiction between Buddhism and Shintō. Also, the order of Mountain Priests allied itself with these Buddhist schools and came to be known as the Shingon Shugen-dō and Tendai Shugen-dō, respectively. In the course of time the monastic centres at Mt. Hiei and Mt. Kōya (founded by Kūkai, 50 mi. S. of Kyōto) became rich, powerful and corrupt, overshadowing all the old Buddhist institutions at Nara and the historic Shintō shrines.

Spiritual Awakening During the Kamakura Period.—The Kamakura period is noted for a number of great individuals who exerted a far-reaching influence on the religious life of the people; *e.g.*, Hōnen and Shinran, who advocated Amida pietism (*see* AMITABHA); Dōgen, who systematized Zen (*q.v.*) Buddhism; and Nichiren, a patriotic prophet and the founder of the Nichiren sect. Among the warriors the Bushidō (*q.v.*) became the guiding principle. There was also a movement to restore the ancient glory of Japan. In the political domain this resulted in a short-lived restoration of the imperial rule (1334–35), and in the religious domain it gave rise to the Shintō movements in reaction against the Buddhist domination of the Heian period.

Social Disintegration and Religious Strife.—The Ashikaga period (1338–1573) was marked by a series of natural calamities and political rivalries, but, on the other hand, it also witnessed the development of the lyric drama (nō) and the tea ceremony. Cultural leadership was maintained by Buddhist monks, especially those of Zen Buddhism, which became a semiofficial state religion.

Social disintegration during the 16th century was greatly accentuated by a series of conflicts among religious groups, such as the followers of Nichiren, the followers of Shinran (known then as the Ikkō or "One Direction" sect) and the monk soldiers of the Tendai monastic centre at Mt. Hiei. They engaged in bloody battles, invoking the holy name of Buddha, fighting for the political control of ecclesiastical jurisdictions. Buddhist institutions became in many instances dens of mercenaries and vagabonds, while many Shintō shrines were totally neglected.

The social and political chaos sent many ambitious young men to build their careers in foreign countries or engage in foreign trade, and foreign trade brought Europeans to Japan. Portuguese traders were soon followed by Roman Catholic missionaries; the Jesuit Francis Xavier (*q.v.*) and his companions arrived on Japanese shores in 1549. To the Japanese, Roman Catholicism, known as the *Kirishitan* sect, was not only a new religion but a symbol of European civilization. While some of the oppressed peasantry welcomed the gospel of salvation, the merchants and trade-conscious warrior lords regarded Catholicism as an important link between themselves and the expanding European continent. Some of them dispatched emissaries to the Vatican and to courts of Catholic princes in Europe.

Catholic missionary work was encouraged by Oda Nobunaga, who was trying to unify Japan and who, although he had no religious interest in it, used Catholicism to counteract the political strength of the powerful Buddhist institutions. Under Nobunaga's successor, Toyotomi Hideyoshi, the *Kirishitan* sect was greatly restricted. (See *History*, below.) However, according to one report sent to the Vatican, there were about 150,000 Japanese converts toward the end of the 16th century.

Tokugawa Period.—The initial policy of the Tokugawa feudal regime toward Roman Catholicism wavered because of two considerations: the Tokugawa rulers were afraid of the Catholic nations, which were expanding rapidly in Asia; at the same time, they did not wish to lose trade with Europe. Prohibition edicts were issued repeatedly against Japanese *Kirishitans*, but they were not thoroughly enforced. The severest blow came to the Roman Catholics in 1637, when thousands of Kyushu *Kirishitans* rebelled against the Tokugawa regime. When the uprising was quelled, Japanese Catholics were ordered to renounce their faith; if they did not, they were either tortured or shipped out of the country. Medieval Roman Catholicism in Japan was brought to an end.

Following the *Kirishitan* uprising, the Tokugawa regime took the far more drastic measure of "seclusion," cutting off all trade and other relations with foreign powers with the exception of the Netherlands. In order to exterminate Japanese *Kirishitans*, every family was required to belong to a Buddhist temple, thus making Buddhist priests *de facto* officials of the regime. While the Tokugawa rulers utilized religion, however, they did not trust the ecclesiastical authorities and took pains to minimize their influence. By rigidly stratifying the society into the four classes of warriors, farmers, artisans and merchants, the Tokugawas attempted to maintain permanent martial law to guard against insubordination. The Buddhist and Shintō ecclesiastics, however, considered apart from the hierarchical social order, were governed by the commissioner of temples and shrines.

In order to cement the feudalistic social structure, the Tokugawa regime depended on Neo-Confucianism (*see* CONFUCIANISM) as the guiding system of morality. What attracted the Tokugawas was the Stoic qualities in Neo-Confucianism, especially in the tradition of Chu Hsi (*q.v.*; Shushi in Japanese). To a regime that was trying to rationalize its existence, the Neo-Confucian ideology of heavenly sanction for the empirical social order was enticing. According to this paternalistic ethic, the superior was urged to be benevolent and just, while the inferior was expected to be obedient and to observe propriety. The Tokugawa rulers emphasized Neo-Confucian ethics as the cornerstone of education, which was systematized and propagated by such influential men as Kinoshita Jun-an, Arai Hakuseki and Muro Kyūsō. The cardinal virtues thus taught were filial piety, loyalty, obedience and the sense of indebtedness to one's superiors.

Neo-Confucian moral concepts also helped the development of the Bushidō, which, although it was never meant to be a religion, was greatly influenced by Buddhism and Shintō, as well as Confucianism, and developed a quasi-religious cult. In times of war Bushidō taught the capacity to stand on the verge of life and death, and in times of peace it taught the virtues of self-renunciation, frugality, obedience to superiors and benevolence. One of the best examples of Bushidō was the incident of the 47 retainers (*see* FORTY-SEVEN RŌNIN). During the greater part of the Tokugawa period the ruling regime managed to keep peace and civic order by indoctrinating the warriors, who were at the top of the social ladder, to be examples to the inferior classes.

The influence of Neo-Confucianism and Bushidō, however, was confined for the most part to the warrior class. Among the farmers, artisans and merchants, Buddhism and Shintō continued to maintain their strength. But Buddhism entered upon a period of spiritual decadence that promoted the gradual release of Shintō from its age-old domination. Greatly encouraged by the cooperation and assistance of Neo-Confucian scholars, Shintō leaders aspired to restore their faith as the national religion of Japan.

The institutionalization of religions during the Tokugawa period did not meet the needs of the common people, and the spiritual vacuum was filled by many popular, eclectic, semireligious movements. Among the oppressed peasantry, many crude apocalyptic messianic movements arose, attracting men and women with incantation, faith healing and the promise of this-worldly benefits. Some of these movements later developed into Sect Shintō denominations.

Modern Period.—The combined pressures of western nations after 1853 persuaded the Meiji government to lift the edict banning Christianity in 1873, and religious freedom was guaranteed in the constitution of 1889: "Japanese subjects shall, within limits not prejudicial to peace and order, and not antagonistic to their duties as subjects, enjoy freedom of religious belief" (art. 28). The modernization of Japan, however, was initiated by a paternalistic, authoritarian government, which attempted to revitalize Shintō as the national religion. Thus, the government separated Shintō from its close affiliation with Buddhism, and the department of Shintō was established to superimpose Shintō on the new Japan.

The movement known as Haibutsu Kishaku ("Extermination of Buddhism") reached its climax in 1870–71, when in the Toyama district alone 1,730 temples were reduced overnight to 7. Such extreme measures elicited severe criticism and a series of local riots, and the government had to soften its anti-Buddhist policy. The department of Shintō was replaced in 1872 by the ministry of religion and education, which tried to advocate patriotism, reverence for Shintō deities and the emperor cult. Gradually Buddhism recovered its strength and, in order to gain emancipation from the government policy, Buddhists, even though they were against the introduction of Christianity, fought for religious freedom.

With the lifting of the ban against Christianity, various branches of Christianity initiated vigorous evangelical and educational programs. The Russian Orthodox Church started its work in Hokkaido and gradually pushed southward to Tokyo; the Roman Catholic Church started in Kyushu and pushed eastward to Tokyo; the Protestant churches concentrated their efforts in various urban centres. In addition to missionaries there were a number of devoted Christians among the foreign teachers employed by the Japanese government, and some of them had a lasting influence on their students. W. S. Clark, president of Massachusetts Agricultural college, was invited to develop the Sapporo Agricultural school in Hokkaido, and through his personal influence developed many prominent Japanese Christian leaders. The Christian movement found a great inspiration in the person of Joseph Hardy Niishima (Niijima), who had risked his life to leave Japan before the official opening of the country, studied at Amherst (Mass.) college and returned to Japan in 1874 as the first native Christian minister. In 1876 Niishima founded the Dōshisha school, which remains one of the influential Christian universities. Protestants made notable contributions in education, especially among women, and in social and philanthropic works. In 1883 the Protestants reported 130 churches, 70 educational institutions and about 5,000 members.

At Kyushu, the stronghold of Roman Catholicism, many "hidden" Catholics had secretly observed their faith throughout the Tokugawa period. In 1884 Catholics in southern Japan alone numbered 24,656, most of them living in Kyushu, and in 1891 Kyushu had 27,909 Catholics out of the 44,505 in all Japan. At first the Paris Foreign Mission society was the only Roman Catholic agency working in Japan, but after 1904 the Spanish Dominicans, the German Society of the Divine Word, German Franciscans and Jesuits, Canadian Franciscans and Italian Salesians started missionary work in various parts of Japan.

Western science and philosophy also affected the religious situation in Japan. As early as the 1870s Mill, Darwin, Huxley and Herbert Spencer were introduced, and soon Voltaire and Rousseau began to attract Japanese students. A little later Kant, Hegel and Schopenhauer became the intellectual idols in the colleges. Japanese Buddhists found their greatest inspiration in Schopenhauer, Spinoza and Hegel.

In 1889, the year of the new constitution guaranteeing freedom of religion, the Japanese government banned religious instruction in schools, although "moral teaching, if applicable to all religions, could be given" (ordinance 12). The ministry of education intended to give a special advantage to Shintō, by interpreting it not as a religion but as a patriotic cult; henceforth education became the means of inculcating an ethnocentric nationalism and strengthening the emperor cult.

Following the spirit of the Imperial Rescript on Education (1890), the government required a course on moral teaching in public schools and advocated obeisance at Shintō shrines by adherents of all religions as a nonreligious patriotic cult. Encouraged by these measures, extreme nationalists began to attack Christianity on the grounds that it was incompatible with nationalism. Meanwhile, the government applied the new category of Sect (Kyōha) Shintō to popular messianic movements in order to separate them from Shintō, which was to be kept nonreligious and suprareligious. Between 1882 and 1908, 13 such denominations were recognized by the government.

In the period of social ferment that characterized the first quarter of the 20th century, the demands for universal suffrage, organization of labour and other such movements for social justice came to be suspect as Bolshevik-inspired; in opposition to them, the emperor cult, Shintō, *Yamato Damashii* ("Japanese spirit") and national ethics were trumpeted as ideological weapons against all "foreign" and "dangerous" ideas. In the 1930s all liberal thinking and expression, in religion, philosophy, art or culture, were condemned as dangerous.

In 1936 Japan joined Germany in an anti-Communist pact, and the government began to press all religious bodies to cooperate with the national aim to extend the imperial rule abroad. The Roman Catholic Church, which previously had taken the position that obeisance at Shintō shrines was a religious ceremony, changed its stand under pressure. All religious bodies were asked to send their representatives to the front to pray for Japan's victory. In 1939 the Religious Bodies law was enforced, by which the government could control all aspects of religious organizations, and Buddhism and Christianity were urged to unite their respective denominations. Further, a Religious league composed of Christian, Buddhist and Sect Shintō federations was organized in 1941 to provide a spiritual bulwark for the nation.

After World War II.—Japan's surrender to the Allied powers in 1945 was followed by the disestablishment of state Shintō and the renunciation of the dogma of the emperor's divine nature. Assured of freedom of religious belief, practice and propaganda, the Buddhist, Christian and Sect Shintō denominations which had been forced into union during the war later declared their independence.

New Religious Cults.—Many splinter sects which were once identified with Buddhism or Shintō separated from them, and numerous New Religious Cults (Shinkō Shūkyō) emerged. The term New Religious Cults came to be used loosely in counterdistinction to religions already existing, and it included those movements which developed in the wake of World War II. They are usually classified into five categories: (1) those which stemmed from Buddhism; (2) those which accept a monotheistic belief or, more technically, monolatry; (3) those which accept henotheism (*i.e.*, recognize the existence of several gods but make one god the centre of worship); (4) those which are utopian-messianic; and (5) those which are primarily concerned with practical ethics. Some of the New Religious Cults of course fit into more than one category; in addition, some of them are so new that their founders are still living, and some of them continue to receive new revelations, so that their doctrinal systems are not clearly defined. Each sect has an independent institutional structure and trains its own teachers, many of whom are volunteers. Members, however, are not always followers of one sect exclusively, and more often than not they consider themselves also Buddhists and adherents of Shintō.

Most of these sects are eclectic. Their teachings betray the influences of Buddhism, Shintō, Confucianism and Christianity. Their doctrines are characteristically simple, they are skilfully organized and their founders are usually charismatic leaders. Their simple teachings appeal to the masses, who do not feel at home with the complex doctrines of established religions but want simple, direct and practical teachings.

These sects give their followers a sense of belonging that they do not get elsewhere; newcomers are made to feel welcome, and the sects promote mutual aid and public welfare, several of them operating educational, medical and philanthropic institutions and some even having excellent museums and libraries. Unlike the older religions, these sects hold informal services and meetings, and they make use of the techniques of group psychology. All are highly centralized in structure, utilizing cell group systems, as well as "incentive plans." Some have semimilitary disciplines and hierarchical systems. All use modern mass media of communication and have efficient methods of tithing.

What gives each of these sects its distinct character is the personality of the founder or organizer. Many of the founders boast unusual spiritual powers in divination, sorcery, incantation, fortunetelling and healing, and they have the capacity to attract and maintain rapport with a large number of followers. For the most part, they appeal to the lower middle class, especially middle-aged or older women, although some claim followers among the intelligentsia, the upper middle class and young people. About 100 of

these sects are members of the Union of New Religious Cults (Shin-shū-ren). In some ways they have much in common with the Sect Shintō denominations, and the relationship between them is complex.

Sōka Gakkai (Value Creating society), described by its supporters as "true Buddhism," was founded as a lay movement of Nichiren Shoshu Buddhism by Tsunesaburo Makiguchi in 1930. After World War II it became militantly nationalistic and claimed 10,000,000 followers by 1962 when it elected 15 members to the Japanese house of councilors (senate), more than any party except the Liberal-Democrats (142) and the Socialists (66). Other New Religious Cults, including the Reiyūkai, Risshō Kōseika, House of Growth and Perfect Liberty corporations claimed more than 8,000,000 members.

Older Religions.—All this is not to suggest that the older religions are declining. The Grand Shrine of Ise alone averages 2,500,000 pilgrims annually, and the Sect Shintō denominations, such as Tenrikyō, are growing rapidly. (For the contemporary development of Shintō and Sect Shintō denominations, *see* SHINTŌ.) The Buddhist sects are also holding their strength.

The strength of Buddhism in Japan lies in the intelligentsia and rural population. Buddhist scholarship is very high, as illustrated by the activities of the Association of Indian and Buddhist Studies. Many Buddhist scholars are well versed in Sanskrit literature, as well as western philosophies and religions. The Young Men's and Young Women's Buddhist associations are active, and a nondenominational lay Buddhist movement (Zaike Bukkyō) appeals to both the intelligentsia and the masses. The rural populations are inclined to be ultraconservative and are susceptible to superstitious beliefs and practices. Many of the Sect Shintō denominations and the New Religious Cults have recruited their adherents from the traditionally Buddhist rural population. Buddhist sects reported more than 35,000,000 adherents in the 1960s.

Christianity.—Among all religions affected by the Religious Bodies law of 1939, Christianity was the hardest hit. Most of the Protestant churches were forced by the government to join the Church of Christ in Japan (Kyōdan) in 1942, and in 1944 both the Roman Catholic Church and the Church of Christ joined the Japan Wartime Patriotic Religious association, along with the Shintō and Buddhist bodies.

After World War II, Christianity enjoyed full freedom. Notable features in the postwar period were the rapid progress of the Roman Catholic Church and the so-called fundamentalist wings of Protestantism; also, some of the denominations which joined the wartime union later broke away. Christianity in Japan suffers from its "foreignness" and lack of roots. Churches and related institutions congregate in cities, and very little work has been done in the rural areas; not until after World War II were programs for industrial and rural areas developed. Nevertheless, the Christian influence is growing among middle-class Japanese, especially through the church-related educational institutions. In the second half of the 20th century Christians numbered about 500,000, of whom more than half were Roman Catholic.

See also BUDDHISM; ZEN; CONFUCIANISM; SHINTŌ.

(J. M. KA.)

4. Culture.—Japan's insular position, far removed from the crossroads of Asia, created a marginal cultural situation with the result that the Japanese tended to lag behind other Asiatic peoples in the development of their civilization. While the Chinese were writing by 1400 B.C., it was not until *c.* A.D. 400 that the Chinese system was borrowed by the Japanese. Buddhism reached China from India in A.D. 65 but its first entry into Japan is not recorded until the 6th century A.D.; and it was not until 1700 that the popular drama was fully developed in Japan, while in China it relates to the Yuan dynasty (A.D. 1280–1368). The same general retardation may be shown with respect to the development of printing, philosophical schools, especially the Buddhist and Neo-Confucianist, and mathematics.

This cultural isolation had the further effect of hindering creativity. Japanese inventive talent has tended to concentrate on improving and adapting cultural elements from China and Korea to Japanese patterns. Dependent on the Asiatic mainland until 1868, the Japanese quickly readjusted following the Meiji restoration of that year and turned their energies to importation of ideas from the west.

Japanese culture is marked by the specialized adaptations, modifications and improvements of borrowed elements. With respect to writing, for example, they invented the syllabaries that accommodate the Chinese system to the Japanese language. In art, literature, the drama, architecture, etc., the Japanese have worked with Chinese or Chino-Korean prototypes but have adjusted them to their own styles and uses to create distinctive variations. Given Chinese Buddhism, the Japanese developed new sects, such as Shin and Nichiren, explored new avenues of Buddhist thought, as in Zen, and modified Chinese Buddhism on the popular level so as to identify it with ancestral reverence and a mortuary cult. As a result, Buddhism plays a more significant role in Japan than in China. Out of Chinese Neo-Confucianism the Japanese developed the warrior code or Bushidō (*q.v.*) of the medieval samurai and the highly ritualized tea cult (*chanoyu*). From the raw materials of Chinese poetry came the exquisite haiku and tanka forms (*see* JAPANESE LITERATURE); and related to the pattern of female entertainers of China and Korea arose the elaborated institution of the geisha (*q.v.*). The Japanese were selective in their borrowing of Chinese culture elements; for example, traditional Chinese concepts of government, such as the theory of the responsibility of the emperor, bureaucratic organization and the civil service system, were not congenial to the Japanese. Japanese belief in the divinity of the emperor and their fairly rigid class structure prevented their adoption of Chinese political institutions despite the acceptance of much Confucian ideology and philosophy. Similarly, although after 1868 the Japanese adopted, in part, European legal codes, educational and military systems and western science and technology, they improved on much of what they borrowed. Modern Japanese contributions to the biological and physical sciences have been outstanding.

The ritual qualities of Japanese civilization have often been noted. Custom demands extremes of politeness, of great attention to formal ritual, as in modes of greeting, and creates a rigidity in social situations. It has been suggested that security in Japanese society rests on a high degree of conformity and homogeneity. While changes in Japanese culture have been rapid and revolutionary at times, social structure has remained remarkably stable. Japanese society has a facility in adapting itself fairly readily to mobile external circumstances while remaining intact. For other aspects of Japanese customs and culture *see* BATH; BED; JAPANESE MUSIC; JAPANESE PAINTING AND PRINTS; JAPANESE SCULPTURE.

Kinship and Marriage.—The Japanese, unlike the Chinese, did not develop the elaborate extended family. Kinship, even in the changing urban setting of modern times, remains very important but is confined to a relatively small circle. The kinship group is composed of the descendants of the great-grandfathers in the male line. A traditional household usually consists of husband and wife, their unmarried children and the eldest son and his wife and children. Women join the household of the husband's family as a rule but, as in China, a couple lacking sons may adopt a son-in-law not only to carry on the ancestral obligations of the family line but also to maintain the continuity of the lineage. The emphasis on the household and family requires a high degree of mutual co-operation and responsibility.

One characteristic of Japanese social organization is the extension of the circle of co-operative relationship. Japanese society has thus created a kind of quasi kinship in bonds of association that lie outside the kinship circle, but are formalized, permanent and co-operative. Within the village these range from the *kumi* —groups of three to five households—to the more elaborated paternalistic structures in political and other local groups. The members of co-operative units within neighbourhoods, often called *buraku*, assist each other in arranging festivals, funerals and community affairs. A strong sense of co-operation exists within labour associations, craft guilds and temple memberships. An employer assumes special responsibilities for those in his charge; they in turn are bound to him and each other by customary obligations.

Co-operative associations apply generally across Japanese society as a whole. Urban life developed relatively late among the Japanese, essentially as a result of the adoption of western technology and industry, and even in cities the local neighbourhood comes to resemble the rural village organization, which is the backbone of Japanese society. The result has been a rigid social system with little mobility for the individual.

Marriage also reflects patterns of fixed obligations. The marital ties are not conceptually religious but are founded in social and economic relationships. Except in some of the more highly westernized urban areas that were subject to rapid change after the end of World War II, marriage is not a matter of individual choice founded in romantic ideals but rather an arrangement between families worked out on the basis of class and economic status. It furthers the co-operative bond between unrelated family and household groups and its associated customs involve a large number of individuals apart from the immediate families involved. Neighbourhood groups, labour associations and the wider community are all concerned. Included as an important part of the marriage preliminaries are the matchmakers who locate the eligible pair. The rites of marriage involve ritualistic gift exchange reflecting the economic and social status of the families involved and marking the formation of a new family unit. A marriage is customarily celebrated with feasting, special costumes and merrymaking. In rural Japan, a ritual drink is shared by the bride and groom to symbolize the marriage bond. Modern Japanese law requires only a registration of marriage and no specific ceremonies. Probably as a result of Christian influences, both the Buddhist and the Shintō sects have instituted marriage ceremonies.

See *Agriculture: Social Conditions and Land Reform*, below, for a discussion of rural life; and sections on *Religion*, *History* and *Population*. (R. F. Sr.)

IV. HISTORY

Prehistory.—The origins of the Japanese people and the nature of early Japanese society are not firmly established. Until the introduction of the Chinese writing system the Japanese had no way of keeping records, and the oldest extant histories, the *Records of Ancient Matters* (*Kojiki*) and the *Chronicles of Japan* (*Nihongi* or *Nihon-Shoki*), date from 712 and 720 respectively. (*See* Kojiki.) Since they cover a great span and in addition were written under the impact of the Chinese tradition, they are not always reliable guides. Archaeological evidence was not fully exploited before World War II because of the taboos that surrounded the official theories concerning the divine origin of the imperial family. After World War II intensive archaeological work helped to suggest promising lines of approach for the prehistory of the islands, but many problems remain unsolved. (*See* Archaeology.) In addition to archaeology and the early histories of Japan, Chinese histories that contain appendix discussions of China's less-developed neighbours provide much information about early Japan.

No conclusive Paleolithic remains have been found in the Japanese islands which probably were first inhabited in the 2nd or 3rd millennium B.C. Analysis of shell mounds, tombs, pottery and house sites has made it possible to distinguish two principal Neolithic cultures. The first of these, named for the cord design (wavy mat markings) on its pottery, is known as Jōmon and is usually assigned dates extending from about 2500 to 250 B.C. Jōmon sites abound in many parts of Japan, and their similarity to sites in eastern Siberia has led to the belief that the peoples who left them came from the north. It was long thought that the Ainu (*q.v.*) were descendants of Jōmon peoples, but modern scholarship is less confident of this identity and contents itself with statements about a remote relationship between Jōmon and both Ainu and Japanese. Jōmon culture was that of a food-gathering, nonagricultural people who hunted and fished. They had no domesticated animals except the dog, no loom weaving and little carpentry; they did have polished stone tools. Their pottery, while not wheel thrown, was carefully and increasingly decorated with cord impressions. House sites reveal simple one-room dwellings, dug into the ground, with a central pole supporting a roof which contained an opening for smoke from the fire.

The later Neolithic culture is known as Yayoi for the street in Tokyo where the first site was discovered. Yayoi is clearly related in its techniques to the rice-growing areas of the Asiatic mainland, and probably reached Kyushu in streams of immigration from the south along the Ryukyu Islands, as well as from Korea. Archaeologists assign the approximate dates 250 B.C. to A.D. 250 to the Yayoi culture. Toward the end of this period a bronze culture reached Japan, and numerous archaeological discoveries testify to its spread. Yayoi sites show a pottery which is wheel thrown. Irrigated rice culture supported a growing population at a higher standard than had previously been the case, and tools of many kinds were developed. Overlapping with, and part of, the Yayoi culture was a movement of settlers from northern Asia who came to Japan by way of the Korean peninsula, possibly deflected from invasions of China by the strong frontier defenses of the Ch'in and Han dynasties. Chinese bronze culture reached Japan by way of this population movement from Korea before the Christian era and began to change and replace the Yayoi culture wherever the two made contact. The first points of contact were in all likelihood in southern Japan, especially on Kyushu, giving the groups residing there a considerable technological and military advantage in their competition with their neighbours.

The general cultural development up to the historic period with the characteristic associations of each period are summarized in Table I.

Early History.—Some time in the 3rd century A.D. further elements of Chinese culture, including iron, entered Japan from Korea, part of which had been a colony of the Han dynasty since 108 B.C. The possibilities which this opened up for the Japanese chieftains were very great, and it is apparent that frequent attempts were made to get in direct touch with the source of the superior tools, weapons and technology. There is a record of a visit of an envoy from Japan to China in 57 A.D. After the 2nd century A.D. bronze implements found in the burial sites were replaced by more effective iron implements, and from the 3rd to the 8th century A.D. the archaeological sites suggest a greatly expanded social and political stratification. Great earth and stone tombs were thrown up in coastal areas from Kyushu and along the shores of the Inland sea, with the largest in the Yamato plain, the site of the first historic capitals. These give evidence of large-scale organization and a high degree of central control. Indeed, the tomb assigned to the emperor Nintoku is one of the largest of its kind in the world

Table I.—*Chronological Table of Japanese Prehistory*

Date	Culture	Period	Characteristics
?	Pre-Jōmon	Early prehistoric	Paleolithic-Mesolithic; hunting, nonagricultural base; core tools, blades, microliths
?	?	?	?
2500 1000 750 500 250	Jōmon	Middle prehistoric	Neolithic but nonagricultural; hand-made pottery; chipped and ground stone tools
B.C.	Yayoi	Late prehistoric	Rice cultivation; wheel-made pottery
A.D. 250	Yayoi	Protohistoric	Copper and bronze casting; iron (?); rise of social classes
500	Tumulus	Semihistoric	Iron weapons and tools; tombs of earth mounds; warfare
560	Asuka	Historic	Horses; "megalithic" tombs
710	Nara (historic)		Buddhism; Chinese writing, etc.

and probably required the labour of about 5,000 men for at least a year. The tomb or Tumulus period provides greatly improved weapons and ornaments and gives evidence of a society of conquest. Potteries and tools show competent forging and heating. Ornamentation includes the curved jewel, *magatama*, a comma-shaped object which became, with the sword and mirror, one of the three imperial regalia. Hollow clay figures, the *haniwa*, represent warriors, women, horses and even residences. The early his-

tories state that *haniwa* were substituted for human sacrifices in tombs, but archaeologists have discovered no evidence that humans were in fact so used; most conclude that the clay figures decorated the outside of the tombs. The clothing of the *haniwa* provides clear indication that this society, which may be called semihistoric, was dominated by the mounted warrior on horseback, a figure whose clothing and armament resemble that of his counterparts in northern Asia. The entry of Buddhism in the 6th century ended the construction of the great tumuli, and the entry of the Chinese script made possible the transition from semihistoric to historic.

When the evidence provided by the Chinese dynastic histories is added to that provided by the archaeologists, it is possible to speculate in general terms about the process of unification and organization which the great tumuli suggest. The Wei history, which was compiled around A.D. 297, speaks of the Japanese as the "people of Wa, [who] formerly comprised more than one hundred communities." Relations with these groups began in Han times, and in the 3rd century 30 of them still maintained contact with China. "Wa" is described as a "queen country," with its seat of government located in Yamatai. It is not fully clear whether this was located in Kyushu or whether it refers to the great Yamato plain which became the site of the historic capitals and the centre of the imperial mausoleums and tumuli, but there is little doubt that the Wei records indicate a steady process of conquest and development under a dynasty which seemed to them matrilineal in its organization.

Further signs of development of central power and political influence are furnished by evidence from the middle of the 4th century indicating that Japanese soldiers were active in Korea. The small state of Karak (Mimana), near modern Pusan, alternately competed with and aided its northern neighbours Paekche (Kudara) and Silla (Shiragi) in the warfare that followed the fall of the Chinese colony in north Korea. Its origins are probably to be traced to a connection with clans that had crossed to Japan earlier, but there is little question that from the 4th century on the Japanese possessed the ability to send leaders and warriors back across the waters to give battle in Korea. The *Kojiki* credits an invasion around 200 to the empress Jingō, and even after this date is corrected to the 4th century with the help of the Chinese records, the expedition indicates a very considerable growth in power and unification of Japan. The Chinese records also indicate that the Chinese court on at least two occasions in the 5th century confirmed the Japanese "king's" claim to military supremacy in Korea. The annals of the Korean state of Silla confirm that the Japanese invaded repeatedly in the 4th and 5th centuries. Mimana was an important channel for the acquisition of the superior technology and learning of the mainland. Its loss to Silla in A.D. 562 helped bring on reforms in politics and society designed to prevent further military and diplomatic disasters. (M. B. J.; R. F. Sr.)

From Myth to History.—The outlook and beliefs of the early Japanese are known through the myth cycles contained in the *Kojiki*. Early Shintō (*q.v.*) was little more than a polytheistic nature cult. It consisted chiefly of shamanistic practices designed to propitiate and honour the spirits or deities (*kami*) responsible for the agricultural fertility upon which life depended. The cult emphasized a ritual simplicity and lustral purity, and its simple shrines contained no images.

The Shintō myth cycles of the *Kojiki* can be divided into five groups. The first deals with the cosmogonic myth. After seven generations of gods, two deities, Izanagi and Izanami, gave birth to the islands of Japan, the sun-goddess and other deities. A second cycle describes the descent of the "august grandchild of the sun-goddess" to Japan. A third cycle tells of the doings of the sun-goddess and her brother, Susanowo (the storm-god). A fourth cycle deals with the deities in Izumo associated with the storm-god. A fifth and final cycle deals with the victorious campaign begun by the first emperor, Jimmu Tennō, and continued by his descendants, to unify the Japanese islands. The traditional dating gives 667 B.C. as the time he left the island of Kyushu to establish his primacy in 660 B.C. However, critical historians are inclined to date the beginning of the historic period of Japan in the 3rd or 4th century A.D.

The *Kojiki* and *Nihongi* contain evidence for the national outlook of an agricultural people who revered a beneficent nature with their seasonal taboos and ceremonies, a race which peopled the islands and their valleys with spirits to propitiate and appease and who saw in the sun-goddess the greatest of such deities. The close relation between Shintō and the government was evidenced by the fact that the emperor served as the high priest of the sun-goddess cult. Although the dates and longevities assigned to early emperors need to be corrected, there is sound reason to look behind the events as they are recorded in the *Kojiki* and *Nihongi*, however shadowy, to the formation of the early Yamato state. (*See* also *The People: Religion*, above.) (J. M. Ka.)

The Clan Period.—The *Kojiki* and the *Nihongi* describe the emperors as absolute rulers, and treatment of their reigns is heavily affected by the Chinese pattern of historical writing. Thus the emperor Nintoku (*c.* 313–399) is credited with all the virtues of the Chinese sage-king, suspending taxes in difficult years, deferring palace repairs in order to keep from interfering with agricultural production and reflecting on the prince's responsibilities to his people, while the emperors Yuryaku and Buretsu (*c.* 456–479 and 498–506 respectively) are charged with offensive conduct clearly modeled on that of the last Chou emperors in the Chinese *Classic of History*. Despite this, the chronicles suggest a good deal about early Japanese society and government before the adoption of Chinese institutions in the 7th century.

This was a period of great clans (*uji*), descendants of the tribes that had come from Korea. The imperial clan head had a large degree of primacy over his fellow clan heads, but for a time it was probably based more upon his religious than his political importance. The other clan chiefs were charged with religious functions for the particular deities from which their clans claimed descent, so that although their pretentions were less lofty than those of the sun-goddess' descendants they were nevertheless considerable. Members of each clan worshiped a common deity which was held to be their progenitor, so that the society gained much of its strength from principles that may be related to ancestor worship. As the clans grew, sections or branches might break off and move elsewhere, but the pattern of worship usually remained unchanged. At the court in the Yamato plain there were a number of high officials, heads of supporting clans, who were charged with hereditary priestly and ritual functions, while others performed guard duties or purveyed weapons and other necessities to the throne. Thus a small number of clan chiefs competed for favour and influence at court. Their rivalry was later an important element in the disputes over cultural, religious and political policy.

Specialty tasks were performed not by the clansmen but by hereditary guilds or associations of workers known as *be* or *tomo*. Five such had been commissioned to accompany the "august grandchild" when he descended to rule Japan, and others were established to fit needs as they arose. These guilds were attached to clans, and constituted their chief form of property and influence; often, as for the Imibe (ritualists or abstainers) or Mononobe (armourers), they gave their name to one of the great families which were important at court. The imperial clan, which was, theoretically, the only one capable of creating new units of this sort, had a consequent advantage in taking measures to extend its power and its agricultural and material income.

Although there was as yet no clear theory of government hierarchy or bureaucracy, the records indicate an approximate gradation wherein the greatest clan heads, great chieftains and great deity chieftains were in a position of such wealth and influence as to pose a potential threat to the throne, while lesser rural gentry, *kuni-no-miyatsuko*, controlled or, often, owned outlying areas. It is impossible to trace the pattern of administration with any degree of confidence, but it seems clear that the court faced a growing problem in its relations with great clans whose leaders possessed the wealth and power to rival its claims. It had many advantages in this struggle. Most of the craftsmen and scholars who fled to Japan from the confused warfare in Korea were commended to the imperial clan, and they provided it with some of its margin of technical superiority. When the Mimana foothold in Korea was lost in the 6th century, the Ōtomo clan, which had

been charged with its defense, went into decline. There remained a sharp rivalry between two great clans, the Mononobe and the Soga, with the great ritual clans, the Imibe and Nakatomi, vitally concerned in the competition that ensued.

The struggle of the Soga (*q.v.*) for power can be documented with assurance, for after 400 the chronicles gain in reliability. Disputes between clans were made inevitable because there was no clear succession rule for the imperial clan; it was possible for clans to sponsor rival candidates for the throne. In 538 (some sources prefer 552) the Korean state of Paekche sent the Japanese emperor a Buddhist image together with sacred writings and assurances that this was the religion of the civilized world. Undoubtedly much knowledge of Buddhism had entered Japan earlier, but this convenient incident is usually cited as the introduction of Buddhism into Japan. Thereafter the Soga stood forth as sponsors of the foreign civilization. With responsibility for the imperial granaries and treasury, they enjoyed ready access to the learning and skills possessed by the Chinese and Korean immigrants. After some sharp struggles relating to the propriety of worshiping the imported images, the Soga came to the fore as sponsors of the new learning.

The Soga ascendancy over their Mononobe and Nakatomi rivals was consolidated in 592, when Soga Umako had the emperor Sujun assassinated and replaced him with his niece, the emperor's younger sister, who ruled as Empress Suiko from 593 to 628. The imperial clan was now in danger of being eclipsed. Soga daughters were married to emperors and Soga clansmen filled all important positions. As heir apparent and regent, Soga Umako selected Umayado, a young nephew of the empress, better known as Prince Shōtoku (Shōtoku Taishi). Under this remarkable man, who dominated the government from 593 to 621, Japan prepared to move from clan to imperial organization.

Shōtoku Taishi.—The work of Shōtoku Taishi (*q.v.*) foreshadowed the adoption of the Chinese pattern of government. His years as regent came shortly after the Japanese loss of Mimana and coincided with a period of massive unification in China, where the Sui dynasty was established in 589. Shōtoku and his Soga sponsors set themselves to promote the foreign learning and religion, improving contacts with the mainland, controlling the territorial magnates and clan heads in Japan and increasing the national strength and unification. Although it is difficult to distinguish the historical figure from the legends which surround him, it is clear that he must be credited with substantial achievements. He was a devout Buddhist, and did all he could to speed the growth of the foreign religion. Priests from Korea lectured at the imperial court, and the great nobles were instructed to build Buddhist temples. Shōtoku himself was responsible for the construction of the Shitennōji (in Ōsaka city), which was completed in 596, and the Hōryūji, near Nara city, which still stands as one of the great monuments of early Japan; he is also credited with learned commentaries on the sacred scriptures of Buddhism, the *sutras*. He expected Buddhism to be a central element in reforming and civilizing life in Japan. In its train came masterpieces of sculpture, architecture and painting which opened new worlds for the Japanese. In addition, Buddhism seemed central to the Chinese pattern; Sui and T'ang times marked the height of Buddhist influence in China.

In political affairs Prince Shōtoku's administration showed a desire to substitute a bureaucratic hierarchy of the Chinese variety for the rivalry of the great clans. There is a good deal of doubt about the extent of his success, but these intentions are important evidence of the growing trend to look to China for guidance. In 603 hierarchic ranks were set up at court. Each bore the name of a virtue and was of two grades; the holders were entitled to wear particular colours and costumes. This was the first attempt to replace the hierarchy of heredity with one of appointment and service. That the idea faced many difficulties is clear from the Seventeen Articles, a set of injunctions issued in 604, exhorting the nobles to be true to Confucian principles of harmony, duty and decorum and emphasizing the importance of Buddhism, whose treasures "comprise the destiny of all living things and claim the supreme worship of all religions of the world. What man in what age can fail to reverence them? . . ." These injunctions, the so-called constitution of Shōtoku, thus attempted to establish moral foundations for national life. Undoubtedly, as the chronicles make clear, they received more lip service than they did compliance, but they demonstrated that the moral foundations Japan's rulers would seek to institute would be those of mainland China. The idealized picture of Shōtoku which has come down to us is that of a Chinese sage-ruler who sought to promote the unity and the welfare of his people by developing his own virtue and morality, devoting himself to study and to the arts of civilization and spending much effort in the task of collecting historical materials for a compilation that was to make clear the basis for imperial rule in Japan. This history has not survived, but it is probable that some of the materials collected found their way into the *Kojiki* and *Nihongi*.

After Shōtoku's death, however, it was clear that the ills of the times had not been reformed and that the system of clan competition was no longer adequate to Japan's needs. The Soga family departed from the pattern established by Soga Umako; his descendants began to seize the property of rival clans and to take for themselves imperial airs. As the *Nihongi* relates of the Soga clan head, "The people of the various clans came to his gate, and waited upon him. He called himself their father and them his boys." In the face of this undoubted danger to the imperial clan and the goals toward which Shōtoku had worked, men who had studied in China combined with members of competing clans to strike down the Soga pretenders.

The Chinese Influence.—By the 7th century much Chinese culture had entered Japan by way of Korea. Korean scribes had brought with them knowledge of the Chinese writing system and copies of Chinese classics and Buddhist *sutras*, and official favour for Buddhism in 7th-century Japan meant that there would be frequent interchange of ecclesiastical figures anxious to convey the true learning and proper ordination. Shōtoku's injunctions and commentaries on the *sutras* give evidence of a mastery of Buddhist and Confucian principles, and his court ranks show his awareness of some of the principles upon which the Chinese bureaucracy was based. The loss of Japan's Korean possessions and the desperate position which Paekche, Japan's old ally, faced in its struggle with its neighbouring state of Silla, however, put a new premium on contact with the mainland. Shōtoku had plans for re-establishing Japanese control in south Korea, and he mobilized a large force in Kyushu for that purpose. The plans for the invasion miscarried, however, and thereafter internal reforms prevented further attention to foreign wars. But since it was increasingly important to establish direct relations with China, missions were sent to the court of the Sui emperor.

In 607 Japan's first official embassy, headed by Ono-no-Imoko, sailed for China. The ambassador returned the following year with a Chinese envoy. It was seven years before another official Japanese mission sailed, but there were groups of scholars and priests who went to China in smaller parties for study. Because of the disorder in Korea large numbers of Korean priests and artisans also came to Japan, so that the supply of learned men and technical knowledge grew steadily.

Those who studied in China were dazzled by the wealth and power of the country they saw. The Sui dynasty was overthrown by a palace coup in 618 and replaced by the T'ang, under which Chinese power and cultural eminence reached new heights. The Confucian pattern of bureaucratic hierarchy and examination for talent was more extensively developed than before, and at the same time the Sui and T'ang periods marked the apogee of official favouritism for Buddhism. As a result, the inherent contradictions between the creeds, contradictions that produced persecutions of Buddhism by the 9th century, were not yet evident to the Japanese visitors. The basis of the economic power of the new Chinese state, and one which the Japanese were to attempt to emulate, was a pattern of landholding wherein the state periodically divided the land into plots proportioned according to the family size; thereby it could claim as its own a proportion of the revenue of the rice paddies; additional taxes claimed handicrafts and labour. Great as the difficulties of applying this system were in China,

where cultivation was dependent upon the efficient manipulation of the state-controlled irrigation works in the north China plain, it was to prove even more difficult to carry out in Japan. It required a large and dependable bureaucracy to administer it, as well as large tracts of level land. In spite of its inapplicability, the system was part of the pattern of dynastic power that the Japanese who studied in China admired, and they sought to copy it on their return.

The Taika Reforms.—One of the marks of the adoption of Chinese civilization was the utilization of the Chinese calendar. This was first done in A.D. 604 under Shōtoku, and since according to the Chinese lore great changes came in the 58th year of the twenty-first 60-year cycle, the scholars, by counting backward, established 660 B.C. as the proper date for the accession of Jimmu Tennō. The introduction of Chinese governmental ideas was thus considered comparable to the divine establishment of the empire in its importance. Next came the practice of assigning appropriate names (*nengō*) to year periods, and in 645 the first such era was named Taika ("great reform") for the reforms which were inaugurated.

The Taika reforms began after a political *coup d'état* in which the Soga clan chief was killed. The leading figures involved were a member of the Nakatomi clan named Kamatari (who was later to receive the family name Fujiwara) and Karu, a brother of the reigning empress, who succeeded to the throne as the emperor Kōtoku (645–654). Also prominent were a priest, Bin, who had returned from China in 632, and a lay student and diplomat, Takamuku Kuromaro, who had returned in 624. Takamuku later served as ambassador to Korea and China, where he died in 654. Both were given the rank of "national doctor" (*kunihakase*), and it was undoubtedly they who instructed Kamatari in the Chinese patterns to be followed. The reforms began with the enunciation of general principles. In 645 the great nobles were summoned to the court to hear a proclamation of the new theory of absolute monarchy. The next year, after administrative preliminaries had been worked out, four sweeping articles set out the main lines of the new order. Private property in land or workers (the *be* or *tomo*) was abolished. The region around the capital was set up as an administrative district and governors were appointed. Registers of population were ordered to make possible the equitable division of land to cultivators, and old taxes and levies were canceled to make way for the new system that was to follow. This marked the beginning of a series of innovations that did not end until 702, when the code of Taihō (the era name) was promulgated. Thereafter the Chinese system of government was in effect, although there were some significant additions and deletions. A Japanese feature was the department of worship, which, concerned with the native shrines and ceremonies, was given precedence over the department of state. Throughout the bureaucracy, the hierarchy established was one of birth and not of merit tested by examination. The department of state, presided over by a chancellor assisted by ministers of the right, the left, and councilors and controllers, had eight ministries, of which four were concerned primarily with the affairs of the imperial house. A significant omission from the Chinese pattern was a central board of works, indicating that the central administration lacked the power or the need to command *corvée* labour for great projects in the way that the Chinese court carried out its responsibility for enormous irrigation and flood control projects. Public works large in scale for Japan were carried out, but it is significant that a number of revolts followed the imposition of projects which were felt to be excessive in cost and demand.

On the local government level, provincial and county divisions, within which village organization and government was prescribed, were laid out. Since the entire system depended upon the vigilance and fidelity of the local officials, to whom were delegated responsibility for census registers and land allotment, it is interesting to note that most posts on the county level were allotted to families of local eminence. This boded ill for the land system which was designed to replace the ownership of the clans with the authority of the court.

It is difficult to determine the degree to which the new laws and ordinances had effect in the countryside. Most of the bureaucracy and most of the efforts were devoted to the metropolitan or *kinai* provinces, and undoubtedly the Taika reforms made for very great changes there. In outlying districts, however, it is doubtful that the edicts can have served to expropriate the old landholders very effectively. The codes provided for a redistribution of land every six years, but this schedule was never rigidly maintained. In T'ang China, where there was a vigilant effort to prevent local loyalties from outweighing loyalty to the central government, the complex system of registration and redivision worked poorly after the early years of the dynasty. In Japan, where local posts were explicitly reserved for local grandees, the difficulties must have been magnified. The Taika plans, formalized by the Taihō code, nevertheless represented an ambitious and, in view of the difficulties, remarkably successful attempt to change the basic structure of Japanese government and society. They were perhaps too far in advance of the state of society, but it is clear that the clan system was dated and outgrown. Increasing development of new agricultural areas and new opportunities for settlement were bringing about a rapid dissolution of the old craft corporations or *be*, so that the Taika changes were in step with the trend of Japanese social development. In most respects, however, the outcome was neither Chinese nor pre-Taika Japanese, but a new combination of both. This is perhaps most clearly seen in the class structure. While the Chinese system was based, in theory, upon selection of officials of ability through examination of their learning, the Japanese system maintained a hierarchy of birth. A class and official structure with appropriate grades was carefully spelled out, and although some steps toward examinations for those of good birth were later taken it was clear that this was never meant to interfere with the priorities for those of proper lineage. This undoubtedly eased the transition period, since the old elite were not asked to give up their status but to exchange it for a new status in a new hierarchy with all the prestige of modernity. Whatever their limitation, the Taika reforms mark a turning point in Japan's institutional history.

A. The Imperial State

Nara.—Before the 8th century there was no permanent capital in Japan. The court moved from one town to another, probably because in Shintō belief a sovereign's death would cause a ritual defilement. With the increasing complexity of government after Taika, such moves must have become more and more difficult. Basic to the Chinese system, moreover, was the great capital city which functioned as centre of government and visible evidence of the greatness of the state. In 710 the empress Gemmyō decreed the establishment of a permanent capital in the Yamato plain. Heijō-Kyō, or Nara (*q.v.*), was planned to be 2½ by 3 mi. in area, and although never more than one-quarter built it was Japan's first great city. Like the Chinese capital of Ch'ang-an on which it was modeled, Nara was laid out with careful attention to the requirements of geomancy, or divination by means of land forms and lines of direction. Great avenues ran south from the imperial palace, which occupied the north central position, and equally large avenues ran east and west. The principal thoroughfares were lined with the great monasteries and temples of the Buddhist sects and with the residences and palaces of the officials and aristocracy. Much of the national wealth found its way into the magnificent structures and works of art in Nara, and it was so incomparably superior in splendour to any other spot in Japan that this cultural and material eminence may have been an important factor in attracting the presence and the loyalty of the clan leaders. So long as the mastery of Chinese civilization was the order of the day, no one with any aspirations to importance or eminence could afford to absent himself from the capital. Nara was the centre of a road network. Over 60 provincial units of administration were classified as central (*kinai*) or within the seven circuits (*dō*). Along the major routes post stations at intervals of about 12½ mi. provided fresh mounts for imperial messengers who sped to or from the capital. Evidence of the spread of central power and authority can be seen in the reduction and

incorporation of the northern province of Dewa in 712 and that of Ōsumi in Kyushu in 713. The Kyushu station, with its strategic importance for communications with T'ang China, was particularly important for the court. Economically, the growth of population and occupation of frontier areas, as well as the discovery of gold and copper, contributed to the prosperity of the regime. A mint for coinage was decreed, and the first of 12 issues struck off; the court offered special rewards to encourage use of coins. In religion, provincial temples (*kokubunji*) served to suggest the power and influence of the central government.

The Nara period was formative for many cultural developments. The *Kojiki* and *Nihongi* were compiled at Nara. Sometime after 760 there was also compiled the first anthology of poetry, the *Manyōshū*. In the main the poetry is Japanese as distinguished from Chinese in approach and feeling. Themes of love and of appreciation of the beauties of nature predominate. (*See* JAPANESE LITERATURE.) There is a famous statement of loyalty to the sovereign or clan leader which contains the lines, "By the sea our corpses shall steep in the water. On the hills our corpses shall rot in the grass. We will die by the side of our sovereign, we will never look back." This sentiment is ascribed to the Ōtomo clan, the hereditary bodyguard, but later generations of loyalists, for whom these became sacred words, lived up to them rather more fully.

The nobles who led the Nara government needed skill in politics, as well as in poetry. The 74 years during which Nara was capital were remarkable for the large number of sharp succession disputes. During the period there were four reigns by empresses (two of them by the same lady, who abdicated only to return under a different name), and these opened up rich opportunities for intrigue and ambition, especially, in one case, for the empress' priestly adviser. The twice-empress in question, who ruled as Shōtoku from 765 to 770, was dominated by the monk Dōkyō until her death in 770, after which Dōkyō was banished. The council of ministers refused to allow a woman to succeed her, and thereafter there were no female rulers until the 17th century, by which time the throne lacked authority or responsibility for government.

There was also a military challenge to face from the Ainu, who were being pushed steadily to the north by the tide of Japanese immigration and settlement. The warfare revealed grave weaknesses in the national armies, shortcomings which could be ascribed to basic failings of the land and tax systems. The tax on paddy land had not proved particularly onerous, and the tax on produce or handicraft articles caused relatively little hardship. It was the labour tax, however, that produced the greatest dangers of official malpractice. According to the codes, every third man between the ages of 20 and 60 was subject to military service. He could be posted a year at the capital and three years on the frontiers, during which he was to furnish his own equipment and food. In idle times he could be used as labour by the officials in the areas he served. In addition, each file often had to supply and maintain six horses.

It was clearly an enormous burden for villagers to have family members called up. Gradually the Nara armies became demoralized and weak, little more than a sorry rabble. Worse than the military setbacks, however, were instances of oppression of conscripts by officials who were accustomed to dealing with subordinates as though they were their private property. Frequently, military levies were used as labour for private projects, particularly land reclamation. The codes encouraged this by providing for tax immunities to further the extension of cultivated land. Concessions so made by the government usually resulted in permanent alienation of what should have been public land. Officials also had other opportunities for mistreating their farmers. The government codes established "charitable granaries" (*gisō*) to ward off famines and they authorized interest-bearing loans of seed rice (*suiko*) to farmers whose crops had failed. These became instruments of exploitation, as the codes show by warning officials against forcing their people to borrow seed rice. The defects of this system could hardly have been corrected by legislation, although the court tried repeatedly to issue edicts on the subject; it was evident that families with long-standing interests and a proprietary attitude toward the areas they governed were not prepared to change their outlook to conform with one expected from civil servants. The farmers, caught between powerful officials and a government powerless to restrain them, either absconded or sought the protection of more powerful neighbours.

None were more powerful than the great Nara temples and monasteries. The recipients of special status and favour from the court, they functioned as a state church during the Nara period. Vast amounts of the imperial wealth were devoted to them by patrons like the devout Emperor Shōmu (701–756; reigned 724–749). In 752 he dedicated the Great Buddha of the Tōdaiji in a ceremony in which he publicly declared himself the slave of the Three Treasures—the Buddha, the law and the church. Many of the objects used in the dedication service are still preserved in the imperial storehouse at Nara, the Shōsōin. The great monuments of Nara which survive—the Tōdaiji, Yakushiji, Hōryūji and many other monasteries and temples—are all Buddhist, and they testify to the enthusiasm and fervour with which the court patronized the foreign religion. Buddhism also influenced the pattern of legislation. Imperial edicts constantly stressed the importance of Buddhism as the "wealth of the country," and each province was ordered to construct a seven-storied pagoda and to establish a guardian temple. Edicts were issued forbidding the sacrifice of retainers at the death of an important person, special amnesties were issued for criminals, at times it was forbidden to kill animals. It is not surprising that the monk Dōkyō should have attempted to take advantage of the favoured position which the clerics enjoyed.

The Heian Period.—In 784 the capital was moved from Nara to a place 30 mi. away called Nagaoka, and ten years later to a spot called Uda, where a city, first named poetically "The Capital of Peace and Tranquility" (Heian-Kyō) and later, more simply, "The Capital" (Kyōto; *q.v.*), developed. Although the reasons for the move from Nara are not fully known, it is probable that the court's desire to escape the power and influence of the great Buddhist centres that had grown up around it in Nara was an important element. Kyōto, with its access to the sea by the Yodo river, was also more convenient for communications with the coastal ports. The new city, like its predecessor, was modeled on Ch'ang-an, and was laid out on a grid of 3 by 3½ mi. The geomancy of land forms and "wind and water" was judged favourable, and on Mt. Hiei, to the northeast, the new and growing monastery of the Enryakuji (founded 788) offered protection from the most dangerous direction for demonic intervention. The city was never fully built up on the scale originally planned for it, but its eastern half became and remained one of the great examples of a planned administrative centre. The plan provided streets and wards for each artisan group to simplify control of standards and production; great markets, one in the west and one in the eastern sector of the city, functioned on set days for officially approved commerce; and the great thoroughfares running north-south and east-west were soon lined with the residences of the great. Most subsequent court leaders were known by the area of their residence; the Ichijō and Sanjō ("first avenue" and "third avenue") families of nobles were only two of numerous examples that might be cited. The Buddhist sects were not allowed to dominate the city with great structures close to the imperial palace, which again had the honoured and favoured position in the north central sector; temples were for long kept at a reasonable distance, and the area where they were permitted to build later became known as the "temple district" (*teramachi*) for its proliferation of temples. The expenses of the move to Kyōto were very great. Provinces were assigned set quotas of stones and wood and officials had to send quotas of labourers.

This vigorous activity bore the stamp of an able and energetic ruler, the emperor Kammu, who reigned 781–806. He is one of the few sovereigns who stand out for the vigour of their purpose, and his measures were clearly designed to eliminate or lessen some of the evils that had developed in the Nara system. Although he was personally a devout Buddhist, he instituted measures to prevent the ecclesiastical hierarchy from seizing too much power and property. Edicts forbade temples from accepting land from farmers and from accumulating wealth in an unreasonable manner,

while court support for two new denominations which represented a break away from the old Nara sects proved a useful way of curbing the great monasteries. Other measures sought to stop the growing movement of farmers away from government fields and that of government fields from the tax rolls. Extant tax registers illustrate the degree of the danger: one district in the province of Bitchū had 20,000 males liable to conscription and taxation in A.D. 660 but reported fewer than 2,000 in 767. Court revenues had sunk, and when efforts were made to recoup government losses the farmers who remained were taxed more harshly, increasing the likelihood that they too would flee or commend their fields to powerful neighbours or temples. Edicts were now issued ordering absconders to return, fixing the rate of interest on seed rice loans at 30% and declaring, in "acts of virtue" (*tokusei*), a cancellation of debts.

Perhaps the chief problem the court faced was that of controlling local officials and to deal with this it called in genealogical charts to correct falsifications; other orders forbade the purchase of rank with money. Most of the decrees document the failure to establish a disciplined, dependable civil service. Emperor Kammu also tried to deal with the setbacks that the Ainu had given the Nara armies on the northern frontier. After several generals, equipped with the best arms the government could commandeer, were defeated, a special commission, *sei-i-tai-shōgun* ("great generalissimo for the subjugation of the barbarians"), was given to Sakanoue Tamuramaro, who scored impressive victories at the end of the 8th century. He did this by relying not on the conscript armies, which had proven useless, but by building up battalions staffed by sons of local magnates who had a direct interest in the victories. These new, smaller units contributed to victory but also, in the long run, to localism and disunity, for they were an indication that the military strength of the future would lie with local grandees rather than with central conscript armies. The title of *sei-i-tai-shōgun*, which Sakanoue returned after his victories, later became the designation for the military lord who served as apex of the feudal hierarchy that was to come.

Kammu's successors failed to equal his achievements, but in their search for ways of restoring and maintaining the imperial prerogative and income they developed important modifications of the Chinese pattern of government that had been established in the Nara period. Modifications had already been introduced into the imported laws and bureaus in the Nara years, but in Heian times the process of adaptation was very much accelerated. The massive bureaucratic structure had from the first proved to be unwieldy and, in part, superfluous. As the realm of the public shrank in proportion to that of the private sector and as ranking offices became the preserve of titled courtiers who held them by reason of birth and not of ability, there was an obvious need to bypass the old boards. This was done by creating new offices, not incrusted with the honour and privilege of the others, by means of which the administrative procedures could be streamlined. The first of these, the *kuraudo* or archives bureau, was established in 810 to block an attempt that was being made by court bureaucrats to reinvest an abdicated sovereign with imperial power. The bureau gradually became an efficient channel for orders, ordinances and memorials, and it took over much of the function of the council of state. It is significant, however, that the old councils and their officers were not abolished or in any way disturbed; rather, their function, which had tended to become increasingly honorific, became entirely so. Around 820 a sort of police commission, the *kebiishichō*, was set up to help maintain order and dispense justice. In time it built up its own codes and customary law and, since it attracted men of courage and vigour, it speedily displaced in function the boards staffed by titled nobles who lacked both qualities. An audit office (*kageyushi*) also took over many of the functions of the former revenue and audit officials. These simplified and efficient boards functioned in somewhat the same way that comparable agencies served the interests of the great families and temples, and they suggest that the court, instead of being able to make good its earlier claims to absolute authority and full ownership of the land, was now only one among the great economic and political powers, dealing with its own problems in somewhat the same way its rivals dealt with theirs. It was some time before this was completely the case, but this aspect of the Heian administrative picture should be kept in mind in studying the modification of the pattern set up by the codes of Taihō.

The Fujiwara.—The most remarkable innovation of the Heian period, however, and the one that gives the greatest insight into political and social developments, was the rule of regents drawn from the Fujiwara (*q.v.*) family. Nakatomi-no-Kamatari, who had taken a leading part in the Taika reforms, had continued as a principal minister of the government that instituted the Chinese administrative system. He was later given the name Fujiwara, and his four sons were progenitors of the four branches of the Fujiwara house; of these the northern branch became most powerful. During the Nara period the Fujiwara failed to attain leadership, but early in the Heian period a series of able Fujiwara family heads emerged in control of the imperial government. They made no attempt to replace the emperor, but preferred to have him reign while they ruled. This pattern of indirect rule, with its separation of real and titular authority, was not entirely new; the Soga had practised it for a time, although the members of that clan eventually developed imperial pretentions. But the Fujiwara, and after them the several dynasties of shoguns, were content to maintain and honour the throne while seeing to it that its policies furthered their interests and desires. Their principal device was that of placing Fujiwara daughters in the palace as principal concubines or consorts of the reigning emperors. The emperors were often persuaded to abdicate at an early age—a decision that was not difficult to force on them since the throne carried with it onerous ritual duties with few of the rewards of decision making—after which a minor emperor would reign under the tutelage of his maternal grandfather or, at times, uncle, who would hold the title of regent. The Heian period and the centuries which followed are remarkable for the number of early abdications from the throne by emperors who preferred the leisure and comfort of "retirement" to the burdensome ceremony of "rule." The Fujiwara statesmen preferred for themselves two offices. That of *sesshō*, "regent," was of some antiquity and had been designed for incumbency during a ruler's minority. To this was now added the office of *kampaku*, which may also be translated as "regent" although some historians have rendered it as "civil dictator." Its holder was, for long periods of time, the first minister of the empire. The first member of the Fujiwara to take the title *kampaku* was Fujiwara Mototsune, in 877. Between 858 and 1068 there were 15 emperors, of whom 7 were minors, while 8 abdicated. The Fujiwara power reached its height under Fujiwara Michinaga, who controlled the court from 995 to 1027. He was father-in-law to four emperors and grandfather of four. There was still no absolute succession rule, and Fujiwara regents had the power to determine succession.

The Fujiwara regents were responsible for most of the significant developments in the field of legislation during the Heian period. The Taihō code of 702 was amended and changed by compilations of *kyaku* and *shiki*, emendations and additions that were issued by official order. Fujiwara regents were also responsible for the development of the non-Chinese offices which gradually superseded the authority of the boards set up after the Taika reforms. Succession to the post of regent became considered a matter of Fujiwara family rather than state business, and there was not as yet any national sentiment strong enough to overcome the principles of family (or clan) interest. The regents saw their interests so closely intertwined with those of the imperial house that they had a direct reason for upholding the prestige of the latter. Yet theirs was at the same time a separate dynasty, following its own succession policy, concerned with its own landed interests, constructing its own ancestral temples and frequently staging entertainments more lavish than the court itself could afford. The authority of the court was becoming tenuous, and in a sense its continued primacy depended upon the prestige which the brilliant life at Kyōto gave the courtiers in the eyes of leaders in other parts of the country. The splendour had come to depend upon income from the rural estates of the nobility more than from tax revenue. So long as the cultural prestige of the capital

continued unimpaired, its political decline was not immediately apparent.

Shōen.—The power of the Fujiwara and the cultural splendour of Kyōto are well known because of the histories, diaries and novels that document it. It is more difficult to study the process whereby the economic and political base of the Kyōto primacy was being eroded by changes in landholding and administration in the countryside.

The Taihō codes had been based upon the assumption that all land was the emperor's and that fields would be parceled out to farmers for occupancy subject to a periodic redivision, while officials and nobility were to receive fields whose income would support them during their tour of duty. But in actuality the redivision of farm plots was rarely carried out, even in the areas closest to Kyōto; in many outlying areas there are good reasons for doubting that it was ever done at all. Fields allotted to officials, furthermore, were seldom returned. During the Heian period, life at court became both more attractive and more venal. There were numerous devices for extending one's term in office and consequently lengthening the period during which income from the rank fields could be enjoyed. The records show that when new officials were appointed, they often had difficulty in taking possession of their office and especially of their office fields. This was particularly the case when the incumbent had good ties either with the Fujiwara in Kyōto or with local families who supported him. It also became common for newly appointed officials to remain in Kyōto instead of attending to their duties in the provinces. They could send deputies to collect their income. More and more, provincial offices were regarded as grants of income and status; not infrequently they were purchased outright.

As the private sector increased at the expense of the government ricelands, small parcels gradually were combined into larger units known as *shōen* or manors. These grew out of the fields originally given for office, merit, reclamation or, in piety, to temples. As the difficulties of farmers on government tax rolls multiplied, they tried to commend their allotment fields, which were gradually being recognized as their private property, to tax-exempt neighbouring estates. The *shōen* profited from this process of commendation (*q.v.*), similar to the European feudal practice. Typically, the *shōen* was controlled by local families who relied on the patronage of powerful nobles at court in whose name the manor was formally registered. In return for this patronage the farmers sent to Kyōto income that made possible the luxurious life of the court nobles. Within the *shōen*, farmers who had commended their fields or who had fled the burdens of life on government fields found that the incidence of labour tax tended on the whole to be lighter than the one they had known. There was less call for large-scale public works, and the dreaded conscription regulations no longer applied. Gradually the status of the smallholding farmer who worked his plot of government land changed as, dependent on the protection of powerful neighbouring families, he became attached to his land and approached a status of serfdom. There were, however, many varieties of status and of *shōen*, and it is difficult to speak with confidence of a national pattern. Many *shōen* were divided into several parcels of land, and sometimes rights of tax and income were shared by the managers with the Kyōto "owners," neighbouring temples and government tax collectors. But the government's role gradually declined. *Shōen*, which were first allowed a lower tax rate, gradually ceased to pay any taxes at all, and in time the estate managers denied government agents the right of survey, entrance and police jurisdiction. The great court families, and especially the Fujiwara, naturally led in the possession of such estates, which were scattered throughout the realm. The same was true of the great temples. By 1069, when the emperor Gosanjō tried to check the process of alienation of land by establishing a record office (*kirokujo*), he was quite unsuccessful. The remnants of the imperial realm, scattered throughout the provinces, had become only one among a series of national networks of *shōen*. Effective authority of the Heian court declined.

Heian Buddhism.—The two great figures in Buddhism during the Heian period were Saichō, posthumously called Dengyō Daishi, and Kūkai or Kōbō Daishi. Both studied in China. Saichō returned in 805 to establish the Tendai (*T'ien-t'ai* in Chinese) school in Japan; he erected the great Enryakuji monastery. While it began with cautious court favour as an implied alternative to the wealthy and powerful sects of Nara, Tendai became one of the great landed sects during the Heian period.

Kūkai returned in 806 from the T'ang capital of Ch'ang-an and established the Shingon ("True Word," Chinese *Ch'en-yen*) school; he founded his monastery (816) south of the Nara plain, on Mt. Kōya. Shingon doctrines of Buddhism introduced into Japan a great wealth of occult practices and colourful ceremonies which had great appeal for the Heian noblemen with their strong belief in spells and exorcism. Kūkai became a popular figure whose life is obscured by the legends surrounding him.

Both the new denominations attempted to reconcile Buddhism with Shintō, and both attracted the aristocrats at the capital. Thanks to the piety of the court and its nobles, their lands increased steadily, and by the end of the Heian period they found themselves subject to all the evils of worldly mindedness with which their founders had earlier reproached the Nara sects. The new sects, with their colourful ceremonies and impressive arts and rituals, changed the character of Japanese Buddhism very considerably. Insofar as can be judged from the literature of the Heian period, however, it is difficult to claim for the Kyōto courtiers any profound appreciation of the intricacies of Buddhist philosophy. Since Heian society was greatly concerned with portents and divination, the ceremonies seldom expressed more than a desire to appease the supernatural. In the main, religion was expected to protect the country. Buddhism ultimately became the national faith in the far more simple cult of Amida (Amitabha), Lord of the Western Paradise, whose aid and salvation could be attained by a mere repetition of the proper prayer. It was in this manner that Buddhism, stripped of most of its philosophical subtleties, came to have a direct meaning for large numbers of Japanese after the 11th century. (See *The People: Religion*, above.)

Relations With China.—The gradual departure from the Chinese model in administrative techniques and organization did not indicate a lessening of respect for the T'ang empire. There were 12 official Japanese embassies to the T'ang court, and a number of projected missions that never reached their goal. These missions were large affairs, numbering as many as 600 persons, and were costly projects for the Japanese government. The monk Ennin (Jikaku Daishi), who was attached to the last formal mission, which sailed in 838, describes in a diary the trip and its dangers, his experiences in T'ang China and his return to Japan, where he fell heir to Saichō's see, the Enryakuji monastery. In addition to formal missions there were private journeys by traders who also transported students. The Japanese court was eager to obtain such Chinese luxury goods as incense, perfume and medicines, and the early narrative, *Taketori monogatari*, in which a princess sets her suitors the task of procuring rare merchandise from China and India, shows that possession of these items was part of the world view of Heian society. However, the principal impetus to the contact with China was the desire for religious and philosophical knowledge, and the most important items of import were Buddhist books and art objects.

It was natural that the urge to travel to China lessened after Ennin and other pilgrims brought word that Buddhism was on the decline there and that the T'ang empire was showing signs of weakness. In 894 the prominent minister and scholar of Chinese literature Sugawara Michizane, who had managed, by his ability and adroitness, to rival the Fujiwara in influence, was appointed ambassador to China. It was over 50 years since an embassy had been sent. Sugawara, who may well have feared that absenting himself from Kyōto would mean his eclipse by the Fujiwara, submitted a memorial which marks the end of the first period of borrowing from China. He pointed out that reports from previous Japanese visitors showed that China was in disorder, that Buddhism was being persecuted and that there was nothing to be gained by an official embassy; he advocated cutting off all intercourse with China. His memorial was accepted, and its author continued to

grow in power and favour. His Fujiwara rivals would not brook his competition, however, and Sugawara was later "exiled" as viceroy to Kyushu, where he died in 903. Sugawara was later deified under the name of Tenjin and was revered by Japanese as the god of literature.

Heian Society and Culture.—The literary record for the Heian period is extraordinarily rich and permits close inspection of many of the most intimate aspects of life at the capital. It deals, inevitably, with the inner court aristocracy—a relatively small number of courtiers, numbering perhaps 4,000 or 5,000. Theirs was a society in which personal relations and family connections counted for a great deal. It was a society governed by rigid standards of taste though not of morality, and it was a society in which the ladies played a large role. The courtier was judged by his ability to cap a poem with a graceful couplet, by his taste in clothes and colour, his skill in music, incense burning, calligraphy and painting and by his ability to carry on romance with discretion. Force and courage mattered less than grace and gaiety. The monuments of literary excellence were mostly the work of the court ladies, and their prose played a large part in establishing a classical pattern of language. The author Murasaki Shikibu, whose *Genji monogatari* (*Tale of Genji*) ranks as one of the world's earliest and greatest novels, also wrote a diary, which, like the *Makura no sōshi* of Sei-Shōnagon, her contemporary, allows numerous and revealing glimpses into the life at court. (*See* JAPANESE LITERATURE.) These works, to be sure, give only one aspect of Heian society, and present a somewhat idealized picture of life at court around the year 1000. They make it clear that personal advancement at court depended on personal relationships. None were more sensitive to nuances of approbation and displeasure, gracious acceptance and graceful snub than the ladies who recorded the events of their daily life. Power at court had become concentrated in the hands of the Fujiwara regents, while in the provinces new leaders were rising. In consequence, the role that remained for the functionaries in the older offices was largely a ceremonial one. It was probably inevitable that the rest of the aristocracy developed its extraordinary sensitivity to form and detail and its aptitude for amorous dalliance and graceful diversion. Human relations were the key to power and influence in court society. Matters of costume, of art and of romance furnished the surest indication of taste and breeding, and they had a political and social relevance that justified treating them with the loving care which the literature gives them.

Many diaries kept by the great Fujiwara ministers in Chinese are extant. These show that the ministers were far from pleasure-seeking dilettantes who ignored more important aspects of their work, but they bear out the importance of form and detail and personal relationships for the courtiers. They add other notes of simplicity, reserve and austerity which make it clear that despite the splendour of life in Kyōto, aesthetic tastes were modified by an asceticism and restraint that ultimately became the most marked qualities of Japanese art and architecture.

The religion that emerges from these literary records is concerned more with ceremony and ritual than it is with creed or morality, and it is not sectarian in any sense. The great nobles patronized shrine and temple, and invoked the aid of whichever seemed appropriate to the particular need or time. Their society believed deeply in spirits and in exorcism; the scene from the *Tale of Genji* in which Prince Genji's wife, the Lady Aoi, is exorcised may be considered a classic description of such a ceremony. It may be that it was the colour and the panoply of great Buddhist ceremonies, as it was the rich material for artist and sculpture in the Tendai and Shingon sects, that attracted the nobles most. Architecturally, the need for great halls for the ceremonies and rituals which the new sects emphasized added new, spacious halls to the temple complexes. The residences of the nobles showed that here too the rigid adherence to Chinese canons of the Nara period was undergoing change, as the formal architecture of Chinese inspiration was blended with the simpler lines of Japanese wooden-floored, thatched-roofed structures whose irregular lines and design complemented the garden settings in which they were placed. Indeed, it can be seen from the *Tale of Genji* that although great stress was placed on Chinese learning, so that Confucian texts and T'ang poets were part of the equipment of every literate man, the close reliance on Chinese precept was coming to seem rather old fashioned. When Genji's son reaches manhood the professors of Chinese learning are called in to go through the proper forms, but for the novelist and her readers those gentlemen seem faintly ludicrous. Chinese verse continued to be written, but the significant poetry was in Japanese. The second of the great anthologies, the *Kokinshū*, was completed around 905 and was prefaced by a famous discussion by Ki no Tsurayuki on the place and role of poetry. Its 1,100 poems were almost all short poems, 31-syllable tanka. Most dealt with topics of nature and love. In poetry, as in the prose of the court ladies, a classical style of Japanese had developed. It is clear that there was a large literature, of which only a small part has survived.

The court literature documents the distaste the civilized aristocrats felt for the countryside. It becomes clear why so many officials were reluctant to take up provincial posts, and why the appointment to Kyushu meant exile for Sugawara Michizane. The countryside seemed uncultured and even barbaric, and most of the nobles and their ladies could not imagine life away from Kyōto. Yet by the 10th and 11th centuries, during which the great masterpieces of Heian literature were being produced, the countryside was in large measure the private property of the nobles who lived on the income of their manors. That income was becoming less predictable as the estate managers came to realize that there was no real way of forcing them to contribute. Kyōto reflected the change. Fire and storm required constant expenditure to keep up the great buildings. By the 11th century parts of the capital were falling into decay, and the literature breathes a consciousness of change and decline. In part, this reflects a sentimental melancholy that had distinguished the Japanese outlook from the first, and in part it reflects the gentle despair of Buddhism that the law of change and decay, as of death and rebirth, is inexorable. But the fires that followed natural disasters were also indications of declining standards of order and efficiency. As law and order declined depredations from the countryside became inevitable, and descendants of young men who had left the capital for the harsh life of the country because there was no opportunity for them at court returned to find that they now possessed the power to influence and change the society that had rejected them.

The Retired Emperors.—The emperor Gosanjō, who came to the throne in 1068, had no Fujiwara connections and showed a strong desire to rule himself. Surprisingly, the Fujiwara seem to have been lacking in the daughters that had helped them in their rise to power. Equally important in the Fujiwara decline were rivalries within the family and the apparent dislike on the part of the new emperor, who had spent over two decades as heir apparent watching a Fujiwara regent rule the nation. Gosanjō tried to reform court procedures and expenditures, and in 1069 he established the *kirokujo* to verify claims of the nobility and temples to their *shōen*. It enjoyed only limited success, since it was impolitic if not impossible to attack the Fujiwara directly. Gosanjō died in 1073, to be succeeded by the emperor Shirakawa. Shirakawa continued his predecessor's attempts at personal rule, and abdicated in 1086 in order to continue his efforts from retirement.

There followed a period of government by retired and frequently cloistered emperors, which lasted until 1156. The practice of early retirement in order to avoid formal participation while retaining effective control was a common one in the familistic structure of Japanese society, and it is not surprising that the emperors, burdened as they were with empty ritual, should have sought to win the benefits of retirement for themselves. But while earlier imperial retirements, when not dictated by the interests of maternal Fujiwara relatives, had been motivated by a desire for greater leisure and ease, those of this period were motivated by the desire to bypass the authority of the Fujiwara regents in order to assume greater responsibilities.

The former emperors set up headquarters in their residences and worked through bureaus not unlike those used by the great families to manage their estates. An administrative centre or *mandokoro*

dealt directly with official matters. The retired emperors dominated their sons who served as titular emperors, and as a result power shifted from the titular emperor's maternal to his paternal relative.

Perhaps the chief result of this was the decline of Fujiwara power and prestige. Early in the 11th century virtually all appointments of the highest rank had gone to members of the Fujiwara family, but by 1100 members of other families, especially the Minamoto, held a majority of important posts. In seeking personnel for the new posts the retired sovereigns tended to look to new groups, and they often relied on members of families which, although possessing considerable landed wealth, lacked the aristocratic pedigree of the men whom they replaced. As a result, there was for a time a decline in standards of learning, of deportment and of culture, for the Fujiwara, however self-seeking, had been magnificent patrons of the arts and of religion and models of courtly behaviour.

Despite the promising beginning made by Gosanjō, the retired emperors who followed him proved to be more interested in luxury and the advantages of power than in responsibilities and reforms. This was particularly true of the retired emperor Shirakawa, who patronized temples, particularly after he took holy orders, with a view to flaunting his wealth and magnificence. He encouraged venality by his dependence upon representatives of the new wealth, and spent enormous sums on Buddhist images and temples, seriously depleting what remained of the imperial resources. The system of rule by retired sovereigns (*insei*) also led to much confusion, for there was sometimes more than one retired emperor in addition to a titular sovereign. Under such circumstances competition for favour and revenue offered inviting opportunities for groups anxious to gain from a succession dispute. It was such a struggle that ended the period of imperial rule in the civil warfare of 1156.

B. The Development of Feudalism

Rise of the Military.—The process of the accumulation of large tracts of land in private hands made possible the rise of local administrators with confidence in their own abilities. As their lands were removed from the tax rolls the income of these classes rose. They gradually dared to withstand interference from provincial and national officials and developed their own forces for keeping order within their areas. It seems probable that most of the forces so recruited were drawn from the sons of landholding farmers who entered the *shōen* system in a relatively favourable position, but they found their leaders in aristocrats who came to the country to find greater scope for their ambitions and who, hardened by the vigour and the danger of their new life, were prepared to test their strength in contests with each other and with the national power.

The 10th century was one of widespread disorder throughout Japan. The cultured aristocrats in Kyōto lacked all power to effect their desires outside the capital, for the old conscript armies had degenerated and the more recent *kebiishichō* had become a haven for well-connected nobles seeking sinecures. In some areas commoners armed for their own protection while in others police measures were undertaken by officials with special commissions as "pacification officials" (*tsuibushi*). But this did not result in an increase of strength for the central government, as the provincial governors could succeed in this program only by enlisting the support of local gentry, with the result that they speeded the process of fragmentization of power while trying to restore order.

On a number of occasions, government officials put themselves at the head of such groups and led insurrections that threatened to plunge the country into complete chaos. In 939 and 940 Taira Masakado, who had been sent to the eastern provinces in an official capacity, led a rising of local magnates that united, for a brief period, most of the Kwanto plain against the central government. Some sources credit him with imperial aspirations. The court hurriedly appointed a "subduing-the east generalissimo," but before his arrival Masakado met his death fighting with hostile groups of local warriors in 940. Fujiwara Sumitomo, who was dispatched by the court to deal with piracy, put himself at the head of pirate and dissident local bands to control most of the strategic areas along the Inland sea. A special *tsuibushi* was named, and Sumitomo was defeated in 941. Both risings illustrated the possibilities of leading the rural leaders. Both were put down, not by the central government, which was wholly dependent on the favour of its supporters, but by locally organized and led forces. Again, when an invasion from China was feared in 1019, those exhorted to resist were the gentry of Kyushu.

It was inevitable that the local leaders and estate managers should come to realize that there was no real necessity to send any surplus to the nominal owners of their estates at Kyōto, and that their Kyōto patrons were as dependent upon them militarily and politically as they were economically. Still, it required much time for this to penetrate their consciousness; the capital retained the prestige of cultural advancement and the regional groups were not yet sufficiently united to think beyond local issues. Ironically, it was the court nobles themselves who called the warriors in. They did so to solve their own police problems. The Fujiwara under Michinaga, for instance, maintained close relations with the Seiwa Genji (Minamoto) group of warriors; their help became particularly necessary in order to deal with the marauding groups of monkish warriors from the temples to the north and south of Kyōto. The depredations of these groups were usually aimed against each other but they proved destructive to the capital which lay between them. The great temples had become venal, powerful and secular. This had come about partly because of the aristocracy's action in placing its sons as abbots. Abbots numbered 7 in A.D. 819 and 57 in 1086. Accumulation of land and wealth had accompanied this growth of the hierarchy, with the result that the aristocracy, which first helped to secularize the temples, now found the new secular forces threatening its own interests. The warrior-monks frequently took advantage of the superstitions of the aristocracy to terrorize the court and enforce their demands. The rural leaders had fewer compunctions about dealing with these incursions, and their help was requested more frequently in the 11th and 12th centuries. Then, in 1156, a succession dispute brought the warriors into the capital to stay.

Taira and Minamoto.—The great warrior leagues were headed by families which claimed imperial descent. It had long been the practice to send younger sons of the emperor to the country in the event that there was no place for them at court; by provisions of the codes they were expected to change their name after six generations. Thus the principal branch of the Minamoto family was known as the Seiwa Genji (Gen being the Chinese reading of the character for Minamoto) because they traced their origin to the emperor Seiwa (858–876). They began as allies of the Fujiwara, and the relations between the two houses were particularly close during the time of Fujiwara Michinaga, the greatest of the regents. The first Minamoto served in official appointments in the provinces, and his descendants served at court as military officers and also as provincial officials. In these capacities they were well placed to gain support from rural families of importance, and they also rendered useful service to the Fujiwara. At first, the private holdings of the Minamoto were centred in western Japan, but the family members who settled in eastern Japan gave such a good account of themselves in frontier wars against the Ainu and against the rebel Abe Kiyowara that they came to have great holdings in the east. The other principal warrior league, that of the Taira family (or Heike, as the Chinese reading has it), descended from a grandson of the emperor Kammu. They began with large holdings in the eastern provinces, but because of Minamoto victories there and because of the eclipse of their rebel chief Taira Masakado in 940 their centre of strength shifted to the Inland sea area. The Taira helped the court by subduing the pirates who controlled the Inland sea in the 10th century. In so doing, they gained many retainers and the opportunity for trade and profit with Sung China.

During the 10th century the warriors of the country gradually affiliated with two great leagues headed by these families. Although the bonds of lord and retainer were based upon a pretense of family relationship, there was not necessarily any family

connection between all the principal figures on either side. For many years the two "family" leagues were not closely united at all. In the early warfare of the 11th century there were Fujiwara, Taira and Minamoto on both sides of the struggle, just as there were members of the imperial family whose interests the warriors were professedly championing. Each victory resulted in a number of sharp reversals of policy for important warrior families and the bonds of absolute loyalty, although frequently avowed, were not always proof against the likelihood of defection.

Warfare erupted in Kyōto in 1156 and 1159. The first war, called that of the Hōgen era, was caused by a succession dispute. The retired emperor Toba, who died in 1156, had tried to elevate his fourth son to the throne as Goshirakawa instead of permitting his earlier son, Konoe, to remain as emperor. On Toba's death a struggle developed between adherents of a third son of Toba, Sutoku, and Goshirakawa. There were members of the Taira, Minamoto and Fujiwara families on each side. The adherents of Goshirakawa were victorious, and the leaders of the opposition were slain.

After the Hōgen war Goshirakawa ruled until 1158, after which he abdicated to rule from retirement until 1192. By that time he had put two sons and three grandsons on the throne. In 1159 and 1160 resentment on the part of the Minamoto over the superior rewards that had been meted out to the Taira after 1156 resulted in a coup against the Taira. Although the Minamoto were at first successful, the Taira recovered to deal them a crushing defeat. This was the celebrated war of the Heiji era, the subject of the classic military tale *Heiji monogatari* and depicted in the narrative scroll housed in the Boston (Mass.) museum.

Taira Kiyomori.—Taira power reached its peak under Taira Kiyomori (1118–81). He became head of the Taira clan in 1153, and by the time of the Taira victory in 1160 he had shown political skill as well as ruthlessness and resourcefulness. Although Kiyomori possessed the power to make great political changes after the wars of 1160, he showed little liking for the task. Instead he chose to exercise his power through many of the techniques that the Fujiwara had used before him. He saw to it that his close relatives received titles and positions at court, while he himself was given the highest rank that could be given a subject. He married daughters into the Fujiwara family and into the imperial family; in 1180 he found himself in the typical Fujiwara position of having a grandson, Antoku (then aged two), on the throne. Kiyomori himself held high office (chancellor) only a short time, as he preferred to exercise his influence through a sovereign he could dominate. He maintained close relations with the retired emperor Goshirakawa, but neither trusted the other fully.

Kiyomori's ruthlessness came to the fore in the treatment he meted out when he discovered that conspiracies had been formed against him. He did not hesitate to use the death penalty, which had fallen into disuse under the Heian rulers, for monks implicated in one such plot. His attitude toward the warrior-monks was an important measure of the difference between the new military leader and the old court rulers. The Heian leaders had refrained from striking back against the monks who invaded Kyōto to capitalize on their psychological advantage in a credulous and superstitious society. Kiyomori, however, was not afraid to show force when his personal interests were threatened. Although he personally shared most of the outlooks of his contemporaries—he took the tonsure—he attacked and sacked the Tōdaiji and Kōfukuji monasteries in Nara.

At the height of his power Kiyomori decided to move the capital to his own city of Fukuwara, on the site of the present city of Kōbe (*q.v.*). He was apparently motivated by a desire for more ready access to the Inland sea and China trade routes, and he was also anxious to remove himself from the intrigue and backbiting of the Kyōto aristocrats who despised him as an upstart. The move was made, only to be reversed after six months, partly, it seems, because of the health of the then ailing emperor Takakura. After the court returned to Kyōto, Kiyomori took up headquarters in his Kyōto palace. He was by now thoroughly distrustful—not without reason—of the emperor Goshirakawa, and restricted his actions so closely that the system of government by retired emperors came to an end.

By the time of Kiyomori's death in 1181, the Taira partisans were in very strong positions, but no significant change had been made in the system they inherited in Kyōto. Many Taira retainers and relatives had been rewarded with estates and offices throughout the realm, but Kiyomori's principal power was still based on the products and trade of the Inland sea area. In other regions the local gentry, although formally committed to Kiyomori, were restive and discontented with the division of the spoils that had been made, and continuing loyalty was far from certain. The Taira interlude was important not so much for any changes as for the character and lineage of the new leaders. In one sense the Taira period was one of continual disaster as fire, pestilence and famine struck the nation. The mood of pessimism that resulted is well mirrored in the *Hōjōki* of Kamo no Chōmei. Its description of life in Kyōto with its hardships and alarms makes it clear that the glory of the Heian capital had come to an end.

Minamoto Yoritomo.—The Taira greatness was not of long duration. Minamoto Yoritomo (*q.v.*; 1147–99) had been spared after the Minamoto defeats in 1160, when he was sent to Izu to live under the guardianship of a Taira vassal named Hōjō. There he quietly gathered supporters and waited for a chance to restore his family's fortunes. In 1180 an imperial prince issued a mandate to the Minamoto to strike the Taira, and although the attempted rising failed in Kyōto, Yoritomo used the mandate as a justification for a foray immediately after. Despite early setbacks he was able to gain much support among Taira vassals in the east who were discontented with the policies of Kiyomori. In the years that followed Minamoto armies defeated the Taira at Ichinotani (1184), Yashima (Shikoku) and Dannoura (1185), a great sea battle in which the child emperor Antoku and his entourage were drowned. These celebrated battles provided material for military romances (*gunki*) and drama for future centuries. During the wars Yoritomo maintained his headquarters at Kamakura (*q.v.*) to the east, and left the fighting to his younger brother Yoshitsune and his cousin Yoshinaka. It was not an age of trust, and Yoritomo's jealous and suspicious nature made him break with each of these after they had gained their great victories. The last to be hunted down was Yoshitsune, whose melancholy flight with his trusted retainer Benkei ended with his suicide in northern Japan after he was brought to bay. He became one of Japan's great heroes, and Benkei was immortalized as a paragon of loyalty, courage and resourcefulness.

Minamoto Yoritomo was by instinct conservative and cautious, and although he made great changes in Japanese society he did so with the professed desire of restoring traditional ways. He showed great respect for the throne and the retired emperor Goshirakawa, which was not fully returned; it was not until the latter's death in 1192 that Yoritomo received the title he coveted of *sei-i-taishōgun*. He thus became the first shogun (*q.v.*) and began the line of feudal overlords who were to have effective political rule for the next 750 years. Although Yoritomo was deferential to the court, he saw that the military structure of the nation was under his control and that rewards would come only from Kamakura, which now became, as seat of the *bakufu* (*q.v.*) (camp office or military government), a second administrative centre.

Yoritomo did not try to sweep away the distinctions that had accumulated around *shōen* and government offices, but he did take steps to restore some central control to a system that had become increasingly anarchic. He suggested to the court that the estates the Taira had confiscated or expropriated should be taken back again, presumably for distribution to his own retainers. Then, in 1185, before his military primacy was fully established by the elimination of possible competitors, he wrung from the court permission to place *shugo* (often translated as "constables" or "guards") in each province and *jitō* ("stewards" or "district headmen") in taxable areas. By this means he obtained part of the revenue of each area, and he influenced and to an extent directed its administration. Perhaps more important, he could reward the leading warriors whose loyalty he required with lucrative

and prestigious appointments. But the lack of uniformity that characterizes any feudal order remained; in some areas the same family head served as official of a *shōen*, as *jitō* and as an official in the provincial government. Such a person would in all probability be too deeply rooted in the loyalties of his supporters to make it advisable to antagonize or move him; his descendants were likely to become feudal lords of the locality.

The feudal order that developed under the Kamakura shogunate marked an important stage in Japanese social history. Generations of unrest had tended to convert the class lines that existed in the *shōen* system—owner, manager, owner of commended fields, tenant, labourer—into a pseudomilitary order; all were expected to join in the common defense if necessary. The warfare of the 12th century separated out the upper levels of this hierarchy, who became mounted knights with an intense pride of class and family. They were the champions who rode out ahead of the host, announced their lineage and challenged their opponents to combat. It was the effect of the Kamakura order to link all such groups into an order which was modeled on that of the clans with their blood ties, so that the warriors or samurai were called *gokenin* ("men of the family"), and they repaid their lord for his protection with their loyalty and gratitude. The Confucian learning with its familistic emphasis translated these terms into those of family relationships, a trend that blended easily with the Japanese sense of family hierarchy. In Kamakura times there also developed other characteristics of the Japanese feudal code such as loyalty to death, suicide to save one's honour (*see* HARA-KIRI) and intense pride of honour and name. More than his European counterpart, the Japanese samurai (*q.v.*) owed his lord an unconditional and total loyalty; it was not limited to the stipulations of a contractual engagement. Although the warfare of the period is full of instances in which self-interest outweighed such claims and battles were frequently won by treachery instead of heroism, impressive evidences of the strength of these claims of honour remain. At the same time, however, the *bakufu's* claim of loyalty to the imperial court had the effect that little of the old hierarchy was done away with. Fujiwara regents continued to serve titular and often retired emperors at Kyōto, although their area of authority had virtually vanished.

At the death of Yoritomo in 1199, the power of the Minamoto family (Genji in the Chinese reading) gravitated into the hands of the Hōjō (*q.v.*), the family who had first sheltered Yoritomo in Izu and who had provided him with a wife. They took the title regent (*shikken*) and dominated the councils of the *bakufu*. The Hōjō provided a series of exceptionally able administrators, and they showed vigour when the *bakufu* seemed threatened. In 1221 court nobles under the leadership of the retired emperor Gotoba conspired with temple armies and disaffected vassals to attack Kamakura. The Hōjō crushed their opponents on the field, exiled three former emperors including Gotoba and deposed the titular emperor. One of the benefits of this rising for the *bakufu* was that it provided an excuse for the confiscation of several thousand estates belonging to those implicated, with the result that the loyalties and gratitude of the armies who had put down the rebellion were ensured for some time to come. Thereafter the *bakufu* had the power to determine succession to the throne as well as the selection of the principal ministers in Kyōto.

The *bakufu* organization received its final statement in 1232 when its feudal code, the *jōei-shikimoku*, was issued for the guidance of the *bakufu* courts as well as for the constables and magistrates throughout the country. The code dealt in general terms with the functions of officials and principles of inheritance and succession; it gave many indications that the *bakufu* under the Hōjō had become a more truly national feudal administration instead of remaining narrowly concerned with the interests of the eastern warriors who had served Yoritomo.

Cultural Developments of the Kamakura Period.—During the Kamakura years Buddhism spread from the capital to the countryside. The older sects did not die out, but the principal developments in Buddhism concerned the spread of the Zen sect and of the popular faith sects.

The Zen (*q.v.*) or meditative sect flourished in south China during the Sung period of the 10th to 13th centuries. Zen was peculiarly suited to the needs of the military men who were ruling Japan, and most of the great Hōjō regents had Zen advisers. Not a few Zen masters were also sword masters. Zen emphasized experience and discipline, and most of the Zen masters were highly learned men who brought with them much of the Neo-Confucian canon of Chu Hsi (*see* CONFUCIANISM). Zen also ushered in the idealistic and impressionistic monochrome art of the Sung period. With Zen came tea, used as an aid to meditation and a boon to health, and with the tea ceremony came great advances in the art of ceramics, whose connoisseurs held as their ideal the irregularity of the *temmoku* ware of Sung China, with its distinctive depth of glaze.

Among the commoners, Buddhism expressed itself in the popular faith sects of Amida and the Lotus. The Amida sect was implicit in much of Tendai, and it had its origins in the Heian period. Its simple message of salvation was well fitted to the needs of the common people in an age of crisis. It was taught by a series of evangelists of whom the greatest were Hōnen (1133–1212) and his disciple Shinran (1173–1262). The great image of Amida erected at Kamakura in 1252 symbolizes the faith that was adopted by most Japanese Buddhists.

An interesting variant of popular Buddhism was that of Nichiren (1222–82), who preached faith in the Lotus *sutra* as the sole path of salvation. Nichiren warred against rival sects with an intolerance unmatched in Buddhist history, and warned that unless his teaching became the basis of the nation Japan would suffer a great disaster. The Mongol invasions which followed made him seem prophetic, and the sect he founded consistently tended toward nationalistic forms of expression. (*See* also *The People: Religion*, above.)

In literature the Kamakura period saw the end of the production by court ladies that had distinguished the Heian period. They gave way to epic tales of the great battles, often recited by traveling minstrels. The most famous of these, the *Tale of the Taira Family* (*Heike monogatari*), recounted the startling rise and fall of the Taira cause as an object lesson in the transitory nature of human glory. (*See* JAPANESE LITERATURE.) In architecture the distinctive developments were the monumental temple style associated with the great Zen monasteries and the large auditoriums required for the popular faith sect temples. (*See* JAPANESE ARCHITECTURE.) Art found new subjects in portrait painting, both of the strong political leaders of the time and of the dynamic Zen abbots, while the first steps toward the idealistic monochrome paintings of the Zen style were taken. (*See* JAPANESE PAINTING AND PRINTS.) In sculpture new techniques of joining released sculptors from their bondage to the individual block of wood and permitted figures of striking realism and extraordinary dimensions, a process which is inseparably associated with the name of Unkei. (*See* JAPANESE SCULPTURE.)

The Mongol Invasion.—Despite the rupture of formal relations with China in the 9th century, private trade and contact had continued as priests, students and merchants continued to make the trip. After the T'ang dynasty was replaced by that of the Sung in 960 a vigorous trade in books and cultural imports was carried on by Chinese merchants to the towns along the Inland sea; this trade had been an important source of money for the Taira cause. In 1279, however, the Sung were overthrown by the Mongol armies whose khan, Kublai or Khubilai, established himself as emperor of a new Yüan dynasty. (*See* KUBLAI KHAN.) Projects of conquest carried Mongol power to Korea and southeast Asia, and Japan inevitably came in for attention also. Marco Polo, who served in the Mongol bureaucracy for a time, described the island of Zippangu (a corruption of the Chinese reading for Japan) as rich in gold. In 1267 Korean ambassadors arrived with the khan's orders for submission, but the Hōjō regent Tokimune encouraged the court to take a strong line of refusal and mobilized his vassals. In 1274 a Mongol armada carried in Korean ships came to Hakata on Kyushu by way of the islands of Tsushima and Iki, whose defenders were overwhelmed.

Although the Japanese warriors fought well their tactics and weapons were no match for the mass formations and longbows used

by the Mongols. A violent storm that destroyed most of the Mongol fleet saved the day for the defenders, and the Mongols retired with enormous losses. A second expedition, staged from both China and Korea, approached Kyushu in 1281. Under Hōjō Tokimune's direction all possible warriors had been mobilized and a sea wall designed to obstruct the landings had been constructed. The invading forces managed to land at several points, but in vigorous fighting during the summer months the Japanese defenders fought on somewhat equal terms. The fall typhoon season providentially arrived and with it a divine wind or *kamikaze* that destroyed most of the invading fleet. The Chinese and Korean forces were driven off with tremendous loss of life. The Mongols planned, and Tokimune expected, a third attempt, but despite general mobilization on both sides it never came.

The Mongol crisis became a national epic in which the national deities had intervened to save the sacred soil of Japan from the pollution of foreign conquest. It was the occasion for a revival of trust in the national deities and especially the sun-goddess and her shrine at Ise. Even the Buddhism of Nichiren reflected the martial vigour and nationalistic strains of the time. The invasion and the preparations made for the defense also had very important economic and political effects upon the *bakufu*. It was forced to make sweeping demands upon its vassals with no possibility of rewarding them with enemy lands or estates. There are numerous indications that by the end of the 13th century many of the warrior class were deeply in debt to moneylenders and the merchants whose growth in influence had been a significant feature during the peaceful years of Hōjō rule. In 1297 an "act of virtue" (*tokusei*) attempted to bolster the economic position of *bakufu* retainers at the expense of the merchant class by forbidding creditor appeals for the collection of debts and ruling out the foreclosure of mortgages on retainer estates. Such measures, however, defined the problems rather than solving them. As the *bakufu* was unable to reward its vassals they rewarded themselves, and the annals of the time are full of indications that *jitō* were seizing the manors to which they were assigned while *shugo* were taking over the provinces in which they served. The lines between province and estate and Kyōto were strained and broken, and in the countryside a new and more truly feudal order of subinfeudation developed. It was not uniform, and it was not without its own dynamics; in many areas landholders were aggrandizing themselves at the expense of their neighbours and tenants, and rising as *myōshu* to challenge the authority of the *jitō*. It became clear that the *ad hoc* solutions Yoritomo had brought to the problem of order and income were no longer adequate. A rising vigour within certain sectors of Japanese society and a weakening of the bonds of loyalty and gratitude of the vassals had created a situation wherein ambitious men would use force to improve their position.

The Ashikaga Shogunate.—The Kamakura shogunate was overthrown early in the 14th century by the emperor Godaigo (ruled 1318–39), who was able to rally support from discontented warriors. His first venture was crushed and he himself exiled to Oki, but he escaped, gathered a large following and defied Kamakura. The *bakufu* sent against him a large force headed by one of its vassals, Ashikaga (*q.v.*) Takauji, who, seeing that greater opportunities existed for him in the other camp, switched his allegiance and deserted to Godaigo's cause. The years 1334–35 are often referred to as a "restoration" of imperial rule. Godaigo attempted to make it such, but in his attempt to return to the system of imperial rule of an earlier day he alienated his warrior followers, who had expected generous rewards in land. As a result it was possible for Ashikaga Takauji to establish himself at Kamakura in 1335 and to drive Godaigo out of Kyōto that same year. Takauji set up an emperor from another branch of the imperial family, and was appointed shogun in 1338.

Until 1392 there were two imperial courts, for Godaigo retired with his loyal supporters to the mountainous country of Yoshino south of the Nara plain where he resisted all attempts to crush him. His Yoshino or southern court marked a significant point in Japanese nationalism, since his adherents rationalized their position by emphasizing issues of imperial divinity and continuity. *The True Account of Imperial Rule* (*Jinnō Shōtōki*) of Kitabatake Chikafusa, one of Godaigo's most important supporters, begins with the ringing phrase, "Great Japan is a divine country," and goes on to excoriate the pattern of shogunal usurpation of the imperial prerogative. Another of Godaigo's supporters, the great samurai Kusunoki Masashige, is credited with prodigious feats of valour in the warfare that took place; he earned an honoured place among models of virtue praised by partisans of the imperial house in later days. The southern line of emperors is recognized as the legitimate one, although it gave way to the northern at the time of unification in 1392.

Unlike the Minamoto, the Ashikaga established their capital in Kyōto, in the Muromachi district, for which the arts of the period are called. There they headed an administration modeled in most respects on that of the Kamakura *bakufu;* a Kamakura branch ruled the eastern part of Japan. This division is significant, for it showed that the east, which had formerly been less populous and less productive, was now so vital to any government that pretended to rule Japan that it could not be left to emissaries from Kyōto. Both the Kamakura and Kyōto headquarters of the *bakufu* were staffed by its leading vassals, and rivalry and jealousy between these great families weakened Ashikaga unity. The Ashikaga *bakufu* was never as strong as its predecessor. Its priority was not based upon a series of great conquests comparable to those of Yoritomo, and it never established more than a general suzerainty over many of the great military figures. Its power and eminence were greatest during the shogunate of Yoshimitsu, who was shogun from 1368 to 1394 and who lived until 1408.

The political history of the Ashikaga years is turbulent and confusing, but there were important developments in social history. One of these was the rise in importance of the merchant class. The Ashikaga had numerous estates, but they were not able to exploit them fully. Instead, they derived a significant percentage of the large sums they required for their luxurious life in Kyōto from foreign trade. Outwardly this took the form of tribute missions to Ming China, in which the shogun styled himself "king of Japan" and accepted in form the status of tributary state. His chief service to his Ming overlord was to control the pirates or *wakō* that ravaged the coasts of Korea and China. In return for this the Ming gave to Yoshimitsu and his successors valuable gifts and large sums of coins which became the standard currency used in transactions in Japan. The shogunate reaped further benefits from the trade by leasing ships to the great Zen temples, to other lords and to merchant guilds. These ships were permitted to accompany the official missions and to sell their products in Chinese ports. Yoshimitsu's successors hesitated to accept tributary status as he had done, but they remained anxious for the Chinese copper coins. The importance of the trade as a stimulus to and mirror of economic growth in Japan was great. After official missions came to an end, private bands of traders and marauders continued to make the trip to China. There was a steady growth of merchant guilds and specialty groups in Japan, some licensed by the *bakufu* and some lesser lords; warrior indebtedness was so constant that shoguns found themselves issuing frequent "acts of virtue" canceling debts; such edicts, however, had less and less effect.

The China contact also made possible continued importation of the artistic products of Sung and Ming China, and Japanese ceramics and painting made important strides under the patronage of the art-loving shoguns and the great Zen temples of Kyōto. Some painters like Sesshū (1420–1506), whose monochrome landscapes mark a high point of the tradition, studied in China. In dramatic arts, Yoshimitsu patronized performers who developed the techniques and repertoire of the nō, Japan's great lyric drama (*see* Nō Drama). Numerous architectural masterpieces survive to testify to the taste of the Muromachi patrons. Among them are some of Kyōto's greatest Zen temples and their gardens. Yoshimitsu's Kinkakuji or Golden pavilion (built in 1397), although burned and rebuilt after World War II, and his successor Yoshimasa's Silver pavilion (Ginkakuji, begun 1482) are among Japan's great treasures. A feature of the temples and residences of the period was the development of the tearoom, a small chamber in which the restful and meditative tea ceremony was held.

Many of the treasures of the Ashikaga period, and most of its great families, disappeared during and after the warfare which broke out in 1467 in Kyōto. For a decade fighting raged in and around the capital, and even after subsiding there it spread to the provinces as the urge for wealth and power that had brought the great vassals into conflict in Kyōto led them to try to unseat their rivals on their home grounds.

Social Change.—The disorder and warfare brought to light the evidence of very profound social changes that had been taking place, changes which help to account for the disappearance of so many eminent families and their vassals after 1467. In the countryside the development of a social organization approximating that of the modern village had given landholders and rural leaders an opportunity to mobilize their inferiors (small holders, tenants and servants) against their superiors when conditions became unbearable or when those superiors were absent from the province. In 1428, for instance, petitions were forwarded from village leaders in provinces close to Kyōto asking for remission of back taxes and a lighter tax burden in the future. When these petitions were ignored, rebellions broke out and spread among communication routes between the leading temple and trade centres. After further outbreaks, in 1485 leading farmers in the province of Yamashiro met to discuss a way of ridding themselves of the scourge of feudal armies that marched across their fields seizing "taxes" as they passed. They selected a committee of 36 to make decisions and managed to keep feudal levies out of the province for the better part of seven years. Under pressure of this sort, the old-style *jitō*, who had concerned himself chiefly with eliminating rival tax collectors and who had established no real link with the peasants of his area, was doomed.

Even more striking was the case of the old *shugo* feudal lord Asakura in the Japan sea coastal province of Echizen. There popular faith Buddhism had first been introduced by Shinran in the 13th century. His successor Rennyō (1415–99), head of the Honganji church in the 15th century, preached in the same area, organizing churches which ministered directly to the needs of the villages. Soon the metropolitan temples in Kyōtō complained that their estates and branches were no longer transmitting income to them; when they enlisted the aid of the feudal lord Asakura the countryside rose in revolt. Organized and led by their priests and armed with simple weapons, the farmers proved more than a match for the sword-wielding samurai; their sect became known as Ikkō, "One Direction" or "Single Minded." Members met regularly for instruction in the faith and in discipline. Village leaders whose sons became priests had a natural claim to the loyalties of their members, and in battle the sectarians, certain of their salvation, proved that the superiority of the mounted aristocrat was nearing its end. The Ikkō sectarians spread along the Japan sea coast and into eastern Japan. The great Honganji temple at Ōsaka became their headquarters. Not until new methods of warfare were worked out in the 16th century were they to lose their power.

The difficulties of dealing with these new social forces were such that most of the old warrior types, who were oriented toward competition on a national political scene and indifferent to the welfare of their farmers, were doomed to extinction. The first to go were those closely allied with the Ashikaga for they expended themselves in a losing cause. The wars that began in 1467 broke old loyalties. Throughout the country insubordination and disloyalty, expressed in the phrase *gekokujō* ("inferiors striking superiors"), became the rule.

The feudal lords who survived the change were usually on the outer fringe of the national scene. The future belonged to a new style feudal lord or *daimyō (q.v.)*. These often came from the lower ranks and began as retainers or estate managers for the *shugo* lords whom they replaced. They were usually men with strong ties to rural leaders, and before setting forth on national conquest they concentrated on securing the loyalties and services of the village leaders in their own domains. It required almost half a century of intermittent, small-scale warfare of consolidation before such figures, who began with a modest redoubt and a few followers, were able to gain the loyalty of neighbouring figures and move on to larger things. Then, just as units of control were becoming larger and unification seemed at least a possibility, new weapons from abroad helped to accelerate the process.

C. The Unification of Japan

The 16th century was a time of great upheaval and constant fighting, but by the end of the century Japan had achieved substantial unification or, at least, pacification. This was pre-eminently the achievement of three great generals. Oda Nobunaga, Toyotomi Hideyoshi and Tokugawa Ieyasu were men of exceptional ability; their military and political measures ended the disorder of the previous era and created a stable base for the measures of the Tokugawa shogunate which endured until 1867. Each of the three worked against the background of new foreign technology and religion, and thanks to the presence in Japan of Portuguese and Italian Jesuits and British and Netherlands merchants the period is unusually rich in illuminating side lights on the character and work of the great unifiers.

Arrival of the Europeans.—In 1543 a storm drove a Portuguese vessel bound for China north to the small island, Tanegashima, off the southern tip of Kyushu. The visitors were well received, and the firearms they brought were soon dubbed *Tanegashima teppō* ("iron rods") and manufactured in Japan. The vessel was followed by others that traded in the Kyushu ports. In 1549 a vessel included Francis Xavier (*q.v.*) among its passengers. Xavier had with him two fellow Jesuits, two servants and three Japanese who had been won to the faith in south Asian stations. Xavier left two years later with the conclusion that it would be wise to attempt to win China to Christianity first, but he was enthusiastic in his appraisal of the Japanese he met. "It seems to me," he wrote his superiors, "we shall never find among heathens another race to equal the Japanese"; he praised the qualities of honesty, courage and respect for status which he found everywhere. By the time he left Japan, he referred to the Japanese as "the delight of my heart" and considered them superior to Europeans in many respects. He left behind him a Christian community of about 1,000 converts.

For the next half century the work of the Christian missionaries and their teaching (*Kirishitan-shū* or *Tenshu-kyō*) enjoyed a considerable success. The most dramatic chapters were written by the Jesuits, who, under Portuguese patronage and Italian management, admired the emphasis upon class and hierarchy they found in Japan and suited their message to it. Themselves largely drawn from aristocratic backgrounds, the Jesuits felt that if they could but make their message palatable to the samurai and *daimyō*, the other Japanese must necessarily be won. Within the Jesuit order, hierarchic ranks were rigidly maintained, and in dealing with their aristocratic Japanese hosts—who alone, among Asians, were permitted into the order—the Jesuits seemed equally the representatives of a military society, comparably schooled in self-mastery, courtesy and courage. Able linguists and interpreters who enjoyed the respect of the Portuguese captains, the Jesuits were also able to profit from the eagerness of the Kyushu *daimyō* for the trade the Portuguese brought. After the breakdown of Japanese relations with Ming China, the Portuguese were the only sources of Chinese silk and Indian and Persian luxury goods as well as European firearms. Thus the power to influence the selection of a port of call was highly useful, and the Jesuit spokesman Valignano wrote his superior: "Your Reverence must understand that after the grace and favour of God the greatest help that we have hitherto had in securing Christians is that of the Great Ship."

The "great ships," usually carracks (galleons) of 600 to 1,600 tons, came annually from Macao. The Japanese regarded them with wonder and depicted the ships with their colourful passengers in the famous *namban byōbu* ("southern-barbarian screens"). In order to finance their far-flung activities, the Jesuits found it necessary to enter the trade themselves. They were allotted a regular share of the silk tonnage; in addition, under pressure from their *daimyō* converts, they also took part in the currency exchange that made it profitable to export Japanese silver to buy gold. At Nagasaki, which was to become Kyushu's great port, the Jesuits established a permanent base. The *daimyō* there ordered his retainers to become Christian, burned Buddhist temples and invited

the Jesuits to establish their headquarters. This they did, and beginning with 1571 the "great ships" came regularly to Nagasaki, which thereafter, even after the expulsion of the missionaries and the proscription of Christianity, remained the only port for foreign trade until the 19th century. The Christian community grew rapidly, and the Jesuits' report of 1582 claimed 150,000 converts. Many of these were no doubt nominal, including forced conversions ordered by newly won *daimyō*, and many were surface, the work of opportunistic lords anxious to gain European trade and weapons. But the number of Japanese who chose exile or death to recantation in later years shows that the missionaries also made major gains. During their most successful periods of work, they enjoyed the protection and favour of the newly emerging political leaders Nobunaga and Hideyoshi.

Oda Nobunaga.—The internal wars that had gone on intermittently since the outbreak of the Ōnin wars in 1467 had resulted in numerous changes in the political make-up of Japan. After the decade of warfare around the capital in 1467–77, most of the lords had had to retire to their provinces to put down revolts from below, whether from farmers (as in Yamashiro or in the case of the Buddhist sectarian rebellions) or from local magnates who had developed followings that enabled them to erode the sources of support for the higher authorities. In the process most of the *shugo*-type *daimyō* who had derived from Kamakura and Ashikaga appointments had been removed. By the first half of the 16th century a process of reconsolidation had begun to take place as new powers emerged, first on the local level in opposition to the old *shugo daimyō*, and then on the county and provincial levels in opposition to competing neighbours whose lands and small fortifications were absorbed. The number of important military figures grew smaller, their areas larger, and it was inevitable that they would try again to achieve a national primacy. Some of the great figures with national aspirations were hampered by powerful neighbours. Takeda Shingen and Uesugi Kenshin, for instance, were in a state of virtually permanent warfare, as a result of which neither was able to devote himself fully to national ambitions. At Kyōto the court and the Ashikaga shogun had deteriorated in material well-being and political authority, but it was logical that newly ambitious men should try to capitalize on whatever legitimacy could be gained from authorization by these traditional forces.

The first steps toward unification were taken by Oda Nobunaga (1534–82), who may also serve as a representative example of the changes that had taken place. Nobunaga was the descendant of a man who had served as estate manager in the Japan sea province of Echizen under a *shugo* family named Shiba. When the Shiba moved to Owari (the Nagoya plain), the Oda family accompanied them, grew in power and influence and ultimately replaced them. Nobunaga began with four districts in Owari under his control, and he built these up until he had unified most of Japan. His first great victory came in 1560 when he defeated Imagawa, lord of Tōtōmi. Thereafter, allied with Tokugawa Ieyasu and skilfully utilizing the new techniques and weapons of war, Nobunaga entered Kyōto, installed Ashikaga Yoshiaki as shogun and made a show of serving the emperor so that he could cite loyalty to emperor and shogun against any possible competitors. Several years later, in 1573, when Ashikaga Yoshiaki had become uneasy under his patronage and secretly asked a rival military figure for help against him, Nobunaga unceremoniously deposed the shogun and banished him, thus ending the Ashikaga shogunate.

Nobunaga met some of his most determined resistance from Buddhist sectarians of the Ikkō movement, and his efforts to subdue the great Ōsaka Honganji headquarters of the sect by force were not fully successful. The sectarians, who had been in touch with Nobunaga's rivals throughout Japan, caused him much inconvenience until they agreed to a truce in 1580. Equally annoying to Nobunaga was the conduct of the monastic armies of Mt. Hiei outside Kyōto, who allied with two of his most bitter enemies. In 1571 he assaulted the Enryakuji monastery on Mt. Hiei and, with none of the compunctions that had deterred earlier enemies of the religious armies, burned every building and killed every inhabitant. Buddhist political power never recovered.

The Jesuits were recipients of Nobunaga's favour. He granted them permits to travel and preach anywhere in his provinces, welcomed them to his great Azuchi castle and showered them with instances of his favour. "In proportion to the intensity of his enmity to the bonzes and their sects," the Jesuits wrote their superiors, "is his good will toward our Fathers who preach the law of God, and he has shown them so many favours that his subjects are amazed. . . ." It would seem that Nobunaga respected the character and courage of the Jesuits, and since he could trust so few of his contemporaries and equals he enjoyed talking with them. "Either you are thieves who are compassing some fraud," he told them once, "or this Gospel of yours is really a fine thing." The Jesuits in turn were pleased with Nobunaga's destruction of the centres of organized Buddhism. They despaired of his conversion, however, and concluded correctly that he was basically a skeptic: "he openly proclaims that there are no such things as a Creator of the Universe nor immortality of the soul, nor any life after death."

Nobunaga's distrust of his contemporaries and subordinates proved well founded. In 1582, when a body of troops led by Akechi Mitsuhide was filing through Kyōto on its way to the front in southern Honshu, Akechi turned to attack Nobunaga in his Honnōji headquarters instead. Hopelessly surrounded, Nobunaga committed suicide. At the time of his death he had conquered 30 of Japan's 68 provinces, most of them forming a compact area around the capital of Kyōto. Major problems remained in outlying areas on Kyushu, Shikoku and to the north, but Japan was well on its way to unification. Nobunaga received from the court the title of minister of the right in 1577, but his power and authority clearly rested upon his armed might.

Toyotomi Hideyoshi.—Leadership now passed to Toyotomi Hideyoshi (1536–98), a man of humble birth who had risen to become one of Nobunaga's most successful generals. Hideyoshi first crushed Akechi Mitsuhide and then entered into a compact with a number of other vassals. By 1584 Hideyoshi had achieved unquestioned mastery of Nobunaga's lieutenants, with Tokugawa Ieyasu acting as his principal ally. He now proceeded to complete the work of unification. His headquarters were established at Osaka. Campaigns in Shikoku (1585), Kyushu (1587) and Odawara (1590) completed the unification of Japan. After the fall of Odawara, Tokugawa Ieyasu established his centre at Edo (modern Tokyo).

Hideyoshi then looked abroad for new laurels, and after bombastic warnings addressed to the rulers of Manila, Goa, Formosa, Ryukyu and Korea, set himself to the conquest of China. He planned to take Korea in the spring of 1592; by December Peking was to fall and two years later the imperial court would move from Kyōto to Peking, while Hideyoshi would establish in south China the headquarters for the construction of a vast Asian empire. His achievements were to fall short of these impressive plans. Great expeditions to Korea in 1592 and 1597 resulted in impressive victories, but Hideyoshi's supply lines were inadequate for his needs. Korean maritime superiority forced him to retreat. The second expedition was largely punitive in nature, and Hideyoshi died before it achieved its purpose. The principal cultural effect of the invasion was the forced migration of Korean potters to Japan in the train of the daimyō, in whose realms they developed the distinctive ceramics of the Tokugawa period.

Christianity.—Hideyoshi at first continued Nobunaga's policies of favour to the Jesuits. He was anxious for trade and welcomed commercial growth, as shown in his efforts to attract merchants from Sakai to his new city of Ōsaka. The Christian movement, in the 1580s, seemed to be making excellent headway, and among Hideyoshi and his followers the outward appearances of western dress and religion seemed to be becoming a fad. But complications came from within and without. The Jesuit-Portuguese domination of European contacts was broken by the appearance of Spanish galleons from Manila bringing with them Franciscan missionaries who challenged the propriety of the Jesuits' tactics of concentrating on the upper classes. Competition between the mission orders and between the Spanish and Portuguese interests made the Japanese suspicious of both.

At the same time Hideyoshi, after the subjection of Kyushu, was quick to entertain doubts about supporters who seemed to have a secondary allegiance to Rome. In 1587 he ordered the missionaries to leave, charging them with forcing Japanese to become Christian, teaching their disciples to wreck temples, eating useful animals and taking slaves to the Indies. The order to depart was not, however, obeyed. The Jesuits sent a few priests to China, but connived with their daimyō converts to continue their work. As competition between the Jesuits and other missionaries increased, however, it was more difficult to maintain the subterfuge of compliance with Hideyoshi's order, for Franciscans and Dominicans insisted on public services and preaching to attract the commoners. In 1596 the wreck of a Spanish galleon brought threats from its pilot that if his cargo was not protected the Spanish king would seize Japan, as he had other countries to which missionaries had first been sent. Shortly afterward came the first persecution of Japanese Christians. It was as yet small in scale, but it showed that the rulers of a united Japan would not favour proselyting for a foreign religion.

Development of Feudal Controls.—Hideyoshi's achievements were made possible by overwhelming military power. He utilized to the full the advantages of the new firearms. Military strategy changed as large bodies of troops, many of them nonsamurai, replaced the emphasis on the chivalric individual combat of earlier times. Defensive breastworks replaced individual bravado. Great castles, situated in the centre of the territories they controlled and erected on stone ramparts which allowed clear fields of fire, symbolized the power in the hands of Japan's new military despots. As order returned to the country, Hideyoshi directed his daimyō to guard against further upsets from below. The last years of the 16th century saw the production of many codes of law as the feudal lords followed Hideyoshi's lead in regularizing and rationalizing their administration and procedure.

Hideyoshi did not attempt to control all of Japan, but reserved large areas of the provinces nearest the Kyōto-Ōsaka plain for his own administration and income. The rest he parceled out to his vassals. Some whom he had conquered he left in control of their territories; others found their holdings reduced in size, while still others were dismissed in order to open up rewards for his close vassals. In somewhat the same manner, the daimyō invested their vassals with fiefs, retaining personal administration over only part of their realm. The vassals were responsible for duty in war and for providing labour service for public works, but the demands on them often went far beyond this. Loyalty was expected to be total, with no discernible contractual limitations. Each daimyō, on acceding to rule, was invested by Hideyoshi, and the same was true of the daimyō and their own vassals. Hideyoshi took steps to limit the type of defense works and the number of castles the daimyō could erect in their realms, lest they prepare for a trial of strength with him. The daimyō also followed Hideyoshi's lead by keeping near to them the persons or relatives of their principal vassals, as symbols of submission and guarantees of loyalty. They themselves spent a great deal of time at Hideyoshi's court. There were thus sharp limits to the degree of autonomy that accompanied subinfeudation. The daimyō expected his vassals to follow his example and general instructions, and Hideyoshi expected the same from his daimyō. As a result, late-16th-century Japan saw the establishment of similar, if not identical, procedures of institutional rationalization in all areas.

The first need was to see to the economic base of the system. To this end, land surveys were conducted in each area to determine the exact areas of tillage, patterns of landholding and average yield. These minute surveys were the first to be held in many years, and they furnished the basis for taxation procedures for centuries afterward. Hideyoshi used the statistics that were gained in these surveys as the basis for the assessments he made against his daimyō for the costs of the Korean campaign and the costs of the numerous building projects he carried on at Kyōto, Fushimi and Ōsaka. Henceforth the fiefs and areas were rated as to their *kokudaka* or koku (approximately five bushels) yield of rice. Uniform national units of measure were set forth, and a more or less uniform tax allowed the tiller approximately one-third of his yield. The uniform land system that resulted marked the end of the remnants of the *shōen* system.

Next came measures to control the commoners in order to guarantee production of the estimated yield and to guard against unrest. In 1588 Hideyoshi issued edicts ordering that arms should be collected from commoners. "The possession of unnecessary implements of war," the edict read, "makes difficult the collection of taxes and dues and tends to foment uprisings . . . perpetrators of improper acts against official agents shall be summarily punished, but in that event the paddy fields and farms of the violators will remain unattended and there will be no yield of crops." The edict went on to explain that the swords would be used as nails and bolts in the construction of a giant Buddha, which would benefit the people in the next life as well as in this. Thus the kind of social change that had made possible Hideyoshi's rise from farmer's son to ruler of the land was to become impossible. Further orders forbade change of status and residence; peasants who left their fields were to be punished, and the entire village with them. Surveillance was to be carried out by the institution of five or, at times, ten family units, in which all were responsible for the infractions or delinquency of any one. At the top of the network of mutual security units stood the village headman, the link between feudal administrators and the tax-producing peasant.

Nobunaga, Hideyoshi and their fellow daimyō did all they could to encourage merchant developments. They were eager to enjoy the fruits of commercial prosperity, and they prized the goods that could be produced only by artisan and merchant specialists. They ordered the dissolution of the craft guilds (*za*, as in *ginza*, the silver guild) that had proliferated in Ashikaga times, and struck down the toll stations that made internal shipping slow and expensive. Hideyoshi did all he could to attract merchants from trading towns like Sakai, and he offered them tax immunity in his new capital of Ōsaka. Merchants and artisans were graded in several ranks; those in the higher classifications were particularly the recipients of his favour, but all benefited from the favourable conditions created by a larger regional market.

The daimyō followed Hideyoshi's example in this as in other respects; as they developed their new castle towns, regional merchant centres grew around them. The castle towns also became centres of administration; to them were drawn more and more of the samurai, including those who had been given fiefs to administer. The late Ashikaga class of warrior-farmer, the landed yeoman whose tenants could manage his acres while he went to the wars, was replaced by a sharp distinction of class between farmer and fighter, with the latter increasingly occupied in the duties and delights of the castle town.

The exuberance of the new era with its urban development and self-conscious despots was reflected in its arts. Momoyama art, named for Hideyoshi's palace, is distinguished by the rich decorative techniques devised for the homes, temples and castles of the new magnates. A rapid and vigorous style developed that was far removed from the ascetic aesthetic of the Ashikaga charcoal ink masters. The dark recesses of the palaces and castles brought in the use of gold and silver foil as backing for screen paintings which needed strong colours to bring out their designs. Art of this sort was the work of professionals, and not something that could be done by the gentleman-scholar in his moments of contemplation. The magnificence and splendour of this tradition have largely perished, but its waning echoes can still be heard in the Tokugawa mausoleums at Nikkō (*q.v.*).

D. The Tokugawa Period

Hideyoshi was considered ineligible for the title of shogun because of his low birth, and instead he received the old rank of *kampaku* from the court. He planned to have his second son, Hideyori (1593–1615), inherit his lands and titles, and he appointed a group of five vassals as guardians. They quarreled soon after Hideyoshi's death, however, and Tokugawa Ieyasu (*q.v.*; 1542–1616) won a crushing victory over his rivals at Sekigahara in 1600. (*See* Sekigahara, Battle of.) Ieyasu was appointed shogun in 1603, and established his headquarters at Edo. This battle determined the political make-up of Japan for the next 250 years,

as Ieyasu distinguished between his allies (*fudai daimyō*) and rivals (*tozama daimyō*) in apportioning offices and territories. Ieyasu strengthened and his grandson Iemitsu (1604–51) perfected the system of feudal controls which Hideyoshi had begun.

Centralized Feudalism.—Japanese historians often use this curious term to describe the degree of central authority the Edo *bakufu* retained despite its nominally feudal appearance. After Sekigahara and again after the fall of Hideyori's partisans at Ōsaka in 1615 the shogun reapportioned fiefs almost at will. Daimyō were divided between hereditary retainers (*fudai*) of the Tokugawa family, of whom there were at first 145; related houses (*shimpan*), of which there were 23; and 98 "outside lords" (*tozama daimyō*), who submitted after Sekigahara. The related houses included three family seats of Owari, Mito and Kii, which were to provide a successor if the shogun lacked an heir; together with the senior *fudai* houses they staffed the central councils of elders (*rōjū*) and the boards that conducted national affairs for the *bakufu*. The shogunate kept under its close control lands producing nearly 7,000,000 koku of rice, approximately one-fourth the national total, of which 3,000,000 were allotted to vassals of less than daimyō rank, the so-called bannermen (*hatamoto*). For its own lands the shogunate maintained full responsibility through commissioners (*bugyō*), deputies (*daikan*) and inspectors (*metsuke*) appointed from among its retainers, while vassals of daimyō rank were free from close control except for certain supervisory functions concerned with controls on Christianity and periodic visits by *bakufu* representatives.

The daimyō were controlled by a variety of means. Their marriages had to be approved, they were expected to contribute lavishly to *bakufu* building projects such as the Edo and Ōsaka castles and the Tokugawa mausoleums at Nikkō. They were forbidden to repair castles or fortifications without permission or to establish toll stations or check points (*sekisho*), a privilege reserved for the *bakufu*. Most effective of all the controls was the system of alternate attendance (*sankin-kōtai*) whereby daimyō were required to reside in Edo in alternate years, leaving their heirs and wives as hostages while they returned to their fiefs. The processions to Edo came at specified times and involved vast expenditures; residence in Edo, usually in one of three great estates maintained by each lord, proved extremely costly and sapped military energies by ceremonial concerns. The duration and timing of the attendance was changed in later years, but the Tokugawa never relaxed their insistence on the Edo residence and hostage system. Codes governing the conduct of retainers and requiring regular oaths of loyalty were a further guarantee of good behaviour.

After the fall of Hideyori and his partisans, the shogunate also regulated with care the behaviour of the emperor and his court. A modest income placed the emperor on a standard of living suitable for a small daimyō. He was prevented from having contact with the feudal lords, and special injunctions urged the court nobles to concentrate on arts and letters. High shogunal officials stationed in Kyōto regulated the conduct of the court and kept its intercourse with feudal lords to a minimum. The shogunate also improved the institutions worked out in Hideyoshi's time to guarantee a stratified feudal society. Its codes of law were echoed in the realms of its vassals. Society was thus organized on the principle that the samurai was its most honourable member, succeeded, in order, by the peasant who provided the rice, the artisan who provided necessary goods and the merchant who performed functions of exchange. Below these ranks were the dishonoured classes traditionally associated with contemptible vocations such as tanning. The various fiefs issued similar codes. Thus despite the formal division of Japan into autonomous fiefs the politics and power of the central feudal administration were felt throughout the land. Only a few of the most powerful *tozama daimyō* were autonomous in any true sense, and even they found it necessary to devote more and more of their wealth and time to the ceremonial attendance in Edo.

Foreign Relations and the Exclusion System.—Tokugawa Ieyasu began with hopes of extending Japanese trade and commerce. He did little to enforce the ban on Christian activity and he negotiated with the Spanish to request technical help in developing mineral resources. Requests for trading arrangements were addressed to the countries of southeast Asia and unsuccessful efforts were made to reopen trade with Korea and China. From 1602 to 1636 about 350 Japanese ships, licensed by the shogunate, sailed to southeast Asian countries, and Japanese settlers in the trading towns of the Philippines, Siam and Cochin China came to number approximately 10,000 persons. For a time an adventurer-trader, Yamada Nagamasa (d. 1630), was an influential figure in Siamese wars and politics.

Gradually fears of Christian subversion outweighed Ieyasu's desires for trade. European rivalries transferred to Japan were a factor in his concern. The rival missionary organizations had continued to calumniate each other, and as the Franciscans and Dominican orders strove to outdo the Jesuits it was more difficult to overlook infractions of the laws against evangelizing. More important was the arrival in 1600 of a Dutch vessel, the "Liefde," piloted by an Englishman, Will Adams. The Portuguese and Spanish urged the Japanese to execute the newcomers as pirates, while the latter assured the Japanese that their countries in Europe had waged a long and difficult struggle against the religious and political imperialism of Catholic Spain. Ieyasu saw the possibility of having European trade without the disadvantage of European missionaries who might win over his vassals. Several irregularities in the *bakufu* administration revealed the fact that fellow converts had been using each other as channels to official favour, and some of his retainers were quick to memorialize on the danger of a creed that seemed to teach obedience to foreign priests rather than to daimyō. In 1614 an edict ordered all missionaries to leave; all Japanese were ordered to register as members of Buddhist sects, and Buddhist priests were to check and report on their congregations annually.

The Ōsaka campaigns of 1614 and 1615 saw many of the remaining Christian daimyō siding with the cause of young Hideyori, who died in the flames of his castle. Tokugawa hostility toward Christianity now intensified. In 1617 foreign priests were executed for the first time, and under the third shogun, Iemitsu, persecution was carried on with savage intensity. By this time most of the missionaries had left, and many of their converts had emigrated to the Spanish colonies in southeast Asia. In 1624 the Spanish were expelled, and Japanese Christians were forbidden to go abroad; non-Christians could still travel, but not to Spanish possessions. The British East India company, which had not flourished, withdrew from Japan in 1623. Individual Englishmen, however, had prospered; Will Adams stayed in Japan until his death in 1620, enjoying the status of a petty daimyō while he continued his trading ventures. After the departure of British and Spanish there remained the Portuguese, who were restricted in 1636 to an artificial causeway and island in Nagasaki harbour, and the Dutch.

In 1637 a great rebellion marked the last stage of the Christian movement for several centuries. On the Shimabara peninsula east of Nagasaki there had been numerous Christians, and dispossession of the previous daimyō had resulted in large numbers of masterless samurai (*rōnin*, "wave men") as well. These joined to rise in protest against brutal treatment and misrule in 1637. The first shogunal troops sent against them failed to crush the insurgents, who retired to a castle at the tip of the peninsula in hope of foreign assistance. The rebellion had begun for economic and political reasons, but it became increasingly Christian in nature as believers flocked to join the insurgents. After it was put down and the insurgents were slaughtered, all further contact with Portugal was forbidden. When an embassy from Macao arrived in 1640 hopeful of reopening relations, all but a handful of the emissaries were executed to discourage further efforts. Thereafter it was a capital crime for Japanese to attempt to leave the country or, having left, to return. The construction of ocean-going ships was forbidden, and the remaining Christian suspects were hunted down with ruthless severity. Japanese inquisitors contented themselves with apostasy, and their tortures sufficed to bring about the recantation of several missionaries. For the rest of the Tokugawa period regular investigations ascertained the beliefs of descendants of Christians, and the results were reported directly to the *bakufu's* commissioner of shrines and temples. From the temple surveys

came later Tokugawa census figures. On the whole, the warrior converts who had been the Jesuits' principal concern were forced to abjure, and their descendants were under such careful surveillance as to rule out continued Christian belief. The commoners who had been the objects of the other missionaries showed surprising resistance to persecution and hardship. When Mass was held at Nagasaki by a French priest for the foreign community in 1865, foreigners and Tokugawa officials alike were astonished to see large numbers of fishermen from the village of Urakami appear for the Mass. They had carried on Christian services secretly for over two centuries.

During the rest of the Tokugawa period foreign contacts were limited to the Dutch, who were moved to the man-made island (Deshima) that had been constructed for the Portuguese in Nagasaki harbour. At first the Dutch lived under the closest scrutiny in conditions of great humiliation. The trading station, an outpost of the Netherlands East India company centred on Java, was at first sufficiently profitable to compensate for the humiliation. By the 18th century, when the profit lessened, the humiliation did too; thereafter Deshima achieved its greatest importance as a window on the world through which the Tokugawa regime, which eschewed any contact with the west, was nevertheless able to learn and to obtain what seemed useful and relevant in western culture. From the Tokugawa standpoint, the exclusion system served its purpose since, by excluding foreign interference and minimizing Japanese contacts with foreigners, it was possible to perpetuate social institutions and regulations of the 16th century into the 19th. In ruling out imports and foreign trade of any dimensions, however, the system made for a closed economy in which a Malthusian limit operated to keep the population below 30,000,000 and in which, after a great creative efflorescence in the 17th and 18th centuries, creative energies seemed to flag.

Cultural Developments.—The long years of the Tokugawa peace saw the development of cultural patterns that owed little to outside stimuli. These matured early, and the great works of literature and the theatre were produced during the Genroku era (1688–1703). It was a culture produced for the merchant class which had profited from the new opportunities offered by the urban concentrations and commercial patterns which grew out of the Tokugawa institutions. The great city of Ōsaka, with almost 500,000 inhabitants by 1690, was the first centre of this culture; serving as it did the needs of a national economic centre, it had the first and largest merchant developments. In the 18th century the centre shifted to Edo, which came to number well over 1,000,000 in population.

The merchants had many spheres of life closed off to them by the rigid class system the Tokugawa tried to enforce, but as they handled more and more of the rice and monetary transactions for the feudal classes they had abundant opportunity to prosper. There developed a special cult of pleasure for men who had no security before the law and who could not hope to rise politically or socially by their wealth. In Ōsaka and other great cities the licensed quarter became a city of lights and merriment, of music, pretty courtesans and crowded theatres—a city where a man's worth was judged by his wealth, and where he was temporarily liberated from the compelling Confucian values which surrounded him in home and work. It was a life best described in the naturalistic novels of Ihara Saikaku (1642–93), who detailed the rise and fall of wastrel sons and imperious courtesans with a cynical detachment and clinical precision.

The centre of the townsmen's interest was the kabuki theatre (*q.v.*), which was a Tokugawa development. The kabuki repertoire furnishes one of the best sources for the values and strains of Tokugawa society. Its themes were the same as those of the puppet (*Jōruri*) theatre, and the great playwright Chikamatsu Monzaemon (1653–1724) provided much of the repertoire for both forms. Kabuki offered martial fare for the adventurous, but for social history the domestic dramas are particularly valuable. These set values of human feeling against those of duty and obligation, and mirror the problems which beset the townsmen. Kabuki actors were the cynosure of the public eye, and although the shogunal moralists legislated against them and tried to discourage the actor worship that pervaded the towns, they succeeded only in testifying to their importance.

The comparable development in art was the woodprint, which was capable of large-volume production to grace the homes of the commoners. Beginning as single-colour prints, the woodprints grew steadily in inventiveness and variety during the 18th century, until the great Edo print makers developed the multicoloured "brocade print" (*nishiki-e*). In the last stage in this great tradition, print makers turned from ladies of the licensed city and actors of the stage to portray scenic points along the highways of the country, as in the familiar prints of Katsushika Hokusai and Andō Hiroshige (*qq.v.*).

In poetry the changes were less startling, although the 17-syllable haikai, perfected by Matsuo Bashō (*q.v.*), reflected some of the same trends in its use of everyday language. Aside from the large volume of verse—some of it considered Japan's finest—produced in this tradition, there was also a large output of more traditional and Chinese poetry, just as there were important schools of artists who painted in the Chinese manner of the Ming dynasty. Official patronage went to artists who chose their subject matter in the Chinese tradition. The court school of Kano painters, however, combined many schools to develop a distinctive style and approach. In fiction the shogunate favoured the didactic novels of Kyokutei Bakin (1767–1848), which owed much to Chinese tradition. But while such works were important and numerous, they were overshadowed in interest for the historian by the materials that were produced to suit the tastes of the commoners in the towns.

Economic Problems.—The political institutions which had been set up to ensure the primacy of the Tokugawa family and the superiority of the warrior class brought in their train economic consequences that plagued administrators of the Tokugawa period. The enforced absence of the feudal lords from their fiefs while in residence in Edo meant that they had to sell a major portion of their tax rice on the Ōsaka market to defray the cost of travel to and residence at the shogun's capital, thereby placing them at the mercy of the Ōsaka rice dealers. The separation of warriors from the land meant that in castle towns as in Edo increasing numbers of retainers were forced to sell their rice incomes or stipends for the necessities of urban life. Everywhere the warrior class found itself dependent upon merchant assistance and services. By training and education the samurai were schooled in scorn of figures and calculations, which seemed the tools of shopkeepers, with the result that there was rising opportunity for the merchants in Ōsaka and in the castle towns. Though their political and social status was low this did not prevent them from accumulating money, and by the Genroku period large numbers of daimyō were in debt to Ōsaka merchants. The merchants had no security in law for their property, and so they were intent on the opportunity of the moment. In periods of irregularity or laxity merchants also attained considerable importance and favouritism from "corrupt" officials who neglected their Confucian standards. On the national level, such times often saw power in the hands of shogunal favourites and chamberlains instead of the normal council of elders, while bribery and corruption tended to replace exhortations to frugality.

It is clear that the agricultural production of Japan increased steadily during Tokugawa days thanks to land reclamation and better methods of fertilization and cultivation. The ruling class, however, never realized a rise in land tax comparable to the new rise in yield; it is not clear whether tax requisitions remained standard because of inefficiency or because special tax benefits had been offered to encourage reclamation. In any event it would seem that the increased yield tended to go to the landowning farmers in the villages and that it sharpened the distinctions between them and their tenants. Tokugawa commentators deplored both the wealth and the poverty of villagers, many of whom were in such desperate plights that infanticide (*mabiki*) was frequently resorted to in order to save food for the children who remained. Tokugawa laws against the sale of land show that the money economy was affecting agricultural relationships in many areas. Feudal lords devised numerous irregular and special tax levies to increase their income. When these became too burdensome, movements of protest and rebellion often broke out. There were several hundred

rebellions during the Tokugawa years, and although most of them were localized protest movements they reflected dislocations in the economic picture.

The shogun and the daimyō tried to attack these problems in a series of reforms that usually came immediately after long periods of laxity and favouritism. These reforms included attempts to increase their income, economies to lessen expenditure and legislation designed to slow the erosion of rural values under the impact of the commercial economy. Income was increased by instituting new official monopolies of whatever crops within the domain could be sold at Ōsaka and other markets. Paper, lumber, cotton, wax and similar products were marketed under official auspices. To handle such affairs guilds, which had been discouraged in favour of "free trade" since the days of Nobunaga and Hideyoshi, were reconstituted in an effort to license and control merchant activities that affected official well-being. Economies included restrictions on display and ostentation for all classes, and they particularly sought to end excessive comforts and unnecessary consumption by the commoners. At such times clothing, cakes, candles and hairdressing were regulated. Reforms of this sort came in the first quarter of the 18th century under the minister Arai Hakuseki in 1710 and the shogun Yoshimune (1716–45), who sought to undo the excesses that had developed under the shogun Tsunayoshi (1680–1709). After 1787 the minister Matsudaira Sadanobu tried to reverse the corruption that developed during the sway of the chamberlain Tanuma Okitsugu (1767–86). In 1841 the minister Mizuno Tadakuni attempted to combat merchant influence that developed during the reign of the shogun Ienari (1787–1837), but failed utterly to achieve his purpose.

Each of these reforms was less successful than its predecessor, largely because the difficulties it was designed to correct had become more deeply rooted and the economic maladjustments had become more widespread. When Mizuno attempted to legislate against the guilds, he discovered that it was virtually impossible to provide for the food supply of Edo unless the shipping guilds were given their accustomed privileges. The shogunate and the fiefs thus continued to seek for solutions to the social change that had followed from the political measures of Ieyasu. Retainers' salaries were halved as "temporary loans," merchants were occasionally expropriated and large forced loans (*goyōkin*) were demanded from the merchants. On the whole, such reforms, designed to return to an earlier and more truly feudal social order, had the best success in outlying and remote areas. In the highly developed and sophisticated sectors which the shogunate ruled they were least effective. The reforms of the minister Mizuno Tadakuni in the 1840s, for instance, failed of their purpose, while simultaneous measures taken by daimyō in Satsuma in south Kyushu and in Chōshū on western Honshu enjoyed much greater success. There were few Tokugawa statesmen and scholars who did not realize that something was amiss with their society when feudal lords were in debt to despised merchants and when peasants were driven to flight or infanticide to maintain life. This consciousness of crisis was a significant element in the readiness to consider sweeping changes when the appearance of the western powers added a new intensity to their concern. It was logical for them to conclude that much of their poverty could be traced to the requirements for attendance in Edo, and that the shogunate had sacrificed national well-being to its own political purposes.

Intellectual Trends.—Ideas about political and social reorganization formed against a background of intellectual speculation that took many forms. During the long Tokugawa peace the samurai administrators and scholars turned their thoughts from war to the arts of peace. Ieyasu encouraged Confucian studies at the outset of his family's dominance, and the bureaucratic needs of the years which followed encouraged the trends that he inaugurated. Confucius and Confucianism were never more honoured than under Tokugawa feudalism; and each daimyō appointed Confucian tutors and advisers to acquaint him with the lessons which the past had to offer.

A number of Confucian schools flourished. The Sung Neo-Confucianism of Chu Hsi, with its Buddhist and Taoist elements, was the most favoured school; its emphasis on loyalty was appropriate to Tokugawa times. It was not ruled the official teaching until 1790, but it had great influence from Ieyasu's time on. There were Neo-Confucian scholars in all parts of Japan. Their rationalism, humanism and history-centred approach played an important role in the development of a large body of scholarly learning. The proclamation of Neo-Confucian orthodoxy did not carry with it proscription of other schools, of which there were many. The school of Wang Yang-ming, with its emphasis on the primacy of the moral sense and intuitive knowledge, played an important role in offering a variant to the official school. These and other interpretations often existed in combination, and in some of the great fiefs of the southwest a nominal adherence to Neo-Confucianism left room for a strong skepticism toward the China-centred cult of the capital.

The Confucians' interest in the past was shared by scholars who sought to learn of their country before it had been changed by Chinese thought. These *kokugakusha* or national scholars began their work with rigid textual studies of the first great poetry anthology, the *Manyōshū*, and they ended with vigorous polemics against the Confucian and Buddhist influences which, they felt, had clouded the virtue of an earlier and purer time. The most important of many scholars of this tradition was Motoori Norinaga (1730–1801). The national or Shintō scholars were not always at loggerheads with the Confucians, and elements of their teaching were to be found in combination with other strains. The school of historians subsidized by the Tokugawa house of Mito wrote their works in a spirit which combined the Confucian loyalty to the emperor as true ruler with Shintō reverence for his supernatural characteristics.

A third major variant was the school of western or Dutch learning. *Rangaku*, as it was known, began to filter slowly from the Dutch trading station at Deshima during the 17th century. But for long the proscriptions on literature that might be Christian—including translations done by the Jesuits in China—and the general restrictions on the movement and influence of the Dutch kept *Rangaku* from having much effect. These restrictions were relaxed after 1720. Interest grew in western medicine, particularly after a dissection in 1771 established the accuracy of a western treatise on anatomy, and in military science, which had made great advances during Europe's intermittent wars. As more European works were imported into Japan and the number of scholars who could read them grew, the way was open to learn of European affairs, power and influence. By the late 18th and early 19th centuries Japanese "Dutch scholars" were aware of the power of the west and the folly of trying to withstand it without taking basic steps to strengthen Japan. Many feudal lords employed such scholars as physicians, and by the 19th century the larger fiefs had begun to sponsor western studies in hopes of strengthening their military and material potential.

There was thus a wide choice available in the intellectual climate of Tokugawa Japan, and the several schools that have been mentioned existed in a variety of combinations. On the whole the shogunate permitted intellectual inquiry so long as it was not Christian and did not question or discuss policies openly. The ideologist-activists of the mid-19th century combined elements of several schools in forming their program of action. Thus Yoshida Shōin (1830–59), who became, by his martyrdom after the arrival of the foreigners, one of Japan's modern heroes, began with Confucian values and outlook, dabbled in western learning sufficiently to develop a lively curiosity and alarm about the prospects for Japanese independence, and stressed a doctrine of loyalty to the emperor who was, for him, both Confucian ruler and Shintō priest-king. The specialized teachings of the intellectuals and scholars thus became simplified in the course of their transmission downward. Under the crisis brought on by the foreigner's revelation of the shogunate's weakness, theories became slogans which served as rallying cries for programs of action.

The Opening of Japan.—In the last quarter of the 18th century the occasional arrival of foreign ships in search of trade or supplies startled the Japanese and alarmed the scholars of western learning, who saw in the ships evidence of significant intentions menacing Japan's independence. The Russians, whose expansion

overland had brought them to the Pacific shores in the 17th century, approached from the Kuril Islands north of Japan. In 1787 an expedition to Japan was authorized by Catherine II the Great. This and future efforts were inconclusive, and in 1811 a naval officer, V. M. Golovnin, was captured and imprisoned by the Japanese in retaliation for damage Russian sailors had done in coastal raids. The shogunate reacted by placing the undeveloped northern island of Ezo (Hokkaido) under its direct administration, and a number of scholars, among them Hayashi Shihei (1738–93) and Honda Rimmei (1744–1821), wrote booklets in which they discussed ways of improving Japan's defenses against the menace from the north.

Great Britain renewed its interest in Japan during the Napoleonic Wars when, with Java under British rule, Deshima was the only spot which continued to fly the Netherlands flag. In 1808 the "Phaeton" entered Nagasaki harbour and, receiving an unfriendly reception, seized hostages, secured its supplies and escaped before countermeasures could be taken. Far more startling were the stories that came via the Deshima station of Britain's victory over China in the first "Opium War" of 1839–42. Scholars aware of this assumed that Japan would be the next to be tested, and Takano Chōei (1804–50) published, and was punished for, a pamphlet highly critical of the shogunate's obscurantist tactics.

During this period the role of the Netherlands trading station increased in importance, and the imports of books and weapons grew steadily. The Dutch, and especially the scientists who were attached to the station as doctors, received better treatment and had far more opportunity to contact and instruct Japanese friends than ever before. Philipp Franz van Siebold, who was in Japan from 1823 to 1829 and again in the middle of the century, played a significant role in instructing young Japanese scholars, but when King William II of the Netherlands wrote the shogun in 1844 to advise the wisdom of opening Japan before the western maritime powers should force the issue the letter was not accepted. The shogunate, preoccupied with the reforms being carried out in those years and conscious of its military weakness, preferred to delay foreign relations as long as possible.

It fell to the United States to force the opening. Great Britain had led in China and was more than willing to step aside, while U.S. policy makers were anxious to anticipate what they felt was an inevitable British advance. Japan was in any case of more importance to the United States than to Great Britain, since it lay athwart the great circle route to China and because U.S. whalers who fished the North Pacific needed sources of shelter and supplies. Every motive of commercial advantage, as well as the powerful promptings of manifest destiny, thus contributed to the expeditions to Japan. The first, in 1846, was commanded by Commodore James Biddle. Biddle presented copies of the new treaties with China and requested a similar arrangement with Japan, but his requests were ignored. His peaceful departure after some rude treatment seemed a victory to the Japanese, but they had been much impressed by the size of his ships. It was realized that such warships had the capability of coercing Edo by blocking its ocean-borne food supply from Ōsaka.

In 1853 a new mission commanded by Commodore Matthew Calbraith Perry (*q.v.*) was sent. He presented his demands in the summer of 1853, announced he would return for a reply the following year and sailed for China. The U.S. ships caused consternation in Edo. The Japanese had known, through the Dutch, of Perry's coming, but they were powerless to prepare adequate defenses. Later in the summer the Russian envoy, Adm. E. V. Putiatin, came, and Perry, hearing of this, advanced his date of return, arriving in Feb. 1854. At Kanagawa (*see* KANAGAWA, TREATY OF), near modern Yokohama, conversations were held which led to a treaty signed on March 31. Japan agreed to open the ports of Shimoda and Hakodate to U.S. ships in need of supplies, to extend relief to shipwrecked mariners and to permit a U.S. consul or agent at Shimoda.

The treaty had no clear provisions for trade, envisaged the procurement of supplies through shogunal officials and opened two poor and remote ports. It was, however, the first step in a process that was completed by Townsend Harris, the consul general, who arrived in 1856. Harris worked with the greatest patience and tact. He had no ships at his disposal, but he made effective use of the news of Chinese reverses in renewed warfare with England and France. He insisted on presenting his credentials personally to the shogun in Edo, and in 1858 he worked out the first modern treaty calling for trade. Its provisions governed duties, coinage exchange, extraterritoriality and freedom of religion for Americans with right of residence in six ports, of which the last was to be opened by 1863. The treaty-port system, developed in China, was now established in Japan. The most-favoured-nation clause extended U.S. benefits to the other powers who followed in short order to claim their treaties. The treaty was unwelcome to the Kyōto court, but shogunal officials ratified it on their own authority in 1859.

Thereafter foreign representatives and traders played an important role in Japanese politics until the end of the shogunate in 1867. Atrocities against them by antiforeign fanatics resulted in punitive steps, as when the British shelled Kagoshima in 1863 and a foreign flotilla shelled Shimonoseki the following year. Foreign traders disrupted old patterns of trade and provided new commercial opportunities for merchants previously at a disadvantage in competing with the traditional guilds. And the foreign ministers entered the political scene with advice and threats. The United States, which led in opening Japan, was soon outdistanced in trade and influence by Great Britain. French minister Léon Roches saw the possibility of a favoured position for the second empire by sponsoring a program of technical and military aid for the shogunate. British minister Sir Harry Smith Parkes and his knowledgeable interpreter Sir Ernest Satow, however, realized that the future lay with the great fiefs of the southwest which had begun to show signs of hostility to the shogunate.

E. The Meiji Restoration

The term "restoration" is commonly applied to the political changes that returned power to the throne during the reign of Mutsuhito, who took the reign name Meiji ("enlightened rule," 1868–1912). (*See* MEIJI.) The slogan of "return to antiquity" (*fukkō*) made it possible to interpret sweeping changes as traditional in motivation. Actually the Meiji changes constituted a social and political revolution that began before 1868, and political innovations ended only with the promulgation of a constitution in 1889.

Fall of the Tokugawa.—The arrival of the foreigners in the 1850s provided a new issue for domestic politics and a new measure for effectiveness of the feudal administration. When it became clear that the "barbarian-subduing generalissimo" was unable to protect Japan from the barbarians, and that his concessions to them were made in spite of their known repugnance to the imperial court in Kyōto, the two shogunal boasts of loyalty to and protection for the court proved spurious. The slogan *sonnō-jōi* ("Revere the emperor! Drive out the barbarians!") was first raised by men who sought to influence shogunal policy, and then taken up by others who wanted to embarrass the Tokugawa. The shogun's ratification of the Harris treaty and others which followed was carried out in the face of strong opposition from the Kyōto court, and it brought to the surface antagonisms that had developed during the long years of peace and study. They did not immediately centre in distant fiefs, but in the Tokugawa house of Mito, which had done much to sponsor Confucian scholarship. The Mito daimyō made vigorous attempts to involve the Kyōto court in affairs of the *bakufu* with a view to establishing a nationwide program of preparedness. For this he was punished by the head of the Edo council of elders, Ii Naosuke. In 1860 Ii was assassinated by men from Mito and Satsuma. This bold assault upon the chief of the Tokugawa administration inaugurated years of violence. Many of those who took part were young samurai who had become friends during periods of study in Edo fencing academies. Their swords availed little against the foreigners' guns, but they took a heavy toll of political enemies.

The years which followed were a time of extremism. The Tokugawa shogunate, anxious to rally support among its feudatories and to help them to prepare their defenses, relaxed its controls and regulations concerning attendance in Edo, and thereby increased

the opportunities for intrigue and conspiracy. In many fiefs young enthusiasts now tried to push their feudal superiors into a less cautious and more strongly antiforeign position. It soon became obvious to most men that expelling the foreigners by force was impossible. Each antiforeign act provoked stern countermeasures and diplomatic indemnities which tightened the foreign hold on the country. After the bombardment of Kagoshima and Shimonoseki there could not be any doubt of the foreigners' military superiority. Thereafter the slogans of antiforeignism and exclusion continued to be used chiefly as a means of obstructing and embarrassing the shogunate. The Edo policy makers were forced to make surface concessions to the antiforeign elements which succeeded only in arousing the hostility and distrust of the treaty powers. After the arrival of the British minister Parkes in 1865, Great Britain in particular began to tire of the difficulties of negotiating with a *bakufu* which stood between them and the Kyōto court, and began to consider ways of dealing directly with the latter. It gradually became clear that ultimate authority and moral supremacy lay in Kyōto.

In some fiefs the young extremists who tried to alter the policies of their superiors found themselves unable to budge them from their conservative positions. From Chōshū (now part of Yamaguchi prefecture), foreign shipping in the Straits of Shimonoseki was shelled in 1863. This drew the foreign bombardment the following year. Samurai opinion grew so vehement that after the fief authorities submitted to Tokugawa discipline in 1864 a swift military coup brought to power, as the daimyō's counsellors, a group of men who had led the radical antiforeign movement. But they were no longer blindly antiforeign; several had secretly traveled to England. Their aims had become national—to overthrow the shogunate and create a new government headed by the emperor. The same men developed new militia units based on western training methods and arms, units which included commoners as well as samurai. Chōshū became the centre for discontented young samurai from other fiefs who were impatient with their leaders' caution. In 1866 Chōshū allied itself with the great fief of Satsuma in expectation of a Tokugawa attempt to crush all *tozama daimyō* opponents and erect a centralized despotism with French help.

When the Tokugawa armies attempted to crush Chōshū in 1866 they were successfully repulsed and the shogunate lost power and prestige swiftly as a result. The death of shogun Iemochi in 1866 brought to power Hitotsubashi Keiki (who took the name Yoshinobu), a man whose long service in national affairs had made him fully aware of his ambivalent position and the pressing needs for national unity. He spurned suggestions of his advisers that he seek French help to put down his enemies. When he was urged by the lord of Tosa to resign his powers, he did so rather than risk a full-scale assault by Satsuma and Chōshū, confident that as lord of eastern Japan he would emerge as an important figure in whatever new political organization should develop. But his enemies were not put off so quickly. The young Meiji emperor, who had succeeded to the throne in 1867, was guided by the counsels of several nobles in close touch with leaders of Satsuma and Chōshū, and the last shogun was skilfully maneuvered into a choice between giving up his land, which would risk revolt from his vassals, or appearing disobedient, which would justify punitive measures. Keiki's armies advanced on Kyōto, only to be defeated. Satsuma, Chōshū and Tosa units, now the "imperial army," advanced on Edo, which was surrendered without a battle. Fighting continued to the north until the summer of 1869, but the Tokugawa cause was doomed. Early in Jan. 1868 the principal lords were summoned to the imperial palace in Kyōto to hear a proclamation announcing the restoration of imperial rule. The next year the capital was moved to Tokyo, and the building of the modern state began.

From Feudal to Modern State.—The Meiji government began without a clearly enunciated program of political policy, but its goals were reasonably clear. The leadership group was dominated by the Satsuma, Chōshū and court figures who had outmaneuvered the shogun. They were convinced that Japan would need a unified national government in order to achieve military and material equality with the western powers. Most of them, like Kido Kōin and Itō Hirobumi of Chōshū and Saigō Takamori and Ōkubo Toshimichi of Satsuma, were young samurai of modest rank, but they did not therefore represent in any sense a "class" interest. Indeed, their measures destroyed that class. In order to gain backing for their measures they enlisted leaders of fiefs with which they had worked—Itagaki and Gotō of Tosa, Ōkuma and Soejima of Saga, Yuri of Echizen—and maintained their cooperation with court nobles like Iwakura and Sanjō.

The co-operation of the impressionable young emperor was essential to their purposes. They had come to power at a time when it was taken for granted that western strength depended on constitutionalism, which produced national unity; on industrialization, which produced material strength; and on a well-trained military. The new slogan of the day became *fukoku-kyōhei* ("rich county, strong arms"). Knowledge was to be sought in the west, whose good will was in any case essential if the "unequal treaties" were to be revised. Therefore a number of missions to the west were organized. In 1871 Iwakura Tomomi (*q.v.*) led a large number of his fellow government leaders to visit Europe and the U.S. The experience gained abroad strengthened convictions already formed as to what was to be done.

The Meiji leaders began with measures to lessen the feudal decentralization on which they blamed much of Japan's weakness. In 1869 the Satsuma, Chōshū, Tosa and Saga leaders persuaded their daimyō to return their lands to the throne, and after this petition was accepted other lords hastened to follow suit. The court took steps to regularize and make uniform administration in the fiefs, but it appointed the former lords as new governors. In 1871, with the war against the Tokugawa won, the government was prepared to take its second step; it had been realized that the decentralization had been ended only in name. The governor-daimyō were now summoned to Tokyo, and feudalism was declared abolished. The approximately 300 fiefs became 72 prefectures and 3 metropolitan districts, and in future years this number was further reduced by one-third. For the most part the daimyō lost all contact with administration, and although they were rewarded with titles in the new European-style peerage that was set up in 1884 their political importance was slight.

It was equally necessary to take steps to put an end to the complex system of social stratification that had existed under feudalism. The feudal lords could be given titles and reasonably generous pensions, but it was far more difficult to make arrangements for the samurai, who numbered, with dependents, almost 2,000,000. In 1869 laws were issued replacing the old hierarchy with a new and simpler division whereby court nobility and feudal lords were termed aristocracy (*kazoku*), samurai were termed *shizoku* and all others were called commoners (*heimin*), including even the previously unlisted pariah groups. The samurai, now that their old administrative function was lost, were given pensions equal to a part of their old income. When the regime found these pensions too heavy for its treasury to carry, the pensions were changed to interest-bearing but nonconvertible bonds. During the same years, laws were enacted to discourage the samurai's special hairdo; the wearing of swords, the former badge of class, was later banned.

The pensions and bonds were soon lost, since few of the warriors had had occasion to develop commercial aptitude; even where they were not lost, the inflation that accompanied government expenditures lessened their value greatly. In 1873, moreover, a system of nationwide conscription was instituted, depriving the samurai of their traditional monopoly of military service. There were a number of samurai revolts. The most serious centred in the great fiefs of the southwest which had led in the restoration movement, and where warriors previously had reason to expect the greatest rewards. Some revolts, as in Chōshū, were expressions of discontent against administrative measures that deprived samurai of their importance while in Saga the dissidents championed a proposed foreign war to employ samurai.

The last and greatest revolt came in 1877 in Satsuma, led by the restoration hero Saigō Takamori (*q.v.*). The new conscript levies were hard pressed to defeat Saigō, and the government found it necessary to enlist former samurai and empty its military acade-

mies in order to put down the revolt. Fortunately for the government, the revolts expressed regional discontents and were never co-ordinated. Even in the case of the Satsuma war, the malcontents enlisted only part of the support they expected; loyalties of most of the Satsuma men in the central government remained with the imperial cause.

The abolition of feudal principalities and the expropriation of the feudal classes made it possible to do away with the old land system and institute a predictable and regular national tax. In 1873 land surveys were begun to determine the amount and value of land on the basis of average yield in recent years. A tax in money of 3% of the value was then set as the land tax. Out of the same surveys came certificates of ownership of land for farmers, who were also released from feudal controls which had hindered their choice of crops as well as their freedom to move or to change vocations. The land measures were some time in being completed, and as they involved basic changes there was widespread confusion and uncertainty among the farmers, frequently expressed by short-lived revolts and demonstrations. The establishment of private ownership, added to the energetic measures the regime took to promote new technology, fertilizers and seeds, soon produced a striking rise in agricultural output. The land tax, supplemented by printed money, was the principal source of the government's income.

Although it was hard pressed to find money to meet its obligations for pensions and administrative costs, the government went forward with a program of industrialization which had been part of its original plan. Aside from military industries and strategic communications, the program was carried out in private hands, although it had the advantage of subsidies and administrative encouragement. Trade and manufacturing benefited from the new national market and legal security which the government had created. In addition, disorder in China made it possible for Japanese traders to sell on international markets without serious Asian competition.

The pattern of government encouragement through pilot plants and experimental stations changed in the 1880s when a fear of excessive inflation resulted in a decision to sell most of the new plants to private investors. These were usually persons who had close relations with government officials. The small number of individuals who came to dominate many enterprises in this manner were known as the *zaibatsu* or financial cliques. With tremendous opportunities and few competitors, the same firms appeared in enterprise after enterprise. Their aims were close to those of the government leaders, and there were often close friendships between them. The house of Mitsui, for instance, had close relations with several Meiji leaders, while that of Mitsubishi was founded by a Tosa samurai who had been a colleague of the restoration leaders.

Equally important for the building of a modern state was the substitution of national for feudal loyalties. The latter had already gone into decline with the abolition of the feudal classes, but true national unity required the propagation of new loyalties among the masses previously inarticulate and powerless. The early restoration government was influenced by the Shintō revival. It elevated a bureau of Shintō, the state cult, to the highest position in the new political hierarchy and it strove to replace Buddhism by a strong cult of the national deities. Christianity was legalized in 1873, with great reluctance, after the Iwakura mission reported from Europe that this would be necessary, and thereafter it seemed particularly important to bolster traditional outlooks without risking foreign condemnation by forcing a state religion upon the Japanese. The education system proved to be an ideal vehicle for ideological orientation. A system of universal education was announced in 1872. It began modestly, and for a time its organization and philosophy were western inspired. During the 1880s, however, as the government leaders saw their countrymen turning to western ideas and as they learned of the new nationalist orientation of schooling in Europe, the Japanese system was altered to include emphasis on "ethics"; and in 1890 an imperial rescript on education laid out the lines of Confucian and Shintō ideology which were to constitute the moral content of later Japanese education. By this means, loyalty to the emperor, who was hedged about with Confucian teaching and Shintō reverence, became the centre of the citizen's ideology. At the same time the state distinguished between this secular cult and religion to avoid charges of indoctrination. As a result, the government leaders could permit "religious freedom" at the same time that they required a form of worship as the patriotic duty of all Japanese subjects. The uniform system of mass education so oriented was also utilized to project into the nation at large the ideal of samurai loyalty that had previously been the heritage of the ruling class.

The Constitutional Movement.—In late Tokugawa days it was widely believed that constitutions provided much of the unity that gave western countries their strength, and the Japanese leaders were eager to bring themselves abreast of the world in this respect. An early government plan of 1868 experimented with a two-chamber house, but it proved unworkable in view of the government leaders' preference for having their own way. The emperor's so-called charter oath of April 1868, however, committed the government to seek knowledge and wisdom throughout the world, abandon customs of the past, allow all subjects to fulfill their proper aspirations and determine government decisions by reference to a broadly based opinion.

To these statements of intent were added protests from below. The democratic movement grew out of a split in the leadership group over government policy in domestic and foreign matters. Itagaki Taisuke (*q.v.*), Gotō Shōjirō and other leaders of the Tosa faction combined with Etō Shimpei and others of the Saga fief in 1873. Their demands for a punitive expedition against Korea, whose obscurantist government had insulted Japanese envoys, had been refused because domestic reforms were to come first, and they resigned their positions. The same debate had cost the government the services of Saigō Takamori, who retired to Satsuma prior to leading the Satsuma rebellion in 1877. Instead of championing the old order, however, Itagaki and his friends called for a popular assembly so that future decisions would reflect the will of the people (by which they initially meant their fellow samurai) and thus preserve unity. Some of those who joined the group were more angry than democratic; Etō Shimpei was killed after leading a group of Saga followers in revolt in 1874. Itagaki and his Tosa followers organized themselves into discussion and mutual-help groups and, gradually growing in political confidence and ability, organized themselves on a national basis as the Liberal party (Jiyūtō) in 1881. It should be noted that the movement had only a narrow social and regional base at this time, and that its purposes were to promote effective national unity rather than tolerance of diversity and dissent.

New divisions within the narrowing leadership group brought a second political party into the field. When the remaining Meiji leaders were asked to submit their opinions on constitutional problems in 1881, Ōkuma Shigenobu (*q.v.*), a Saga leader who had sided with the peace party in 1873, revealed a relatively "liberal" draft instead of first submitting it for the scrutiny of his colleagues. At the same time that he did this, he revealed sensational evidence of corruption in the disposal of government assets on Hokkaido. Ōkuma was forced out of the government, after which he organized his Progressive party (Kaishintō) in 1882. Itagaki's Liberal party had a predominantly rural backing of former samurai and village leaders, many of whom objected to government taxation policies; the new party of Ōkuma had a predominantly urban base and attracted much support in the business and journalistic worlds. (See *Administration and Social Conditions: Political Parties and Pressure Groups*, below.)

The government, stung by Ōkuma's defection, countered with a promise by the emperor that a constitution would be instituted in 1889; the populace—by which was meant the parties—were urged to await the imperial decisions quietly. The constitution was prepared behind the scenes by a commission headed by Itō Hirobumi (*q.v.*). The period of constitution writing coincided with one of intense economic distress as the government sought to stem the inflation caused by the spending of the 1870s. Finance Minister Matsukata Masayoshi's policies succeeded in this pur-

pose, but his deflationary measures caused hardship in the countryside and provided a situation in which party agitation could easily kindle direct action. After being embarrassed and frightened by several instances of this and hampered by severe government repression in the form of police and press controls, the parties dissolved temporarily in 1884. Itagaki and Gotō traveled to Europe, and returned more than ever convinced of the need for national unity in the face of western condescension.

Itō Hirobumi also traveled to Europe to get help in the preparation of the new constitution. In Prussia he found what seemed an appropriate balance of imperial power and constitutional forms; this seemed to offer modernity without sacrificing effective control. Several German jurists assisted him and his commission. As a counterweight to the influence of a popularly elected house, Itō first organized a new European-style peerage in 1884. The government leaders, military commanders and former daimyō were given titles and readied for future seats in a house of peers. A cabinet system was installed in 1885 and a privy council, designed to judge and safeguard the constitution, was set up in 1888. Itō resigned as premier to head the council and thus saw his document safely through.

The constitution was completed by 1889, and elections for the lower house were held to prepare for the initial diet which met in 1890. The constitution took the form of a gracious grant by the emperor, and it could be amended only upon imperial initiative. Its provisions were couched in general terms. Rights and liberties were granted "except as regulated by law." As in the Prussian system, if the diet refused its approval of a budget the previous year's could be followed. The emperor was "sacred and inviolable"; he commanded the armies, made war and peace and dissolved the lower house at will. Effective power thus lay with the executive, which could claim to represent the imperial will. The education rescript, also introduced in 1890, was to guarantee that future generations would accept the imperial will and authority without question. In spite of these and other antidemocratic features, the constitution provided a much greater area for dissent than had previously existed. The lower house had the power of initiating legislation. Private property was inviolate and freedoms, even when subject to legislation, were greater than none at all. Even the budgetary arrangements meant that increased support for the military could be had only with diet approval. Initially a tax qualification of 15 yen limited the electorate to about 500,000. This qualification was lowered in 1900 and 1920, and in 1925 universal manhood suffrage came into effect. The difficulty the government leaders had in controlling and manipulating the lower house, despite their power of dissolution and their resources for intimidation and bribery, illustrated the manner in which the constitution had altered the political picture. In turn, the way the party leaders co-operated with their erstwhile enemies when given a reasonable amount of prestige and patronage illustrated what large areas of agreement they shared with the Meiji oligarchies.

With the promulgation of the constitution the Meiji restoration and revolution came to an end. Thereafter the government leaders, who would soon retire behind the scenes to influence the political world as "elder statesmen" (*genrō*), acted to maintain and conserve the balance of ideological and political institutions they had worked out.

F. Imperial Japan

Foreign Affairs.—With internal reforms completed, the Japanese government set itself to achieving equality with the western powers. This had been one of the major goals since the beginning of the Meiji period. Treaty reform, designed to end the humiliating judicial and economic privileges the foreigners enjoyed by virtue of extraterritoriality and fixed customs rates, had been attempted as early as the Iwakura mission of 1871, but the western powers refused to consider it until Japanese legal institutions had been brought into line with those of the west. The Japanese made several attempts for compromise arrangements in the 1880s, but these were denounced by the press and opposition groups in Japan; in one case a nationalist extremist threw a bomb at Foreign Minister Ōkuma, nearly killing him. The treaty provisions for extraterritoriality were formally changed in 1894, after the completion of the Meiji institutional reforms; tariff autonomy came into effect in 1911, at the end of the Meiji period.

Asian matters took second place to internal problems during most of the Meiji period, as the government leaders held to a policy of caution; even those calling for a "positive" policy justified their arguments by pointing out that foreign adventures would provide an outlet for samurai energies and a focus for national unity. The government withstood pressure for such a course during the debate about Korea in 1873, although it lost the services of some of its most popular leaders. In 1874 a punitive expedition was launched against Formosa to chastise the aborigines for murdering Ryukyuan fishermen. This lent support to the Japanese claim to the Ryukyus, which had been under Satsuma influence in Tokugawa times; the islands were incorporated into Japan in 1879 despite Chinese protests. Adventures in Korea, however, although they were espoused by nationalists and, on occasion, liberals who sought to advance their cause in conjunction with Korean reformers, were avoided by the government, which was conscious of its need for internal reform and foreign approval. The matter was complicated by a growing Chinese readiness to resist Japanese interference in the affairs of China's most important tributary state. Chinese interests in Korea were represented by Yüan Shih-k'ai (*q.v.*) after 1883, and he was alert to the danger of Japanese gains. Incidents in 1882 and 1884 which might have led to war with China and Korea were instead settled by compromise. Itō met with the Chinese statesman Li Hung-chang at Tientsin in 1885 to work out an agreement in which China and Japan agreed that neither would send troops to Korea without first informing the other.

By the early 1890s it was increasingly clear that Chinese influence in Korea was becoming predominant. At the same time, the Meiji leaders found themselves hard pressed to maintain control over the diet in the early years of its operation. In 1894 a rebellion in Korea provided the occasion for a Korean request to China for assistance in putting it down. When the Chinese informed Tokyo of this, Japan quickly rushed troops to Korea and, after the rebellion was crushed, showed no inclination to withdraw. Hostilities between Chinese and Japanese forces broke out first at sea and then in Korea in July–Aug. 1894. Japan's modernized forces were everywhere victorious. The Japanese navy sank or captured much of the northern Chinese fleet, which had been dogged by bureaucratic inefficiency and corruption in the supply services. A peace treaty was negotiated at Shimonoseki between Itō Hirobumi for Japan and Li Hung-chang for China on April 17, 1895. By its terms both powers recognized the independence of Korea; China ceded Formosa, the Pescadores Islands and the Liaotung peninsula, granted Japan all rights enjoyed by European powers and made significant new economic concessions as well; new treaty ports were opened, and Japan received an indemnity of 200,000,000 taels in gold in two installments. A subsidiary treaty of commerce signed in 1896 gave Japan freedom to engage in trade, manufacture and industry in China's treaty ports, and provided for tax exemption within China for all goods so manufactured. Japan thus marked its own emancipation from unequal treaties by imposing even harsher terms on its neighbour. But the European powers were not yet prepared to welcome Japan as a full equal in the imperialist scramble in China. Germany, France and Russia forced Japan to return the Liaotung peninsula to China; in 1898 Russia forced China to grant it the lease of that peninsula with its important naval base at Port Arthur. The war thus demonstrated that even though Japanese arms sufficed to win Asian victories they could not maintain them without western sufferance. The war nevertheless proved a tremendous source of prestige for Japan, and it brought the Tokyo government much internal support; it also strengthened the hand of the army in national affairs. Army leadership rested with Yamagata Aritomo (*q.v.*).

Although Chinese influence had been removed in Korea the Japanese found that they still met resistance; instead of accepting Japanese leadership, Korea sought the help of the Russians as a counterweight. During the Boxer rebellion (1900) Japanese

troops took a major part in the work of the allied expedition that rescued the foreign nationals in Peking, but Russia took advantage of the emergency to occupy south Manchuria, thereby strengthening communications with Korea. Realizing the need of protection against a possible combination of European enemies such as the one that had blocked earlier gains in Manchuria, the Japanese government began talks that led to the Anglo-Japanese alliance (*q.v.*). By its terms each signatory was to come to the aid of the other in the event of an attack by two or more powers while remaining neutral if the other was at war with a single power. With this safeguard the Tokyo government was prepared to take a firmer line with respect to Russian advances in Manchuria and Korea. In 1904 Japanese ships attacked the Russian fleet at Port Arthur without the formality of a declaration of war. Japanese arms were everywhere successful; the most spectacular victory was that in Tsushima strait when the ships of Adm. Togō Heihachirō (*q.v.*) destroyed the Russian Baltic fleet, which had sailed around half the globe in an effort to tip the scales. But Japanese armies, despite victories at Port Arthur and in Manchuria, were strained to their utmost, and it was with relief that Japan accepted Pres. Theodore Roosevelt's offer of good offices for the negotiations that led to the peace signed at Portsmouth, N.H., Sept. 5, 1905. By its terms Japanese primacy in Korea was recognized, and Russia surrendered to Japan its economic and political interests in south Manchuria (including the Liaotung peninsula), as well as the southern half of the island of Sakhalin. The victory over Russia represented a tremendous achievement for Japan. It altered the balance of power in Asia, and its demonstration of Asian ability to cope with a great European power, albeit a backward one, accelerated the development of nationalist movements in Asia. Within Japan, however, the failure to secure a Russian indemnity to cover the costs of the war made the treaty unpopular. (*See* Russo-Japanese War.)

After the conclusion of the war Japanese leaders made new efforts to guide the course of reform in Korea. They now had a free hand, and Korean resistance was met with force. Itō Hirobumi was sent to Korea as resident general; he forced through treaties which gave Korea little more than protectorate status and forced the abdication of the Korean king. In 1909 Itō was assassinated, and the following year Korea was formally annexed to Japan. Korean liberties and resistance were crushed under military rule. By the end of the Meiji period Japan had thus achieved equality in every sense with the west, and had in fact succeeded its rivals as the strongest military and imperialist power in Asia.

Japan had abundant opportunity to use its new power in the years that followed. World War I found the western powers fully occupied in Europe. Japan took part in the war in compliance with the Anglo-Japanese alliance, but except for some convoy assistance it limited its participation to the seizure of the German Pacific islands and the German holdings on the Shantung peninsula. When China pressed for return of these, the Japanese government presented the so-called 21 demands in Jan. 1915. After several months of negotiation, Pres. Yüan Shih-k'ai reluctantly agreed to provisions which extended the duration of the Manchurian leases and to joint control of the Han-yeh-p'ing company's steel- and ironworks in central China. The German Shantung holdings were to be settled by agreement between Japan and Germany at the time of the peace treaty; subsequently Japan agreed to hand back the territory in return for further commercial privileges. China promised not to alienate harbours in Fukien province to any other power without Japanese approval. The Chinese successfully resisted group v of the 21 demands which would have reduced China to the status of a Japanese ward. The new privileges brought Japan abundant opportunity for the exploitation of Manchuria. But the ill-feeling aroused by the negotiations, together with Chinese chagrin at failure to recover these losses in the treaty of Versailles, cost Japan whatever hopes there might have been of Chinese friendship. Subsequent Japanese sponsorship of corrupt war-lord regimes in Manchuria and north China helped to confirm the anti-Japanese nature of modern Chinese nationalism.

Japanese behaviour during the Allied intervention in Siberia in 1918 after the Bolshevik Revolution furthered the impression of Japanese rapacity. It was generally concluded that the underdog had now become the bully, and one of the principal results hoped for from the disarmament conference held at Washington, D.C., in 1922 was a lessening of Japanese influence. The network of treaties that was worked out replaced the Anglo-Japanese alliance with a set of treaties designed to restrain Japanese ambitions while guaranteeing Japanese security. Japan, Great Britain, the United States and France concluded a four-power pact which replaced the Anglo-Japanese alliance, while in the five-power pact for disarmament limitations were set up for capital-ship construction on a ratio of five for Great Britain and the U.S. to three for Japan. Parallel guarantees against fortifying advanced bases assured Japan of safety in Pacific waters. The nine-power pact would, it was hoped, protect China from further unilateral demands. Subsequent to the official conference sessions Japan agreed to retire from Shantung, and shortly afterward Japanese armies also withdrew from Siberia and northern Sakhalin. In 1925 a treaty with the Soviet Union extended recognition and brought to an end the active hostilities with the Soviet government.

The mid-1920s thus saw the end of Japan's great surge forward in the Pacific and brought hope that a new quality of moderation and reasonableness, based on the absence of irritating reminders of inferiority and weakness, might characterize Japanese policy. Under the administration of Foreign Minister Shidehara Kijūrō that followed, these hopes seemed well founded.

Constitutional Government.—The inauguration of constitutional government in 1890 found the government having difficulty achieving its purposes because of a vigorous and often obstreperous opposition in the lower house of the diet, and it was probably due to the general determination to prove to a skeptical world that parliamentary institutions could work in Japan that the party and government leaders co-operated sufficiently to make the system work. The first cabinets, led by Yamagata, Matsukata and Itō, attempted to maintain the principle that the government, which in their view represented the emperor, should be aloof from parties, and that it was the duty of the lower house to approve government requests. This policy failed, for the parties were desirous of increasing their power and patronage and therefore sought cabinets responsible to the lower house. After several struggles which were resolved by the use of money and force on the part of the government, it was only the Chinese-Japanese War of 1894–95 that produced the kind of unity the constitution makers had envisaged. In the years that followed the oligarchs formed alliances with the two parties, usually exchanging a cabinet seat or two for support in the lower house. These arrangements proved to be unsatisfactory as the party leaders soon raised their sights. In 1898 Itagaki and Ōkuma combined forces to form a single party, the Kenseitō, and since this ruled out successful administration by a nonparty cabinet they were allowed to form a government. But their alliance was of short duration, as long-standing animosities and jealousies made it possible for antiparty forces among the bureaucracy and oligarchy to force their resignation within a few months.

There now developed a discernible division in the ranks of the dwindling group of Meiji leaders. Yamagata Aritomo, the Chōshū restoration hero, dominated the army and much of the bureaucracy. During the two years he held power after the fall of the Kenseitō cabinet in 1898 he strengthened legal and institutional safeguards against political party rule and secured an imperial ordinance to the effect that the service ministers should be career officers on the active list; this gave the army or navy power to break a cabinet. Partly in reaction to this growth of institutionalized power, the other outstanding member of the oligarchy, Itō Hirobumi, also of Chōshū, formed his own political party in 1900, the Rikken Seiyūkai, enlisting most of the former followers of Itagaki, who thereby abandoned a good many of their political principles and all their autonomy of action in return for power and patronage.

After 1901 both Itō and Yamagata retired from active participation in politics; until 1913 cabinets were led by their protégés Saionji Kimmochi (*q.v.;* 1849–1940) and Katsura Tarō (1847–

1913). Basic decisions of politics and policy, however, continued to be made by the core group of elder statesmen. They advised the emperor on all important decisions and selected prime ministers by rotating power between the two principal factions. Saionji was the last to be recruited into this extraconstitutional body, although prime ministers in the 1920s and 1930s were often consulted as "senior servants" (*jūshin*).

With the death or enfeeblement of the first generation of leaders, the pattern of political manipulation changed. No subsequent group could match the prestige the Meiji leaders had enjoyed. The death of the Meiji emperor in 1912 ended a remarkable reign. He was succeeded by a son who took the reign name Taishō ("great righteousness," 1912–26); his mental illness prevented him from approximating his father's fame. The growth in power of new social forces like those of the world of business found expression in their control of the political parties and resulted in an increasing role for professional party politicians. The genrō's last attempt to seat Katsura in 1912 ended in failure, while his successor, Adm. Yamamoto Gombei, was discredited by scandals in naval procurement. Ōkuma Shigenobu emerged from retirement to head a cabinet during World War I, and was succeeded by a military cabinet under Gen. Terauchi Masatake. In 1918, however, discontent with Terauchi's reactionary posture and his administrative incompetence combined with the rising power of the party professionals to bring about the appointment of Hara Kei (*q.v.*; Hara Takashi) as prime minister. Hara was the first nontitled person to hold that office, and his appointment marked the first "party cabinet." His assassination in 1921 cut short his cautious efforts to reduce the power of the military and the bureaucracy and to extend the franchise. After several short-lived cabinets headed by nonparty figures, a highly successful party cabinet was organized in 1924 by Katō Takaaki (1860–1926). Under him universal manhood suffrage was introduced. The army was reduced in size, moderate social legislation was enacted and universal manhood suffrage extended the franchise to about 14,000,000 voters. In these same years Katō's foreign minister, Shidehara Kijūrō (*q.v.*), withstood demands for stronger steps in China's civil war and pursued a conciliatory course in Siberia, despite demands from nationalists who utilized presumed outrages in China and the discriminatory United States Immigration act of 1924 to warn of the futility of appeasing or co-operating with other powers.

But while the parties scored significant democratic advances in some respects, in other ways they showed themselves thoroughly distrustful of popular freedoms. As the parties grew in power they tended to look to bureaucrats for leadership; important party figures like Hara, Katō, Takahashi Korekiyo and others entered the parties from the bureaucracy. The businessmen who supported the parties and the bureaucrats who led them shared a fear of the social movements that followed industrialization and the importation of foreign ideas. The growth of the labour movement had already been checked by a Peace Preservation law introduced under Yamagata in 1900. This was strengthened under Katō in 1925, as conservatives generally began to fear subversion in labour and tenant movements. A small Communist party was organized by a group of intellectuals in 1922, and the general interest in Marxist thought contributed to more fears of subversion. Under the Meiji constitution party governments had to make their peace with the military, with the house of peers and with the conservatives close to the throne; whatever ideas for reform they had therefore had to be worked out with the utmost caution. Frequently the diet found itself virtually powerless and this encouraged an irresponsibility evidenced by frequent corruption and disorders in the chamber. This did little to win popular respect for the machinery of representative government. There were no institutional changes to make it possible for a government to be firmly based on popular support. The Meiji constitution, which was never changed, was so ambiguous in its provisions for the executive that the party prime ministers could achieve little unless they secured, through compromise, the co-operation of forces which were quite antagonistic to their supposed purpose of democratic government.

Social Change.—Changes in the social and intellectual scene outstripped those in the political. Many of them were related to the development of industry. After the treaty of Shimonoseki the government utilized the Chinese indemnity to subsidize the Yahata (Yawata) steel- and ironworks, which were established in 1897 and began production in 1901. Yahata depended on China for its ores. After 1900 Japan's population exceeded the capabilities of domestic food production with the result that there was need for import of food as well. The growing textile and other consumer-goods industries expanded both to meet Japanese needs and to earn the credits required for the import of raw materials. Heavy industry was encouraged by government-controlled banks which provided capital where needed. Strategic industries, notably steel and the principal rail trunk lines, were in government hands, but in the main the new growth was in the private sector, albeit somewhat concentrated in the hands of the *zaibatsu* financial and industrial giants. (See *The Economy*, below.)

The enlarged urban population produced movements of social inquiry and protest. In 1895 the industrial labour force numbered about 400,000. Several efforts were made to organize socialist movements, but they speedily ran afoul of police repression. Peace Preservation laws were passed in 1900 and 1925, and in 1928 a revision of the law passed under Katō made it a capital crime to agitate against private property or Japanese state polity (*kokutai*). In 1903 a small group organized the *Heimin Shimbun* ("Commoner's Newspaper"), which published the *Communist Manifesto* and opposed the Russo-Japanese War in the name of the workers of Russia and Japan before it was forced to cease publication. The Christian pacifist Uchimura Kanzō joined in these protests, but later parted company with the socialists. The labour and socialist movements gained in strength after World War I, but had many handicaps. Leadership was usually theoretical and doctrinaire with little real contact with the workers. Police repression and the difficulties of organizing the labour force of diverse industrial empires like those of Mitsui and Mitsubishi also kept the labour movement from making headway. The increasing confidence and power of management, which came to influence and at times control the political parties, were in marked contrast to the slow progress of the labour movement. The Katō cabinet of 1924–26 was sometimes referred to as a "Mitsubishi cabinet" because of its close relations to Mitsubishi interests and families.

In the countryside the principal reflection of the new trade patterns was the additional impetus to silkworm production to augment the farmers' income. The farm villages also provided the bulk of the labourers for the new industries, and farm daughters were to be found in many of the textile plants. The early decades of the 20th century were not years of agricultural prosperity. The farmers were handicapped by growing fragmentation of holdings and increasing tenantry. The rising number of tenants resulted in the growth of tenant organizations, especially during and after the prosperity of World War I. Government efforts to encourage voluntary reform measures brought only a law for mediation of disputes in 1924. This made little real impact, and the financial panic of 1927 aggravated rural conditions and indebtedness even before the collapse of the U.S. silk market in 1929 spelled disaster for the farmers and workers alike. (See *The Economy: Agriculture*, below.)

The most lasting social changes were those found in the great metropolitan centres where the growing labour force and the new middle "salary" groups were concentrated. The Tokyo-Yokohama area was devastated by a great earthquake in Sept. 1923, and its rebuilding as a modern metropolis symbolized the growth and orientation of the urban society. The currents of enthusiasm during and after World War I, in which Japan joined the Allied cause, were uniformly international and largely American in inspiration. Western music, dancing and sports became popular, and the rising standards of living and expectation produced the need for more and better higher education. Women shared in the changes. The participation of women in office work in the new enterprises and the rise of a feminist movement, however unsuccessful, marked the beginning of changes in the family system.

The educated class grew in numbers and in vigour. Currents of

thought included western-style democracy and the new radicalism of the Soviet Union; the influence of Marxist thought and analysis went far beyond the ranks of the struggling Communist party—which was, in any event, soon crushed by the police. Political liberalism was championed by the Tokyo university figure Yoshino Sakuzō (1878–1933), who formed student and intellectual groups whose title—Shinjinkai, "New Peoples Associations"—symbolized the self-conscious break with tradition. Minobe Tatsukichi (1873–1948), a distinguished constitutional theorist, introduced the idea that the emperor was an "organ" of the state and not, as conservatives had it, the sole source of sovereignty. Such men came in for sharp criticism and had, in time, to resign their positions, but they had great influence and symbolized as well as stimulated the more advanced currents of thinking.

Unfortunately the base for these new currents of liberalism was a precarious one. Politically and institutionally no advances—beyond the universal manhood suffrage of 1925—were scored, while under the Peace Preservation laws of 1928 a special police corps was established to seek out "dangerous thoughts." Economically the urban classes were dependent upon the continuance of the favourable trade patterns of the 1920s. When the great depression at the end of the decade wrecked Japan's foreign markets and removed the possibility of the villagers' augmenting rice income with that of silk, and when the irresponsibility and occasional corruption of diet representatives contrasted with poverty elsewhere in Japanese society, there were many prepared to listen to charges that the political party government, dominated by selfish *zaibatsu* interests, had neglected Japan's markets in China, imperiled morality and decency at home and allowed subversive trends to flourish while the politicians reaped personal gains at the expense of the taxpayers and the nation.

The Rise of the Militarists.—The notion that expansion through military conquest would solve Japan's economic problems had some currency before the great depression of 1929, but the hardships that both rural and city workers experienced thereafter gave the idea new plausibility. One of the key arguments advanced to support it was that of surplus population. Japan's population had grown from 30,000,000 at the time of the Meiji restoration to almost 65,000,000 in 1930. Each year the problem grew worse and the imports of needed foodstuffs increased. It was also argued that emigration to many areas was cut off because of discrimination against oriental peoples. Emigrants to the United States had suffered from prejudice in the San Francisco school exclusions in 1906 and they had been the targets of the discriminatory act of 1924 as well as numerous state laws forbidding the purchase of land by persons ineligible for citizenship. Japanese were barred from Australia altogether. Efforts made by Japan and China to secure a racial equality clause in the League of Nations covenant had been frustrated by western statesmen who feared the anger of their constituents. So the argument ran that there was no recourse to be expected without resort to force.

To these economic and racial arguments were added a distrust of party government. The armed services had opposed several international agreements which the party governments had accepted. The Washington conference had allowed a smaller ratio of naval strength than the navy had desired, and the government of Prime Minister Hamaguchi Osachi in 1930 accepted the London naval conference limitations of cruiser strength and forced them through a reluctant diet and privy council over the service objections. The Katō government had cut the army strength by four divisions. Many service leaders had also bridled under the moderation Foreign Minister Shidehara had shown in China during the Kuomintang northern expedition in 1926 and 1927, and they would have preferred a much stronger stand. The Seiyūkai cabinet under Prime Minister Tanaka Giichi (*q.v.*), who had been invited to head that party, reversed Shidehara's policy by intervening in Shantung in 1927 and 1928. Tanaka was forced out in 1929 and replaced by Hamaguchi, under whom Shidehara returned to control of the foreign office. It could be seen that such vacillation earned Japan ill will and expensive boycotts in China without gaining any advantage.

Significant numbers of military leaders were inclined to resent the restrictions the civilian governments had placed upon them, and since they had direct access to the throne and possessed the ability to break a cabinet by refusing their co-operation, their power was considerable. It would be wrong to attribute such views to all or even most of the high command. Many senior figures knowledgeable in politics approved of party government, and navy leaders tended to be more discreet. But enough army officers in particular held this position to furnish a possible focus for dissatisfaction among other groups in Japanese society. The idea of the frugal, selfless samurai was peculiarly useful as a contrast to the stock characterization of the selfish party politician.

These economic pressures and political misgivings were exploited by civilian groups of ultranationalists who opposed parliamentary government as "un-Japanese." Since Meiji times there had been a number of rightist organizations dedicated to the theme of internal "purity" and external expansion. They sought to preserve what they thought unique in the Japanese spirit, and therefore fought against excessive western ways and ideas. There were many such organizations, the most important of them associated with the life of Tōyama Mitsuru (1855–1944). Some originated in the Meiji period when nationalists had felt obliged to work for a "fundamental settlement" of differences with Russia; the Kokuryūkai ("Black Dragon" or, more accurately, Amur society) was one such, while others, like the Seisantō (Productivity society), were frankly keyed to labour and social problems. The National Purity society (Kokusuikai) worked to preserve just that, while the Ketsumeidan or Blood Sworn league was terrorist. Most of the organizations attracted rootless young men who were willing to risk their lives in the tactics of terror and suicide that traditionally stirred emotions in Japan. Their leaders were against political parties and big business as they were against acculturation and westernization, and by allying with rightist forces, civilian and military, they alternately terrorized and intimidated their presumed opponents. A number of business leaders and political figures lost their lives as victims to members of these groups, and the assassins' success in publicizing and dramatizing the virtues they claimed to embody had a considerable importance in the ethos of the troubled 1930s. It is clear, however, that the terrorists never had as much influence as they claimed or as the west thought they had.

The principal motive force for the reaction against parliamentary government was provided by junior officers in the armed services. Largely from rural backgrounds, distrustful of their senior leaders, ignorant of political economy and contemptuous of the politicians with their urban luxuries, the young officers were ready marks for a number of rightist theorists. Many of them were animated by goals that were national socialist in character. Kita Ikki (1883–1937), a former socialist who had passed through the Kokuryūkai's organizations which sought to help Chinese revolutionaries in 1911, wrote in his *Outline Plan for the Reconstruction of Japan* that the Meiji constitution should be set aside in favour of a revolutionary regime advised by "national patriots" and headed initially by a military government which should nationalize major forms of property, place limits on wealth, end party government and peerage systems, and then prepare to grasp the leadership of a revolutionary Asia. Kita helped persuade a number of young officers to take part in the violence of the 1930s, and in large measure their plots were designed to create a disorder so great that military government would follow. Once this had been achieved, they thought, "the army" would know what to do next.

The Kwantung army, which invested the Kwantung (Liaotung) peninsula and patrolled the South Manchurian railway zone, provided a rich harvest of officers keenly aware of Japan's continental interests and prepared to take steps to further them. Their incidents were designed to place the civilian government in an untenable position and to force its hand; the Tokyo terrorists similarly sought to change foreign as well as domestic policies. The pattern of direct action in Manchuria began with the murder of Marshal Chang Tso-lin, the war-lord ruler of Manchuria, whose train was bombed in June 1928. The action was not authorized by the Tanaka government, and helped to bring about its fall. Tanaka's cabinet, however, dared not investigate and punish those

responsible, and this contributed to the feeling of extremist officers that their lofty motives would make retribution impossible. The succeeding government of Prime Minister Hamaguchi (Hamaguchi was mortally wounded by an assassin in 1930) showed intentions of restraining military activists and powers, however, and the next plots centred around plans for replacing civilian government altogether. In March 1931 a coup involving highly placed army generals was planned to terrorize civilian politicians into a grant of martial law, but it was abandoned because of lack of agreement among the principals.

On Sept. 18, 1931, came the Manchurian incident which launched aggression in east Asia. A Kwantung army charge that Chinese soldiers had tried to bomb a South Manchurian railway train (which arrived at its destination safely) resulted in speedy and unauthorized capture of Mukden followed by the occupation of all Manchuria (*q.v.*). The civilian government in Tokyo found itself powerless to stop the army, and even army headquarters was not always in full control of the field commanders. Prime Minister Wakatsuki Reijirō gave way, in Dec. 1931, to Inukai Tsuyoshi (Ki; 1855–1932). Inukai's efforts to stop the armies by imperial intervention were frustrated when the army discovered them beforehand. In 1932 naval officers took the lead in extremism; after the resolution of an incident at Shanghai there was a terrorist attack in Tokyo in May that took the life of Inukai. The terrorists failed to fell their other targets and they failed to secure a proclamation of martial law. The army, however, now announced that no party cabinet would be acceptable to it. To forestall its desires for power the last genrō, Saionji, recommended retired Adm. Saitō Makoto as prime minister. Plotting continued furiously, culminating in the revolt of a regiment about to leave for Manchuria. On Feb. 26, 1936, a large number of outstanding statesmen (including Admiral Saitō and Finance Minister Takahashi Korekiyo) were murdered; Prime Minister Okada Keisuke escaped because the assassins mistakenly shot his brother. For several days the rebel units held much of downtown Tokyo, and it required great care to convince the conscripts that their junior officers had acted without warrant and in violation of their proper loyalty. When the insurrection was put down on Feb. 29 the ringleaders were quickly arrested and executed, and with them fell their mentor Kita Ikki. Therewith the influence of the young extremists, often referred to as the Imperial Way faction (Kōdō ha), gave way before that of the more cautious Control faction (Tōsei ha), which had less sweeping plans for internal reform but shared many of the foreign policy goals of the young fanatics.

In view of the disesteem for the party politicians and the forces of big business, the only possible source of prestige sufficient to thwart the military lay with the throne. The senior statesmen, however, were cautious lest they imperil the imperial institution itself. The young emperor Hirohito (*q.v.*) had succeeded to the rule in 1926, taking as his reign title Shōwa. His outlook was more progressive than that of his predecessors; he had traveled in the west and his interests lay in marine biology, a scientific attachment the ultranationalists felt unfortunate in one whose role it was to embody the Japanese mystique. Saionji and the other palace advisers feared the radicalism of the young extremists and thought a strong stand by the emperor would only widen the search for victims. Saionji himself was on almost every assassination list, and he feared that the extremism might lead to dethronement of the monarch. Therefore he chose to bide his time, hopeful that national or international currents would shift in such a way as to change or thwart the extremists' plans. Unfortunately this was not to be. As international criticism of Japan's aggression on the mainland grew in volume many Japanese rallied to the support of their soldiers.

The Road to World War II.—Each advance by the military extremists resulted in a new compromise concession to them by more moderate elements in the government, and each of these in turn brought greater foreign hostility and distrust. Manchuria was fully occupied early in 1932, and rather than attempt to thwart the military the government agreed to reconstitute it as the "independent" state of Manchoukuo. The last Manchu emperor of China, Hsüan T'ung, was first declared regent and then enthroned as emperor in 1934. Actual control lay with the Kwantung army, however; all key positions were held by Japanese with surface authority for co-operative Chinese and Manchus. The League of Nations appointed a committee headed by Lord Lytton which, on the basis of an on-the-spot investigation, recommended in Oct. 1932 that Japanese troops be withdrawn, Chinese sovereignty in Manchuria recognized and a large measure of autonomy granted to Manchuria. The League accepted these recommendations and called upon member states to withhold recognition from the new puppet state. When this was passed the Japanese delegation, led by Matsuoka Yōsuke (1880–1946), walked out of the League chamber; shortly afterward, in March 1933, Japan formally withdrew from the world body. Thereafter Japan poured technicians and capital into Manchoukuo, exploiting its rich resources to establish the base for the heavy-industry complex that was to undergird the new order in east Asia. The military planners avoided contacts with the old *zaibatsu* firms whose ties with the political party governments they had deplored, and worked through new firms of their own selection and creation to develop the plants that were seized and dismantled by Soviet forces at the end of World War II.

Aggression in Manchuria was supported by moves in north China, where boundary areas were consolidated in order to enlarge the economic basis of the "co-prosperity sphere." In the winter and spring of 1932 the Japanese navy precipitated an incident at Shanghai in order to put an end to a boycott of Japanese goods there. Japan was not yet prepared to challenge other powers for control of central China, however, and a League of Nations commission arranged terms for a withdrawal in May 1932. Frustrated naval officers returned to Tokyo to carry out the violence that cost the life of Prime Minister Inukai on May 15. More important militarily was the move south from Manchuria into Jehol in Jan. 1933. This led to the T'ang-ku truce in May, whereby a demilitarized zone was set up between Peking and the Great Wall. This brought the fighting to a temporary close. In 1934 a statement by the information chief of the Tokyo foreign office made it clear that Japan would brook no interference in its China policy, and that Chinese attempts to procure technical or military assistance elsewhere would bring Japanese opposition.

From then until 1937 external ambitions had to wait for the resolution of domestic crises. Feb. 1936 saw the military revolt in Tokyo that marked the high point of the extremist faction and the consolidation of power by the Control faction within the army. Finance Minister Takahashi Korekiyo (1854–1936), whose policies of reflation had brought Japan out of its depression slump, was killed, and his opposition to further inflationary spending stilled. Further efforts by the palace advisers to defer full power for the military brought short periods of rule under Hirota Kōki and Hayashi Senjūrō. When these failed, the leadership went to the popular but ineffective Konoe Ayamaro, scion of an ancient court family, in June 1937. The same years saw the kidnaping of Chiang Kai-shek (*q.v.*) by Chinese border armies at Sian in Dec. 1936 and his agreement to a consolidation of Nationalist and Communist efforts into an anti-Japanese front. To this alarming development was added the evidence that the Japanese people were not yet prepared to renounce their parliamentary system. In the spring of 1937 general elections showed a startling strength for a new Social Mass party, which received 36 seats out of 466, and a heavy majority for the two parties (the Seiyūkai and its rival the Minseitō) which had combined forces against the government and its policies. The time seemed ready for new efforts by civilian leaders, but the field armies anticipated them.

In July 1937 Japanese troops opened fire on Chinese units at the Marco Polo bridge near Peking. Thus began the "China incident." Japanese armies took Nanking, Hankow and Canton despite vigorous Chinese resistance; to the north, Inner Mongolia and the provinces of Shansi and Shensi were invaded but not fully invested. After the fall of Nanking, the Konoe government began peace feelers. On discovering that the Nationalist government, which had retired to Chungking in Szechwan, refused to compromise, the Japanese installed a more co-operative regime at Nanking in 1940 under the former Kuomintang leader Wang Ching-wei. Meanwhile, in Nov. 1936, the anti-Comintern pact had been signed with

Germany and later with Italy. This was replaced by the tripartite pact in Sept. 1940. The Axis allies recognized Japan as the leader of a new order for Asia, and the three signatories agreed to assist each other if any one was attacked by a power not then at war. This was directed against the United States, since the Soviets and Nazis were then allied; Soviet Russia was, indeed, invited to join in the tripartite pact later in 1940.

Japanese relations with the Soviet Union were considerably less cordial than those with Germany. The Soviets entered the League of Nations in 1934, after the Japanese had left. The Russians consented, however, to sell their Chinese Eastern railway holdings to the South Manchurian railway in 1935, thereby strengthening Manchoukuo. In 1937 the Soviet Union signed a nonaggression pact with China, and in 1938 and 1939 Russian and Japanese armies tested each other in two full-scale battles along the border of Manchoukuo. The Soviet-Nazi pact of Aug. 1939, however, was followed by a neutrality pact between the Soviet Union and Japan in April 1941. Foreign Minister Matsuoka Yōsuke was taken aback by the German invasion of Russia in June 1941, and lost his position after an unsuccessful attempt to persuade his government to join in the German attack.

The German-Japanese tie was never a close or effective one. Both parties were limited in their co-operation by distance, distrust and claims of racial superiority. The Japanese were uninformed about Nazi plans for attacking the Soviet Union, and the Germans were not told of the Pearl Harbor plans. Nor, despite formal statements of rapport, did Japan's state structure approach the totalitarianism of the Nazis. A national mobilization law (1938) gave the Konoe government sweeping economic and political powers and in 1940, under the second Konoe cabinet, the Imperial Rule Assistance association was established to merge the political parties into one central organization. Yet the institutional structure of the Meiji constitution was never altered, and even the wartime governments never achieved full control over interservice competition. The Imperial Rule Assistance association and its fronts never succeeded in mobilizing all segments of national life around a leader. The emperor remained but a symbol, albeit an increasingly military one, and no *Führer* could compete without endangering *kokutai*, the national polity. Moreover, wartime social and economic thought retained important vestiges of an agrarianism and familism which were in essence premodern rather than totalitarian.

During the events which have been described, Japan's relations with the democratic powers deteriorated steadily. Both the United States and Great Britain did what they could to assist the Chinese Nationalist cause. The Burma road, constructed with great difficulty, permitted the import of minimal supplies to Nationalist forces. Japanese efforts to close this route were constant, and successful briefly in 1940, when the British, facing desperate odds in Europe, felt they could not risk a second war. Anti-Japanese feeling had strengthened in the United States, especially after the sinking of a U.S. gunboat, the "Panay," in the Yangtze river in 1937. In 1939 Secretary of State Cordell Hull denounced the 1911 treaty of commerce with Japan, with the result that embargoes became possible in 1940. Pres. Franklin D. Roosevelt's efforts to rally public opinion against aggressors included efforts to stop Japan, but even after the outbreak of war in Europe in 1939 public opinion in the U.S. was averse to courting war by stronger measures.

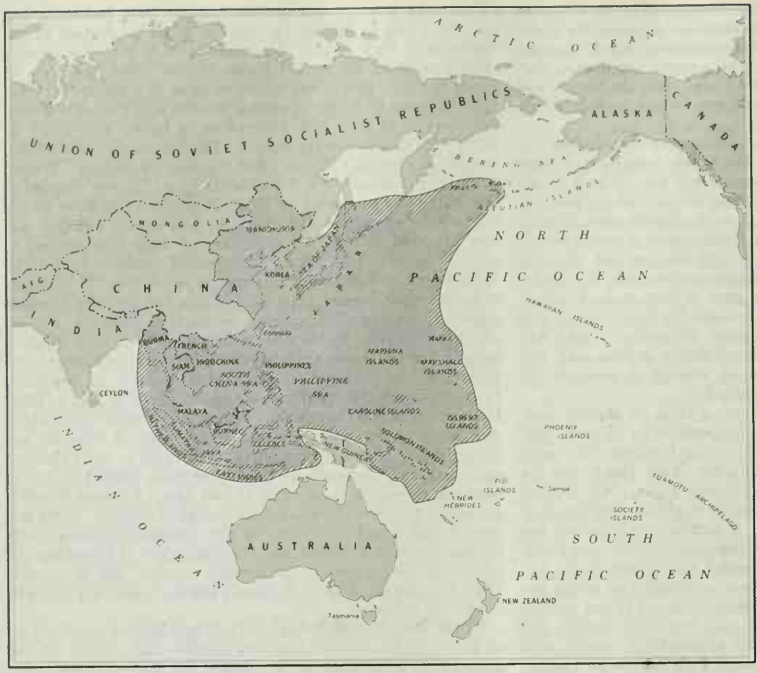
The European war presented the Japanese with tempting opportunities. After the Nazi attack on Russia the Japanese were subjected to German urgings to join the war against the Soviets and their natural inclination to seek richer prizes from the colonial powers to the south. In 1940 Japan had occupied northern Indochina in an attempt to block access to supplies of the Chinese Nationalists, and in July 1941 it announced a joint protectorate with Vichy France over the whole colony. With this new base for action in southeast Asia the way was prepared for further moves.

The United States reacted to the occupation of Indochina by freezing Japanese assets and declaring an embargo on oil to Japan. Japan's stock-piling had been inadequate, and the cutoff of U.S. petroleum presented the government with the alternatives of conciliating the U.S. by withdrawing from at least Indochina and possibly China or seizing the sources of oil production in the Netherlands East Indies. Negotiations with Washington were carried on under the second Konoe cabinet which had come to power in 1940. Konoe was willing to agree to a withdrawal from Indochina, and he sought a personal meeting with President Roosevelt, hopeful of some U.S. concessions or favour with which he might convince his military leaders. The state department refused to agree to a meeting without prior Japanese concessions. Pressed by his war minister, Gen. Tōjō Hideki (*q.v.*), Konoe resigned in Oct. 1941 to be succeeded by Tōjō. A deadline laid down by the military for agreement with the U.S., first set for October, was now advanced to Nov. 29. Secretary of State Hull refused to agree to Japan's "final offer": Japan would withdraw from Indochina after China had come to terms, in return for U.S. promises to resume oil shipments, cease aid to China and unfreeze Japanese assets. Hull also decided against a previously worked out counter-offer lest the United States position seem to be weakening. Japan's decision for war made, the negotiators Nomura Kichisaburō and Kurusu Saburō received instructions to continue to negotiate. Preparations for the opening strike against the U.S. fleet at Pearl Harbor were now set in motion. The Japanese military, presented with great opportunities for solving problems of material and strategic needs and forced to retreat or advance by their previous aggression and alienation of western opinion, elected to try to establish, through a "new order in east Asia," a sphere in which Japan, as the centre of an industrial bloc of Manchuria, Korea and north China, would draw from the rich colonies of southeast Asia the raw materials it needed, while inspiring them to friendship and alliance by destruction of their previous masters. But in practice, "east Asia for the Asiatics," Japan's slogan, turned out to mean "east Asia for Japan."

World War II and Defeat.—The Pearl Harbor attack (*q.v.*) on Dec. 7, 1941, achieved complete surprise and success. It also unified U.S. opinion and made possible the determination to see the war through to a successful finish. This invalidated a major premise upon which the Japanese had based their decision. They had expected that once they invested and fortified their new holdings a reconquest would be so expensive in lives and treasure that it would discourage the "soft" democracies. Instead the U.S. fleet was rebuilt with astonishing speed and the chain of defenses breached before these riches could be effectively tapped by Japan.

The first years of the war brought Japan astounding victories. Japanese troops occupied Manila Jan. 2, 1942, although Corregidor held out until May 6; Singapore fell on Feb. 15, the Netherlands Indies were taken early in March and Rangoon on March 8. The Allies had difficulty maintaining their communication lines to Australia and the loss of the British battleships "Repulse" and "Prince of Wales," added to the U.S. Pacific fleet disaster, seemed to promise the Japanese navy freedom of action. In Japan Prime Minister Tōjō grew in confidence and popularity and began to style himself somewhat in the manner of a fascist leader. In the months that followed, however, it developed that the U.S. navy had not been permanently driven from the South Pacific. The battle of Midway on June 4–6, 1942, cost the Japanese fleet aircraft carrier strength it could ill afford to lose. (*See* WORLD WAR II: *The War in the Pacific.*) The battle for Guadalcanal in the Solomons ended with a Japanese withdrawal in Feb. 1943.

After Midway, Japanese naval leaders began to analyze shipping and battle losses and concluded that Japan's outlook for victory was poor. Their conclusions were carefully kept to themselves. When the fall of Saipan in July 1944 brought U.S. bombers within range of Tokyo the Tōjō cabinet was doomed. It was replaced by that of Koiso Kuniaki (1880–1950). Koiso formed a supreme war direction council which was designed as a link between the cabinet and the high command. By this time it was becoming evident that Japan was losing the war, but no group was ready with a program acceptable to the military leaders. It would require efforts to reach the emperor in order to alert him, for no one else could hope to dissuade the military. There were also grave problems about breaking the news to the Japanese people, who had been told only of victories. The great fire raids of 1945 brought



THE JAPANESE EMPIRE IN 1942

destruction to every major city except the old capital of Kyōto. Even then, the generals held out for continuing the war, confident that a major victory or a protracted battle would be the best way of gaining honourable terms. The Allied talk of "unconditional surrender" provided a good excuse for continuing the fight. By Feb. 1945 the emperor was meeting with a group of senior statesmen, including Konoe, Okada and other former premiers, to discuss steps that might be taken. When U.S. landings were made on Okinawa in April 1945 the Koiso government fell. The new premier, Adm. Suzuki Kantarō (1867–1948), a veteran of the Chinese-Japanese War (1894–95), had been on assassination lists in the 1930s and severely wounded once. His problem was not whether to end the war but how best to do so. The first plan advanced was to ask the Russians, with whom Japan was still at peace, to intercede with the Allies. Konoe was to travel to Moscow. The Soviets, however, were planning to enter the war themselves, and they delayed a reply while their leaders took part in the Potsdam conference in July. The Potsdam declaration of July 26 offered the first ray of light with its statement that Japan would not be "enslaved as a race nor destroyed as a nation." The path to an honourable surrender seemed to open.

On Aug. 6 and Aug. 9 the atomic bombs took their toll of life in Hiroshima and Nagasaki. On Aug. 9 the Soviet Union declared war and marched into Manchuria, where the Kwantung army, whose best units had long since been withdrawn, could offer only slight resistance. The Japanese government now attempted to gain as its sole condition for surrender a qualification concerning the maintenance of the imperial institution. After the Allies replied that the will of the Japanese people would be respected, the emperor insisted on surrender. The Pacific war came to an end on Aug. 14. The formal surrender was signed Sept. 2, 1945, in Tokyo bay aboard the U.S.S. "Missouri." Military extremists made a last attempt to block the radio broadcast of the emperor's announcement to the nation, but they were unsuccessful. There were a number of suicides among the military and nationalists who felt themselves dishonoured, but the emperor's prestige and personal will, once expressed, sufficed to bring an orderly transition. To increase the appearance of direct rule the Suzuki cabinet was replaced by that of Prince Higashikuni Naruhiko.

Investigators who studied the political and economic setting in which the surrender was adopted concluded that neither atomic bomb nor Russian entry was involved in the decision, although they probably operated to advance the date. It was concluded that the submarine blockade of the Japanese islands had brought economic victory by preventing exploitation of Japan's new colonies, sinking merchant tonnage and convincing Japanese leaders of the hopelessness of the war. Air strikes brought the consciousness of defeat to the people, while military operations had destroyed the Japanese navy and air force so that the home islands could be threatened. Japan's largest armies, however, were never defeated, and this influenced the army's eagerness to fight on for better terms. Occupation found Japan's cities destroyed, its stock piles exhausted and its plants gutted. The Japanese government, whose boasts and guarantees had proven hollow, stood without prestige or respect. An alarming food shortage and spiraling inflation threatened what remained of national strength. The time was ripe for changes. (*See* also WORLD WAR II.)

G. After World War II

The policies that were to be followed in occupying Japan had been the subject of sharp debate in Washington during the war. Although some advocated doing away with the influence of the prewar Japanese "moderates" altogether, in the end a great deal was left to the initiative of the supreme commander. The Potsdam declaration had held out for the Japanese promises of freedom of speech, of religion and of thought and of fundamental human rights, and specified that the Japanese government was to remove all obstacles to the revival and strengthening of democratic tendencies among the Japanese people. Subsequently, on Aug. 29, a document outlining United States initial postsurrender policy was worked out by the departments of state, war and the navy; this became the basic statement of principles. As ultimate objective it envisaged a Japan no longer a menace to the United States or to the peace and security of the world, ruled by a responsible government which would respect the rights of other states and support the objectives of the United States as reflected in the charter of the United Nations. It was hoped that Japan would conform as closely as possible to principles of democratic self-government, and the U.S. would not impose any form of government not supported by the freely expressed will of the Japanese people. Japan would be limited to the four main islands and such minor islands as were to be specified at a later date, and it was to be disarmed and demilitarized, with the authority of militarists and militarism "totally eliminated" from political, economic and social life. The Japanese people would be encouraged to develop a respect for individual liberties and human rights, and they would be given opportunity to develop an economy adequate to meet the peacetime requirements of the population.

Power to carry out these objectives was given to Gen. Douglas MacArthur, supreme commander for the Allied powers (SCAP),

who received his directives through U.S. military channels. By agreement of the U.S., British and Soviet foreign ministers, a Far Eastern commission representing all the Pacific allies was established for the formulation of policies and review of MacArthur's actions, but whatever recommendations and directives ensued would reach him through normal military channels. An Allied council for Japan representing the Soviet Union, China, the British Commonwealth and the supreme commander sat in Tokyo to furnish on-the-spot advice and consultation. The supreme commander was to consult this council before issuing orders, the exigencies of the situation permitting, but the final decision was his. In practice SCAP paid the Allied council little heed and acted swiftly to forestall Far Eastern commission directives. As a result he was little hampered by outside interference. The occupation was thus largely a U.S. affair. SCAP became a huge headquarters containing several thousand persons, including both the headquarters staff of the Pacific campaigns and personnel who provided the technical, administrative and bureaucratic staffs. MacArthur worked through the Japanese government and made his wishes known by directives or more discreet suggestions. He had to be consulted on all major decisions of policy or politics, and thus functioned somewhat in the manner of the genrō of an earlier day.

The efforts at "democratizing" Japanese society seemed successively radical and cautious, and they were criticized as doctrinaire and halfhearted by turn. Japanese writers have often pointed to a change in the political and economic climate during 1947 and 1948 in which, they feel, the spirit of reform gave way to a concern for rebuilding and resuming production. Some have suggested that fear of excessive social and political change brought about a sharp turn in SCAP policies. It is evident that the fall of China to Communism altered the U.S. view of Japan's role in international affairs and increased the desirability of speeding Japan's economic recovery. But while there was a shift in emphasis there was none in long-range goals. The original goals had often been tentative and general in nature, and the success of some reforms made it desirable to re-evaluate and moderate at a later date. The SCAP attitude toward Communism, labour and deconcentration underwent decided changes. A decade later, however, historians were largely agreed that the measures taken by SCAP had created an open historical situation in which new forces could and did rise; such trends proved successful and lasting in areas where occupation measures had coincided with trends toward change long present, though suppressed, within Japanese society.

The early months of the occupation saw SCAP move swiftly to remove the principal supports of the militarist state under which Japan had gone to war. The armed forces were demobilized; state Shintō was disestablished; nationalist organizations were abolished and their members "purged" from holding important posts. Other purges removed from active roles all individuals prominent in wartime organizations and politics, including commissioned officers of the armed services; later the purge was extended to include all high executives of the principal industrial firms. In Tokyo an international tribunal tried General Tōjō and other war leaders, sentencing 7 to death, 16 to life imprisonment and 2 to shorter terms. Millions of Japanese were repatriated from the former colonies and from southeast Asia. The home ministry, which had controlled wartime Japan through its appointive governors and national police, was abolished and the education ministry was deprived of its sweeping powers to control compulsory education. Since central control and military influence were being attacked by a military government which needed centralized powers in order to be effective, the occupation's role was often a contradictory one. In the course of issuing instructions to the Japanese government to make certain that changes were being carried out, SCAP ensured the survival of that government as one intimately concerned with the pattern of local events in all parts of the country. And since in most cases factors of geography and economic rationality reinforced the logic of centralization, many of the moves toward decentralization were modified or reversed a half decade later.

Political Reform.—The new political structure of Japan centred around a new democratic constitution. The indirect rule, unseen cliques and shadowy nature of real power behind the façade of imperial rule made the Meiji constitution clearly inadequate and SCAP informed leading Japanese citizens that constitutional reform should receive first attention. The veterans of earlier decades of parliamentary government proved unable to grasp or accept the kind of reform that was intended. Between Oct. 1945 and Feb. 1946 a cabinet committee headed by Matsumoto Jōji prepared revisions in the Meiji constitution, but when submitted to SCAP its draft proved to contain few and superficial changes. General MacArthur's government section rushed a new draft to completion in six days. This was then submitted to the Japanese government as basis for further Japanese deliberations. Despite the misgivings of conservative statesmen, it was approved by the emperor and submitted for amendment to the first postwar diet, which had been elected in April 1946. In these elections women had voted for the first time. The constitution, slightly modified, went into effect on May 3, 1947. Its preface stated in ringing tones the intention of the Japanese people to ensure peaceful co-operation with all nations and the blessings of liberty for themselves and their descendants. The constitution included a 31-article bill of rights, and art. 9, with its famous renunciation of war as a "sovereign right of the nation," pledged that "land, sea, and air forces, as well as other war potential, will never be maintained." The emperor was described as the "symbol of the state and of the unity of the people, deriving his position from the will of the people with whom resides sovereign power." The prewar Meiji constitution had described him as "sacred and inviolable." Earlier, on Jan. 1, 1946, the emperor had, by proclamation, renounced claim to divinity. The constitution provided for a bicameral diet, with the greatest power for a house of representatives whose members served for four-year terms. The old peerage was dissolved, and the house of peers replaced by a house of councilors whose members served six-year terms. The prime minister was to be chosen by the diet from among its members, and an independent judiciary, as in the U.S., had the right of judicial review.

The new constitution thus reversed the Meiji pattern which had reposed all sovereignty in the imperial institution, whence power could be drawn by imperial household officials, service heads and the privy council as well as by the cabinet head. Instead, with the exit of the service heads, the privy council and the peers and with a nonpolitical role laid out for the emperor, authority clearly lay with the elected diet which selected the executive from its ranks. For the first time in modern Japan the nature and role of the executive were clearly defined. Parallel changes made prefectural governors and other local officials elective, so that the government could be responsive to the popular will. (See *Administration and Social Conditions*, below.)

The 1947 constitution was drawn up hastily, and subsequent research by Japanese scholars led to the conclusion that SCAP had rushed to anticipate the recommendations of the Far Eastern commission. But despite its unfamiliar concepts and foreign inspiration the constitution worked well and it gained widespread support in Japan. Since its implementation coincided with the purge of most of the leaders of prewar and wartime Japan, conditions were favourable for the development of new ideas and methods.

However, politics continued to be controlled largely by SCAP. By the time the San Francisco peace treaty went into effect in 1952, several elements of the political pattern had changed. Decentralization in some fields had proven expensive and inefficient. The police, for instance, while less centralized than in home ministry days, had returned to a substantially national organization. Despite the announced goals of local decentralization, changing patterns of communications and administration had shown the logic of incorporating many small units of administration into larger units, a trend particularly marked in the countryside where villagers merged to form "towns" with a more rational tax structure. Art. 9 of the constitution had been compromised by the decision taken by SCAP to form a "police reserve" of 75,000 men during the Korean War emergency. The force, later renamed the self-defense forces, came to number about 200,000. Inevitably the desirability of amending the constitution by rewording art. 9 was

argued, and as this became possible, talk arose of amending other sections of the document as well. The socialist opposition prevented such moves, however, and the revisionist forces were unable to muster the two-thirds majority necessary to force revisions through the diet.

Perhaps the most important development in the political structure was the emergence of a strong executive. With the abolition of competing forces that beset the premiers of the 1930s, the postwar prime ministers found themselves in charge of the administration and, with rearmament, the armed forces as well. Thus responsible leadership replaced the ambiguous claims of imperial rule of earlier days, and prime ministers were limited only by their control of their party.

Economic and Social Changes.—SCAP's political democratization was reinforced by economic and social changes which were designed to create interest groups prepared to use their new rights to safeguard and protect the new political and economic structure. Changes in the countryside, in industry and in social legislation all had the same purpose of breaking or weakening the old pattern of hierarchic control that had distinguished the "family state" ideal of the Meiji leaders.

In agriculture the occupation moved to carry out a land reform to convert tenants into owner-farmers. Tenancy had risen during the years after World War I, and the measures taken by the prewar Japanese government had proven ineffectual. Since the political parties were based largely on a rural electorate dominated by landowners, it is not surprising that they were slow in turning to agrarian reform. Japan's wartime governments, however, made important changes in land relationships. In their attempts at national unity and equal sacrifice, they created agricultural associations to collect all rice. Absentee landlords received the lowest rate of payment, and the tenant's relations with his landlord became much less important. Moreover, peasant sons in the armed services had been able to send part of their pay home, while the shortage of labour had made it possible for many farm family members to secure gainful employment in factories. Thus important preliminaries in rural well-being, not least among them the opportunities of the black market, had taken place prior to SCAP's instructions to the Japanese government to prepare a land-reform plan. The government plan proved inadequate in the opinion of occupation authorities, and in the spring of 1946 a SCAP plan was drawn up; it became law in October. By its terms village and prefectural land commissions were elected with tenant, owner-farmer and landlord representation to select land for purchase and to select eligible purchasers from among tenants. The government then bought the land at preinflation prices and sold it to the tenant. Four years later the reform had changed the ownership pattern of over two-thirds of Japan's cultivated acreage and advantageous tax and price arrangements had enabled the majority of the new owners to pay for their land. The average family holding remained slightly under 2½ ac., and in view of the continued population rise and the change in laws covering primogeniture, there was an increase of the fragmentation of land. Nevertheless, the reform revolutionized patterns of landholding and helped produce a striking rise in rural well-being. (See *The Economy: Agriculture*, below.)

Plans of the U.S. reparations mission, headed by Ambassador Edwin W. Pauley, for changes in the industrial sector at first contemplated ruinous reparations. In the thinking of the Pauley report (Dec. 1945), Japan would have lost most of its heavy industries and received the lowest priority in Asia for assistance. Disturbances elsewhere in Asia and the economic crisis in postwar Japan, however, brought about a reconsideration of the wisdom of such moves. With the exception of Japanese assets overseas, and a small number of war plants, reparations were very nearly limited to agreements worked out between Japan and each of its Asian victims after the San Francisco peace treaty of 1951. (*See* REPARATIONS.)

A similar moderation marked the course of planning for deconcentration of the great *zaibatsu* firms. At first they were seen as Japan's chief war potential and later as essential elements in economic recovery. Of 325 concerns marked for investigation and possible dissolution in 1948, only 30 became the subjects of SCAP action. The major units of the *zaibatsu* empires, the holding companies, were liquidated and their securities made available for public purchase. New legislation sought to enforce fair trading and to guard against a return of patterns of monopoly. War profits taxes wiped out many large fortunes and hit at all large concentrations, while capital levy, inheritance and graduated income taxes were designed to equalize the tax burden. The extension of the purge of wartime leaders to the business world removed the top executives of 250 concerns from action for most of the occupation years. By 1950 extensive changes, although far short of those initially proposed, had taken place in the industrial world. The large banks, however, had not been broken up, and they proved to be the centres for a measure of reconsolidation in the years after the occupation.

The balance of economic power was also affected by measures which produced a strong and vigorous labour movement which contested political and economic primacy with management in postwar Japan. After the home and welfare ministries were dissolved, a new labour ministry was established in 1947. The release of all political prisoners, carried out in the early months of the occupation, freed the core of the Japanese Communist party, and most of those released turned their attention to organizing the labour movement, hoping to use it as a path to power. Trade-union, labour relations and standards laws modeled on New Deal legislation in the United States were passed, and soon a strong union movement showed 6,500,000 members in 33,940 unions. The early union movement was led by men with strong political ambitions. When a general strike was announced for Feb. 1947 with the avowed purpose of overthrowing the government, SCAP issued an injunction against the move. Thereafter occupation policy was concerned with reconstruction and no longer exclusively with liberation, and steps against inflation, political radicalism and Communist control of labour unions followed. Under the Socialist cabinet of Prime Minister Katayama Tetsu there was an emphasis on labour education, and in July 1948 SCAP ordered the government to take steps to deprive government workers—who included the communications unions—of the right to strike. A new labour organization, the General Council of Trade Unions (Sōhyō), was sponsored as a counterweight and gradual replacement for the Congress of Industrial Labour Organizations (Sambetsu), which had become leftist dominated. After 1951, however, Sōhyō too became increasingly antigovernment and anti-American. Although some of the occupation measures deprived labour of useful weapons for fighting its way to power, the strength of organized labour expressed through the Socialist party remained a significant difference between the pre- and postwar social and political scene in Japan. The government's failure to carry through a police law designed to curb labour radicalism and sabotage in 1958 demonstrated the powerful support that labour could command in the diet, in the press and in public opinion generally.

The social legislation of the postwar era saw energies and hopes long repressed by the Japanese government spring to full flower. The civil code, which had buttressed the power of the male family head with numerous legal supports, was completely rewritten to allow for equality between the sexes and joint inheritance rights. Feminism was expressed in the right to vote and in the presence of women as elected diet representatives. The abolition of the peerage created in Meiji days symbolized the modernization of society.

The years after the peace treaty of 1951 saw a number of changes in the pattern of occupation reforms. The land system remained unaltered, and rural well-being was at record heights. Industrial reconsolidation reunited many of the earlier financial empires which required maximum efficiency in order to compete on international markets. Proportionately, however, the old firms had not regained their former power, nor was their management family centred as had once been the case. Social legislation, moreover, had created such strong interest groups that prospects of substantial reversals of the postwar changes seemed slight. For many of the newly liberated generation, the new order was symbolized by the matrimonial match between Crown Prince Akihito

(b. 1933) and a commoner, Shoda Michiko, in 1959.

(For educational reform see *Administration and Social Conditions: Education*, below.)

International Relations.—Japan's return to international relations at the end of the occupation found it stripped of its former colonies of Formosa and Korea. Both of these, in fact, had military forces far superior in number to those maintained by Japan. Japan's sovereignty did not extend even to the islands traditionally claimed by it, as the United States maintained its occupancy of Okinawa while the Soviet Union laid claim to the Kurils. International relations were not conducted on the pacifist lines envisioned by the 1947 constitution with its pledge of disarmament. The Korean War, which broke out in June 1950, resulted in the establishment of Japan's postwar armed forces by General MacArthur. This made more urgent the negotiation of a peace treaty. Since there was little likelihood of securing agreement with the Communist bloc, arrangements were worked out between the principal allies before and during the command of Gen. Matthew B. Ridgway, who succeeded MacArthur as supreme commander in April 1951.

The San Francisco conference convened in Sept. 1951 to sign the treaty that had been worked out. By its terms Japan recognized the independence of Korea and renounced all rights to Formosa, the Kurils and south Sakhalin; Japan agreed to accept United Nations assignment to the U.S. of trusteeship over the mandated islands in the Pacific as well as the Bonins and Ryukyus, and accepted all obligations of the United Nations charter. The treaty recognized Japan's "right of individual or collective self-defense," which right was exercised in the simultaneous enactment of a security pact with the United States whereby U.S. forces would remain in Japan until such time as Japan could "assume responsibility for its own defense." Japan agreed not to grant similar rights to a third power without U.S. approval.

The treaty went into effect in April 1952. India and Burma did not attend the San Francisco conference, but India signed a similar document in 1952 and Burma in 1954. The San Francisco treaty made no arrangement for reparations with Japan's Pacific victims, but provided that Japan should negotiate subsequently with the countries concerned.

Effective resumption of relations with the nations of Asia came only after treaties covering reparations had been worked out; these were signed with Burma in 1954, with the Philippines in 1956 and with Indonesia in 1958. Shortly after regaining independence, Japan negotiated a peace treaty with the Republic of China on Formosa which did not, however, prejudice Japan's freedom to negotiate with the Communist People's Republic of China if it so desired. In 1953 an unofficial trade pact was signed between private Japanese groups and Communist Chinese authorities, and this proved to be the first of a number so negotiated. Subsequently Japan, together with the industrial countries of western Europe, relaxed the list of goods embargoed to Communist China in hopes of improving its trading position. The Peking government, however, made skilful use of trade for political purposes, encouraging it and stopping it at moments most calculated to embarrass Japan's conservative governments. Thus in 1958 trade was cut off altogether because of an insult to the Communist Chinese flag at a trade fair in Japan. It was clear that to satisfy Peking's demands for large-scale trade would endanger Japan's relations with the U.S. and the Republic of China, with which a sizable and favourable trade balance had developed, and there was little prospect for overcoming these difficulties.

The Soviet Union attended the San Francisco conference but failed to make its objections to that treaty heard. In 1956, however, Japan and the Soviet Union restored diplomatic relations, and in Dec. 1956, with the Soviet veto no longer invoked, Japan became a member of the United Nations. Subsequently Japan took an active part in United Nations meetings and the specialized agencies; Japan also became a contributing member to the Colombo plan group of nations for economic development in south and southeast Asia. With the China market in its prewar dimensions and profits permanently lost, posttreaty Japanese governments made vigorous efforts to maintain and enlarge their share of trade with the U.S. and the west, while numerous plans for the development of raw materials and markets in India and other non-Communist Asian countries were set in motion.

In 1960 a ten-year treaty of mutual co-operation and security was negotiated with the United States to replace the 1951 treaty. Numerous concessions to Japan were made, but the U.S., under the treaty, was to retain the use of military bases in Japan without time limit; the two nations also pledged to co-operate economically and to settle any disputes by peaceful means. Public demonstrations and rioting in protest against the treaty were unsuccessful in preventing its ratification by the diet. These demonstrations, led by student and left-wing groups, however, greatly embarrassed the government of Nobusuke Kishi (1896–), which canceled an invitation for a state visit by Pres. Dwight D. Eisenhower in June 1960 because it was feared that the U.S. president would be in danger if further rioting broke out.

Post-World War II Politics.—After the surrender in 1945 Japanese politics at first returned to the pattern that had been interrupted by the militarist domination of national life. Extremists of the right were discredited by their identification with the loss of the war. Their major figures were purged or arrested, and until 1952, when mass "depurges" permitted all but those convicted by the international tribunal to resume their careers, little rightist organization was possible. Thereafter some of the figures of the 1930s re-emerged, including some who had been members of the prewar leagues of terrorists and assassins who had escaped punishment and who now sought to rally "patriotic" forces. The rightists proved to have little unity, however, and they could offer no program of leadership in Asia as they once had done. They were handicapped by the decline of influence in the military business sector that had formerly helped to underwrite their activities. Most importantly, rightist ideology found few listeners among the postwar generation accustomed to its new freedoms. As a result, the rightists were often limited to efforts to revive national holidays like Feb. 11 ("Foundation day" for Emperor Jimmu) and demonstrations against the Soviet Union and Communist China.

Extremists of the left fared better for a time. With the surrender and release of political prisoners and with the repeal of the Peace Preservation laws that had hampered political organization in prewar days, prominent Communist party leaders like Tokuda Kyūichi (1894–1953) and Shiga Yoshio (1901–) returned to action, and the popular Nozaka Sanzō (1892–), who had spent the war years with the Chinese Communists at Yenan, returned to Japan. Although the land reform deprived them of an issue they used elsewhere in Asia, the postsurrender years, with their confusion and economic hardship, provided a favourable climate for Communists. The high point of Communist influence at the polls came in the general election of 1949, at a time when restlessness under the occupation yoke was compounded by the economic slowdown that had followed the imposition of the deflationary policies recommended by SCAP minister of finance Joseph M. Dodge. In that year the Communists placed 35 candidates in the house of representatives and received nearly 10% of the vote. The next year came the Korean War with its revelation of Communist purposes. It was accompanied by a steady improvement in economic conditions as Japan provided numerous services for the United Nations military effort. In 1950 SCAP ordered the purge of Communist leaders from politics under the same directives that had earlier banned the rightists as "undemocratic forces." Most chose to go underground, reappearing after the end of occupation control. By that time popular sympathy with the Communist cause had declined markedly. The steady rise of living standards, the unco-operative attitude the Soviet Union had shown in negotiating over the Kuril Islands and in fishing treaty discussions, a popular distaste for the Communist opposition to the imperial institution and widespread dislike for the extremist tactics shown by leftist labour unions all combined to create an unpromising climate for Communist politicians.

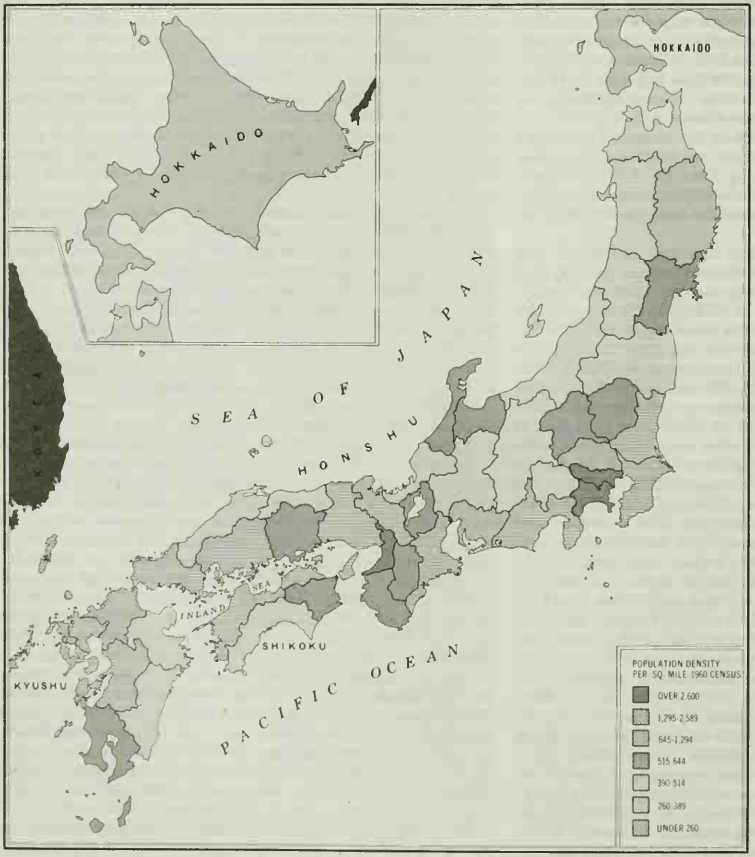
The vicissitudes of right and left thus left the way open for the prewar "moderates," who were in any event the only groups immediately acceptable to occupation authorities since, by disas-

sociating themselves from the politics of the 1930s and the war years, they had not become liable for the purge. Thus figures of the 1920s and early 1930s re-emerged, as did also the remnants of the party organizations of those years. The cabinet which was formed shortly after the U.S. arrival was headed by Shidehara Kijūrō, who was replaced in May 1946 by Yoshida Shigeru (1878–). Both were career diplomats and bureaucrats, and both possessed the ability to work with SCAP authorities, a quality naturally essential during the occupation years. In 1947 and 1948 there was an interval of rule under Katayama Tetsu, a socialist who headed a coalition cabinet but who was unable to carry out a socialist program. In 1948 Ashida Hitoshi held office for five months, but he was forced out after the revelation of scandals implicating his administration. Yoshida returned as prime minister in 1948 and remained in his post until Dec. 1954, thereby setting a record for modern Japanese prime ministers. It was he who negotiated the peace treaty and security pact in 1951, and who set Japan's postsurrender course of close co-operation with the democratic powers.

Independence and the return of purged politicians resulted in the candidacy of Hatoyama Ichirō (1883–1959) for Yoshida's position, and the Liberal party was split between their followers as a result. The San Francisco treaty and security pact also split the Socialist party into two factions: the left opposing both the treaty (because it did not include the Communist countries) and the security pact with the United States, the right wing favouring the treaty while opposing the security pact. Yoshida's replacement by Hatoyama in 1954 failed to heal the divisions in the Liberal party, and the following year the Socialist parties reunited. The conservatives, threatened with a united assault from the socialists, now followed suit and formed the Liberal-Democratic party in Nov. 1955. Hatoyama remained in office until the Soviet peace and United Nations entrance had been achieved, after which he resigned to be replaced by Ishibashi Tanzan in Dec. 1956. On Ishibashi's retirement for reasons of health, Kishi succeeded in Feb. 1957. Kishi, a former bureaucrat who had been arrested, though not tried, as a war criminal, illustrated the political acceptability of prewar leadership. He made no change, however, in the policies which Yoshida had inaugurated of close co-operation with the U.S. and the UN. Kishi resigned in July 1960, following demonstrations and riots protesting the Japanese-U.S. mutual security treaty. Hayato Ikeda, a leading economic authority who had served as Kishi's minister of international trade and industry, was then elected prime minister by a special session of the diet.

The principal issues which agitated Japanese politics in the years after the return of independence were international and national. In international affairs the socialists were strongly critical of their government's reliance upon United States direction and its failure to pursue a more determined course toward recognition and trade with Communist China. They reproached the government with violating national honour. In national affairs, however, the charges were reversed, as the conservative governments probed for ways of revising and moderating the U.S.-inspired changes in administrative, educational and legal institutions, insisting that an independent country required its own integrity of tradition, while the socialists, fearing a return to the police controls of the 1930s and 1940s, fought each proposed change bitterly. Socialist strength in the house of representatives was such that the conservatives were unable to force constitutional changes, which required a two-thirds majority of the 467-member house of representatives. *See* also FAR EAST: RELATIONS WITH THE WEST.

(M. B. J.; X.)



POPULATION DENSITY OF JAPAN, BASED ON THE 1960 CENSUS

V. POPULATION

Japan is a land of high population density. In the 1960 census the population was 93,418,501, and the density per square mile was 654.5. The 1955 population was 89,275,529 with a density of 625.5. The density is not relatively high compared with some industrialized countries of western Europe, but considering the prevailing importance of agriculture and primary production in Japan and the limited area of arable land (about 15% of the total), a severe population problem pertains. The average rural population density of many lowland areas exceeds 1,000 per square mile; if urban populations are included, the average density is doubled. Japan, with an area of 142,727 sq.mi., less than that of

TABLE II.—*Area and Population (1960 Census)*

Island Prefecture (capital)	Area (in sq.mi.)	Population	Density per sq.mi.
Hokkaido			
Hokkaido (Sapporo)	30,077	5,039,206	167.5
Honshu			
Aichi (Nagoya)	1,953	4,206,313	2,153.8
Akita (Akita)	4,482	1,335,580	298.0
Aomori (Aomori)	3,711	1,426,606	384.4
Chiba (Chiba)	1,944	2,306,010	1,186.2
Fukui (Fukui)	1,647	752,696	457.0
Fukushima (Fukushima)	5,320	2,051,137	385.6
Gifu (Gifu)	4,046	1,638,399	404.9
Gumma (Maebashi)	2,445	1,578,476	645.6
Hiroshima (Hiroshima)	3,255	2,184,043	671.0
Hyōgo (Kōbe)	3,216	3,906,487	1,214.7
Ibaraki (Mito)	2,351	2,047,024	870.7
Ishikawa (Kanazawa)	1,619	973,418	601.2
Iwate (Morioka)	5,897	1,448,517	245.6
Kanagawa (Yokohama)	912	3,443,176	3,775.4
Kyōto (Kyōto)	1,789	1,993,403	1,114.3
Mie (Tue)	2,226	1,485,054	667.1
Miyagi (Sendai)	2,813	1,743,195	619.7
Nagano (Nagano)	5,260	1,981,433	376.7
Nara (Nara)	1,426	781,058	547.7
Niigata (Niigata)	4,855	2,442,037	503.0
Okayama (Okayama)	2,726	1,670,454	612.8
Ōsaka (Ōsaka)	699	5,504,746	7,875.2
Saitama (Kawagoe)	1,468	2,430,871	1,655.9
Shiga (Ōtsu)	1,551	842,695	543.3
Shimane (Matsue)	2,558	888,886	347.5
Shizuoka (Shizuoka)	3,000	2,756,271	918.8
Tochigi (Utsunomiya)	2,486	1,513,624	608.9
Tokyo (Tokyo)	781	9,683,802	12,399.2
Tottori (Tottori)	1,347	599,135	444.8
Toyama (Toyama)	1,642	1,032,614	628.9
Wakayama (Wakayama)	1,820	1,002,191	550.7
Yamagata (Yamagata)	3,600	1,320,664	366.9
Yamaguchi (Shimonoseki)	2,345	1,602,207	683.2
Yamanashi (Kōfu)	1,723	782,062	454.9
Kyushu			
Fukuoka (Fukuoka)	1,892	4,006,679	2,117.7
Kagoshima (Kagoshima)	5,529	1,963,104	556.3
Kumamoto (Kumamoto)	2,846	1,856,192	652.2
Miyazaki (Miyazaki)	2,986	1,134,590	380.0
Nagasaki (Nagasaki)	1,578	1,760,421	1,115.6
Ōita (Oita)	2,437	1,239,655	508.7
Saga (Saga)	928	942,874	1,016.0
Shikoku			
Ehime (Matsuyama)	2,182	1,500,687	687.8
Kagawa (Takamatsu)	718	918,867	1,279.8
Kōchi (Kōchi)	2,743	854,595	311.6
Tokushima (Tokushima)	1,600	847,274	529.5
Total	142,726*	93,418,501†	654.5

*Includes 63 sq.mi. of lakes Towada and Naka. †Includes 73 persons in disputed area between Nagano and Gifu.

France or the state of California, has a population more than half that of the U.S. The future of Japan may well depend on how this population problem is solved. In contrast to the highly congested lowlands, many mountainous areas show remarkably small populations and these are tending to decline. This is in part due to the rugged character of the terrain but more to the traditional dependence on rice paddies and the increasing capacity of the lowlands, because of growing industrialization, to support large populations.

Lowland densities of agrarian population are greatest in southwestern Japan and gradually decrease northeastward. A belt of remarkably high rural density stretches from the Kwanto plain into northern Kyushu. The agrarian villages of this area include many nonagricultural activities, but the rise of commercial agriculture, such as truck gardening and fruit production, and the resulting intensive use of land have demonstrated that these dense populations can be supported without lowering the standard of living. Rural living standards there are the highest in Japan. An important characteristic of agricultural villages is their elasticity of population capacity. This has frequently been shown during times of industrial crises and after periods of war, when villagers returned home.

Estimates vary as regards population figures in successive periods of Japanese history. It is generally conceded that there was a total population of about 18,000,000 at the beginning of the Tokugawa period (1615–1868). Under conditions of prevailing peace and rapid land reclamation, population had risen by the middle of the 18th century to 30,000,000. It remained around this figure until the Meiji restoration (1868). The principal natural check was a high death rate, and the principal artificial one was provided by the social structure, whereby younger sons were discouraged from marrying and begetting children unless the oldest son was childless. Infanticide, known as *mabiki* or "thinning of the crop," though not widespread was not uncommon and served as an additional check. Under the powerful and positive policies of the Meiji government, agriculture, fishing and mining were rapidly expanded and manufacturing was inaugurated; means of transport and of communication were improved; banking facilities were established; and progress in medical care and sanitation was made. Four major periods of population change can be identified.

The first is the period 1868–97, when drastic measures were taken toward modernization. The development of Hokkaido became an urgent national policy. No important changes, however, occurred in the rural economy, and the agricultural villages continued in size and economy much as they had in feudal times. Accelerated reclamation of underdeveloped areas led to significant increases in agrarian populations on the lowlands of Kwanto, Tohoku (northern Honshu) and southern Kyushu. Urbanization was in its infancy and it was not until the end of this period that cities began to absorb surplus populations from the villages. Hokkaido and newly reclaimed areas began to fill up.

The second period, 1898–1918, marks the first stage of important industrialization in Japan. There were phenomenal increases in urban population and a decline in rural areas. In the first half of the period, light industries, especially spinning, grew rapidly In the latter half, heavy industry had its beginnings. Growing industrial cities, mining districts and sericultural areas created large demands for labour, inducing migration from agrarian communities. An excellent example is the population increase in the Chikuhō mining area of northern Kyushu. Absolute decreases occurred in rural Kansai, Hokuriku, northern Shikoku and wide areas of mountainland in Chūgoku. Only the rural districts of Tohoku and southern Kyushu still retained powers of absorption. Tokyo and Ōsaka grew rapidly, while Yokohama, Nagoya, Kyōto and Kōbe and the northern Kyushu conurbation developed.

During the third period, 1919–45, industrial stagnation followed World War I, after which there was phenomenal expansion. Cities absorbed population at an accelerated rate, and the rural areas of absolute decrease expanded. Most of the cities increased in population from three to five times and new cities sprang up. There were striking population increases in the four major industrial areas centring around Tokyo, Ōsaka and Kōbe. Nagoya and in northern Kyushu. Smaller cities elsewhere suffered decline. The concentration of population in the core industrial belt of Japan was the most significant feature of this period.

The fourth period began during the abnormal years of World War II. There was a marked shift in the relation of urban to rural population. During 1944 and 1945 the principal Japanese cities were subjected to repeated and disastrous aerial bombardment. Many inhabitants were killed and great numbers fled into the rural centres or onto farms. Population figures for the major cities, as a result, showed a startling decrease. Tokyo, which had about 7,000,000 inhabitants in 1940, had less than 3,000,000 in 1945; Ōsaka, with more than 3,000,000 in 1940, had about 1,000,000 in 1945. Most of the other cities showed corresponding decreases. After 1945 there was a reversal of the trend. Thus Tokyo

TABLE III.—*Population of Principal Cities*

City and prefecture	1960	City and prefecture	1960
Akita, Akita	203,661	Nagoya, Aichi	1,591,935
Amagasaki, Hyōgo	405,955	Niigata, Niigata	314,528
Aomori, Aomori	202,211	Nishinomiya, Hyōgo	262,008
Asahigawa, Hokkaido	188,309	Okayama, Okayama	260,773
Chiba, Chiba	241,615	Omuta, Fukuoka	205,766
Fukuoka, Fukuoka	647,122	Ōsaka, Ōsaka	3,001,563
Fuse, Ōsaka	212,754	Otaru, Hokkaido	198,511
Gifu, Gifu	304,492	Sakai, Ōsaka	339,863
Hakodate, Hokkaido	243,012	Sapporo, Hokkaido	523,839
Hamamatsu, Shizuoka	333,009	Sasebo, Nagasaki	262,484
Himeji, Hyōgo	328,689	Sendai, Miyagi	425,272
Hiroshima, Hiroshima	431,336	Shizuoka, Shizuoka	328,819
Ichinomiya, Aichi	182,984	Shomonoseki, Yamaguchi	246,941
Kagoshima, Kagoshima	296,003	Takamatsu, Kagawa	228,172
Kanazawa, Ishikawa	298,972	Tokushima, Tokushima	182,782
Kawasaki, Kanagawa	632,975	Tokyo, Tokyo	8,310,027
Kitakyushu*	986,401	Toyama, Toyama	207,266
Kōbe, Hyōgo	1,113,977	Toyohashi, Aichi	215,515
Kōchi, Kōchi	196,288	Toyonaka, Ōsaka	199,065
Kumamoto, Kumamoto	373,922	Utsunomiya, Tochigi	239,007
Kure, Hiroshima	210,032	Wakayama, Wakayama	288,155
Kyōto, Kyōto	1,284,818	Yamagata, Yamagata	188,597
Maebashi, Gumma	181,937	Yokkaichi, Mie	195,974
Matsuyama, Ehime	238,604	Yokohama, Kanagawa	1,375,710
Nagasaki, Nagasaki	344,153		

*Created in 1963

rose from 3,000,000 in 1945 to 4,500,000 in 1949 and by the early 1960s had over 8,000,000 inhabitants (*see* Table III). A repatriated population of nearly 7,000,000 had to be absorbed and there was a short but explosive increase in the birth rate. By 1950 industrial rehabilitation was well under way and the reconcentration of urban populations proceeded at an accelerated rate.

Soon both birth and death rates showed remarkable declines and the most rapid drop in birth rate ever recorded occurred between 1947 and 1960—from 34.3 (per 1,000 population) to 17.2. This startling decrease in births could not have resulted solely from deferred marriages, continence and the usual economic pressures of industrialization and urban life. The Eugenic Protection act of 1948 (with later amendments) was primarily a health measure but permitted by extension legalized abortions and birth-control measures including sterilization of women. In review, Japan's population has increased threefold from 1868 (*see* Table IV).

TABLE IV.—*Growth of Population*

Date	Total population (in 000s)	Birth rate	Death rate	Rate of increase
		(per 1,000 persons)		
1868	30,000	....	....	....
1874	35,154	24.6	20.5	4.1
1890	39,902	28.3	20.4	7.9
1910	49,184	33.9	21.1	12.8
1920	55,391	36.3	25.4	10.9
1925	60,210	35.0	20.3	14.7
1940	71,400	29.0	16.2	12.7
1947	78,101	34.3	14.6	19.7
1955	89,276	19.4	7.8	11.6
1960	93,418	17.2	7.6	9.6

In 1872 the agrarian population constituted 78% of the total. By 1960 it was reduced to less than 40%. This does not indicate an absolute decrease in farm population and production; most of the rapid total increase was absorbed by the growing industrial cities. (R. B. H.)

VI. ADMINISTRATION AND SOCIAL CONDITIONS

The political institutions of Japan in the second half of the 20th century are strikingly different in many respects from those existing before 1945. When Japan was defeated in World War II and occupied by Allied forces, there were two initial objectives of overriding importance: first, to punish those judged responsible for war crimes and to level the Japanese war machine; second, to lay the foundations for a democratic government and society. Both of these objectives were entrusted largely to U.S. authorities. The military forces stationed in Japan were almost wholly American, although there were small contingents of British and Australian troops. More importantly, while both the Far Eastern commission in Washington and the Allied council in Tokyo had some nominal supervision and control, in fact U.S. authorities made the basic policy decisions. Thus Japan came under the strong influence of U.S. ideas and institutions. Many of the reforms undertaken bear the clear imprint of the New Deal.

1. The Constitution.—The major political landmark of the reform period was a new constitution which went into effect on May 3, 1947. This constitution replaced the old Meiji constitution of 1889. Both Japanese and Americans participated in its drafting, but there can be no doubt that the American role was a crucial one. Under the new constitution the emperor was deprived of his absolute monarchial power and became a mere symbol, the peerage was abrogated, women were permitted to vote and the voting age for adults was lowered to 21, conscription was abolished and war renounced, academic freedom was guaranteed and a "bill of rights" on western lines was drawn up. Any constitutional amendment must first be approved by a two-thirds majority of the diet and then submitted to popular referendum, a rather difficult procedure.

Upon Japanese surrender, the supreme commander for the Allied powers (SCAP—a term also used to designate the occupation as a whole) decided to work through a Japanese government and follow legal procedures in making basic changes rather than to rule directly and by fiat. Japanese leadership of this period was provided mainly by conservatives. Their ideas on such matters as constitutional revision rarely satisfied U.S. reformers. Conservative draft constitutions providing minimal changes were rejected or returned for further amendment. Ultimately, U.S. authorities took a very active part in the drafting process. Some unofficial Japanese constitutional drafts circulating during this period suggested even more basic alterations than were finally made. Conservatives continued to agitate for amendments and set in operation a committee to study constitutional reform. They were especially anxious to repeal the so-called antiwar clause and to modify the provisions concerning the emperor, the house of councilors and some other parts. They were also critical of the fact that the constitution of 1947 contained too many American ideas and maintained that it was not feasible for Japan unless various modifications were made. The Socialists, however, had no desire to accept any conservative amendments.

2. The Emperor.—Under the 1947 constitution, supreme power is vested in the people. The preamble, which resembles the American Declaration of Independence, contains a forceful statement commending popular sovereignty, representative government and peace. This is a significant contrast to the Meiji constitution in which complete sovereign power was acknowledged to belong to the emperor. Indeed, that constitution was interpreted as a gift from him and hence conservative theorists frequently asserted that he was above any constitutional restrictions. This doctrine was the closest approximation of a divine-right theory to be maintained in any modern nation during the 20th century.

The Meiji constitution was drafted at imperial request after considerable political tension. Opposition to the Sat-chō oligarchy reached a climax in 1881, and to reduce political pressure, the emperor was caused to proclaim that within nine years the Japanese people would be granted a constitution. Then a group headed by Itō Hirobumi set to work, borrowing heavily from German practice and theory. The Prussian constitution was a very definite model for the constitution of 1889, and certain German scholars and technicians rendered assistance in the drafting process itself. Heavy emphasis was placed upon the absolute powers of the emperor. To him were given the rights of all major political appointments, including that of the prime minister. The cabinet was made responsible to him rather than to the diet, and military leaders also drew their authority and power directly from him. Only he could initiate amendments to the constitution.

In fact, the emperor did not wield these powers himself. The political genius of Japan was expressed more in oligarchy than in personal absolutism. But the importance of the throne as the supreme symbol of modern Japanese nationalism cannot be overestimated. Essentially this was a recent phenomenon. Prior to the Meiji restoration of 1868, the imperial institution had long been severely circumscribed and even neglected. Few Japanese of an earlier period would have considered the emperor as the apex of their political institutions and society. Many would not have known of his existence. When western pressures accelerated the decline of the old order, however, the emperor was available as a rallying point for the anti-Tokugawa nationalist movement. The court nobles and young samurai who took over the government after 1868 invoked the name of the emperor on every possible occasion to produce a spirit of patriotism and unity. Through such means as Shintōism, mass primary education and military indoctrination, an image of the emperor as father of his people, head of the nation and symbol of the totality of Japanese history was developed. Such an image was potent at nearly every level of society although precise interpretations naturally varied. Many Japanese were too sophisticated to accept mythological explanations without question, but this does not necessarily mean that they depreciated the imperial institution. It is probably misleading in any case to assert that the Japanese people thought of the emperor as a living god ruling over them. The Japanese term *kami*, usually translated as "god," does not have all the connotations of the western word. It means supernatural in a sense, but not omniscient, omnipotent and omnipresent. In addition, according to Japanese mythology the entire Japanese race was descended from various *kami*, with the emperor being in direct

lineage from the highest *kami*, the sun-goddess. Thus all Japanese were in some degree "supernatural" and possessed of a superior culture. (See *History*, above.)

It is true, however, that elaborate pageantry surrounded the emperor and great homage was paid to him. His public movements were carefully regulated; under no circumstances was a subject allowed to gaze down upon the emperor when he passed. Direct contact with him in any form was rigorously excluded, and his personal name could never be spoken. The emperor was even given a special word for the personal pronoun "I" which he alone could use. Many incidents of superpatriotism have been recorded, such as those of people risking their lives to carry his picture out of burning buildings. There can be no doubt that the ritual surrounding the emperor was highly effective, serving to create an extraordinary loyalty on the part of the Japanese people to the state. Among simple folk like the peasants, a reverence for him akin to worship existed, and the peasant boys were the central core of the modern Japanese army.

Even prior to World War I, the political powers of the emperor were largely conducted in his name by high-ranking officials, the genrō, or elder statesmen. The emperor Meiji (reigned 1867–1912) did play some political role in his mature years. The use of his name and authority became an issue in the middle and late Meiji era. When he died, however, he was succeeded by his mentally incompetent son, Taishō. This fact, together with broad sociopolitical changes developing in Japanese society, tended to remove the emperor further from direct political involvement. Taishō's son, Hirohito, received a fairly liberal education and was personally prepared to accept parliamentarism. Thus the decision-making process in prewar Japanese politics did not involve positive imperial participation. All elements of the Japanese nationalist movement, however, continued to utilize the name of the emperor in forwarding their programs. The legal powers of the emperor, moreover, remained, and in one moment of supreme crisis, at the time of the Japanese decision to surrender at the end of World War II, the emperor did take a personal position that proved decisive.

The 1947 Constitution and the Status of the Emperor.—Under the constitution of 1947, legal imperial powers were reduced to those of ceremony and symbolism. The emperor appoints officials only after they have been designated by responsible authorities in the same manner as the British throne. His other duties pertain to such ceremonial actions as promulgating constitutional amendments, cabinet orders and treaties after these have been properly enacted; convening the diet; attesting to certain appointments and the remission of penal sentences; awarding of honours; and receiving of foreign representatives. In all cases, the initiative in these matters lies with the political leadership and it is held responsible.

Among many Japanese conservatives there was a certain nostalgia for the former imperial system and a fear that the new order had weakened the bonds of loyalty, unity and patriotism. Thus some effort was being made to revise the constitution so as to enhance the emperor's position. A partially successful drive was also conducted to reintroduce into the primary-school curriculum courses on *shushin* or "ethics" that would include such themes as filial piety and respect for the emperor. Meanwhile, a considerable "democratization" of the imperial family and institution took place. At the economic level the vast pre-World War II holdings of the imperial family were greatly reduced. The throne was made much more dependent financially upon the government. The new imperial family council that governs such affairs includes as members two representatives of the imperial family, the president and vice-president of each house of the diet, the prime minister, the chief of the imperial household office and two judges from the supreme court.

From a political standpoint, at the very outset of the occupation the emperor was caused, in his New Year's day message of 1946, to deny his divinity and any racial superiority of the Japanese. His statement emphasized the point that "the ties between us and the people have always stood upon mutual trust and affection." This remained a most important factor. In its political position, the Japanese throne moved closer to its British counterpart. To assist in continuing the trend, Hirohito's son was well tutored in democratic values. Moreover, in the early occupation, a considerable effort was made to "humanize" the emperor, sending him out among the people. Despite these changes, or perhaps in some measure because of them, the Japanese monarch retained a deep hold upon the people. It is true that members of the younger generation generally took a more relaxed or casual attitude toward the imperial institution than did their parents, but there were many indications that this institution still commanded overwhelming support from almost all segments of Japanese society.

3. The Executive.—Under the 1947 constitution, chief executive power at the national level is vested in the cabinet, headed by the prime minister. The ministries represented in the cabinet indicate the main functional divisions of government: attorney general, agriculture and forestry, commerce and industry, communication, construction, education, finance, foreign affairs, health and welfare, labour, and transportation. The diet must select the prime minister from among its own members. If the house of representatives and the house of councilors disagree and no adjustment of the differences can be made, the decision of the former prevails. The prime minister is the leader of the majority party or of one party in a coalition, as is normal in parliamentary government. The prime minister has the right to select his own cabinet, although naturally this is a matter for serious political consultation. The constitution does state that all ministers shall be civilians and that a majority shall be diet members.

The powers of the cabinet as stipulated in the constitution are of wide scope. To this body accrues the ultimate responsibility for supervising the entire civil service, administering all laws and directing both domestic and foreign policy. It is specifically charged with preparing the national budget and submitting it to the diet. Beyond constitutional provision, moreover, is the major function of lawmaking, because the cabinet continues to be the central source for basic legislation. Few important laws are initiated within the diet, although amendments may occur in the course of diet committee hearings or floor debates. Generally, significant laws are drafted by the subordinate bureaucracy under cabinet order and supervision. These become the heart of national policy. It must be remembered that centralization of power at the national level remains strong. Hence the cabinet is, in many respects, the focal point of institutional power in Japanese politics.

The cabinet is definitely responsible to the diet, however, and particularly to the house of representatives (this was not usually true under the Meiji constitution when cabinet members were responsible individually to the emperor). If the lower house passes a nonconfidence resolution or rejects a confidence resolution, the cabinet must either resign or dissolve the house within ten days. As long as the government holds a secure majority in the diet there is no likely threat, but each general election is a test for the prime minister and his cabinet, and in cases of narrow margins for the majority party or coalition government, challenges from the diet are frequent. The most intimate contact between top executive and legislative branches probably comes during committee hearings or floor debates and question periods, when ministers must be present to defend their policies. After 1945 the diet became the main political arena, and every postwar Japanese government was cognizant of that fact.

After 1945 a certain shift could be noted in general political behaviour and in the criteria for successful leadership, which was previously confined to councils of senior statesmen, the leader-follower groups within parties, the bureaucracy and the military. Some political leaders attempted to project their personalities to the voting public, borrowing extensively from western techniques. There was somewhat greater emphasis upon individual leadership and the human qualities of the leader. Campaign tours at the grass-roots level came to be considered essential; the old distaste for public speaking and personal contact with the masses receded somewhat. Public-opinion polls were closely watched. Public relations work received more attention. There remained strong "traditional" factors in Japanese politics, and even the so-called "modern" leader had a mixture of traits, as might be expected.

There was little doubt, however, that this was an era of considerable transition.

History of the Bureaucracy.—Discussion of the Japanese executive cannot be limited to top leaders such as the prime minister and his cabinet. A vital part of the national executive is the vast body of subordinate officials and civil servants who man the ministry, bureau and commission staffs. Historically, the badge of office in Japan has carried with it both social prestige and great power. In the Tokugawa era, immediately prior to the modern period, all officials came either from the military class or from the traditional aristocracy that surrounded the imperial court. One of the most significant developments of this period, indeed, was the bureaucratization of the military class. In a period of enduring peace and isolation there was little need for the warrior. Consequently, he was given a Neo-Confucian education and turned into an administrator. Confucianism (*q.v.*) taught that the function of the official was an all-embracing one, including the duty of being both model and mentor to his people. In theory, the proper official was to be benevolent and loving, solicitous of the public welfare and willing to listen to the voice of the people. In practice, however, there was usually a considerable falling off from this high standard. Military-class officials were prone to act in a very officious manner—the traditional term to express this fact was *kanson mimpi* ("officials honoured, people despised")—and whether his position was hereditary or won through some type of prowess, the official usually took full advantage of his opportunities. He expected and received deep respect from all other classes. He was often generously rewarded for favours granted to private parties such as merchants and, within limits, no stigma was attached to such conduct. On the contrary, it was to be assumed. Within their own definitions, moreover, most Japanese officials of the traditional type had a relatively high ethical code but, for many, arrogance was not incompatible with a simple, even austere, mode of life.

In the modern period also, the military class played a prominent initial part in the Japanese bureaucracy. When the Meiji restoration occurred, the military class numbered about 2,000,000 out of a total population of 28,000,000 to 30,000,000. Economic and social change had brought hardships to many of this group, and their unrest was a source of worry for the new Meiji government. Whenever possible, former samurai were given government or police positions. In many cases, of course, personal favouritism was involved. The great bulk of top Meiji leaders came from the old military class, and representatives of the former Satsuma and Chōshū fiefs were especially powerful. As a result, many of the new appointees to both the civil and military branches of the bureaucracy came from these regions. By its opponents, the early Meiji officialdom was sometimes called *hanbatsu* ("clan clique"). Nevertheless, the military class, by virtue of education, training and general social status, was best equipped for holding official positions at that time.

Shortly before the Meiji constitution was promulgated, a civil service system modeled after that of Germany was installed. From that time, the trend was in the direction of officials trained in one of the major educational institutions, particularly the University of Tokyo. To study under the law faculty of the University of Tokyo became the dream of most young aspirants to government careers. The new term for the Japanese bureaucracy became *gakubatsu* ("university clique"). The exclusive emphasis upon Confucianism as the proper preparation for officialdom was altered, but the new training was heavily legalist in character, with German principles predominating. This undoubtedly encouraged the tendencies toward formalism and rigidity in Japanese administrative procedure. The official acted largely "by the book" and was seldom willing to use his discretion or imagination in applying the law. Involved procedures and officiousness continued to be prevalent. On the other hand, in terms relative to the rest of Asia and perhaps to the western world as well, the Japanese officials were efficient, well disciplined and largely uncorrupted. This was true despite the fact that their social status, relative economic position and general morale had tended to decline after the Meiji period. New socioeconomic classes like the industrialists increasingly acquired a portion of the prestige and power that had formerly accrued to the officials. It should be noted, however, that some interchange of personnel between these two groups had begun by the mid-Meiji era.

The background of the Japanese bureaucracy is not complete without reference to events after 1920. By the end of World War I the ranks of the genrō had been depleted by death and old age. With their prestige and unifying force largely gone, the new era was one of mounting competition for power between various bureaucratic groups and the political parties. Sometimes this period has been denoted as the era of quasi-liberalism, because democracy was given its greatest opportunities in the years between 1918 and 1931. The political parties rose in influence and most of the prime ministers were party leaders. The cabinets, however, continued to have a quota of nonparty men, most of them career government officials, and all cabinets had servicemen appointed as ministers of war and the navy. No basic changes were made in Japanese constitutional law or practice. Hence important legal powers remained in the hands of nonelective officials.

The attitude of the prewar bureaucracy toward the parties was generally one of ill-concealed hostility. To be sure, some higher officials joined and even led parties when it seemed important to their careers. The great majority, however, remained aloof and tended to regard most party men as ignorant or corrupt. If one interprets the prewar Japanese executive broadly to include all elements charged with some responsibility for executing law and policy, perhaps the main problem after 1920 was that of serious internal conflict and the inability to find a successful mechanism of co-ordination to take the place of the genrō. Important parts of the civilian bureaucracy fought against party power and undermined party politicians whenever possible. The military bureaucracy was more flagrant in defying party or civilian control. Army firebrands perpetrated such crimes as the murder of the Manchurian war lord Chang Tso-lin in 1928 and the so-called Manchurian incident in 1931. Prime ministers were not only unable to prevent such events from occurring, but they could not get the chief military officers to take proper remedial action or to abide by the policy established by civilian leaders. By the early 1930s Japan presented a classic spectacle of a government divided against itself. This could not be admitted to the outside world, however, and the military were able to take full advantage of a series of *faits accomplis*. (See *History*, above.)

During this troubled period there were repeated efforts to attain some greater degree of co-ordination within the government. The Meiji constitution had given supreme powers to the emperor, but in reality those powers were shared by a multiple executive. The prime minister and his cabinet represented the central administrative and policy-making unit, but they were handicapped by being "infiltrated" with extraneous elements like the military and by the lack of loyalty to their policies on the part of some of their subordinate bureaucracy. The military arm of the Japanese executive was headed up by the supreme war council, but neither this body nor groups subordinate to it were united. Another executive element, the imperial household officials, found increased pressures upon them to act as co-ordinators as the genrō era faded out. Standing alone, however, they had little real power. There were also certain quasi-executive bodies like the privy council whose functions of advising on policy and determining the legality of actions enabled them to block the cabinet on occasion.

One method of seeking co-ordination among these various executive elements was to hold periodic imperial conferences, presided over by the emperor and with the leading executive sections represented. Such conferences, however, were not held regularly enough to meet the needs involved. Liaison councils were established, and some of these were important. Moreover, in the 1920s and early 1930s another body of senior statesmen known as the *jūshin* gradually emerged to take the place of the genrō. The *jūshin* included as members former prime ministers, imperial household officials, the president of the privy council and the last surviving genrō, Saionji Kimmochi. They took over the task of advising the emperor on the selection of prime ministers and other matters of serious consequence. However, they never at-

tained the power and authority of the genrō, and the absence of a truly unifying agency was keenly felt during the hectic period after 1931. The situation produced not only conflict within executive ranks but deep irresponsibility. With power widely dispersed and total policy control impossible, a sense of individual or even group responsibility within the executive was difficult to acquire. This was brought out very clearly in the war crimes trials after World War II.

The Modern Bureaucracy.—After 1945 the Japanese executive was greatly streamlined and made much more cohesive. Up to the early 1960s the military had played no role of consequence, despite the emergence of a national defense force. Such bodies as the privy council were abolished, and the powers of imperial court officials were closely circumscribed. The executive became without question the prime minister, his cabinet and the large body of appointees and civil servants under them. Almost all of the key executive personnel were party leaders as a result of the new constitutional system. It was not easy for the Japanese career civil servant to adjust to this new order, especially for those trained under the old system. Many of them saw a decline in their authority, a deterioration of discipline in the government service and troublesome challenges from the government-worker groups through the new labour unions. An additional complication for many senior officials, moreover, was the significant gap existing between prewar trainees and new recruits.

Very few civil servants were purged after 1945, especially from ranks below the top policy-making levels. There was some attempt, however, to make substantial organizational changes in the bureaucracy and to infuse in it a new spirit. In the new constitution, the central theme of officials being the servants of the people rather than the emperor was clearly set forth. After the occupation was well established, surveys of Japanese officialdom were made, the most important of which was conducted by a specially appointed American Personnel Advisory mission in 1946–47. Out of this work came a new national public service act and a national personnel authority having continuous supervision over the civil service. The old ranks and the former examination system were substantially altered.

Accompanying these legal changes were innovations in training and education. SCAP itself set up some training programs for men already in official service, and in various forms such training institutes continued to be significant. On a broader level, the postwar civil servant was naturally affected by the extensive alterations in secondary school and university curricula. His education became less legal and contained more emphasis upon the various social sciences. It was also less the monopoly of the University of Tokyo, although that institution retained great prestige. Beyond general education for government service, moreover, the opportunities for advanced specialized training both in Japan and abroad increased considerably. Most promising officials had some chance for further study or observation, and many were exposed to new techniques and procedures in use abroad. Technical assistance was imported into Japan in the occupation era, special conferences and concentrated training programs were utilized and overseas visits ranging from 30 days to a year or more were arranged.

The post-World War II Japanese public official was probably better equipped technically than at any time in history, although it should be pointed out that many of the foreign procedures with which he had become familiar were not feasible for Japan and nearly all required some modification. For the most part, Japanese officials matched their competence with hard work and, in addition, their personal integrity was relatively high compared with officials of other societies. There were some indications, however, that the problem of corruption had increased after 1945, due in part perhaps to the rather weak economic position of the civil servant. Nor had the old officiousness disappeared; a goodly quota still existed even among the younger generation of officials, indicating the stubborn nature and deep cultural roots of this force. There were still many officials who took an antagonistic or at least ambivalent attitude toward party politicians. This was to be expected and was by no means unique to Japan. Perhaps the more important fact lay in another direction. The Japanese bureaucracy, as a group, appeared to have accepted parliamentary supremacy and its major implications.

There was even a tendency on the part of many career officials to identify themselves privately with one or the other of the two main party groups, the conservatives and the socialists. The bureaucracy was well organized, and with all of its difficulties and divisions it had a certain *esprit de corps*. Many prewar traditions and biases remained, but the new elements infused into the scene were also impressive.

4. The Legislature.—The power of the diet (parliament or national legislature) increased considerably after the promulgation of the Meiji constitution. Under the 1947 constitution, however, the diet became the highest organ of the state and the centre of legislative power.

Historical Background.—Under the Meiji constitution, the diet was established on the basis of two houses with coequal powers. The upper house, the house of peers, was almost wholly appointive. Initially, its membership was slightly less than 300, but it was subsequently increased to approximately 400. Six categories of peers existed. First were the princes of the royal blood, followed by other princes and marquises; the third category was lesser nobility, counts, viscounts and barons; finally, there were three additional types of imperial appointees: those selected for special state service or merit; representatives of the highest taxpayers; and representatives of the Imperial academy. The first two categories, together with the merit appointees, were eligible for life membership. Individuals representing the other groups sat for seven years. The peers were intended to represent the top rank and quality of the nation and to serve as a check upon the lower house.

The pre-World War II house of representatives was originally composed of 300 members, all elected, but gradually this number was increased to 466. Suffrage began on a very limited basis, restricted to those males who paid 15 yen or more in direct taxes. It has been estimated that this enfranchised only about 6% of the adult population. As time passed, suffrage requirements were liberalized, and in 1925 the diet enacted a universal manhood suffrage act. Women were not permitted to vote. Japan did some experimenting with different types of electoral systems. On occasion the single-direct system was used, whereby the electorate voted for only one candidate. In general, however, the medium-district system was used. Three to five candidates were elected from each district, depending upon its size, on the basis of the highest number of votes, with each voter having only one vote.

In the early period a very high percentage of diet members were landowners or in occupations connected with agriculture. This was to be expected, since this group comprised the great bulk of enfranchised voters and, indeed, a considerable part of the Japanese population. With the passage of time, urban commercial-industrial elements rose in importance within the diet and in the broader political scene as well. Before 1945 labour and other lower-economic-class representation was extremely limited. (See *Political Parties and Pressure Groups*, below.)

The powers of the pre-World War II diet were in many respects largely negative. Without diet approval, no bill could become law, and diet power stemmed essentially from this central fact. The government did have the right to issue imperial ordinances in case of an emergency, but if these were to remain in effect the diet had to approve them at its next session. There was one significant limitation upon the traditional legislative control over the purse strings. If the diet did not pass the budget in a manner acceptable to the government, the government had the right to apply the budget for the previous year. This provision was borrowed from Prussian practice. The diet did not initiate important legislation; this was chiefly the function of the executive. Its committee system underlined this fact. There was no extensive reliance upon standing committees, whereby a member became an expert on some field over the years if his tenure in the house continued. Rather, as in Great Britain, the chief reliance was upon *ad hoc* committees, newly formed at each session. Unlike the British parliament, however, the diet did not have great prestige

with the executive branch. Since the executive was not legally responsible to the diet, and since it was comparatively easy to dissolve the diet and "guide" the elections on behalf of one's party or candidates, the prime minister and cabinet members tended to take question sessions in the diet with supreme casualness. Indeed, on many occasions the diet was treated very ignominiously.

Thus the historical traditions of Japanese parliamentarianism have not been glorious ones. Early in its development the house of representatives developed a popular reputation for venality and rowdyism. This kind of accusation is easy to inflate, but there was enough evidence to influence the Japanese public toward such generalizations. Elections were costly, especially since vote buying and its near equivalents were common practices. It was tempting to gain advance funds or recoup by accepting gifts and fees for political services rendered. This is a problem in every society, and Japan had added reasons for difficulty. The traditional relation between official and citizen, for example, represented a dangerous precedent in some respects. In any case, scandals involving diet members were commonplace, and the impression was built up in many Japanese minds that politics was inevitably a disreputable business.

To transfer Japanese politeness and decorum into the diet setting also proved enormously difficult. Parliamentary practice represented in certain ways a direct procedural challenge to the historic Japanese methods of indirection, intricate negotiations and ultimate consensus. The acceptance of direct majority decisions adverse to one's own views or position has never been easy in Japan. In a broader sense, it can be said that the rules governing the parliamentary "game" as it is played by a few western societies have not been fully accepted by all Japanese players. Even the concept of peaceful change has been difficult to establish, and the problem of personal relations between political opponents has been exceedingly troublesome. Some element of violence has always been close to the surface of Japanese politics. In the early years, many Japanese politicians had their own bodyguards or strong-arm men. Physical violence both in the diet chambers and outside was not uncommon. The diet was often called "the zoo," and this epithet suggested another element of public distrust or disgust concerning Japanese democracy in action.

The Diet After 1947.—Under the constitution of 1947 the diet was drastically altered both in structure and in powers. There remained two houses, the house of representatives and the house of councilors.

The latter takes the place of the old house of peers and has a membership of 250 consisting of two categories: 100 councilors elected from the nation at large with the remaining 150 elected as prefectural representatives. Every voter may cast a ballot for one candidate in each category, giving him a total of two votes. The house of councilors cannot be dissolved and its members serve for six years, with one-half of the members standing for election every three years. In structure, the house of councilors is unique among parliamentary bodies, and it has been under criticism by many Japanese. The decision to abolish the house of peers was based upon its appointive and ultraconservative character. It had become an anachronism, especially when viewed against hopes of democratization, and there seemed little wisdom in merely reducing it to near impotence as had been done to the British house of lords. On the other hand, there was a fear of an omnipotent unicameral legislature and the desire for some type of legislative check-and-balance system. It was not easy to determine a method of selecting upper-house members that would differentiate them from the lower house. The decision to have one portion of the membership sit as national representatives was motivated by the hope that this would induce the selection of nationally prominent individuals. The prefectural representatives give geographic and sectional coverage similar to U.S. senators.

It is possible under this constitutional system for the government to be divided against itself. The house of councilors cannot be dissolved in case of conflict between it and the executive branch. Elections for this house, moreover, are at fixed times, irrespective of political conditions, as is the case with the U.S. system. To mitigate this possible difficulty, the balance of power was shifted on several important matters to the lower house where general agreement with executive policy must prevail. In case of a deadlock between the two houses over the selection of a prime minister, the vote of the lower house takes precedence. The budget must be submitted first to the lower house, and if the two houses cannot agree, the position of the lower house prevails after 30 days. This same provision applies to treaties. With respect to other legislation, if the councilors reject a bill or refuse to act upon it within 60 days, the house of representatives can make it into law by repassing it by a two-thirds majority of the members present.

The house of representatives has 467 members elected from 118 electoral districts. Each district has from three to five representatives, but the voter casts only one ballot, with the candidates receiving the highest number of votes elected. Lower-house members are elected for a term of four years, but the house can be dissolved at any time by the government, in which case elections must be held within 40 days.

As in the past, the Japanese diet rarely initiates important legislation; such laws ordinarily come to the diet under cabinet sponsorship. However, individual member's bills can be introduced in the lower house if they have been signed by 20 or more members, and in the upper house with the signature of 10 or more members. Under diet law, the committee system has been drastically altered to accord more with U.S. practice. Each house has slightly over 20 standing committees dealing with such subjects as foreign affairs, finance and education. Government legislation goes first to the appropriate committee where it is examined and often vigorously debated. Membership on these committees is determined by the diet in rough accordance with the party ratios in each house. A member normally retains his assignments as long as he sits in the diet. Thus he develops some detailed knowledge and may provide a challenge to government policy makers of opposing parties or convictions.

Japanese politics in the postwar period revolved around the diet. That body was no longer on the periphery as it was under the Meiji constitution. Moreover, with all adults over 21 eligible to vote, the diet could claim to be representative of the public will to a greater extent than at any time in the past. Certain historic problems remained, however. Large-scale scandals, though somewhat fewer, were not lacking; the basic causes of corruption had not been solved. Diet procedure also left much to be desired, a number of riots and wild melees having occurred on the floor of the house of representatives. Even provided with constitutional support, the diet had not truly established itself as a respected body in the eyes of the Japanese people.

5. The Judiciary.—Few political changes in Japan after 1945 were as drastic as those pertaining to the national judiciary. The old court system was modeled after the European continental system, especially that of Germany. It was clearly subordinate to the executive branch, and court administration was in the hands of the ministry of justice. There were two broad divisions in the court system: ordinary courts and administrative courts. Heading the ordinary court structure was the supreme court, a large body of 45 justices, most of whose work was done on the basis of 5-man divisional units. The supreme court did not determine the constitutionality of legislation. Its main function was to hear cases on appeal from the courts of appeal and to hear special cases such as those involving treason. Below the supreme court were 7 high courts operating in different districts encompassing the nation, and below them, about 50 lower courts. At the local level, approximately 300 courts serviced minor cases. The administrative court was taken from the German model, and was empowered to make decisions on Japanese administrative acts or rulings where some claim had been raised. This court was particularly active in decisions involving taxes, licences, properties and similar issues.

Apart from the court system, there was also the privy council, which had been given quasi-judicial powers. It was entitled to give advice to the emperor on Japanese organic law when requested. With this grant of authority, it might have evolved into a regular constitutional review body. Despite the fact that the council used

its position on occasion to apply heavy pressure to the government, however, it did not emphasize its judicial role.

The constitution of 1947 freed the judiciary from the legal control of the executive and established it as an independent branch of government. Once again, the court system was headed by a supreme court, but one with vastly greater powers than previously. The constitution specifically granted it the right to determine the constitutionality of any law or regulation as a court of last resort. The new supreme court consists of 15 justices, headed by a chief justice appointed by the emperor upon nomination from the cabinet. The other justices are appointed by the cabinet. Another innovation is the provision that each supreme court justice shall be reviewed by the people at the first general election after his appointment and again ten years later. If rejected by popular vote, a justice cannot hold office. Judges of the inferior courts are appointed for ten-year terms and are eligible for reappointment. All judges may be impeached by a court composed of 14 members elected equally from the two houses of the diet. Under the supreme court are 8 higher courts and 49 district courts corresponding roughly to the U.S. superior courts. About 570 local courts complete the judicial network.

Clearly, the Japanese supreme court was patterned after the U.S. model. It was argued that since Japan had had little experience with effective constitutionalism and the protection of civil liberties, a judicial body empowered to define and defend constitutional lines was highly desirable. The Japanese supreme court, however, proved to be exceedingly timid in touching upon any issue of constitutionality or in upholding individual civil rights against state infringement. In spite of its new powers, the court continued to act very much in the old pattern. In no area of Japanese constitutional change, perhaps, were there such meagre results. One can understand this, however, when it is recalled that not only is judicial review of legislation largely foreign to Japan, but public litigation itself tends to have bad connotations in the Japanese public mind.

6. Civil Liberties.—The 1947 Japanese constitution sets forth the basic rights of the people in about 40 articles. In many respects, these articles represent the most comprehensive grant of rights to be found in any modern constitution. They include not only all of the political rights to be found in British and U.S. organic law, but also economic and social rights usually associated with the constitution of the U.S.S.R. and similar documents. For example, the right to work is guaranteed, as are an equal education for all persons in accordance with their abilities, the rights of collective bargaining for workers, marriages based upon free choice and equality of the sexes, and academic freedom. The rights incorporated in this document are far different from those in the Meiji constitution, where fewer rights were listed and those were of the more conventional political type. More importantly, Meiji constitutional rights were all subject to the phrase "except as regulated by law," meaning that any statute passed by the diet could restrict them. Thus laws like the Peace Preservation acts could be interpreted so as to seriously restrict constitutional guarantees.

However, the protection of civil liberties depends upon more than lofty phraseology in some document. It depends upon the interest that the government and people have in these rights, the training given to police and other law-enforcement agencies, the willingness of the courts to stand firm against violations and the ability of the press and other public organs to point out dangerous trends. In these respects, the postwar Japanese scene was not wholly adequate, but it was greatly improved over the era before World War II.

7. Local Government.—The history of modern Japan is in one sense the history of a continuous movement toward the centralization of political power. The 1947 constitution provides for local self-government with a fair degree of autonomy.

Historical Background.—After the Meiji restoration, the autonomy of the local districts was constantly whittled away. Indeed, this was one of the principle causes for political unrest and was involved in such events as the Satsuma rebellion of 1877. The process of centralization began immediately after the restoration, when the old fiefs were "returned to the emperor" by their military-class rulers and an integrated system of prefectures

PREFECTURES WITHIN THE EIGHT DISTRICTS OF JAPAN. CITIES SHOWN ARE THE SEATS OF PREFECTURE GOVERNMENT

was established in their place. Ultimately, Japan was divided into 46 prefectures with the Tokyo metropolitan area having a separate form of administration. The minister of home affairs appointed all prefectural governors and they were a part of the centralized bureaucracy, as were the prefectural police. Each prefecture had an elective assembly but the appointive officials dominated the political scene, usually by virtue of their connections with the national government. This was particularly true since local financing was weak and most large-scale expenditures were dependent upon aid from the central government.

Below the prefectural level, the traditional *gun* or county-type office was ultimately abolished but city, town and village units were maintained. The offices of mayor and councilman became elective after the Meiji era. Urban government at the local level, therefore, acquired a democratic flavour. The jurisdiction of most local urban units, however, was very limited, and it cannot be said that public interest in municipal elections was high. After the onset of the militarist era, perhaps the aspect of local government calling forth the greatest participation from the average citizen was the neighbourhood association. This association, which had ancient roots, pooled families living in close proximity for a variety of purposes. They could be used as outlets for government propaganda, as units for fire fighting and defense activities and as extended families accepting joint responsibility for all types of political and social obligations. In many respects, the neighbourhood association was the most natural expression of Japanese society and politics beyond the familial group.

Throughout most of the pre-1945 era, more than one-half of all Japanese citizens lived in rural areas, and rural government at the local levels must not be ignored. In agrarian Japan, the traditional, informal institutions and instruments of control retained a very deep significance prior to World War II. The overwhelming majority of rural Japanese lived not in single, isolated homes surrounded by their fields, but in small, rural hamlets called *buraku* where 20, 30 or more families lived together. The social structure of the *buraku* differed considerably from one region of Japan to another, and even within regions, depending upon the predominant type of cultivation or occupation (for example, fishing) and upon other factors. In general, the regions of northwest Honshu produced the most backward, "feudal-type" *buraku* while some of those in the region of the Inland sea were noted for being "advanced" and relatively egalitarian.

Political power or influence at the *buraku* level, however, generally flowed down two channels, the village headman or elder system and the traditionally prominent, affluent family. Sometimes these two channels were fused; almost always they were interrelated. On occasion, a pattern of power akin to political bossism prevailed; often the mechanism was much more subtle. In any case, within the Japanese rural scene, the interactive forces of hierarchy and paternalism tended to be extremely strong. Generally the rural "common man" accepted the guidance of the acknowledged leader of his community and even solicited it. Elections in rural areas merely confirmed a power structure that already existed. Thus scions of prominent landowning families were elected to the diet because their families had always held power. In turn, many of these families engaged in various paternalistic acts toward the community, or individuals therein, assuming a certain responsibility for tending to their "flock" in true Confucian manner.

Local Government After 1947.—Local rural politics after World War II retained much of the pre-1945 flavour despite the changes that took place. The country is divided administratively into 46 prefectures (see *Population:* Table, above), 42 of which carry the suffix *ken* while the remaining 4 are suffixed *to*, *dō* or *fu* (Tokyo-to, Hokkaido, Kyōto-fu, Ōsaka-fu). The prefectures are subdivided into cities (*shi*), towns (*chō*) and villages (*son*, *mura* or *machi*). The U.S. occupation had among its major objectives the decentralization of political power and the strengthening of democracy at the grass-roots level. To this end, many statutes were enacted and local-government teams worked tirelessly. The single most important piece of legislation was the Local Autonomy law of 1947. The immediate effect of this program was to reduce sharply the power of the central government to control prefectural and local affairs. Prefectural governors and other local officials had their posts made elective. Both the police and educational systems were decentralized. A local civil service system was established, and there was a sustained attempt to train local officials.

The decentralization program, however, encountered major obstacles. Opponents of local autonomy claimed that Japan contained neither the financial resources nor a sufficient number of trained personnel to operate local governments on a largely autonomous basis. They charged that such a system caused inefficiency, inequity and discontent. It might be added that Japanese political subdivisions as constituted after 1947 did not evoke in themselves the sentiment of loyalty. Sectionalism remained a factor of some importance, although it diminished greatly after the restoration, but sectionalism was not coterminous with political boundaries and was not really connected with their development. Thus emotional support for self-government at the local levels was not strong. Under conservative leadership there was an intensive and partly successful drive to re-establish many centralized controls. In the early 1960s the socialists put up determined resistance on some fronts, but the pendulum definitely began to swing toward augmented national controls. The Local Autonomy agency, established in 1949 to assume certain functions of the old home ministry, acted as a co-ordinating and policy-making body at the national level.

8. Political Parties and Pressure Groups.—In the Japanese diet political parties have assumed supreme importance.

Background.—Japan has had a longer experience with western-style parties than any other Asian nation. In 1874, shortly after the Meiji restoration, the Aikokukoto (Public Party of Patriots) was formed, dedicated to the establishment of a national assembly and to party government. Its leaders, headed by Itagaki Taisuke, were former samurai from the Tosa area who were dissatisfied with government policies and the distribution of political power. The first full-fledged party movement, however, got under way in 1880–82, after the failure of the Satsuma rebellion had made it abundantly clear that the national government could not be challenged successfully by military means.

Three parties emerged during this period. Each had a small membership, essentially former samurai, and in certain respects operated more in the fashion of a club than a modern party. Yet these parties sought to have some impact upon the broader public through their publications and the speeches of their leaders. The Liberal party (Jiyūtō), successor to the Party of Patriots, was again led by Itagaki. For their philosophic basis, the Liberals borrowed heavily from Rousseau and the ideas of the French Revolution. "Liberty, equality and fraternity" were emblazoned upon party banners. Constitutional government and "civil rights" were central party principles. The Liberal party drew its strongest support from diverse agrarian elements—landowners, landed entrepreneurs and some peasants. Initially it was also heavily sectional in composition, with the Tosa men occupying all leadership posts. Within the party there was no complete commitment to peaceful change; violence was often used or close to the surface, and this gave the government an opportunity to use suppression.

The second "popular" party, the Progressive party (Kaishintō), was more moderate and drew most of its political inspiration from British utilitarianism. Like the Liberals, the Progressives championed constitutionalism and party government, thinking especially in terms of the British model. The Progressive leader was Ōkuma Shigenobu, and around him clustered many bright young university students and urban intellectuals. But the Progressive party also showed a strong sectional trait, since Ōkuma and a considerable number of his supporters were from the old fief of Hizen (Saga). When the Satsuma-Chōshū-Tosa-Hizen coalition split, it is significant that men from the former two areas continued to dominate the government while men from the latter two launched the party movement.

Emerging at a time when the emphasis was upon nationalism with the emperor as its symbol, the popular parties had certain serious problems in espousing the western liberal creed in its entirety. In some measure, they had to adhere to the themes of

solidarity and complete loyalty to the imperial institution. The former theme caused them to argue the case for liberalism on the basis that it would unite the people into a solid bloc, augmenting the power of the state. In this argument, minority rights and the concept of individual dissent were given little attention. The second theme caused the Meiji liberals to vie with the conservatives in asserting their loyalty to the throne, only to see the imperial institution used repeatedly against them. The third party of this period was the staunchly conservative Imperial Rule party (Teiseito). Its leadership came mainly from government officials, Shintō priests and some newspaper editors who had an interest in promoting the government position. With its slogan "revere the emperor, love the country," it advocated a general go-slow policy and one that would make constitutionalism an adjunct to imperial rule.

For a time after 1885 the parties lapsed into inactivity. There was no national diet and the constitution was being prepared in secret, without opportunity for public debate. Before the first diet opened in 1890, however, party lines had been re-established, and the two popular parties carried their struggle against the oligarchy into the diet arena. Government leadership soon became divided over the question of how to handle the party problem. Men like Yamagata Aritomo, famed Chōshū military statesman, favoured "transcendental" cabinets, above party. They abhored the concept of party as a factional device, unrepresentative of the nation at large, and they refused to contemplate union with any party. But it was impossible to conduct policy without some party support, and if oligarchic leaders would not participate in parties, they at least had to form alliances with them on the basis of some concessions, or offer special inducements for votes, including bribes. Some members of the oligarchy like Itō Hirobumi recognized the inconvenience and danger of these conditions, and ultimately determined to join the party movement. From the party standpoint also there were advantages in having oligarchic sponsorship, because this was the only avenue to power.

Thus the old Liberal party came under the leadership of Itō in 1900 and was renamed the Rikken Seiyūkai (Friends of Constitutional Government association). Ōkuma's party, the Progressives, also came under increasing bureaucratic influence in later years. When the era of party supremacy finally arrived, therefore, the two major parties had mixed bureaucratic-"pure party" elements and sometimes these were in conflict.

The era between 1918 and 1931 may be called the era of party government in prewar Japan. Actually, as has been noted, there were some nonparty prime ministers during this period, and the principle of party government was never firmly established. But there can be no doubt that the two major parties, the Seiyūkai and the former Progressives, finally calling themselves the Minseitō or Democratic party, did hold a substantial amount of power. It was also in this period, however, that the attractiveness of party government began to fade for many Japanese citizens. Earlier, the advent of universal manhood suffrage and the movement to abolish "clan government" had been widely heralded as progressive steps. Once so-called party government was established, however, the public was treated to a continuous succession of stories about political corruption, close party-*zaibatsu* (big business) ties and general political decadence. The era of the 1920s, moreover, was a period of intermittent economic crisis. When the depression finally struck Japan with full force after 1929, the political parties bore the full brunt of a savage assault upon democracy, parliamentarianism and capitalism.

After 1925 the first labour parties were established. From the beginning, the left-wing political movement in Japan was fragmented by personal and ideological differences. Leadership was provided by intellectual and labour elements. The moderate wing was represented by the Social Democratic party, patterned strongly along the line of British Fabianism. The Japan Labour-Farmer party, closer to Marxism, occupied a centrist position. The legal left was represented by the Labour-Farmer party, strongly Marxist and serving as a popular front organ for Communism. In addition, an illegal Communist party existed in Japan after 1922 on an intermittent basis. Pre-World War II leftist groups were constantly in flux. Mergers and splits were common. After 1930 deflections into the National Socialist movement also developed. Sans ultranationalist and Communist elements, the bulk of the socialists managed to combine in 1932 into the Social Mass party which lasted until the party era came to a close.

Prior to 1945 the Japanese left-wing movement was extremely weak, never able to elect more than a handful of candidates or poll more than a few hundred thousand votes. Many reasons were involved. State oppression, especially against the far left, was of course one factor. More important perhaps were the underlying weakness of organized labour during this period, the strength of traditional institutions and conservatism in the rural areas and, in general, the limited interest and participation in parliamentary politics by the Japanese "common man." Also involved were the inability of intellectual left-wing leaders to communicate with the people and their tendency to take highly theoretical positions divorced from reality and subject to bitter factional dispute.

As the militarist era began to emerge in 1931, the political parties gradually lost power and public support. In 1940, under pressure, all of them went through the ritual of "voluntary dissolution." One large party, the Imperial Rule Assistance association, was launched in their place. Its function was partly in line with the original hope of many Japanese conservatives: to "assist the emperor" by maintaining the unity of the Japanese people, serving as an outlet for Japanese government propaganda and being available for various services. As a modern mass-man organ, neither the Imperial Rule Assistance association nor its 1945 successor, the Greater Japan Political association, achieved notable results. Japanese leaders were reluctant to attempt on any full scale the techniques of modern totalitarianism. The era of competitive parties in the modern western tradition, however, had come to a temporary halt.

Post-World War II Trends.—The reorganization of political parties in Japan got under way almost from the moment surrender was announced on Aug. 15, 1945. Leaders from the old conservative parties undertook to re-establish their groups under Meiji era labels. Thus the Liberal and Progressive parties emerged shortly after the U.S. occupation began. Personal and power rivalries precluded a unified conservative movement. Meanwhile, the Socialist party (Shakaitō) was launched as a united party of the non-Communist left. Subsequent events, however, were to demonstrate the difficulties of maintaining that unity, and later splits did occur. The first legal Communist party in Japan was also established in Oct. 1945, shortly after the release from prison of veteran Japanese Communist leaders. Another party, the Co-operative party, was organized on a national basis, but it later disappeared. There were also a profusion of district or regional parties, almost all of which quickly succumbed.

The postwar Japanese party movement can perhaps be summarized in terms of three basic factors: first, the continued dominance of the conservatives in the over-all political scene; second, the establishment of a two-party system, but one that proved precarious and possibly temporary; third, continued uncertainty in the Japanese public mind about affiliation with parties and about the concept of party itself. Turning to the first factor, Japan remained a basically conservative society despite postwar upheavals. The conservatives, whether divided or united, tended to poll about two-thirds of the votes in post-1945 elections. The socialists made definite gains over their prewar position but they remained a distinctly minority party. The reasons for conservative dominance were many. The conservatives had most of the "name" leaders, men of broad political and administrative experience whose local political ties were also extensive in many cases. The advantages of intimate contacts with various district elites were often considerable, and in some cases the old prewar organizational structure of the Seiyūkai and Minseitō remained largely intact.

For a variety of reasons, the Japanese rural areas continued to be a bulwark for the conservatives despite socialist inroads in some regions. Trends among the younger farm generation were not completely clear, but most agrarian districts appeared "safe" for the conservatives. Conservatives were also aided by having

greater access to campaign funds, and although labour unions provided increasing campaign funds for the socialists, these did not match conservative war chests. Moreover, the socialists were gravely hampered by internal strife. Major ideological differences existed between the right and left wings of the socialist movement, and even within these groups. The validity of Marxism and the issue of "class party" versus "mass party," not to mention wide divergencies on foreign policy, plagued the Japanese socialist camp. After a serious split in Oct. 1951, the socialists remained as two separate parties until the fall of 1955, at which time they were reunited. The conservatives also organized a united Liberal-Democratic party (Jiyū-Minshutō) in Nov. 1955 to meet the socialist challenge. Thus, at least temporarily, Japan achieved a two-party system, the Communist party vote and that of other minor parties being negligible. Internal difficulties, especially within the Socialist party, continued to be grave, however, and the conservatives and socialists were in actuality two loosely joined federations.

The third factor in postwar Japanese party politics relates to the position achieved by the parties in the public mind. The constitution of 1947 indirectly granted the Japanese parties an unprecedented position of power by clearly establishing parliamentary supremacy. Legal change alone, however, was not sufficient to assure the position of the parties in Japanese society. Many of the traditional sins and weaknesses connected with party organization and tactics continued. Cliques and factional divisions, inadequate grass-roots organizations, leadership weaknesses and problems of corruption all existed in some degree. Party membership continued to be a relatively formal procedure, hence the average Japanese did not think of himself as a Liberal-Democrat or Socialist in the same sense that an American or British voter might. In these terms, party roots continued to be relatively shallow. The concepts of party government and parliamentary supremacy were still, in a sense, on trial before Japanese public opinion. At the same time, however, there were some encouraging signs. In the later elections voter interest was high, running close to 80% for the house of representatives; more intensive campaigning and grass-roots work was undertaken; and the Japanese citizen frequently began to think of himself as loosely affiliated with a given party, even though he would not contemplate membership.

Pressure Groups.—Any analysis of political parties and voting trends must involve some discussion of pressure groups and socio-economic political blocs. Prior to World War II conservative dominance, as noted earlier, stemmed from support given by the landed class and the agrarian element generally, on the one hand, and assistance rendered by the rising commercial-industrial class on the other. The Japanese countryside retained a strongly traditionalist flavour of hierarchy and paternalism, and this was reflected in conservative voting patterns. It would be inaccurate, however, to suggest that rural conservatism followed a uniform course or that it contributed on balance to successful parliamentary government. The Japanese agrarian class, comprising nearly one-half the total population, was divided into a number of categories. In general, landholdings were not large scale but, naturally, the absentee owner and resident landlord groups tended to hold primary economic and political power, especially the wealthiest segment of them. About 44% of all Japanese farmers were either mainly or wholly tenant farmers.

The agrarian group, of whatever category, tended to have grievances in the context of a rapid march toward industrialization. In considerable measure, the peasant paid the price for the industrial revolution without reaping a sufficient number of its benefits. If he owned the land, his taxes were relatively high and only a small amount went for rural development. His operating expenses were heavy, but the prices obtained for his products were usually inadequate except in times of war. At the close of the 1920s almost all Japanese farmers were operating at a deficit. In this climate some agrarian radicalism sprouted, flying, for the most part, antiurban, anticapitalist and antiliberal banners. Usually these movements hinged upon a romantic desire to re-establish the soldier-peasant alliance and a fervent urge to attack the iniquities of urban industrial life. In reality few farmers participated in these movements. For the most part, their political activities were limited to exhibiting loyalty to the emperor and, when the occasion demanded it, becoming soldiers of blind obedience and extraordinary bravery in the Japanese army. This pattern of loyalty and belief in primeval myths was sustained by both the socioeconomic conditions of rural life and the indoctrination and primary education provided by the modern state.

After the end of World War II, many changes took place in Japanese rural life. The program of land redistribution was one of the most far-reaching reforms attempted in the early postwar era. (See *The Economy: Production: Agriculture*, below.) The land-reform program represented a great leveling process, and at least temporarily injected a much higher degree of equality into the Japanese rural scene.

Along with this major reform went many other changes that had a potential effect on the political and economic position of the agrarian class. Laws providing for equal inheritance instead of primogeniture were enacted; legal equality for women was established; substantial changes in primary schooling were made; and, of course, conscription was abolished. Few of the legal changes could be applied completely; some could only acquire validity over a period of time and others might be unfeasible for Japan. Collectively, however, they represented some additional pressure toward sociopolitical change in the rural areas. In addition, after 1945 many factors contributed to the relative prosperity of the Japanese farmer: land reform, heavier dependence on domestic foodstuffs, improved agrarian technology and similar developments. Perhaps this was the chief reason why the Japanese farmer continued to vote strongly conservative. The unanswered question was whether the younger people of the rural areas, products of a different education and environment, would perpetuate the conservative pattern of their parents. There were some indications that political behaviour in the rural areas, while remaining basically conservative, might be subject to more variations and shifts than had formerly been the case.

Since Japan is the only Asian society with some heritage of industrialization, it is important to note the political tendencies of the commercial-industrial groups. First, however, the broad structure of Japanese industry must be drawn. At its base, modern Japanese industry continues to be supported by myriads of small- and medium-sized enterprises, ranging from the simplest handicraft-type operation where worker and employer are undifferentiated to medium-scale factories of a more modern type. These enterprises constitute well over 90% of all Japanese plants, and despite the problems connected with them, they have become an inseparable part of the modern Japanese economy. Entrepreneurs from this group differ widely in their economic position, political consciousness and political affiliations. The weakest of them approach the status of handicraft workers, and most small enterprises suffer constant capital shortage. Thus while this group has tended to vote conservatively, they have economic grievances and the socialists, having garnered some support from their ranks, have hoped to make further gains.

Perhaps the most famous political pressure group in Japan before 1945 was the so-called *zaibatsu* or financial cliques. Great families or industrial-commercial empires like Mitsui, Mitsubishi, Sumitomo and Yasuda had many interlocking ties with the political parties and the government in general. In the early Meiji era the government provided extensive assistance in the launching of modern industrialization. Subsequently, it withdrew very largely from direct participation, but its policies of course had a direct and crucial bearing on commercial-industrial circles. At first the Japanese business class in their approach to officialdom had tended to take the stance of humble petitioners to the lofty court. But increasingly equity was attained and an interchange of personnel took place. Sometimes this was facilitated by intermarriage or close friendships; on occasion, men retired from one field of activity to enter the other. From the ranks of business were drawn government advisers, experts and even cabinet ministers. The ties with the conservative parties were especially close. *Zaibatsu* campaign donations were essential, and large sums of money were involved. Thus the political parties and the *zaibatsu* were often synonymous in the Japanese public mind, although this repre-

sented an oversimplification. No single economic pressure group, however, wielded so much power in prewar Japanese politics.

After the Japanese defeat in 1945, a broadly gauged effort was made to reduce the economic and political power of the "greater" and "lesser" *zaibatsu*. Some prominent industrial leaders were purged. A rigorous policy of economic deconcentration began. *Zaibatsu* family resources were reduced, with forced sales of assets and the ending of their corporation control. Holding companies were dissolved, and all large-scale industry was forced to undergo reorganization, with securities valued at billions of yen placed for sale on the open market. Antitrust legislation was enacted to prevent future cartels and monopolies. The net effect of these changes was to accelerate some shift in top business management and control; many of the old families were speeded toward oblivion, and modern managerial operations in big business became standard. New faces were numerous, even at the top. Certain structural changes also occurred, particularly the removal of cartels. For a time, the political position of Japanese large-scale business was precarious, and its over-all psychology strongly defensive. The ties with conservative political leaders were retained, however, and after 1948 the political power of the urban business class began to rise steadily. Organizations to co-ordinate and present the business point of view, such as the Japanese Federation of Employers' associations, emerged and grew in influence. Once again, by the 1960s, the ties between the Liberal-Democratic party and Japanese business leadership were close; but they were also complicated, with numerous divisions on specific policy issues and with business support going to various rival conservative leaders. Business, however, continued to supply the great bulk of conservative party funds, and had in return an influential role in policy formation.

A rival pressure group that developed after 1945 with unequal but growing power was organized labour. Prior to World War II, as noted, labour played a negligible role in Japanese politics; only about 7% of industrial labour was organized at the peak of prewar union strength, and even this group was badly fragmented. Within a few years after 1945, however, nearly 7,000,000 Japanese workers had entered labour unions as the result of a tremendous organizational drive supported by the U.S. occupation authorities. The political power and the economic position of Japanese labour unions could easily be exaggerated. Their weaknesses of leadership, structure and ideology were obvious. Deep divisions within the movement existed. Nevertheless, organized labour had a growing influence upon the Japanese political scene, especially upon the Socialist party.

The largest segment of organized labour, Sōhyō or the General Council of Trade Unions, with more than 3,500,000 members, threw the bulk of its support to the left-wing socialists, and in the early 1960s it was one of the most influential elements within the Japanese Socialist party. Its services included the contribution of substantial campaign funds through membership assessment and the donation of its organizational facilities for party use. Sōhyō support for the Socialist party, however, was not an unmixed blessing to the socialists. Its insistence upon a militantly leftist program close to orthodox Marxism and upon the Socialist party being a "class party" hampered the socialists in their quest for rural and middle-class votes. Japanese workers, even those in unions, did not all vote Socialist by any means, and in the 1960s three major unions merged into the Domei Kaigi (General Council of Japan Labour organizations) with 1,500,000 members to rival Sōhyō. (*See* LABOUR [TRADE] UNION.) Moreover, labour would not occupy a dominant position in numerical terms in Japanese society even if it were to achieve greater cohesion and ideological unity. It was clear, however, that organized labour in the postwar years had risen to become an important political pressure group.

Many other socioeconomic groups of political significance in Japan deserve some attention. One interesting group comprises the intellectual persons in academic life, artists, writers, journalists and others in similar professions. Within the total contingent of Japanese intellectuals, a considerable segment no doubt support conservatism, but the most articulate elements are clearly on the left, and often serve as leaders. After the early Meiji period, conditions increasingly separated the intellectuals from participation in government. Their function became that of social critics, and their training combined with function to challenge the *status quo*. Moreover, Marxism captured many academic ramparts as a methodology of "science" and "truth," adding another reason for intellectual proclivities toward socialism. There was some challenge to academic Marxism in Japan, but intellectual leadership tended to be committed to the general socialist cause.

One powerful pre-World War II pressure group which was greatly reduced was the military. Whether the Japanese military operated directly through its professional officers and men, or whether it applied pressure through veterans' organizations and patriotic societies, it had the greatest influence upon politics and within conservative circles. The military and its auxiliary organizations remained weak after 1945, and played a very limited role on the political scene. The ultranationalist movement remained quiescent. These facts along with the rise of organized labour and changes within the agrarian social-class structure suggested both the reordering and the fluidity of pressure groups in post-1945 Japan.

9. The Public Welfare.—The history of welfare legislation in modern Japan begins with laws granting protection to workers engaged in such hazardous occupations as mining. In 1911 the first Factory act passed the Japanese diet although it did not go into effect until 1916. This act, which was revised in 1923 and 1925, provided general regulations relating to factory working conditions and the work of women and children, but many of its provisions were limited in scope or could be waived under certain circumstances.

The decade that followed World War I saw the enactment of some social legislation. A law establishing employment bureaus was enacted in 1921, and the following year the diet passed the first health insurance act. In 1926 an act providing for arbitration in labour disputes affecting industries providing essential services was passed, but no law was ever enacted before 1945 defining and protecting the rights of labour unions. Similarly, legislation pertaining to tenant rights in agriculture was very limited, and confined mainly to the establishment of arbitration procedures.

Ironically perhaps, it was during the militarist era after 1931 that the government began to pay stricter attention to the welfare of the working class. Concern about labour efficiency, problems of recruitment and the aggravations of rapid labour turnover prompted a number of welfare measures. Laws pertaining to health and sanitation, accident and illness compensation, retirement benefits, worker housing, recruitment practices and similar problems were put on the statute books. On the eve of World War II, Japan was not too far behind western societies in its welfare legislation. Many of the laws were exceedingly difficult to enforce, however, especially throughout the vast network of small and medium industries, and often little effort toward enforcement was made. Working conditions varied greatly, even within the same industry. Generally, the most fortunate workers were those in large-scale enterprises. Wages and working conditions at all levels, however, were far lower than those in most of western Europe and the United States. This was one reason for serious complaint concerning Japanese exports.

The social welfare program of the Japanese government was greatly expanded after 1945, partly because of U.S. initiative. Land reform, already mentioned, and accompanying legislation furnished basic reforms and legal protection for the owner-cultivator and tenant classes. Some progress was made in supporting agrarian co-operatives and in making agricultural credit available. As a result of these developments and other factors, the Japanese farm population enjoyed unprecedented prosperity, measured in Japanese terms. Purchasing power increased sufficiently to broaden the domestic market considerably. Some agrarian mechanization took place, rural expenditures for clothing and durable goods rose and the Japanese farmer enjoyed his highest standard of living, albeit a very modest one compared with most of the west.

The urban worker also saw substantial improvements in his

status and living standards after 1945. Major legislative milestones of the early occupation era were the Trade Union law, the Labour Relations Adjustment act and the Labour Standards law. These acts, while in some cases subsequently modified, nevertheless provided Japanese labour with a basic code. In addition, a wide range of social security legislation was enacted. Once again, the problem was chiefly one of enforcement, particularly in the field of small factories and household industries.

Health facilities improved rapidly after World War II and some of Japan's medical science laboratories became world famous. By the late 1950s there were more than 98,000 physicians, about 32,000 dentists, 55,000 pharmacists and 5,600 hospitals—approximately 6.6 beds per 1,000 persons. Public hygiene is controlled by the public sanitation bureau of the ministry of welfare in co-operation with a number of consulting bodies.

The population-resources balance of Japan makes social problems complex. In the second half of the 20th century Japan reached a total population of more than 90,000,000 people, with a labour force of over 44,000,000. Because of meagre raw-material resources, Japan must always watch its import-export balance carefully. It must also accommodate sizable increases in its working force; about 600,000 additional workers enter the labour market annually. Despite these problems, as a result of major productive gains and expanding markets Japan enjoyed a fairly high degree of prosperity after 1950, with only occasional readjustments. Public savings were high, consumer expenditures shifted from emphasis on food toward clothing and durable goods and even the very serious problem of housing was somewhat reduced. In terms of living standards, however, the average Japanese still had a great distance to go in order to compare favourably with advanced western standards.

10. Education.—The early history of education in Japan is connected with the study and assimilation of Chinese culture. From Chinese and Korean artisans, priests and scribes, the Japanese acquired new crafts, new ideas concerning government and religion and a system of writing. This last achievement was of vital significance, affecting the entire intellectual development of the Japanese people. Prior to their contact with Chinese writing, the Japanese could hold and acquire knowledge only by oral means. No precise date for the Japanese acquisition of writing can be given, but by about A.D. 400 Korean scribes were using Chinese ideographs for official recordings at the Japanese imperial court.

Japanese education in ancient times followed various patterns. Some students went abroad for their studies, to China and Korea. Teachers and priests from the mainland also came to Japan. By the 7th century a system of higher education was developing in the Nara-Kyōto area. The curriculum included the Chinese classics, calligraphy, composition, law and arithmetic. Some technical schools teaching medicine, calendar making and divination also existed. Education in ancient Japan, however, retained a much more aristocratic flavour than the Chinese system. The broad civil-service examination program, whereby all candidates for public office took a series of tests and sought to attain certain degrees, was never thoroughly applied in Japan. Many noble Japanese families maintained their own private educational facilities, where they emphasized specialties that had brought them power and position. If the Japanese did not basically accept the Chinese educational system, however, they did accept its substantive emphases. By the close of the 8th century the accomplishments prized were proficiency in calligraphy, facility in writing highly stylized prose and poetry and ability in memorizing the Chinese classics.

The advent of the military-feudal era in Japan shifted much of the responsibility for education to Buddhist churches. Buddhist priests organized temple schools throughout the land and gave elementary instruction in reading, writing and ethics to the children. Higher education in this period also developed mainly under Buddhist influence. As in western medieval times, the church served as repository and supporter of knowledge. Schools like Ashikaga college were founded under its influence (*c.* 1190) and great libraries were established by it like that in the Shōmyōji temple, Kanazawa (1275). Even in the heart of the medieval military period, however, Japanese scholars were a part of the feudal courts.

When the Tokugawa family came to power at the beginning of the 17th century, new scope was given to education. The task of this era of long-enduring peace became that of training members of the military class as civil administrators. Hundreds of samurai schools emerged throughout the country, with each fief vying for educational laurels. From 7 to 15 years of age, samurai lads attended as day scholars, thereafter being admitted as boarders. Twice a year examinations were held in the presence of high officials. The relation of the student to the teacher was one of great reverence and respect. The teacher's every command was to be obeyed. Tokugawa military-class education paid great homage to Neo-Confucianism, mixing it with some indigenous values to provide basic ethical teachings. Thus samurai schools stressed filial piety, respect for superiors and the moral code of the military class. Meanwhile, in urban centres, the merchant class maintained their own schools, teaching both Confucian ethics and practical knowledge that could be used in commerce. Other private schools continued, and temple schools were available to some commoners for elementary education.

While the government encouraged the translation and use of Chinese classics, western books were banned. Only toward the very end of the Tokugawa period did a small group of Japanese scholars study "Dutch" learning, thereby opening the new channels down which Japan would move. (See *History*, above.)

In the course of the restoration, the young emperor Meiji was caused to proclaim an oath, one part of which read: "knowledge shall be sought throughout the world, so that the welfare of the empire shall be promoted." Pursuant to this aim, the new Meiji government showed an intensive interest in education. A ministry of education was immediately created and in 1872 a comprehensive educational code, including a program of universal primary education, was announced. Within less than a decade Japanese education made a tremendous spurt forward. In 1873 there were 8,000 public and private elementary schools with slightly over 1,000,000 pupils; by 1879 there were 26,000 such schools with almost 2,500,000 pupils. In the same period secondary schools increased from 20 to more than 700. Tokyo Imperial university was established in 1877, and many other prominent colleges and universities came into existence during this era. By 1908 compulsory elementary education had been extended from four to six years. Technical and vocational schools were also being created for boys, and special secondary schools for girls. In 1938 Japan had about 26,000 elementary schools with 12,000,000 students. There were more than 22,000 secondary and special higher schools with an enrollment of more than 3,500,000. Japan had become one of the most literate nations in the modern world.

The Japanese educational system took many of its points from the European continental systems, particularly the German. In curriculum, the emphasis was placed equally upon western science and technology on the one hand, and traditional Japanese values and ideals on the other. Heavy stress, especially in elementary school, was placed upon *shushin* or ethics courses, where students were taught loyalty to the family, the state and the emperor. Nationalism predominated also in many of the social science materials at this level; mythology took the place of fact. In later years, moreover, the virtues of militarism were invariably lauded. In emphasis, the Japanese system placed stress upon mass education at the primary levels and highly selective education at the upper levels. Most Japanese attended primary schools, but entry into secondary schools, and especially universities, was highly competitive. There was no desire to create an intellectual proletariat, and funds were limited. The number of outstanding private schools or universities, such as Keiō, Waseda and Dōshisha, was few. And the central government, through the ministry of education, dominated all aspects of the system—curriculum, texts and teachers, providing for a maximum of uniformity.

Many Japanese children started their education by attending kindergarten, although this did not form a part of the basic educational system. Formal education started with the *shogakko* or

primary school which provided six years of universal compulsory training between the ages of 6 and 14. All primary schools were coeducational and the tuition was free. Classes tended to be large, often around 50 students. From primary school, students could go on to higher primary school for a two- or three-year terminal program, or go to *chugakko*, "middle school," for five years, usually between the ages of 14 and 19. These were boys' schools but there were special girls' high schools. Tuition fees were modest and the studies were rigorous. Extracurricular activities other than Japanese fencing and wrestling were few. Military training was generally included. Studies included the sciences, literature and mathematics. The intellectual elite went on to *kotogakko* or high school for three years, taking a program roughly equivalent to a U.S. junior-college program, and then a few went to a university for three years. There the coveted degree of *gakushi* or scholar, the Japanese bachelor of arts, was obtained. For those who did not go to high schools or universities, there were certain technical schools and colleges where higher learning of this type could be pursued.

Post-World War II Education.—Striking changes in Japanese education were undertaken after 1945. In part, these were the product of the 1946 U.S. educational mission recommendations. One set of changes related to curriculum. As early as Dec. 1945 the teaching of state Shintō was outlawed and the *shushin* courses were abolished; temporarily, the teaching of Japanese history and geography was also suspended until new texts could be written. Ultimately, greater emphasis was put upon the social sciences and upon classroom procedures intended to bring out the student's personality and self-expression. Memorization of classical passages by rote and ultraformal classroom methods were denounced. The "progressive" classroom was to centre around discussion groups, individual, creative work and similar techniques. To accompany these changes, an entirely new educational structure modeled after the U.S. system was established. This was the six-three-three-four system, with six years of elementary (primary) school followed by junior secondary (high) school, senior secondary school and college. A junior-college program was also instituted, as were special programs for teacher training. Compulsory education was raised from six to nine years, thereby encompassing junior high school. Coeducation at the higher levels was greatly encouraged. To permit an expansion of college education and to break the monopoly enjoyed by a small number of prewar universities, support was given to the development of numerous prefectural colleges, intended to resemble U.S. state universities in some degree. (*See* also EDUCATION, HISTORY OF.)

Yet another major change related to administrative controls. Control over primary and secondary education was given to prefectural and local boards of education and the local school administrators whom they appointed. As a democratization measure, these boards were made elective. The Parent-Teacher association movement was also strongly pushed as a method of involving local communities in school affairs. The function of the ministry of education was now supposed to be that of merely giving advice to local boards on specific educational and technical questions. Its old power to select texts, direct curriculum and unify procedures was greatly reduced.

Few democratization measures underwent more criticism than these educational changes, and various revisions were later made under conservative sponsorship. The new "progressive" curriculum and techniques were strongly criticized as undermining parental discipline, national loyalty and personal morals. Some training in ethics was reintroduced at primary levels, and national supervision over curriculum and teaching methods increased. The six-three-three-four system was attacked for unduly lengthening the compulsory-education period, overemphasizing higher education for the masses and reducing the quality of training. The prefectural colleges were condemned as "glorified high schools" lacking sufficient funds, equipment or trained personnel to be considered full-fledged colleges. The amount of validity in these criticisms was debatable. Meanwhile, new generations of Japanese were being educated, while the system gradually underwent certain modifications. The role of the ministry of education was considerably elevated, and decentralized authority in this as in other fields was gradually receding.

One major political issue was the activities of the strongly left-wing Japan Teachers union, a large national union of primary- and secondary-school teachers. In the early occupation era, Japanese teachers were encouraged to express their political views freely and to join a union. This union, affiliated with Sōhyō, remained numerically strong and on numerous occasions posed a militant challenge to the government. It fought against any reversion toward pre-World War II practices or centralized controls, and demonstrations and strikes were called.

Higher Education.—The system of higher education that provided academic training for the bureaucracy, with separate training for technicians, teachers and women, was reorganized to resemble that of the U.S., with 4 years of college or university following 12 years of elementary and secondary schooling, and with graduate training for the master's and doctor's degrees. In 1948, 12 private universities were chartered, and under the provisions of the National School Establishment law (1949) at least 1 national university was established in each prefecture, formed by the merger of technical institutes, men's and women's normal schools and other public higher-education institutions in each area. Accreditation was assigned to a private association. Although Tokyo remained the university centre of the country, higher education was made available in the prefectures.

The University of Tokyo, founded in 1877, became the Imperial university and then Tokyo Imperial university and was the chief training ground of the bureaucracy. It was reorganized in 1949 and renamed Tokyo Daigaku (university). Other prewar universities in Tokyo included Hitosubashi (1875), Hosei (1879), Keiō (1858), Nihon (1889), Tokyo Institute of Technology (1881) and Waseda (1902); all were reorganized in 1949.

11. Defense.—Historically, the Japanese were usually described as a nation of warriors. In the earliest records, some evidence suggests special military classes with hereditary functions. Mention is made of the clan called Ōtomo ("great escort") and such groups as Kumebe ("corporation of soldiers") and Mononobe ("corporation of arms"). They seem to have ranged in importance below the Nakatomi and Imibe clans whose functions were priestly and political. After the adoption of the Chinese administrative system during the 7th century, more elaborate and distinct military organizations were formed. To obtain soldiers, conscription was used and much dreaded.

Gradually, a group of professional soldiers developed as a result of the Japanese frontier struggles with the Ainu. These men, far away from the centres of power, developed an independence and tightly knit organizational structure. They were the forerunners of the feudal warriors of later days, their leaders being members of the Taira and Minamoto clans and their adherents being sturdy farmers who were trained to fight. By the 10th and 11th centuries, a hereditary class of military men called samurai (*q.v.*) had emerged. By the 12th century, when the Minamoto brought much of Japan under their sway, possession of arms was restricted to the samurai and they began to exercise a position of political and social superiority that was to last in some form down to the 19th century. (See *History*, above.)

The chief weapon of the warrior was the bow. Many feats of incredible skill involving this weapon were immortalized in legend. Originally the bow was of boxwood, but subsequently bamboo alone came to be employed. Binding with cord or rattan served to strengthen the bow, and for precision of flight the arrow had three feathers, an eagle's wing being most esteemed for that purpose. The maximum length of the bow was about 7½ ft., and the unit for the arrow from 3 to 3¾ ft. Next in importance was the sword (*katana*), often regarded as the samurai's favourite weapon. It was a single-edged weapon remarkable for its three exactly similar curves—edge, face line and back; its almost imperceptibly convexed blade; its admirable tempering; its cunning distribution of weight, giving a maximum efficiency of stroke. The 10th century saw this weapon brought to perfection, and in every age, numbers of men devoted their whole lives to acquiring novel skill in swordsmanship.

The sword exercised a potent influence on the life of the Japanese nation. The distinction of wearing it, the rights that it conferred, the deeds wrought with it, the fame attaching to special skill in its use, the superstitions connected with it, the incredible value set upon a fine blade, the honours bestowed on an expert swordsmith, the profound study needed to be a competent judge of a sword's qualities—all these things combined to give the *katana* an importance beyond the limits of ordinary comprehension. A samurai carried at least two swords, one long and one short. His scabbards of lacquered wood were thrust into his girdle, not slung from it, being fastened in place by cords of plaited silk. The short sword was used only to cut off an enemy's head after overthrowing him, and it could also be used as an instrument of suicide. In general, the long sword did not measure more than three feet, including the hilt, but some were five to seven feet long. Japanese warriors also wore armour, suspended from the body rather than being shaped to it in European fashion. Iron and leather were the chief materials, with brilliantly coloured cords fastening the laminae together and with much gold and silver inlay work. The Japanese never had true war horses but rode ponies that looked puny when mounted by men in full battle array. Both stirrups and the wooden saddle frame, however, were often of beautiful workmanship, the former covered with rich gold lacquer, the latter inlaid with gold or silver. In later times chain armour was adopted for the horse, and its head was protected by a monster-faced mask of iron.

In estimating the traditional Japanese military man, it is essential to know something about the ethical code later called Bushidō (*q.v.*) or the Code of Warriors. Its emphasis was upon frugality, loyalty and filial piety—these basic virtues. The samurai was to live a spartan life, eschewing wealth and ostentation, inuring himself to pain and privation, capable of acts of great bravery and sacrifice, schooled to accept death before dishonour. In considerable degree, this creed was transmitted to the modern soldier of Japan, making him a redoubtable foe.

Development of Modern Military Forces.—In the closing years of the Tokugawa era, foreign knowledge, including information on western military techniques, began to seep into Japan. Amid troubled times, the government itself moved to adopt the military system of the west and organized three divisions of all services, with a total strength of about 13,600 officers and men. Although it was disbanded at the fall of the shogunate, this force served as a model for the imperial government. Meanwhile leading fiefs had also commenced modernization drives; some, like Satsuma, adopted British tactics for their military; others followed France or Germany. In 1870 Yamagata Aritomo, later field marshal and often called the father of the Japanese army, together with Saigō Tsugumichi, another man destined for military fame, returned from a tour of military inspection in Europe and organized a corps of imperial guards drawn mainly from Satsuma, Chōshū and Tosa men. In 1873 a system of universal conscription was substituted for hereditary militarism, and the modern army had been launched. It was to prove itself four years later, when it defeated the Satsuma samurai in their rebellion of 1877. Initially, a large number of European instructors were employed, and the French model was favoured, but after the French defeat in the Franco-German War of 1870–71, Germany became the favourite, and the Japanese army borrowed heavily from German methods.

The Japanese navy also began to develop in the late Tokugawa period. Two ships were purchased from the Dutch and one was presented by Queen Victoria. Dutch navigation experts were hired, and French experts helped the government construct a dockyard at Yokohama. Before the fall of the shogunate, the central government had more than ten warships and the daimyō of Satsuma and Tosa each had small fleets. In 1871, after the restoration, steps were taken to separate the navy from the army. A naval academy, a naval arsenal and a code of naval law were formulated. At that time Japan possessed 17 warships of all sorts, most of them wooden and equipped with steam. In 1873 the first of the naval stations was created and at the same time a British naval adviser, Comdr. A. L. Douglas, was obtained. In two years, large war vessels were being launched from Japanese naval yards, while still others were purchased from Europe, chiefly from Great Britain. A large naval program was initiated in 1882, and by 1886 the number of ships necessitated additional naval stations. These were gradually established at Kure, Sasebo, Maizuru and Muroran.

Military indoctrination in modern Japan strongly emphasized two basic principles. Japanese soldiers and sailors were encouraged to make the supreme sacrifice, if necessary, to secure a military goal; they were taught that surrender under any circumstances was a disgrace. It was the inculcation of those ideas that made possible hara-kiri (*q.v.*) and the banzai or suicide charges of Japanese soldiers during World War II, and the kamikaze or suicide attacks of Japanese pilots against enemy ships. The other basic principle was avid acceptance from the west of technical improvements in military equipment. This principle also included an eager study of western military tactics and strategy. During the period 1880–1945 many Japanese army officers went to Germany for further military training. The Japanese navy tended to look upon Great Britain as a model and in later years developments in the U.S. were closely watched.

Japan imitated in many respects, to be sure, but it also adopted and modified and sometimes improved upon western models. Prior to World War II, Japanese battleships were generally faster than their opposite numbers in the U.S. navy. Early in that war Japanese torpedoes were much more effective, and their star shells and parachute flares also performed well. Japanese binoculars and optical equipment in general have been justly famous. Japan was rather late in the development of aviation, but in the early days of World War II its fighter planes and torpedoplanes proved to be equal if not superior to those of the U.S. From the Chinese-Japanese War of 1894–95 onward, Japanese forces in combat acquired experience and proved flexible in adjusting to field requirements; numerous improvements were made in small arms; the deployment of large ground forces was mastered; in the Russo-Japanese War superb new naval tactics were evolved; in the hostilities against China during the 1930s, experience in guerrilla warfare and aerial bombing was gained. Thus the early Japanese victories in World War II were in part attributable to a seasoned, experienced military force.

As the war continued, however, it became apparent that the Japanese military had weaknesses as well as strengths. Japanese military intelligence was weak, and its ability to keep intelligence from the enemy was also inadequate. Japanese use of submarines and its conduct of antisubmarine warfare were inferior to those of the U.S.

Naturally, one of the most basic weaknesses related to the total Japanese industrial potential as compared with that of the U.S. Japan did not have the industrial capacity to wage a sustained war against the U.S., nor were such capacities as it possessed fully and efficiently exploited in the early, critical years of World War II.

There were also major problems of co-ordination and liaison, both within the services and between military and civilian branches of the Japanese government. Some of these have been discussed (see *The Executive*, above). Initially, the army had been a Chōshū stronghold, while the navy was largely built around men of the old Satsuma fief. In later years the army spread its recruitment net broadly over the nation, becoming a massive organization. It has been estimated that about 30% of army officer personnel had "lower middle class" origins prior to World War II, with some coming from peasant stock. This quality of social mobility within the army contrasted with the more aristocratic qualities of the navy. The army tended to be interested in political power, and some elements were dedicated to social revolution. These hoped to combine external expansion with internal reform, wedding nationalism and the imperial symbol to a program of socialism and destruction of the Japanese "plutocracy." Against army radicals, top naval officers for a time served as guard. The navy tended to be more cautious in its foreign policy, and less attracted to political power or revolution.

In theory, co-ordination of the army and navy was attained through a supreme war council which included the chiefs of staff,

war and navy cabinet ministers, field marshals and fleet admirals and a few special military appointees. A smaller unit comprising only the first two groups mentioned above and called the imperial headquarters group was sometimes used to make decisions. In practice, however, rivalries and faulty co-ordination plagued the Japanese forces greatly. (*See* also AIRCRAFT CARRIER; AIR WARFARE; BATTLESHIP; DESTROYER; WORLD WAR II.)

After World War II.—During World War II the Japanese army reached a strength of about 5,000,000 men organized into about 140 divisions. The navy at the outset of the war had 11 battleships, 9 carriers, 18 heavy cruisers, 22 light cruisers, 122 destroyers and 67 submarines. By the close of the war, this formidable war machine had been shattered; 1,700,000 Japanese military personnel had been killed or wounded; the navy had been almost completely destroyed; Japan had lost all of its overseas territories and much of its prewar wealth. One of the first objectives of the Allied powers was to demilitarize Japan and punish those adjudged guilty of war crimes. Within a short time military administrative units had been abolished, and under civilian demobilization bureaus, millions of Japanese soldiers and sailors had been returned to civilian life. Swords, if not beaten into plowshares, were at least handed out to U.S. troops as souvenirs. Top Japanese war leaders were condemned after lengthy trials and several hundred thousand professional military men were purged from further political activities. (This ban was lifted beginning in 1950.)

There was much talk during this era about Japan becoming "the Switzerland of the far east." Japan was dedicated to permanent pacifism under art. 9 of the new constitution, which read:

> Aspiring sincerely to an international peace based on justice and order, the Japanese people forever renounce war as a sovereign right of the nation and the threat or use of force as a means of settling international disputes.
>
> In order to accomplish the aim of the preceding paragraph, land, sea, and air forces, as well as other war potential, will never be maintained. The right of belligerency of the state will not be recognized.

By 1950, however, changed world conditions had caused certain Japanese and Americans to challenge the concept of Japanese pacifism, and a movement toward limited rearmament for self-defense purposes began. Such a step was first authorized by SCAP in June 1950, when it supported plans for a national "police reserve" of 75,000 men to provide for internal defense. In 1952 the title was changed to national safety force, with 110,000 men and the beginnings of a naval force as a result of U.S. aid. This force was expanded to include an air arm and renamed the national defense force in 1954. In the 1960s Japanese ground, sea and air defense units numbered approximately 200,000 men. In reality, however, national defense still rested mainly upon the power of the United States, which maintained military bases in Japan under the terms of the 1960 security treaty.

The reluctance of Japan to rearm stemmed from many factors: continuing memories of the frightful destruction of World War II and the growth of pacifism in some Japanese circles; fear of a resurgent militarism that would stifle democracy; doubts that Japan should or could compete with major military powers; stronger desires for other uses of Japanese taxes. Even the conservatives were reluctant to rearm rapidly, although they favoured repeal of art. 9. The socialists fought repeal bitterly, continued to support disarmament and favoured a neutralist foreign policy that would exclude U.S. bases in Japan. Meanwhile, the Japanese "defense force," which could not be called an army because of the constitution, grew slowly under civilian control and with few political implications of the prewar type. (R. A. S.)

VII. THE ECONOMY

Japan experienced a rapid and remarkable growth of its economy during the modern era dating from the Meiji restoration in 1868. Following centuries of seclusion under the feudal Tokugawa government, Japan emerged as one of the great industrial powers of the 20th century. Though the country is limited in arable land and natural resources, the labour, energy and ingenuity of its people combined to develop a rapidly expanding economy and to provide a rising standard of living for a population which grew from approximately 30,000,000 in the middle of the 19th century to more than 90,000,000 by the 1960s. (*See Population*, above.)

The growth of Japan's economy took place mainly through industrialization, though concurrently considerable progress was made in raising agricultural productivity. The state played an important role during the Meiji era (1868–1912) in the establishment of large-scale industries. The *zaibatsu* system of enterprise management, which concentrated capital in the hands of a few families, also played a decisive role in Japan's pre-World War II economy. Side by side with large-scale enterprise, a great number of medium and small enterprises grew to produce a variety of manufactures, many of which found their way into international trade. Foreign trade held a continuing and significant position among the many factors contributing to the economic development of Japan. Though the economy was in ruins at the end of World War II, Japan rebounded and made great advances. Production, domestic and foreign trade and the development of transportation and communications continued to expand in the postwar era, and Japan again became one of the world's foremost industrial nations.

A. PRODUCTION

1. Agriculture.—While agriculture remains one of the major occupations in Japan, there has been a steady decline in its relative importance. At the time of the restoration approximately 80% of the population was engaged in agriculture; by the 1960s the figure had dropped to just under 30%, and about two-thirds of the farmers held some additional part-time job. After the early 1950s there was a sharp decline in the number of agricultural workers and a continuous exodus, especially of younger people, from the farming areas. The number of farm households, however, about 6,000,000, has been decreasing at a very slow rate.

Japan has long had an efficient and productive agriculture in spite of difficulties and obstacles. Because of the mountainous nature of the country, the amount of arable land is strictly limited and constitutes only a little more than 15% of the total land area.

Certain physical and climatic features are distinctly advantageous to Japan's agriculture while others are equally disadvantageous. In the south and west there is generally greater rainfall, and in many parts of this area it is possible to cultivate two crops a year, usually paddy rice in the summer followed by a winter dry crop, such as wheat. In the north and east, frost and heavy snowfall in winter make it difficult and in many cases impossible to harvest a second crop.

Fertilization.—The land is not particularly fertile. Much of the soil is formed from acidic lava, and its chemical composition makes cultivation difficult. It is also highly porous and readily eroded. For this reason intensive fertilization is necessary. There is almost universal use of night soil or human manure, which is an excellent fertilizer but which also facilitates the spread of typhoid and dysentery if improperly composted. The construction of compost pits is officially encouraged. But night soil and other organic fertilizers (including composts and fish products) are not enough. The depletion of the soil is so great that in most areas Japanese farmers are forced to make heavy use of mineral and chemical fertilizers, especially nitrates. In certain areas it is necessary to add lime to the soil to make up for the natural deficiency in calcium or to make copious use of potash and phosphates. The widespread use of chemical fertilizers in the 20th century is one reason why Japan's food production has been substantially increased. By mid-20th century, the amounts of chemical fertilizers used per acre were higher than for any other country except the Netherlands.

General Characteristics.—Traditional Japanese agriculture is characterized by small-scale, intensive cultivation, supported primarily by manual labour. The chief characteristics, aside from fertilization, are irrigation, terracing, multiple cropping, intercropping and transplantation. The average farm holding is $2\frac{1}{2}$ ac., and more than half of the farmers cultivate farm units that are even smaller. This means careful and intensive cultivation, and frequently the fertilizer is applied directly to each growing plant. While Japanese farms continued to practise intensive cultivation, there were many and far-reaching changes in agricultural technology in the post-World War II period. Among the major changes were: a large increase in the use of chemical fertilizers and agricul-

tural chemicals, such as insecticides and weed killers; the widespread use of new higher-yielding varieties of rice and other crops; and large increases in the production of meat, dairy products, fruits and vegetables. The most dramatic aspect of Japan's changing agricultural technology was the very rapid expansion in the use of farm machinery. For example, virtually all farm households adopted the use of power threshing machines, and the number of power cultivators (or hand or garden tractors) reached an estimated 1,000,000 units. Gross agricultural production in the early 1960s was about 40% higher than in the early 1950s, and, following several years of bumper crops, Japan became essentially self-sufficient in rice production despite its very large population and small amount of land. The great increase in agricultural production brought about by improved technology was accompanied by a significant decrease in the number of agricultural workers, and the percentage of population engaged in agriculture approached that of the advanced industrial nations of the west and was far below that of the rest of Asia.

The Japanese government has taken an active role in the development of the high level of agricultural productivity, among the highest in the world, through various programs designed to encourage the spread of scientific farming methods, and has also supported programs to improve rural living standards. Experimental stations are located throughout the country; extension service programs are common; and the government has sponsored the formation of co-operative societies to help the farmer market his crops and to provide credit at reasonable rates.

While life in the farming communities had not changed as rapidly as in the big cities, major changes had taken place since the early 1950s. Living standards were higher, although they were still generally below those of the city, and, with the expansion of transportation facilities and mass communication, the village was becoming more and more an integrated part of the modern industrial society. Literacy was essentially universal; almost all households had electricity and radios; and television sets and other appliances were widespread through rural Japan. The integration of the rural and urban areas was accelerated by the large numbers of farm household members who had full or part-time jobs in the towns and cities.

Social Conditions and Land Reform.—The prolonged world depression of the 1930s seriously affected many cottage industries and caused widespread hardship among the farming community, and Japanese farmers experienced serious economic and social problems in the period preceding World War II. Toward the end of the war the lot of the Japanese farmer improved when the food shortage caused the price of agricultural products to soar. The condition was temporary, but before an agricultural recession could set in, the U.S. occupation authorities persuaded the Japanese government to make far-reaching land reforms.

Prior to World War II, there was considerable concentration of land ownership in the hands of a few, with about 50% of the arable land being held by less than 10% of the farm owners. Many landowners leased part or all of their farm lands to tenants, sometimes under rather harsh conditions; rentals, on a share-cropping basis, of 50% of the crop were not unusual. Among such owners it was customary to distinguish between resident owners and absentee owners. Resident owners lived in the district and kept in personal touch with their farms, but they left the cultivation of part or all of their lands to tenants. Absentee owners, on the other hand, lived outside the district and took no active part in the cultivation of the land they possessed.

The Land Reform act of 1946 aimed at making a radical change. A strong effort was made to improve the lot of those who remained tenants and who were not able or willing to secure their own land. In place of the old verbal and often vague arrangements between landlord and tenant, the tenant was to be given a written contract that clearly specified his rights. Rentals were not permitted to be more than 25% of the value of the rice crop nor more than 15% of the value of other crops. More important was the effort to break up large landholdings and to permit a considerable percentage of the former tenants to become landowners. Absentee owners were forced to sell their land. Resident owners, on the other hand, were permitted to retain 2½ ac. that they could continue to lease to tenants. Owner-cultivators were normally permitted to retain as much as 7.35 ac. In Hokkaido, because of unfavourable conditions then prevailing, the size of permissible landholdings was somewhat larger. There were cases of inequity and injustice in the application of the law, but most observers agreed that on the whole the Land Reform act worked well. Tenant farming was not eliminated but was greatly reduced.

Staple Agricultural Products.—The Japanese make a sharp distinction between two types of farm lands—lowland and upland. Approximately 53% of the total arable land is classified as lowland, the remainder as upland. The lowland farms are considered by far the more valuable and are almost entirely devoted to the cultivation of rice, the most important crop and the main staple of the Japanese diet. Per capita consumption of rice amounts to about 250 lb. annually. The paddy fields are supplied with water by an elaborate system of irrigation. Approximately 8,000,000 ac. are devoted to the cultivation of rice.

The upland farms are mostly on the hillsides and are generally unsuitable for the cultivation of rice. As far as possible they are terraced and are used for a variety of crops, mainly those which do not require intensive irrigation, including wheat, barley and several varieties of vegetables. The total amount of land devoted to the cultivation of such crops amounted to more than 5,000,000 ac.

Small amounts of cotton, hemp and flax are grown, but more than four-fifths of the land is devoted to food crops. This is partly a result of the efforts of the government to make Japan as self-sufficient as possible in food production, which was seriously imbalanced after the loss of the colonies in 1945. Rice predominates partly because of custom and tradition and partly because it yields more calories per unit of land than any other cereal. Corn (maize) never proved popular in Japan except in poor-land areas, and such cereals as wheat and barley are grown to supplement the rice diet.

Tea and Silk.—The tea and silk industries have long played a peculiar role in Japan's agrarian economy. The Japanese are great tea drinkers and the tea ceremony has evolved as an aesthetic cult. At one time Japan exported huge quantities of tea, especially to the United States. World War II practically ruined this trade. In addition, U.S. taste in tea had gradually shifted from the type of tea grown in Japan proper to that grown in India, Ceylon and Formosa.

Silk production once played a major role in Japan's export economy and later experienced major reverses. Sericulture was intimately tied up with Japan's agriculture and was once an important part-time occupation of many Japanese farm households. The raising of silkworms was practised for many centuries, and reached large proportions during the latter part of the 19th century when Japan's superior methods of processing and grading silk enabled it to take a considerable portion of the trade from China. In the first quarter of the 20th century Japan was the greatest producer of silk for the world market. The trade was dealt a stunning blow by the depression of the 1930s. Silk was considered a luxury and hence was sensitive to a fall in the standard of living.

By 1932 the price of silk had dropped to less than one-tenth of the 1920 price and was finding few buyers. While there was some recovery in price, especially after the outbreak of World War II, silk never reached the price level of the 1920s and declined proportionally in its contribution to Japan's foreign trade. In 1939 silk exports represented only 14.1% of Japanese exports as opposed to an annual average of 36% between 1920 and 1938. The loss in income from cocoons and from wages in silk filatures and small domestic weaving sheds was one of the most important causes of Japan's agrarian depression during the 1930s, since it deprived a large proportion of the farm households of cash receipts above a bare subsistence level and contributed to rural unemployment.

World War II, which made it impossible to export silk to the United States, dealt another serious blow to the industry. The pressure for food was so great that most lands formerly devoted to the cultivation of mulberry were transformed into food-producing areas. By the end of the war the silk-production capacity of Japan was less than 30% of the prewar figure. After 1945 Japan made

strenuous efforts to re-establish its silk export trade. Quality was improved and prices lowered. But in the meantime the U.S. public had become accustomed to the use of such synthetic fibres as rayon and nylon, and the reintroduction of silk met with only a lukewarm reception. In the 1960s there was still doubt as to the future of silk in Japan's foreign trade, although there had been an increase in domestic and foreign demand for raw silk and silk products since the mid-1950s.

Animal Husbandry.—Animal husbandry plays a minor but growing role in Japan's economy. In the past the Japanese were never a pastoral people because of the scarcity of pasture lands, while their prejudice against eating meat, fostered by Buddhism, tended to retard the breeding of animals for food consumption. Moreover, there was a national prejudice against the consumption of milk and dairy products, but this was being gradually overcome in the second half of the 20th century. Because of heavy population pressure, the Japanese have been reluctant to utilize arable land for raising livestock; the food value produced from an acre under grain is many times larger than the food value obtained by feeding the grain to animals.

For many years the one animal that played an important role in Japanese agrarian life was the domestic fowl. Many people who refused to consume beef and pork were willing to eat eggs and chickens. Before World War II there were about 50,000,000 fowl; in 1946 there were only about 15,000,000. With the subsequent easing of the food situation, the number of domestic fowl returned to prewar figures, and the poultry and egg industries have expanded rapidly.

Although per capita consumption of meat and dairy products remained low compared with the advanced nations of the west, changing diets and higher living standards caused a rapid increase. The number of dairy cattle increased from about 200,000 head in the early 1950s to nearly 1,000,000 by the early 1960s, while the number of pigs increased from 500,000 to about 2,000,000.

2. Forestry.—With its abundant rainfall, Japan is a well-wooded country, and green hillsides are familiar features of the landscape. More than 60% of the total area is considered as productive forest. Forest covered more than 55,000,000 ac. in the second half of the 20th century. About half of this area was owned by various government agencies (national, prefectural and local), the rest by private individuals or corporations. The Land Reform act did not affect forest ownership.

There are three main forest zones: (1) The southern zone, characterized by broad-leaved evergreen and deciduous trees, of which the oak is the most important. This zone covers the islands of Kyushu and Shikoku, as well as the southern part of Honshu, the main island. (2) The central zone, characterized by a mixture of deciduous trees (beech, ash, chestnut, poplar) and conifers (pines, cedar). It includes most of Honshu and a large part of Hokkaido. (3) The northern zone, characterized chiefly by conifers (spruce, fir, birch), includes most of the northern and eastern part of Hokkaido and the areas of high elevation in Honshu. There are more than 1,100 species of trees and shrubs, including many varieties of bamboo, in the southern and central zones.

Japan has long made great use of its forest resources. Unlike China, where most houses are built of brick or mud, Japanese domestic architecture is characterized by wooden structures. The major part of the furniture is made of wood or bamboo. Even in the manufacture of utensils, wood is used in preference to metal. For centuries the Japanese have relied upon wood (or charcoal) for both cooking and heating. Modern developments accentuated the need for forest products. The building and maintaining of railroads required large numbers of wooden ties. From the 1920s Japan needed huge quantities of wood pulp and cellulose for the manufacture of paper and rayon. The forests, rich as they were, did not prove sufficient to meet all Japan's requirements, and large quantities of timber were imported, principally from Canada and the Scandinavian countries. After World War II new techniques for using broadleaf trees in the pulp industry made Japan more nearly self-sufficient. In 1960 imports started coming into the country from its new pulp plant built in Alaska.

Large sections of the Japanese forests are useful only for fuel woods and do not produce construction timber. The mountainous terrain of Japan makes many forested regions difficult of access, and the lack of suitable transportation facilities also hampers the exploitation of at least 10% of Japan's total timber resources. Post-World War II reconstruction of millions of damaged houses put an immense strain on forest resources, and Japan cut about twice as much timber as it grew. If that continued, it was estimated that Japan would be deforested in about 50 years. The Japanese government established a special forestry bureau under the ministry of agriculture which was given direct control over the publicly owned forest land and also indirect control over the privately owned forests. The bureau's aims were to provide subsidies, prevent forest fires and improve the methods of woodcutting, reforestation, etc.

3. Mining.—Japan's rise to a position of leadership in industry and commerce is amazing considering that it is relatively poor in many of the basic raw materials usually considered the foundation of industrial and commercial development.

Japan's mineral resources are meagre. There are records of mineral deposits as far back as the 7th and 8th centuries A.D. During the Tokugawa shogunate, small-scale attempts were made to exploit the copper deposits in Tochigi and Ehime, the gold mines of Sado, off the west coast of Japan, and the coal resources of Fukuoka and Saga. Shortly after the restoration the government began to introduce modern methods of mining and of prospecting for hitherto undiscovered mineral deposits. Elaborate geological surveys were carried out, but on the whole the results proved disappointing. It was found that the Japanese islands possessed a great variety of mineral resources, but few were in sufficient quantity and quality to supply the country's projected industrial needs.

Japan is reasonably self-sufficient in the so-called precious metals. The production of gold and silver, though not large by world standards, is sufficient to satisfy domestic requirements. Platinum is found only in minute quantities.

Japan is an important producer of sulfur and copper. For many years domestic production was more than sufficient to meet local requirements, permitting the export of considerable quantities of both commodities. The increasing industrial and military requirements of the 1930s and 1940s altered that situation. Japan was still able to meet its sulfur requirements, but it was necessary to import large quantities of copper. In the second half of the 20th century, copper production had risen to over 250,000 tons, a sharp increase but not enough to supply the rapidly increasing demands of industry. Production of about 250,000 tons of sulfur was sufficient to cover demand. Japan was almost self-sufficient in zinc, with an annual production of 150,000 tons, and limestone was relatively abundant, with production about 40,000,000 metric tons annually. Japan was a leading producer of pyrites, used in the manufacture of sulfuric acid, with an annual output of about 3,500,000 tons.

Iron and the Ferroalloys.—There is a great need for the minerals used in steel production, the most important of which are iron ore, various ferroalloys and coking coal. In these resources Japan is inadequately supplied. Economic iron deposits are found only in small quantities. Domestic sources have supplied only about 10% of Japan's iron requirements. However, through the increased use of iron extracted from pyrites, iron sands and other ferrous materials, Japan was able to produce about one-third of its iron requirements in the early 1960s.

While Japan has small, scattered reserves of many of the metal ores, such as chromite and manganese, the large and increased demands of industry, as well as high costs of domestic production, have led to larger and larger imports of foreign ores. Supplies of other ferroalloys used for the production of special-purpose steels (such as nickel, tungsten, vanadium and molybdenum) are also inadequate. Japan has very little high-grade coal and depends on imports for about half of its coking coal requirements.

Light Metals.—The production of aluminum depends upon a large supply of bauxite, aluminum shale or alunite. Japan has no significant deposits of any of these minerals and depends on imported raw materials for the rapidly expanding aluminum industry.

There remain unexploited deposits of high-alumina clays scattered throughout Japan. There is some possibility for increasing magnesium production, since this mineral can be extracted from sea water, but by the early 1960s large-scale production had not been achieved.

4. Fisheries.—Fish and sea food provide the main source of animal protein in the Japanese diet. After the restoration marked strides were made in deep-sea fishing, and eventually an important export market for fish products was built up. In the 20th century Japan became the leading fishery nation, in several years producing more than 50% of the world volume. The industry, not unexpectedly, suffered a decline during World War II. During the early U.S. occupation period sharp limitations were placed upon the waters in which Japanese subjects were permitted to fish, and the annual catch at that time was only about 35% of prewar levels.

With the return of Japanese fishing fleets to international waters, Japan's fisheries again yielded the highest catch in the world, amounting to more than 6,000,000 tons by the 1960s and exceeding that of the most prosperous pre-World War II period. In addition to sea fishing, there is some inland-water fishing based on culture and breeding in flooded paddy fields and shallow seas. An important whaling industry has also been developed, with annual catches of more than 18,000 whales.

Among the kinds of fish that figure largely in the Japanese catch are herring, sardines, bonito, tuna, sauries and sea bream. Sea foods, such as prawns, eels, cuttlefish and squids, are of great importance.

5. Power.—Of the major energy sources—petroleum, coal, water power and natural gas—Japan is very weak in two, petroleum and gas.

Petroleum.—Japan has made extensive use of petroleum products but was never self-sufficient. Extensive drilling operations were carried out, but by the 1960s only a few successful wells had been tapped, chiefly in Akita and Niigata prefectures in northwestern Honshu. Only about 4,500,000 bbl. of crude petroleum a year were produced, which was less than 2% of normal requirements, leaving the bulk to be imported. During World War II, when U.S. supplies were cut off, Japan was able to utilize the wells and refineries of Sumatra and Borneo. The cutting of that supply line was a factor in Japan's industrial and military collapse. In the 1960s Japan obtained most of its petroleum from areas in the middle east, including large new fields developed by Japanese interests in the offshore area of the Saudi Arabia-Kuwait neutral zone in the Persian gulf.

Coal.—Coal, including lignite, supplies nearly half of Japan's total energy, and the country appears to have adequate resources. Annual coal output normally amounts to more than half of the total mineral production. Before World War II annual production of coal was more than 50,000,000 tons a year. There was a marked drop in the immediate post-World War II period, partly resulting from the enforced repatriation of Chinese and Korean miners. The prewar level was attained in the late 1950s and theoretically this should be sufficient to meet the minimum requirements, but Japanese coal comes in thin, crooked and fragmentary seams, making production costly. Moreover, most of the coal is of rather low quality. It is estimated that only 4% is anthracite, about 75% low-grade bituminous and the rest subbituminous. Little of this domestically produced coal is suitable for coking purposes. Most of Japan's coal production comes from mines in Kyushu and Hokkaido. There are small scattered mines on the main island of Honshu.

Electric Power.—There are relatively large water-power development and potential in Japan as a result of the mountainous nature of the country and an abundant rainfall, which make the rivers and streams well suited for hydroelectric power. Efficiency of production, however, sometimes suffers from seasonal variations in rainfall, a deficit which is met by coal-generated thermoelectric plants. The generating capacity permits the widespread use of electricity in rural as well as urban areas. By the early 1960s the total power output amounted to about 100,000,000,000 kw.hr. annually, in a proportion of roughly one-half hydropower to one-half thermal power.

Following the establishment in Jan. 1956 of the Japan Atomic Energy commission, considerable progress was made in developmental work leading to the earliest possible generation of commercial electric power through atomic reactors.

6. Industries.—Japanese industrial progress was steady but not remarkably rapid until World War I. Full tariff autonomy was not achieved until 1911, so that young industries could not be fully protected. Japan was, moreover, short of capital, and though foreign loans were raised from time to time, they were of modest dimensions. It was not until 1914–19, when the major industrial powers were concentrating on the output of munitions, that Japan was able to make rapid headway in foreign trade and shipping and become a creditor instead of a debtor nation. With the foreign balances thus built up, Japan rapidly increased its industrial capacity. Economic depressions in the decade 1920–30 brought widespread distress and unemployment but also forced upon Japanese industry drastic measures of retrenchment and reform. By 1932 a thoroughly rationalized manufacturing industry, assisted by a rapidly developing educational system combined with the advice of western industrial experts, was able to take advantage of a great surplus of labour from an overpopulated countryside and, aided by a depreciated currency, to supply export goods at amazingly low prices in world markets. The most spectacular success was in the textile industry. (*See* EMBROIDERY and TEXTILES for Japanese textile art.) Ōsaka became a Japanese Manchester. The large companies that operated the mills as a general rule employed country girls who worked for two or three years, receiving food, lodging and enough wages to provide them with a dowry when they left work to get married. While wages in Japanese mills and factories were very low by western standards, conditions of living and working, hygiene and social welfare compared favourably with those of other Asian countries.

Textiles constituted Japan's principal manufacturing industry for several years following World War I. The cotton-textile industry experienced the most important growth. As a producer of cotton goods, Japan came to be of major importance in the world market, ranking only behind the United States and Great Britain. The woolen industry also underwent a notable expansion and Japanese woolen goods won a substantial foothold abroad. Percentagewise, however, it was the rayon industry which experienced the most phenomenal rise, especially during the 1930s. In 1930 Japan's production of rayon yarn was only about 16,000 tons; by 1937 the figure had jumped to more than 150,000 tons.

Japan's industry also became more diversified. Among the industries which underwent notable development during this period were paper, cement, beer, soap, matches and bicycles. Japan became an important producer of clocks and watches. Various branches of the glass industry became significant. Japan was able to produce and export large quantities of electric light bulbs. It was also able to compete with Germany in the production of high-grade optical lenses. Certain old traditional crafts, such as lacquer work and ceramics, were put on a modern industrial basis. The great expansion of Japanese industry at this period was identified with light and consumer industries rather than heavy and producer industries. The latter, however, were not entirely neglected. This was especially true of the chemical industry. Japan became a major producer of chemical fertilizers, sulfuric acid and caustic soda.

During the period 1914–37 most of Japan's industrial development was characterized by the prevalence of the free-enterprise system, with the government playing only a minor role. The government did, indeed, provide tariff protection, and in some cases gave direct or indirect subsidies to infant industries, but compared with the period of the 1880s, government sponsorship and control were relatively insignificant. Because of their possession of capital and technical experience, the *zaibatsu* or big industrial combines were able to secure an important share in Japan's newly expanded industry. But the *zaibatsu* were never able, either individually or collectively, to monopolize the field. Many important manufacturing firms arose completely independent of *zaibatsu* control. Some of these firms carried out large-scale production in big factories, as with the paper industry. In other cases production in any one enterprise was on a relatively small scale and was centred

in factories with only a dozen or so employees. Of great importance was the fact that even Japan's tiny cottage industries were able to take advantage of the country's industrial expansion. In 1936 there were approximately 3,000,000 persons working in factories having five or more operatives, but an equal number of persons were also employed in workshops with less than five operatives, many of them working with their families in their own homes. Cottage industries were prominent in the spinning and weaving of silk and cotton and in such traditional crafts as the production of ceramics and lacquer. They also played an important role in the manufacture of bicycle parts and in many other branches of Japanese light industry, small jobs often being assigned on a subcontracting basis.

Development From 1937 to 1945.—During the middle 1930s, and especially after 1937, there was a marked shift in the development of Japanese industry. The militarists had secured control over the government and, with the beginning of the so-called "China incident" in 1937, Japan was placed on a war basis which lasted until the end of 1945. A significant development in this connection was the enactment of the National Mobilization law which gave the government unlimited power to utilize the manpower, industry and natural resources of the country.

By 1937 it was clear that because of expansionist plans Japan might become involved at any time in a major war with the western powers. This meant that industrial reorientation was necessary since Japan still had to import many essential items from the west and these would be cut off in the event of war. Above all, it was essential that greater emphasis be placed on the heavy and producer industries.

Japan was still relatively backward in the production of steel, machines and machine tools, to say nothing of the airplanes, tanks and trucks which were vital for war. Under government auspices strenuous efforts were made to meet those deficiencies, and on the whole they were strikingly successful. Thus in 1930 Japan was producing only a little more than 2,000,000 tons of steel annually; by 1941 steel production was about 7,000,000 tons; by 1944 plants had been enlarged to provide a capacity of 14,000,000 tons, a production level that was not attained until the late 1950s. The Japanese proved to be first-rate ship designers and constructors and by the beginning of World War II had completed two of the largest and most powerful battleships in the world. In 1930 the motor-vehicle industry was in its infancy, and almost all cars and trucks were imported; by 1942 Japan was producing more than 40,000 trucks. In 1941 Japan was producing about 5,000 aircraft annually; by 1944 the figure rose to over 25,000. The year 1944 marked a peak in Japan's industrial production. By 1945 its factories were already suffering serious bomb damage and were no longer receiving the raw materials necessary to keep them in full operation.

Conditions After World War II.—By the time of Japan's surrender in Sept. 1945, its industry was a shambles. Larger factories and mills were either destroyed or rendered inoperable and required thorough rehabilitation. Many factories that remained could produce only war equipment, the manufacture of which was prohibited. Factories that had once produced large amounts of peacetime consumer goods, such as textiles, had gone to ruin. Only about a quarter of the approximately 10,000,000 spindles in use in 1937 were still in operation. There was a lack of raw materials and money. It is not surprising that early in 1946 Japan was operating at only about one-third of the 1930–37 level.

During the early period of Allied occupation the rehabilitation of industry was handicapped by political considerations, which included controls, purging, reparations and decentralization, the latter aimed at breaking up the *zaibatsu;* for a while serious thought was given to the deindustrialization of Japan.

In the late 1940s the threat of Communist expansion in the far east caused the United States to promote the industrial rehabilitation of Japan, then regarded as a potential ally. The more controversial aspects in the program of reparations, of purging and of decentralization were quietly shelved. The Japanese began to resent the constant regulation of industry by bureaucratic agencies and in 1946 chose Yoshida Shigeru, the leader of the Jiyūto (Liberal party), as premier. The occupation authorities co-operated with the trend and permitted the gradual weakening of controls. (See *History*, above.)

Japanese industry was quick to respond to these developments. Factories were rehabilitated and put back into operation. The long-neglected consumer and light industries were especially prompt in re-establishing their prewar standing, and Japanese exports once more began to play an important part in world markets. Beginning in the mid-1950s, the military campaign in Korea carried out under United Nations auspices had a favourable effect on Japanese industry. The U.S. government placed large orders with various manufacturing firms, and this helped to rehabilitate some of Japan's heavy industries.

By the second half of the 20th century great strides had been made in over-all industrial production, and the all-industries production index not only reached its prewar level but far surpassed it. In spite of continued dependence on imported raw materials, chronic shortages of capital and changing demands of foreign trade, Japan's economy continued to grow at an extraordinary rate. While major advances were made in the older consumer goods industries, such as textiles, china and food processing, the most spectacular growth took place in such industries as metals, machinery and chemicals, and Japan became a leading producer of heavy electrical machinery, rolling stock, optical goods, sewing machines, motor vehicles, petrochemicals, fertilizers and plastics. Japan led the world in shipbuilding, had the world's third largest petroleum-refining industry, was fourth in steel production and was second only to the United States in the production of radio sets and television receivers. Industrial growth was among the highest, if not the highest, of the world's industrial nations, and living standards were beginning to approach those of several of the western industrial nations.

Japan's industries are concentrated in the highly industrialized area between Kwanto and northern Kyushu. There are four main industrial agglomerations: the most important is located on the Kwanto plain around Tokyo; the second centres about Ōsaka and Kōbe; the third area focuses on Nagoya; and the fourth, in northern Kyushu, consists of the Kita-Kyushu metropolitan area (formed from Moji, Kokura, Yahata, Tobata and Wakamatsu in 1963) and Shimonoseki, Fukuoka, Nagasaki, Ōmuta, Saga and Kumamoto. (*See* also *Transport and Communications*, below, for further aspects of the motor vehicle, railway, shipping and aircraft industries.)

B. Trade and Finance

1. Trade.—Trade during the Tokugawa period was of a very restricted character because every feudal chief set up barriers around his own fief and opposed commercial intercourse outside its borders. The central government, during the period of Japan's seclusion from the outside world, forbade any commercial contacts with foreigners except for limited trade with China and with the Dutch. (See *History*, above.)

However, some commercial arrangements were necessary, and the origins of Japanese trading and banking are remotely connected with the practice which developed of tradesmen taking over the disposal of the surplus rice from the various feudal principalities, selling it to the highest bidders, transmitting the proceeds to the feudal chiefs and receiving commissions for their services.

An embryonic form of modern capitalism can also be detected in the arrangements which were worked out for trading companies, with shareholders in the provinces and an authorized representative in Tokyo. The number of merchants who could reside in the capital was regulated, and the granting of a trading licence was a valuable privilege worth a considerable sum of money. A big guild of Tokyo fish dealers was organized in the 17th century. In return for loans which the guild advanced to the fishermen for boats and nets, the latter had to sell their fish exclusively to a designated wholesale merchant, who in turn sold the fish at prices fixed by the guild. Another guild was formed for the purpose of promoting the coastal shipping which alone was permitted under the regulations of that time.

Money operations were also brought under the control of guilds,

and in Ōsaka forms of commercial credit came into use and received legal sanction. Promissory notes, bills of exchange, storage delivery receipts and various forms of money orders came into general use. The guild system operated in favour of its wealthy charter members and led to a good deal of jealousy and discontent, with the result that the guilds were abolished by a sweeping decree of 1841, although they were permitted to reorganize on a somewhat broader basis in 1851. Such trade and money-exchange arrangements as existed before the restoration were largely confined to the capital, Tokyo, and to the commercial centre, Ōsaka. The great majority of the Japanese lived under a very simple form of economy, paying their feudal dues and sometimes receiving compensation in rice and other commodities, while everyday needs were supplied by small local industries.

Japan's foreign trade made slow progress at first, even after the country had begun an accelerated industrial-development program. There were financial difficulties because the relation of silver to gold was much more favourable in Japan than in the west. It was also difficult to get rid of the old tradition of bureaucratic regulation of every detail of trade, a situation not favourable to the free flow of commerce. Japan had comparatively little to offer in exchange for the manufactured goods, equipment and machinery which were needed to develop the country industrially. Principal exports during the first decades of contact with the outside world were silk, tea, porcelain, curios, copper and marine products.

Japan's foreign trade, which was valued at a little less than $7,500,000 in 1870, was about $27,500,000 in 1890. By 1910 Japanese exports were about $223,000,000; by 1920, $945,000,000. Japan gradually began to export commodities which it had formerly imported—flour, sugar, leather, hardware and clothing. By the time World War I broke out Japan was beginning to compete vigorously with Great Britain in Asian markets.

Throughout the 1920s and in the early 1930s Japan was on the offensive in the field of foreign trade. The big Japanese combinations of capital, Mitsui, Mitsubishi, Sumitomo and others, created powerful sales organizations and shipped their manufactured products to all corners of the world in privately owned ships. Swamping of U.S. and European markets with Japanese goods did not occur, partly because of tariff and quota restrictions and partly because Japanese products, apart from a few specialties, were not of sufficiently high quality to appeal to western customers. But in the markets of Asia and Africa, where many people were too poor to buy the more highly priced and durable European and U.S. products, the cheap goods of Japan made tremendous inroads, especially after the world depression had reduced purchasing power still further. Between 1928 and 1935 Japan became the leading textile exporter in the world. During the same period there was a cut of approximately 50% in British textile exports. Price was undoubtedly a main factor in this shift of markets. It was estimated that the Japanese were selling textiles at half the British price.

Foreign Trade, 1937–45.—By 1937 Japan was a leading contender in the world market. Foreign trade played a major role in sustaining the domestic economy and was essential for economic survival. After Japan went on the gold standard in 1897, however, there were few years when its balance of merchandise payments was not unfavourable. Imports grew more rapidly than exports, and there was a chronic adverse balance of trade. In most cases, however, this trade deficit was more than offset by net earnings on shipping and on foreign investments.

Japan had built up its huge foreign trade during the period when international commerce was organized on a fairly free and competitive basis. In 1937 a great change took place in national policy, a change reflected not only in industry but also in the conduct of commerce. At that time the militarists in control of the government were deeply imbued with a semifascist statist philosophy. Thus Japan was converted to a belief in economic nationalism, economic imperialism and the rigid regulation of all commerce by governmental agencies. The government imposed restrictions on imports, especially from the western world, with the result that in 1938 and 1939, for the first time in many years, exports greatly exceeded imports. Japan was determined to strengthen its trade position in China by securing military and political control over that country. However, Japan was still heavily dependent upon materials and markets in areas controlled by the United States, by the Netherlands and by Great Britain. This situation came to a head in July 1941 when these powers embargoed all trade with Japan pending a political settlement. Japan decided upon a desperate gamble. If it could conquer and hold the Philippines, Malaya and Indonesia it would become economically self-supporting. Even trade with the United States, once so rewarding, could be sacrificed without major damage. War was, therefore, decided upon with the announced economic goal of the "greater east Asia co-prosperity sphere"—though the real goal was to secure an area dominated by Japanese industrial and commercial organizations. Governmental control over these organizations became complete. In 1943 previous control agencies were consolidated into a newly established Foreign Trade corporation completely dominated by the government. It practically monopolized all Japanese export trade facilities during the remainder of the war period. In some of the newly conquered areas special development companies were organized in order to establish and maintain Japanese economic control. (See *History*, above.)

Foreign Trade After World War II.—The surrender of Japan in 1945 resulted in the collapse of the entire economic and commercial structure. In 1946 the Foreign Trade corporation was dissolved, and its place was taken by the board of foreign trade, which was completely under the control of the occupation authorities. For nearly two years all imports and exports were conducted on a governmental basis. During the same period there was also a tendency to place restrictions on the size of Japan's foreign trade. In 1947 that policy was altered. Governmental and occupation controls were slowly relaxed and in Aug. 1947 Japan's private trade was reopened.

Instead of demanding tribute or reparations, the U.S. government granted to Japan nearly $2,000,000,000 during the occupation period (1945–51). Much of the money was given in the form of emergency food supplies to prevent disease and starvation, but it greatly eased Japan's economic situation. In addition the U.S. government made large grants of credit to permit the importation of raw materials for processing and re-export. As a result of these measures Japan's international commerce began to revive, and by 1951 Japan was again a major factor in the world market. The most important market areas for Japanese exports in the early 1960s were North America and Asia. For various economic and political reasons, very little trade was carried on with the People's Republic of China.

Adverse balances of trade created by an excess of imports over exports were countered to some extent by direct aid from the U.S. and special procurement orders for U.S. forces based in Japan. However, the balance of international payments in some years showed deficits, for example, in 1953, 1957 and 1961, and constituted a precarious situation.

Domestic Trade.—The importance of domestic trade is noteworthy. Internal trading within the Japanese archipelago is probably the largest and most active for any Asian country.

2. Banking and Currency.—Financial institutions were adapted to the peculiar needs of Japan by the Meiji leaders in their efforts to accelerate economic development. The old banking and currency systems which operated under the feudal Tokugawa regime were abolished, and new methods were introduced, modeled on U.S. and European systems. Toward the end of the 19th century a large number of commercial and savings banks were founded by private entrepreneurs. The government established banks with special functions—the Bank of Japan (for the management of treasury funds and foreign exchange control *see* JAPAN, BANK OF), the Yokohama Specie bank, later the Bank of Tokyo (for foreign exchange), a hypothec bank (for agricultural loans), the Industrial bank (for industrial loans), the Hokkaido Development bank and various colonial banks. These banks were important instruments of national economic policy from the time of their establishment. The government promoted and financed key industries, such as railways, steel and shipbuilding, largely through taxation and loans.

The Japanese financial system depends more on banking institutions than on a securities market for long-term funds. From the Meiji era, a complete stock and bond market system in theory existed in Japan alongside the banking system. However, in practice most debentures were in the hands of banks. Loans for the purchase and sale of shares were made by banks to investment houses and to individuals. Stocks served as security for such loans. The demand for long-term loans, which in the west is normally met through the issue of securities, either shares or debentures, has in Japan been provided by the banks. Thus Japanese banks, though patterned after the English commercial banks whose functions were to receive deposits and to supply short-term operating funds, became more like the mortgage banks of Germany.

Prior to World War II the Japanese short-term or call-money and discount markets were relatively underdeveloped by western standards, and funds in these markets were inadequate. The short-term money market normally serves to keep funds circulating among banks and to maintain reserves. The inflation following World War II brought a decline in transactions by drafts. The concept of maintaining reserves was also gradually weakened among bankers who regarded them as a luxury that could not be afforded by a capital-hungry nation. As a result the banks came to depend on the Bank of Japan more than ever. After 1950 a return to financial "normality" resulted in an increase in funds handled in the call-money and discount markets, though they still fell short of prewar levels.

Japanese banking, despite outward similarities to western banking, developed features quite different from the financial systems it chose as models. The peculiar features of Japanese banking reflect the chronic shortage of capital which has plagued Japan. Following the restoration, the demands of the economy for rapid development could not wait for an accumulation of capital. Thus Japan's "hothouse" growth had to employ to the fullest the credit-creating power of the banking system. As a consequence the banking interests wielded considerable power in financial circles. Following World War II, changes were prescribed which aimed at democratizing economic institutions. These attempted to effect the withdrawal of banks from long-term financing. In the 1960s, however, banks were once again engaged not only in providing short-term credit, but also were reverting to their old practice of making long-term loans.

A great variety of financial and banking institutions has arisen in Japan to meet the complex needs of its economy. These include the Central Co-operative Bank of Agriculture and Forestry and the Central Bank for Commercial and Industrial Co-operatives. Other important financial institutions are agricultural co-operative associations and prefectural credit federations, mutual loans and savings banks and insurance companies. In addition, there are special government organs such as the Trust Fund bureau, Post Office Life insurance, the Japan Development bank, the People's Finance corporation, the Housing Loan corporation and the Export-Import Bank of Japan. There are money markets: call-money market and call-money brokers; discount market and bill brokers; stock market with stock exchanges and stock companies.

With the establishment of the central Bank of Japan in 1882 a new currency-issue system was also inaugurated. Convertible notes were first issued in 1885. In addition to the specie reserve (gold) issue, an "elastic security reserve limitation system" was adopted whereby a security reserve issue was permitted against government bonds and other securities, with 70,000,000 yen as the maximum limit. Subsequently the security-issue ceiling was raised and in 1930, following the example of other countries, the embargo on gold was lifted. At the end of 1931, however, gold was again placed under embargo and in 1941 the currency-issue system was completely altered and a "maximum issue limitation system" was adopted. The Bank of Japan notes were steadily increased during World War II, and after 1945 increased very rapidly. This was a cause as well as the result of the postwar inflation. However, after 1949 the increase in bank notes issued approximated the rate of increase in national income. In the 1950s Japan's currency-issue system became controlled. The limit of the issue of bank notes was determined by the minister of finance. Bank notes could be issued in excess of the set limit but in such a case, where the excess issue extended beyond 15 days, a tax was levied on the amount issued in excess. Against the amount of bank-note issue, an equivalent amount in securities was required. Securities permitted included commercial drafts, loans, state bonds and other credits, foreign exchange, gold, silver, etc. Thus, currency in circulation consisted of Bank of Japan notes, auxiliary coins and government notes; the latter expanded rapidly in World War II and were gradually reduced in the postwar period. In the 1960s denominations of currency in circulation included auxiliary coins of 1, 5, 10 and 50 yen. Paper money in circulation consisted of 100-, 500- and 1,000-yen notes. In 1958 a 100-yen silver coin was introduced and for the first time 5,000-yen and 10,000-yen Bank of Japan notes were placed in circulation. The exchange rate after 1949 remained stable at 360 yen to U.S. $1 and 1,008 yen for the devalued pound sterling. Deposit currency consisting of banking deposits and postal transfer savings became more significant in the late 1950s in line with the development of credit economy, totaling about 50% of cash currency. (*See* also YEN.)

3. National Finance.—Following the end of World War II Japan's national financial system was drastically overhauled. Under Japan's 1947 constitution the cabinet has the responsibility of preparing the national budget, which must be submitted to the lower house of the diet (see *Administration and Social Conditions: The Legislature*, above). Taxes can be imposed or modified only as prescribed by laws enacted by the diet or, with respect to local taxes, by the local legislative bodies.

The constitution provides that the budget be prepared on a fiscal-year basis by the budget division of the ministry of finance. The centre of the government's budget system is the general account, which theoretically includes all revenue and expenditure directly applicable to the over-all fiscal operation of the government. The Japanese government also uses a special account system in its budgeting, which includes a large number of special accounts for the operation of government enterprises and other special aspects of government finance. Theoretically, each special account is self-balancing. In actual practice, however, there were substantial deficits in these accounts in the periods before and after World War II which were covered by direct government appropriations, borrowings and transfers of funds from one account to another.

The postwar fiscal policy of the government was characterized by large deficit financing. Unbalanced budgets and expansion of bank-note issue by the Bank of Japan reflected the principal underlying factors in the postwar inflation. In the early postwar years there were enormous claims on a depleted national income, among the more important being the large amount of war bonds and war indemnity claims and the need to assist private enterprise.

The principle of a balanced budget was introduced in fiscal 1949–50. With expanding economic activity, efforts were made to increase revenues and to hold expenditures to minimum essentials. National taxes provided the bulk of government revenue (particularly in the 1950s). The largest returns come from income taxes, the corporation taxes and liquor taxes. Another very significant source of revenue is the profit from the government monopolies, tobacco, salt and camphor, with tobacco accounting for the largest proportion. In prewar years emphasis was placed on indirect taxes and there were indications in the 1960s of a reversion to increased indirect taxes and decreased direct taxes.

In the postwar years and especially in the early 1950s, local government finance was on a scale approximately equal to the levels of national finance. Increased local government expenditures resulted from changes aimed at instituting a democratic framework, particularly in the field of education. Furthermore, greater freedom permitted more local control over municipal finances. Deficit financing was practised to permit ambitious public-works programs which, in some instances, were unco-ordinated or competitive with central government expenditures for public works.

C. Transport and Communications

For many years after the restoration the serious development of highways was neglected in spite of Japan's rapid progress in other

areas. The rugged terrain made road building difficult and expensive and earthquake destruction was also a handicap. Wheeled vehicles had never played a major role in Japan's economy, and there was no strong demand for highway development, although a great deal of effort was devoted to railroads and coastal shipping.

1. Roads.—Shortly after the restoration, Japan embarked upon a program of road construction and supervision. The first step was taken in 1875, when a conference of the governors of the prefectures was called to discuss the classification and maintenance of highways. It was decided that Japan's highways should fall into three classes: national, prefectural and local. Later, local roads were divided into municipal roads on the one hand and town and village roads on the other.

National roads are built and maintained by the central government. The cost of building and maintaining the prefectural roads is divided between the central and the prefectural governments. The local roads are paid for by the districts they serve. Most local roads are at least 12 ft. wide; important municipal and all prefectural roads were required to be at least 18 ft. wide; and the minimum width of the national roads was placed at 24 ft., but some are considerably wider. Nevertheless, in the 1960s Japanese roads could not in the main be regarded as first class by western standards. Only a small percentage were paved. During and immediately after World War II Japan's highway system underwent rapid and serious deterioration, partly from bomb damage and partly because of the increasing difficulty in securing adequate road-building and maintenance equipment and material. In the early 1960s there were nominally about 600,000 mi. of road, but only 15,000 mi. were national, and of these about 4,500 mi. were paved. The road bureau of the ministry of construction is charged with carrying out a road-building program. Although still far from adequate, road construction was being pushed forward, and a number of modern, paved toll roads were completed.

Vehicles.—The most common vehicles in prerestoration times were man-drawn carts, the norimon and the kago. The norimon was an elaborate type of litter, a miniature house slung from a massive pole and borne by carriers. The kago was a simpler contrivance, a kind of open palanquin; it was also borne by carriers. Both have long since disappeared. An important development took place in the 1880s with the invention of the jinrikisha, a two-wheeled vehicle usually pulled by a single runner. The use of this vehicle spread rapidly throughout Japan and also the other countries of the far east. In the 1930s, however, the jinrikisha lost much of its popularity, and by the beginning of World War II it was comparatively rare. It continued to be used only by a few old-fashioned Japanese and occasionally by doctors and geisha, who sometimes had to go through narrow, winding back streets. A means of locomotion that became extremely popular in Japan, especially after 1918, was the bicycle, and Japanese firms proved adept at turning out large numbers at moderate prices. In many cases even those jinrikisha that remained were converted into vehicles drawn by a man mounted on a bicycle.

The important development of motor transportation in Japan took place shortly after the great earthquake of 1923. In 1924 there were about 40,000 motor vehicles in operation, and that number increased steadily for the next few years. Until 1930 Japan was almost entirely dependent upon imports for its motor vehicles. In the mid-1930s domestic factories and assembly plants went into active operation. Ford and General Motors established assembly plants in Japan, and a number of small Japanese automotive manufacturing companies were set up. In 1938 motor-vehicle production exceeded imports for the first time.

World War II was disastrous for the motorcar industry. Absence of raw materials and war damage caused the production of new cars to dwindle almost to nothing. The industry was rapidly revived in the post-World War II period, however, and by the early 1960s Japan was a major producer of motor vehicles, with an annual production of about 250,000 passenger cars, 600,000 trucks and 1,800,000 motorcycles.

In the early 1960s registered automobiles numbered about 2,500,000, representing a considerable increase over the early 1950s. This was partly the result of an increase in light motor vehicles, such as motor bicycles, three-wheelers and scooters, which are registered as automobiles.

2. Railways.—There were no railways at the time of the restoration. The British minister, Sir Harry Smith Parkes, recommended the building of railways when the southern Japanese island of Kyushu suffered from famine in 1869, while there was a surplus of rice elsewhere. Neither the state treasury nor private capitalists were willing or able, at first, to finance railway construction. But an Englishman, Horatio Nelson Lay, offered to find the necessary funds and a loan of £1,000,000 was floated on the London market. Great Britain supplied some of the engineers and material for the first lines, which connected Tokyo with the neighbouring port of Yokohama, and Ōsaka with its adjacent port of Kōbe. There had been opposition to the railway project in some circles, persons occupied in other forms of transportation fearing ruin, while extreme nationalists feared the loss of independence through the flotation of a foreign loan. However, the leading statesmen of the restoration, Itō Hirobumi and Ōkuma Shigenobu, carried through the scheme, and the presence of the emperor at the opening of the first line, between Tokyo and Yokohama, in 1872 silenced all opposition. The Ōsaka-Kōbe line was completed in 1874 and extended to Kyōto in 1877. While British engineers surveyed the routes and supervised the work during the first few years, the Japanese showed themselves as apt pupils in railway construction as in other industries and trades which they learned from abroad, and they were soon able to dispense with foreign assistance.

The Tokyo-Yokohama and Kōbe-Ōsaka lines were merely the nucleus of the Tōkaidō line, following the route of the historic highway linking up Tokyo and Yokohama with Kōbe, the principal port and chief industrial city of western Japan, and with Ōsaka. The backbone of the Japanese railway system was a trunk line from Aomori at the northern end to Shimonoseki at the southern end of the main island, a distance of 1,153 mi. This line was later connected by an undersea railroad tunnel across the narrow strait of Shimonoseki with railway lines in Kyushu, of which the principal ones were Moji-Kagoshima (232½ mi.) and Moji-Nagasaki (163½ mi.). Despite some military objections, this main trunk line followed the old Tōkaidō route along the sea, although a secondary railway was built along the Nakasendō route in the interior. Additional lines were constructed in Hokkaido and east-west lines furnished connections with the main ports on the Sea of Japan such as Niigata and Tsuruga.

Private Railways and Nationalization.—Private capital, which was at first reluctant and hesitant, was coaxed into active participation in the construction of railways during the 1880s. An important step was the enactment of the Railway Construction law, 1892, which laid down a comprehensive policy of railway building for the future and recommended the consolidation of the existing lines into a single state-owned system. The difficulty in obtaining efficient co-ordination on the part of the 36 private companies during the war with Russia (1904–05) was an important factor in inducing the diet to pass a railway nationalization law, March 31, 1906.

The government railroads were originally under the ministry of communications, but after nationalization they were placed (in 1908) under a special railway board, responsible to the cabinet as a whole. In 1920 the railway board was transformed into the ministry of railways, and operational control was decentralized, being divided between one central and six regional offices. The central office consisted of eight bureaus, to which a ninth, the board of tourist industry, was added in 1930. Post-World War I conditions made necessary certain alterations between the government and the administrative structure, and in 1943 the railways and all other forms of transportation were made subject to a newly created ministry of transportation and communications, which was divided two years later into the ministry of transportation and the ministry of communications, with control over the railroads allotted to the former.

In 1948 the ministry of transportation was given over-all control over the national railroads and also assumed responsibility for the supervision of the private rail lines. It was given the power to approve new railroad construction and to close down existing

lines, and to control ferry services and motor transportation related to the railways. The government railways were reorganized in 1949 into Japan National railways (J.N.R.), a separate and semi-autonomous corporation subject to over-all control by the ministry of transportation.

The national system and the remaining private railroads experienced a slow but steady growth. The railroads were, however, faced with certain problems not common to those of most other countries. The majority of Japanese industrial centres are on or near the coast, and coastwise shipping was favoured over railroads for much of the freight transportation. The railroads carried only about one-third of the tonnage of the country's domestic trade, and the Japanese railroads came to rely upon passenger traffic.

Developments After World War II.—During World War II the railroad system experienced many difficulties. Bomb damage destroyed many locomotives, railway cars and workshops. However, so much of the coastal shipping was either sunk or used for other purposes that the railroads secured a much larger share than usual of freight transportation. Passenger traffic also increased. After the war the Japanese government, aided by the U.S., embarked on a program of rehabilitation and improvement.

The whole country is covered by an extensive railway network. The leading trunk lines are owned and operated by the J.N.R. Private railways and trams, which numbered over 150 in the 1960s, also had an expanded network throughout the country. They were mostly auxiliary feeders to the trunk lines or short interurban lines. The total length of the mainline railways was more than 17,000 mi., of which about 12,500 mi. were government owned and 4,500 mi. privately owned. Only about 18% of the J.N.R. was electrified as compared with 80% of the private railways. There were about 5,000 locomotives (including about 800 electric locomotives) and more than 120,000 freight cars. By the early 1960s a considerable amount of electrification and modernization had taken place, including the addition of diesel power and additional double-tracking.

High rail speeds are limited in Japan because most of the tracks are of narrow gauge, though some private lines utilize standard-gauge rails. The Japanese adopted a gauge of 3 ft. 6 in. in contrast with the standard gauge of 4 ft. 8½ in. Railroad construction requires the use of many tunnels, curves and retaining walls. In such circumstances a narrow gauge seemed more economic and efficient, and the rolling stock was small and lightweight. Because of the number of curves on the track and the size of the locomotives, most Japanese trains are forced to travel comparatively slowly. A new high-speed, wide-gauge Tōkaidō line between Tokyo and Ōsaka was constructed in the 1960s to cut running time between the two cities by about one-half. (*See* also RAILWAY.)

3. Shipping.—A group of islands with deeply indented coasts, Japan is naturally a seafaring country, and up to the 17th century Japanese mariners navigated the seas of eastern Asia with daring and skill. Japan was sufficiently advanced as a naval power to send a considerable force into Korea under Hideyoshi in the 16th century, and Japanese corsairs harried the coasts of southern China. Japanese ships are reported to have traded with Siam (Thailand), Luzon, Cochin China, Annam and other southeast Asian countries. This came to an end when the Tokugawa shogunate adopted a policy of strict isolation from the outside world.

After the Meiji Restoration.—Restrictions on maritime activity were scrapped when Japan began its program of all-out modernization. Even before the restoration the law against the construction of ocean-going craft had been repealed in 1853; and the government of the shogun built a pioneer sailing vessel on the European model. A shipbuilding yard was established at Yokosuka, and a naval college was instituted at Nagasaki. A shipping company which provided coastwise service was established in 1870. The largest Japanese commercial shipping company, the Nippon Yūsen Kaisha (N.Y.K.), was incorporated in 1885, the rising capitalist family of Mitsubishi investing much of the initial capital. The company got its start when it took over 63 foreign steamers that the Japanese government had purchased to transport troops for a punitive expedition to Formosa in 1874. The N.Y.K. steadily expanded its services, beginning with a line between Japan and Shanghai and then opening up connections with north China, Korea, Siberia and later with India and Australia. It inaugurated three services, Yokohama-London-Antwerp, Hong Kong-Japan-Seattle and Yokohama-Manila-Australia, in 1896. Another large shipping company, the Ōsaka Shōsen Kaisha (O.S.K.), came into existence about the same time as the N.Y.K. and these two lines remained in the lead of the Japanese shipping companies.

War was invariably a stimulus to the development of Japanese shipping enterprise. The Chinese-Japanese War of 1894–95 had the same effect as the earlier expedition to Formosa, but on a larger scale. The Japanese government found itself obliged to maintain an army of 200,000 men in a foreign country for a year. As the available supply of shipping was inadequate there was extensive buying of new vessels and after the end of hostilities these vessels remained a part of the Japanese merchant marine. The Russo-Japanese War of 1904–05 was a still greater stimulus. After this war, Japan possessed more than 1,000,000 gross tons of merchant shipping and ranked sixth among the maritime powers of the world. Prior to the Chinese-Japanese War only about 10% of Japan's exports and imports were transported in Japanese ships, but this proportion increased to 40% after the Russo-Japanese War and to 48% at the time of World War I. Legislation designed to encourage navigation was retained. This gave Japanese steamship companies mail subsidies for maintaining regular services to various parts of the world. Ships entitled to this subsidy were required to be of more than 3,000 tons, with a speed of at least 12 knots and not more than 15 years old.

World War I and After.—World War I was an even greater spur to Japan's development as a maritime power than the Chinese-Japanese and Russo-Japanese conflicts. There was a world-wide shortage of shipping and the Japanese merchant marine increased its gross tonnage by 1,000,000 tons. Many new shipping services were opened to all parts of the globe. The percentage of Japan's imports and exports carried in Japanese ships increased to almost 80%. As in other commercial and industrial activities, there was a tendency to dispense with foreigners when their services were no longer needed.

A characteristic of Japanese maritime industry, as of the Japanese economy in general, was the high degree of organization into trusts. Such large commercial organizations as the Mitsui and Mitsubishi firms often produced goods in their own mines and factories, sold these goods through their own trading organizations abroad, financed the sales through their own banks and shipped the goods in their own ships.

The policy of the government had always been to assist, by subsidies and other means, the development of those industries which could contribute to increasing the country's war potential. Although up to 1937 the amount of financial help to merchant shipping was, in terms of absolute values, not remarkably high, yet it was sufficient to permit a steady increase in quantity and improvement in quality. In 1937 Japan possessed more than 2,500 steamships (100 gross tons or over) with a capacity of about 4,500,000 gross tons. The policy of "scrap and build" was carried out so effectively that at this period there were few obsolete vessels left for scrapping.

Shipping After 1937.—The beginning of the so-called China incident in the middle of 1937 brought about several important changes in the development and organization of Japan's merchant shipping. The government foresaw an extended period of hostilities with a great need for expanded shipping facilities, and decided to create a system whereby it would have greater and more direct control, including an accelerated shipbuilding program. In 1937 legislation was passed which gave the ministry of communications (later transport and communications) control over all civilian merchant shipping.

Steps were taken to provide for interest credits with guarantees against loss and the granting of capital for the rapid construction of large and fast vessels. In 1939 several additional laws were passed, the main provisions being to enforce standardized ship construction, to permit the government to determine the nature and costs of building and repair work, to order shipbuilders to improve

or replace their technical equipment and to grant subsidies or other forms of financial assistance for those purposes. Shipbuilding associations were organized and federated. As a result of these measures, when Japan launched its attack on Pearl Harbor in Dec. 1941 its merchant marine consisted of over 2,700 ships (100 gross tons or over) with a gross tonnage of nearly 6,500,000. In addition there were large numbers of smaller vessels, which together totaled about another 1,000,000 tons. At that time Japan stood third among the maritime countries of the world.

World War II and After.—To meet wartime transport problems, the Japanese government in March 1942 seized all merchant shipping and placed it under the direct control of a newly created shipping control bureau, which directed the movement of all ships. The armed forces took over about 4,000,000 tons of shipping in direct support of their operations, leaving only a little more than 2,000,000 tons for civil use, although the government economic planning board insisted that at least 3,000,000 gross tons of shipping would have to be retained constantly for civil needs. In an attempt to meet this shortage, a great many small ships, normally used only for coastal shipping, were diverted to overseas trade, a task for which they were ill suited. The shortage of shipping seriously handicapped Japan's war effort, since it was necessary to import a vast amount of raw materials in order to keep industries in production. Japan's system of convoying, antisubmarine warfare and antiaircraft defense proved grossly ineffective. As the result of Allied sea and air operations, Japan lost more than 2,300 ships with a total tonnage of almost 8,000,000. Japan's shipbuilding capacity was unable to keep up with this attrition, especially since many shipbuilding yards were destroyed by aerial bombardment. By Sept. 1945 Japan had only 1,400,000 gross tons of ships more than 100 tons in size. A large part of that tonnage, moreover, was unserviceable.

After capitulation all Japanese shipping was subject to the control of the occupation authorities, though control was exercised through the Japanese ministry of transportation. The ministry of transportation in turn continued to use the shipping control bureau to control the operation of all vessels of 100 gross tons and over. It was the policy of the government to turn back to private hands the operation of all merchant vessels as soon as possible.

After the termination of hostilities, the government, aided by private industry, made strenuous efforts to repair existing vessels and to construct new ones. The shipbuilding rehabilitation was remarkable. In 1956 Japan became the world's foremost shipbuilding nation. In addition to producing large numbers of ships for export, by the 1960s Japan had again built one of the world's largest merchant marines, with a total of over 7,000,000 gross tons.

4. Air Transport.—During the Satsuma rebellion of 1877 two balloons were built. Kite balloons were used in the siege of Port Arthur during the Russo-Japanese War. An army officer made the first airplane flight in Japan in 1910. In the next year the first civil aviation flight took place. Thereafter civil aviation in Japan had a slow but steady growth. The first regular civil aviation service was established in 1922. Regular scheduled flights between Tokyo and Ōsaka began in 1923 and air-mail service in 1925.

The Japan Air Transport company was formed in 1929 and regular flights were made between Tokyo and Ōsaka on the main island of Honshu and Tokyo and Fukuoka on the island of Kyushu. Services were later extended to Seoul in Korea, Dairen in Manchuria and T'ai-pei on Formosa.

The Japanese government, in accord with general trends at the time, decided to exercise greater control over the growing aviation industry. Under government auspices the Japan Air Transport company and other smaller aviation companies merged to form Japan Airways company. In 1939 this company had about 120 planes and was operating about 12,000 mi. of air routes. At the beginning of World War II, civil aviation was placed under military control. Elaborate plans were made for the training of pilots and aviation schools were established.

After Japan's surrender its civil aviation came to an abrupt end. With the end of the occupation and the signing of the peace treaty, however, the way was cleared for a revival of Japanese civil aviation, which was renewed in Sept. 1951. Following the lifting of restrictions in 1952, air transportation developed very rapidly. Japan Air Lines was established in the fall of 1951 with a capital of 100,000,000 yen. It started regularly scheduled domestic flights Oct. 25, 1951. In Aug. 1952 the U.S.-Japan civil aviation agreement was signed, paving the way for Japan's airline to operate over the Pacific. The Japanese government introduced a bill into the diet, passed in Aug. 1952, which established the Japan Air Lines company (J.A.L.) in Oct. 1953 with a capital of 2,000,000,000 yen. The company opened its international route on Feb. 2, 1954, when the first flight set out for San Francisco. There are about 20 other companies, including Far Eastern Airlines and Japan Helicopter and Aeroplane Transports, engaged in scheduled and unscheduled flights. By the early 1960s Japanese airlines were operating flights to other Asian countries and to western Europe.

Tokyo International airport is located at Haneda, Tokyo. Other airports include Itami in Ōsaka, Itazuke in Fukuoka, Chitose in Sapporo, Komaki in Nagoya, Iwakuni and Misawa.

5. Postal Service.—Japan's postal service was inaugurated in 1871 with the opening of a mail service between Tokyo, Ōsaka and other cities. A service for foreign mail was opened in March 1872, and British, U.S. and French post offices were set up; however, by 1877, when Japan concluded a convention with 25 countries participating in the International Mail Service treaty, these had ceased operation. There was a rapid increase in the number of post offices, of which there were 180 in 1871 and 5,527 in 1882. Thereafter the rate of increase was slower.

The Japanese post office proved itself reasonably efficient. In addition to the ordinary transmission of mail, it assumed duties such as receiving taxes on behalf of the various taxing authorities, distributing government pensions and annuities and providing places where government bonds could be bought and sold. The post office was also authorized to provide a number of banking services, including postal money orders, savings and postal life insurance. The postal savings system (inaugurated in 1875 and modeled on the British) proved immensely popular. Total deposits, which in 1947 amounted to about 56,000,000,000 yen, by the 1960s had surpassed 1,000,000,000,000 yen.

The post-office system was operated at the outset by the ministry of communications and during World War II by the ministry of transport and communications. In 1949 a special ministry of postal services was established. The ministry has about 16,000 post offices under its jurisdiction.

6. Telecommunications.—Telegraph service in Japan was instituted for government messages in 1869. A public telegraph line was opened between Tokyo and Yokohama in the same year. Telegrams in European languages were dispatched in 1870 and in the same year Ōsaka and Kōbe began to exchange telegraph messages. Telegraph service between Tokyo and Nagasaki (with many intermediate points) dates from 1873. In 1879 Japan entered the International Telegraph association. Subsequently the development of the Japanese system was rapid, and the telegraph proved immensely popular with the Japanese. The number of telegrams sent generally exceeds, proportionately, that of any other country except the United States. After 1945 there was a thorough rehabilitation of the whole system, which had greatly deteriorated during the war period.

Japan was not so fortunate in the development of its telephone system though telephone communications in and between Tokyo and Yokohama were established in 1890 and long-distance operations between Tokyo and Ōsaka seven years later. For many years thereafter the number of telephone subscribers increased slowly, largely because of the difficulty in securing telephones. The possession of a telephone was considered an important property right which could be sold or upon which a mortgage could be raised. Consequently, there was strong pressure from subscribers against the granting of additional telephones to new applicants. During World War II the telephone system suffered heavy damage. About one-fourth of the wire system and nearly one-half of the existing telephones were destroyed. Rehabilitation resulted in expansion and improvement, and by the early 1960s the number of subscribers exceeded 3,500,000.

From their inception the telegraph and telephone systems were government monopolies. There was a close association with the postal system, for which reason many local post offices served, even in the 1960s, as telegraph and telephone offices. In 1949, when the post office was made a separate unit, the telegraph and telephone services were placed under a newly created ministry of telecommunications. After 1952 they were under the management of the Japan Telegraph and Telephone corporation. Both services were improved beyond their prewar levels and a program of rapid modernization was undertaken.

International Communications.—Japan's international communications started in 1871 with the laying of a submarine cable between Nagasaki and Shanghai. In later years important submarine cables connected Nagasaki with Vladivostok and Kamakura (near Tokyo) with Guam. Messages to Europe could be sent by way of Vladivostok and to the United States by way of Guam. Both cables were owned by foreign corporations.

Several wireless telegraph stations were set up in Japan in 1908. For a number of years radio was used only for domestic communications or for communications between ship and shore. In 1915, however, regular radio communication was established between Otchishi station in Hokkaido and Petropavlovsk in Kamchatka. In subsequent years direct circuits were established with the principal cities of the world. In 1925 the Japan Wireless Telegraph company was established under government auspices to assure Japan's complete independence of foreign telegraph companies. The government transferred to the newly organized company its powerful station on Mt. Iwaki, erected for the purpose of establishing direct communication with Europe. The company was completely reorganized in 1938 when all international wireless communications were placed in the hands of the government-controlled International Telecommunications company. Large sums were spent to improve the station at Iwaki, but short-wave transmission made the old long-wave system employed there obsolete, and two powerful short-wave transmitting stations were erected, one at Oyama near Tokyo and the other at Yosami near Nagoya. Three receiving stations were also established.

There also was a considerable development of wireless or radiotelephony in Japan. The first experiments were made in 1911, but it was not until 1923 that the service was opened to the public with the inauguration of radiotelephone communications between shore stations at Kōbe and ships in the harbour. This service was gradually extended to the other principal ports. In 1932 the government formed the International Telephone company to foster and control the further development of radiotelephony. This service came to include the Japanese colonies and the major countries of the world. In 1938 the International Telephone company was absorbed into the International Telecommunications company, which gave the Japanese government greater control over all international communications. In 1947 the company was liquidated, control of all wireless services being taken over by the government. After 1949 the International Communications division of the ministry of telecommunications assumed the responsibility for its world-wide operations. In 1953 this division became independent under the new name of International Telegraph and Telephone Company, Ltd.

Radio and Television Broadcasting.—The first experimental radio stations were opened in 1925, and by the end of that year it was decided to place radio broadcasting on a more permanent and formalized basis. The three original stations were merged to form the Broadcasting Corporation of Japan (B.C.J.), which was granted a monopoly of all broadcasting. Though the new corporation was sanctioned and protected by the government, it maintained a semiautonomous position until 1935, when all of its operations were brought under government control. Thereafter the programs served as instruments of government propaganda. Later events showed that this propaganda could also work in reverse. On Aug. 15, 1945, the emperor's order to his people to surrender was transmitted over the radio and proved a valuable aid in securing orderly submission to the occupation authorities.

The Broadcasting Corporation of Japan is not commercialized and derives its revenues solely from licence fees. In the 1960s the number of subscribers totaled more than 11,500,000, and most homes had at least one radio. The B.C.J. maintains local stations, as well as a number of major stations, in the principal cities. Each local station originates part of its own programs, but a great deal of the total radio time is allotted to national network broadcasts. Overseas broadcasts are transmitted daily by Radio Japan. In 1950 the diet passed a law aimed at destroying the monopoly of the B.C.J. by permitting the establishment of private stations.

Regular television broadcasting began early in 1953 by a government-subsidized, noncommercial station. Following a rather slow growth in its early years, television in Japan by the early 1960s was a booming industry. Long-distance microwave circuits connecting the whole country permitted nationwide TV circuits to be established from Hokkaido to Kyushu. The telecasting service area covered 80% of all Japanese households. It was estimated that about three-fourths of urban households had television sets. Tokyo tower, which is higher than the Eiffel tower, is the television-transmitting centre of the capital.

See also references under "Japan" in the Index.

(W. H. Ch.; W. M. McG.; R. B. H.; Ro. B. H.)

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(M. B. J.; I. D. Fe.; R. F. Sr.; R. A. S.; J. M. Ka.)

JAPAN, BANK OF (Nippon Ginko). The Bank of Japan is a central bank established by the law of June 27, 1882. Its charter was originally effective only until 1912, but it was extended for another 30 years from that date. In 1942 a new law chartered the bank for an indefinite period and conferred upon the government sweeping wartime powers over the bank. After World War II the role of the government in the bank's affairs was reduced, although the government continued to hold substantial powers over the bank.

Both the monetary policy and the general operating policies of the bank are formulated by the Policy board (created in 1949) consisting of seven members, four of whom are voting members appointed for four-year terms by the cabinet with the consent of both houses of the diet. These four members must be persons of "superior experience and knowledge," two in the field of banking, one in commerce and industry and one in agriculture. They must not engage in any other remunerative occupation without cabinet consent, nor be candidates for elective public office. The remaining members include the governor of the bank, who is also a voting member, and two non-voting members, one of whom represents the ministry of finance and the other the Economic Planning agency.

Decisions of the Policy board are carried out by the governor with the assistance of the vice-governor, three or more directors and several advisers. Bank officers also include two or more auditors who review the bank's operations. The governor and vice-governor are appointed by the cabinet for terms of five years. The directors, auditors and advisers are appointed by the minister of finance for terms of four, three and two years, respectively.

The monetary powers of the bank include authority to discount and to vary the discount rate; to engage in open-market operations in commercial paper, bankers acceptances, government securities and certain other debt instruments; and, subject to approval by the minister of finance, to vary legal deposit reserve requirements, with an upper limit of 10%. The latter power, conferred on the bank in May 1957 and made effective in Sept. 1959, permits the bank to set different cash reserve requirements for demand and time deposits, and for different classes of financial institutions as stipulated by cabinet order. In addition, the law authorizes the bank, with the permission of the minister of finance, to undertake such unspecified transactions as are necessary "for the maintenance and fostering of the credit system." Under the Temporary Interest Rate Adjustment act of 1947, the minister of finance can cause the bank to establish, change or abolish maximum interest rates that banks and certain other financial institutions may charge or pay.

The bank is also authorized to issue notes, which are the sole currency and legal tender, subject to limits established by the minister of finance, fully covered by a reserve of liquid private obligations and government securities, foreign exchange, certain other foreign claims if approved by the minister of finance, and gold and silver bullion or coin in any proportion. Bank supervision and examination is carried out both by the bank and by the ministry of finance. The capital of the bank is 100,000,000 yen, 55,000,000 of which is subscribed by the government. Private subscriptions are nonvoting. *See* also Central Bank; Japan: *The Economy*. (E. C. Ol.)

JAPAN, SEA OF, a sea, 389,100 sq.mi. in area, between Japan and Sakhalin Island on the east and the Asian mainland. It is a true ocean basin with a mean depth of 4,429 ft. and a maximum of 12,276 ft., but with restricted connections to the world ocean. To the southwest it connects with the East China sea by the straits of Korea and Tsushima, together 120 mi. wide and 300 ft. deep, between Korea and the Japanese main islands of Honshu and Kyushu. Shimonoseki strait links it with Japan's Inland sea (Setonaiki). In the north the three connections to the Pacific and the Sea of Okhotsk, the Tsugaru, Sōya (La Pérouse) and Tatar straits, are much more narrow and shallow. The Tsushima current, a branch of the major Kuroshio current, enters from the southwest through Korea-Tsushima strait and carries water of high temperature and salinity northeastward along the west coast of Honshu and Hokkaido toward Sakhalin. Most of this flow recurves to form a southward current along the coasts of Siberia and Korea, after having been markedly cooled by cold air and diluted by river water.

The climatic influence on the Japanese islands is marked, especially in winter when cold air masses from the Asian mainland are warmed and pick up moisture during their passage over the Sea of Japan. This results in heavy snowfall, especially on the west coast of central Honshu. Winter temperatures on western Honshu and Hokkaido are also substantially higher than those at the same latitudes on the mainland.

The Sea of Japan is part of the world's most important fishing area. Cold-water species abound in the northern part where one of the largest herring runs in the world is found west of Hokkaido and catches of salmon, crab, cod and related fishes are also important. Warm-water species taken in the south include sardines (usually the leading catch in Japan), mackerel, tuna, shellfish and many others. Fishing is important all along the west coast of Japan, but particularly in Hokkaido, southwest Honshu and Kyushu. Fishing ports also dot the Japan sea coast of Korea and the U.S.S.R., particularly around Vladivostok, and the access of Japanese fishermen to these coastal waters is a residual problem of World War II.

Commercially and strategically the Sea of Japan is important to Russia since Vladivostok is the only ice-free port on its east coast. It is likewise important to Japan as a separation from and an avenue of communication to the mainland. In this regard the Korea-Tsushima straits have long been of particular significance,

both as a historic route between Japan and Korea and as the main entrance to the Sea of Japan. These straits were the scene of the destruction by typhoon of the Mongol invasion fleet of Kublai Khan in 1281 and the defeat of the Russian fleet by the Japanese in 1905, as well as of important military activity during World War II and the Korean War. (T. R. S.)

JAPAN CLOVER (LESPEDEZA STRIATA): *see* LESPEDEZA.

JAPANESE ARCHITECTURE. Throughout history the governing factors in Japanese architecture have been the climate, the abundance of wood and the lack of other materials suitable for building. In most of Japan the winters are relatively mild but the summers are hot and humid and, as a consequence, the Japanese have displayed a tendency to build for the summers. Except for farmhouses, buildings reveal a much greater emphasis on ventilation than on insulation; instead of walls, they often have doors or windows extending from the floor nearly to the ceiling and from post to post. The fact that in premodern times wood was almost the only material used made it easy to indulge this preference, for wood lends itself to post-and-beam structures that do not require bearing walls.

Accordingly, Japanese architecture of the past differed basically from western architecture in several ways. In the first place, it was an architecture of columns and beams rather than of arches and vaults, with the result that the spaces enclosed had a strongly geometrical orientation. Second, it was less durable and more susceptible to fire. Third, it tended to be more open and consequently to direct attention from the interior to the exterior. Finally, because it was made largely from wood, it tended to harmonize better with natural green surroundings. These last two features doubtless contributed much to the development of landscape gardening in Japan, as well as to the Japanese inclination toward gardens that simulate nature itself. (*See* JAPANESE GARDEN.)

In addition, Japanese architecture reveals a predilection for asymmetry, a characteristic which is also evident in the Japanese arts; in this respect it contrasts with Chinese architecture (*q.v.*). Though symmetrical plans have often been imported from China, they have usually broken down into freer arrangements in which spaces seem to flow from one into the other without ever resolving into a simple entity.

Prehistoric Architecture.—Recent archaeological discoveries have offered indisputable evidence that Japan was inhabited at least 10,000 years ago by a people who appear to have been at the Paleolithic stage of existence. These people, however, seem to have built no houses and the earliest architectural remains date from the Neolithic period, which is thought to have begun in the 4th or 5th millennium B.C. The culture of the Neolithic dwellers is known by the name Jōmon (literally "rope design") because their pottery is usually decorated with designs made by pressing rope against the clay or by affixing ropelike clay coils. Many of the vessels made in this fashion are extremely fanciful and beautiful and some might well be classed today as abstract sculpture.

The Jōmon people lived in pit houses, traces of which have been found at many sites. The typical pit was an oval 15 or 16 ft. long, 10 or 12 ft. across and about 3 ft. deep. At each end of the pit a tripod of heavy logs was erected and a ridgepole was laid atop these. To the ridgepole were lashed slantwise a number of rafters reaching to the ground around the pit and forming a radial pattern. A thatch which served as both roof and walls was added to the rafters. Later a simple post-and-beam structure was added underneath as a support for the tripods and a second set of rafters was lashed between the beams of this support and ridgepole to form an upper roof, the gables of which were left partially open to allow smoke to escape. Several houses of this type have been reconstructed in recent years. Since they are clearly of northern origin, it may be assumed that the Jōmon people derived ultimately from central or northern Asia, though no clear archaeological connection between Japan and those regions has yet been established.

Pit houses continued to be built in some areas until at least the 7th or 8th century of the Christian era and some architectural historians consider farmhouses of later periods to have derived from them. This theory gains support from the fact that in many areas Japanese farmers continued until the dawn of modern times to rely on carpenters for only the underpinnings of their houses and to build the superstructures and roofs themselves.

Around the 1st century A.D. the Jōmon culture began to give way to a new culture, known as Yayoi from the fact that its remains were first discovered in a district of that name in Tokyo. Whereas the Jōmon people had lived by hunting and fishing, the Yayoi people depended upon agriculture, specifically the cultivation of rice in wet paddies. They possessed bronze and iron implements, presumably of Chinese origin, and knew how to use the potter's wheel. Accordingly, the pottery they produced is technically superior to Jōmon pottery, though less imaginative.

With the arrival of agriculture came the gradual emergence of an upper class composed of landowners, a fact reflected in improved architectural forms. Alongside the pit houses there now appeared ground-level and raised-floor dwellings, both of which had wooden floors and walls. Pictures of these are found on bronze and ceramic relics dating from the earliest phases of the Yayoi and clay replicas have been recovered from a later date.

The raised-floor houses, which probably originated as storehouses for grain, are of particular interest since they indicate a southern origin for the Yayoi people. A number of ethnologists go so far as to insist upon a connection with Polynesia or Malaysia but scholarly opinion as a whole is that the Yayoi civilization came from the general region of southern China. In any event, the raised-floor houses remained a mark of the upper class until modern times.

During the Yayoi period there gradually developed a society of small communities or states, each organized around a particular clan. These fought among themselves until eventually the one that occupied the fertile Yamato plain, near modern Kyōto, succeeded in asserting its control over the others. This became the Japanese imperial family, but the idea of an imperial system was doubtless imported from China. In the 4th and 5th centuries tremendous mounds were raised in honour of dead emperors and patriarchs. Though these do not constitute architecture, they indicate that the Yayoi people or their immediate descendants were capable of construction work on a vast scale, since some of the mounds were larger than the pyramids of Egypt.

In a stylistic sense, the earliest actual relics of Japanese architecture are the Izumo shrine and the Ise shrine, both of which are raised-floor wooden buildings with thatched gable roofs. The Izumo shrine, which is considered somewhat the older in form, is a square building with nine regularly spaced columns and an entrance under one of the gables. According to a 10th-century source, the original shrine was no less than 160 ft. high but the present building, which is an 18th-century reconstruction, is only about half that. The Ise shrine, for its part, is rectangular in plan, with three-column spans in the longitudinal direction and two in the transverse. The entrance is on one of the longer sides, under the eaves of the roof. Among the shrine's distinctive features are freestanding ridge-support posts at either end, extended principal rafters rising in a V-shape above the gables and a row of heavy crosslogs atop the ridgepole.

The Ise shrine has a unique history. In 686 the emperor Temmu ordered that it be rebuilt every 20 years in exactly the same form as before, and though this command has not been carried out to the letter, the building was in fact reconstructed in 1954 for the 59th time. Every effort seems to have been made to avoid change and descriptions from the 8th century indicate that the building is substantially the same now as then. The date of the original construction and the extent to which the building was altered before the emperor Temmu's time remain conjectural but the shrine probably represents an advanced version of a 5th- or 6th-century style. Although it has often been cited as an example of the very earliest Japanese architecture, its various ornamental features indicate that it must have been the product of a long development. The building is sacred to the imperial ancestress, the sun goddess, and therefore probably resembled the palaces in which the emperors lived. It is known, at any rate, that the house of a 7th-century nobleman consisted of a similarly constructed building to which auxiliary eaves had been added on the longer sides. The imperial palaces themselves, however, have all disappeared because it was the custom until the 8th century to abandon the palace and change the

seat of government upon the death of each emperor.

Early Chinese Influence.—Toward the middle of the 6th century the ruler of Paekche, a kingdom on the Korean peninsula, made a present of Buddhist statues and scriptures to the Japanese emperor and in the ensuing two centuries Buddhism, along with its art and architecture, was imported from the continent on an increasingly grand scale. This entailed the immigration to Japan of countless priests, artists, artisans and workmen from China and Korea, who proceeded to educate the Japanese in the advanced arts and crafts of the continent. After 593, when Prince Shōtoku, a devout Buddhist, came to power as regent, the government lent active support to the construction of Buddhist temples; historical sources state that by 624 there were 46 monasteries and nunneries housing 816 priests and 569 nuns.

Of particular interest is the Hōryūji (the suffix *ji* means "temple"), founded by Prince Shōtoku in the early 7th century; despite the fact that it was destroyed by fire in 670 and later rebuilt, it is thought to be representative of Buddhist architecture in the Asuka period (552–645). The nucleus of the monastery is formed by a two-story main hall and a five-story pagoda, which stand side by side in a rectangular compound surrounded by corridors. Both the buildings and the corridors have relatively heavy wooden structures and tile roofs, and the columns show a pronounced entasis, which may have derived ultimately from Greece. The main hall is rectangular in plan, with five-column spans, or "bays," on the front and back and four on the sides. Its upper story is considerably smaller, having four bays on the front and back and three on the sides. There is no direct connection between the columns of the lower floor and those of the upper. The lower floor is surrounded by an enclosed corridor with eaves of its own and the upper floor by a balustrade with openwork in the form of a series of modified swastikas. The eaves, which are very long, are supported by a simple system of brackets: atop each column there is a cantilever arm (*hijiki*) supporting an inner rafter (*odaruki*); on the outer end of the rafter rests a girder which supports the main rafter (*taruki*). This arrangement permits the main rafters to uphold a much longer projection than if the girder rested on the capitals of the columns. As a matter of fact, the bracketing at the Hōryūji is relatively weak and the corners of the roof have had to be bolstered with outside columns, but the principle of supporting the eaves with brackets and cantilevers remained in use in Buddhist buildings until modern times.

In the very middle of the building there was, and is, an altar on which was enshrined an image of the Buddha Sakyamuni, surrounded by attendants and guardian deities. It was the custom for worshipers to perform the rite of circumambulation in the corridors around the inner sanctuary.

The pagoda of the Hōryūji, like other pagodas, functioned primarily as a memorial. (*See* also PAGODA). Though its first floor contains groups of clay images depicting stories about the Buddha, the upper levels are virtually filled with the woodwork necessary to achieve the desired height; in China the upper floors of pagodas were actually used but the Japanese have always been willing to sacrifice the interiors to gain impressive loftiness. Like most later Japanese pagodas, it is built around a huge central column rising from the foundation to the very top of the building. The first floor, which has three bays on each side, serves as the foundation for the second floor, which in turn forms the foundation for the third floor, and so on. As in the main hall, the lowest floor is surrounded by an enclosed corridor with its own eaves and each floor is slightly smaller than the one beneath it. The eaves of the building are supported in a fashion similar to that observed in the main hall. The central column plays no part in supporting the building.

The railings, eaves-support brackets and other architectural devices found at the Hōryūji are very similar to details found in the Chinese rock-cave temples of Yün Kang and Lung-men, which were made in the 5th and 6th centuries, but it is doubtful that there was a particular Chinese prototype for the temple. More likely its style was imported from Korea, where for several centuries Chinese architectural styles had been arriving in waves, the old comingling with the new. In any event, the Hōryūji is considerably more archaic than the temples of the Nara period (645–784), during which the Japanese were in direct contact with China and were able to observe Chinese styles firsthand.

The vastness of the difference between continental architecture, as revealed by the Hōryūji, and earlier Japanese architecture would be difficult to overstate. Where Japanese buildings had had thatched roofs, the new temples had tile roofs; where the columns of Japanese shrines were sunk into the ground, the new buildings rested on stone platforms and the columns were supported by foundation stones (this involved improved horizontal supports to prevent the columns from falling over during construction); where the roof of the Ise shrine was supported by a simple post-and-beam structure, the extended eaves of the new temples required complicated brackets; where the earlier buildings had been made of unpainted timbers, the new ones were painted and decorated with various metal fittings; where the shrines had had little or no interior decoration, the main hall of the Hōryūji was adorned with beautiful murals (destroyed by fire in 1950). Moreover, the new buildings were larger, sturdier and presumably more costly than anything hitherto built in Japan.

The Golden Age of Buddhism.—In the 7th century the T'ang dynasty was founded in China and the Chinese entered upon one of the most glorious periods of their history, a period in which they formed an empire ranging over a large part of southern Asia and maintaining relations with most of the countries of the known world. Direct contacts between Japan and China became more and more frequent and in 645 the Japanese government adopted a program of reform in which it tried to adopt the Chinese political system almost *in toto*. Architectural styles, hitherto imported by way of Korea, began to bear a closer resemblance to those of China and buildings dating from the late 7th century, of which the most important still standing is the pagoda in the east precinct of the Yakushiji in Nara, display a marked development over the Hōryūji.

With the adoption of a Chinese-style administration and the establishment of a bureaucracy, it became increasingly difficult to maintain the ancient practice of moving the capital at the death of each emperor. Consequently, several plans were put forth for the establishment of a permanent seat of government. Such a city took form in the district of Fujiwara, south of present-day Nara, in the late 7th century, but after a short time it was abandoned in favour of Nara itself. There the Japanese government set up a vast new city, modeled on the T'ang capital at Ch'ang-an. In plan the metropolis was approximately square, measuring 2.4 mi. on the north-south axis and 2.2 mi. on the east-west axis. The streets were laid out on a grid pattern, with eight thoroughfares running north and south and nine running east and west. The palace and administration buildings were located in the north-central portion of the city and great temples and mansions were constructed here and there in the remaining sectors. The building of Nara must have been one of the most ambitious city-planning projects ever undertaken and the very fact that it was built at all testifies to the success of the imperial court in bringing the country under its rule.

Needless to say, the buildings in the new capital were for the most part in Chinese Buddhist style and the spread of this style was no longer limited to urban areas. In 741 the emperor Shōmu ordered the construction of a monastery and a convent in each province; in this fashion Buddhist architecture and Buddhist learning were introduced to many of the outlying districts. In 745 Shōmu further announced the construction of the Tōdaiji in Nara, which was to serve as the hub of the network of temples he had constructed in much the same way as the Nara government formed the nucleus of the provincial administrative system. Within the Tōdaiji, Shōmu proposed to erect a huge bronze statue of the Buddha, into which were to be poured "all the copper resources in the country." The hall housing this colossus was to be built by "reclaiming a great mountain." In fact, an early record states that 50,000 woodworkers, 370,000 metalworkers and 2,180,000 labourers were engaged in the construction of the monastery, which stood just beyond the northeast corner of the capital. The hall in which the great Buddha was enshrined was about 290 ft. wide, 170 ft. deep and 156 ft. high. To the north there was a large lecture

TEMPLES AND PAGODAS

Higashi Honganji, Kyōto (1602; reconstructed in the 19th century)

Five-story pagoda of the Kōfukuji, Nara (1426). The temple complex dates from the 8th century

The teahouse of the Ginkakuji, or Silver pavilion, Kyōto. 15th century

The Ginkakuji, Kyōto, built in the 15th century as a residence and later converted into a Buddhist temple

The hall of the great Buddha at the Tōdaiji, Nara, founded in the 8th century and reconstructed in the 17th century

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JAPANESE ARCHITECTURE

Inner gate of the Hōryūji, Nara, Japan, a Buddhist temple founded in 607 by Prince Shōtoku

THE HŌRYŪJI AT NARA

The Yumedono or Hall of Dreams of the Hōryūji, built in 739

The five-story pagoda of the Hōryūji, built in 607

BY COURTESY OF CONSULATE GENERAL OF JAPAN, NEW YORK CITY

Interior of the kondo (main hall) of the Toshodaiji, Nara; 8th century

The grand torii of the island shrine of Miyajima or Itsukushima-jinsha in the Inland sea near Hiroshima. Founded in ancient times, the shrine was restored in the latter part of the Fujiwara period (898–1185)

SHRINES AND TEMPLES

Shrine at Kotahira, Kagawa prefecture

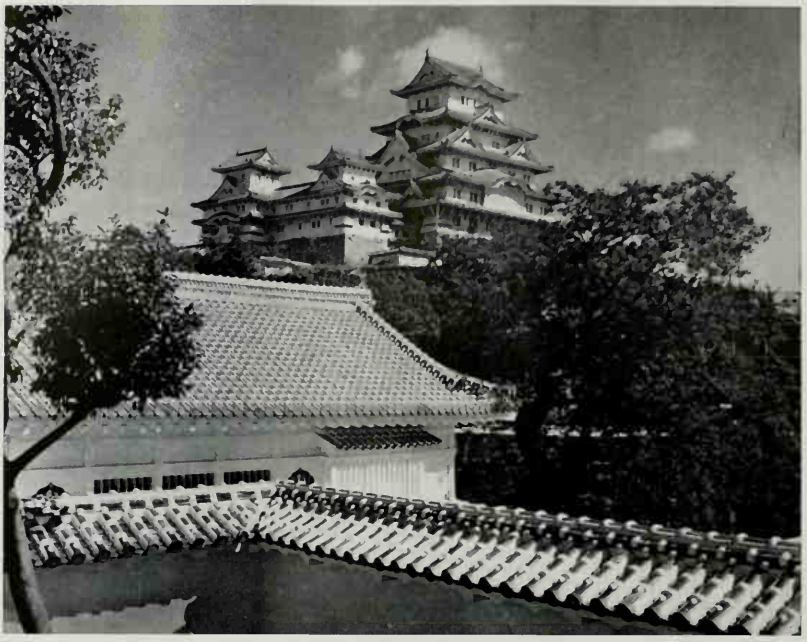
Yomeimon gate of the Tōshōgū shrine, Nikkō

Detail of Tōshōgū temple, Nikkō; Tokugawa period (1603–1868)

BY COURTESY OF (TOP LEFT, CENTRE, BOTTOM RIGHT) CONSULATE GENERAL OF JAPAN, NEW YORK CITY, PHOTOGRAPHS, (TOP RIGHT) BERKO—PIX, (BOTTOM LEFT) PAUL ALMASY

JAPANESE ARCHITECTURE

JAPANESE CASTLES OF THE MOMOYAMA PERIOD (1574–1603)



Himeji castle, rebuilt in 1577 by the warrior Toyotomi Hideyoshi

Entrance to the Ni-No-Maru palace of Nijo castle, Kyōto, built in 1603 by the shogun Ieyasu

Osaka castle, built in 1583 by Toyotomi Hideyoshi (burned in 1868 and later rebuilt)

BY COURTESY OF (TOP, BOTTOM LEFT) CONSULATE GENERAL OF JAPAN, NEW YORK CITY, PHOTOGRAPH; (BOTTOM RIGHT) ROEBELER—PIX FROM PUBLIX

hall and to the south there were an inner gate and a gigantic main gate. In the interval between the latter stood two 300-ft. pagodas, which must certainly have been among the loftiest buildings ever constructed of wood.

Nara-period builders knew few techniques for adding horizontal strength to their structures and they consequently required extremely large timbers to support such massive roofs as that of the Tōdaiji. The necessary trees were available in the countryside but transporting them to the capital presented serious problems. To increase the depth of buildings, carpenters tended to fall back on brackets and corbels; later, when they had devised a leverlike timber (*hanegi*) which, placed across the girder, transmitted part of the weight of the eaves to the interior, these brackets and corbels became somewhat superfluous and ultimately grew to be as much decorative as structural.

Though most of the buildings in the Tōdaiji have been destroyed, the great Buddha is still standing and the building housing it, which is an 18th-century reconstruction on a somewhat smaller scale than the original, is considered to be the largest wooden building in the world.

The Tōdaiji was the most ambitious temple built by the Nara government but it was by no means the only one. Indeed, the influence of Buddhism on the state was stronger than it has ever been since and government contributions to the church were so large that they greatly weakened the imperial treasury. Partly for this reason, the capital was moved south to Kyōto in 794 and a new metropolis similar to Nara was constructed there. Since the new capital was called Heian, the ensuing historical period is known as the Heian period (794–1185).

Japanese Reaction.—In the first half of the 9th century the gradual weakening of both the Japanese and the Chinese court caused a rupture in Chinese-Japanese relations, and in the following three centuries Japan settled down in comparative isolation to digest the culture that had been imported from the continent.

Buddhism and Buddhist architecture underwent drastic changes. The influential sects of Nara, whose great temples had been built in symmetrical plans on flat ground within the capital, were eclipsed by the newer Tendai and Shingon sects, both of which preferred to build their monasteries on secluded mountaintops, and the symmetrical plans gave way to free arrangements which accorded with mountainous terrain. Buddhist buildings in general tended to become smaller and simpler.

The main buildings of the Nara monasteries, like their Chinese models, had been designed in such a way that the icons they contained were visible from outside, where worshipers stood to pay their respects to the Buddha. Because of the frequency of rainfall in Japan, there developed the practice of erecting a separate shelter in front of the temple proper and as time went on the two buildings were joined into one. As a result, Japanese temples came in many instances to be considerably deeper and darker than their Chinese prototypes, a circumstance which accorded well with the tendency of the Tendai and Shingon sects to emphasize the mysterious qualities of their religion.

Though the Shintō faith was not destroyed by the impact of Buddhism, it was greatly changed. Because of the tendency of Buddhism to absorb rather than overwhelm local religions, Japanese Buddhism by the 8th century had already advanced the theory that the Shintō gods were in reality Japanese manifestations of the Buddhas and this creed gained wide acceptance. In the Heian period Shintō shrines appeared within Buddhist temples and Buddhist temples within Shintō shrines; one result was that Shintō buildings, though retaining much of their earlier simplicity, acquired such features of Buddhist architecture as curving roofs, painted exteriors and ornamentation under the peaks of gables.

To judge from the lecture hall at the Hōryūji, which is supposed to have been originally a house belonging to a noblewoman, it would appear that upper-class Nara-period houses resembled Buddhist temples, at least to the extent of having curved roofs and bracket-supported eaves. In 9th-century Kyōto mansions belonging to the higher aristocracy seem to have consisted of a number of buildings arranged according to symmetrical plans and joined by corridors. The central building was called the *shinden* (literally "sleeping palace"). To the south of it lay a pond and on the north, east and west corridors led to auxiliary buildings called *tainoya*. From the south sides of the east and west *tainoya* more corridors led to small kiosks, which either stood beside the pond or extended out over it. In addition to these buildings, there were others housing the kitchen, the servants' quarters, the stable and suchlike.

From the name of the central building, the style of this type of house is known as *shinden-zukuri*. It is likely that only the very rich could afford a residence of the scope described and that the lesser nobility made do with modifications of it. Certainly the symmetrical plan, which was inspired by Chinese architecture, was in many instances abandoned. Nevertheless, the *shinden-zukuri* style served as a model not only for Kyōto aristocrats but for the provincial nobles as well, though the provincial residences must have been comparatively modest.

The *shinden* itself was a rectangular building with verandas and auxiliary eaves on all sides. Aside from a small sleeping room in one corner, the building was almost completely open. Instead of exterior walls it had heavy lattice doors, the upper halves of which were hinged and the lower halves of which could be removed entirely. Except at night the upper halves were usually kept open and on special occasions the lower halves were taken out. There were no permanent interior partitions, private areas being set off as needed by means of screens and curtains. The floors were of wood and people sat on thick straw mats spread about the house as needed.

The *shinden-zukuri* house must have been sublimely impractical and one can easily imagine that only those able to maintain a retinue of servants could have lived in it. At the same time, it was an appropriate dwelling for the elegant courtiers of ancient Kyōto, who dressed in voluminous robes and spent much of their time holding banquets, poetry contests and other ceremonies of various sorts. The openness of the *shinden* gave it maximum communication with the garden, which usually consisted of a series of miniature landscapes modeled on famous scenic spots, and at the same time provided excellent ventilation during the muggy Kyōto summer. Though no early example of *shinden-zukuri* survives, the Imperial palace at Kyōto, which was constructed in the mid-19th century, is considered to be a reasonably accurate replica.

During the 10th and 11th centuries a new form of Buddhism developed in Japan. Based on the worship of the Buddha Amida, it dispensed with both the magic and the philosophical speculations of the Tendai and Shingon sects and adopted the creed that the only requirement for salvation was a sincere invocation of the Buddha's name. The simplicity of this doctrine appealed to nobleman and plebeian alike and as a result Amidism largely replaced the earlier Buddhist sects. Many aristocrats, apparently unable to wait for the future life, built temples in which they attempted to reproduce on earth Amida's western paradise, as described in the canon and in paintings from the past. Such temples were centred around a hall of Amida, which was ordinarily a square structure with a sanctum, one-bay square in the centre, surrounded by a space where worshipers might perform the rite of circumambulation. The simplest halls were only three-bays square but others were very large and all of them were lavishly decorated on the inside. The most remarkable still standing is the Phoenix hall of the Byōdōin in Uji, a relatively small building, which is a study in grace and elegance. This building, incidentally, incorporates some features of the *shinden-zukuri* style.

Second Period of Chinese Influence.—During the 12th century the actual control of Japan passed from the Kyōto court to a military government in Kamakura. Around the same time contact with China was restored and Zen Buddhism was imported. These events had a profound effect on architecture. For one thing, two new styles of Buddhist architecture appeared. The first, which is called "Indian" (*Tenjikuyō*) but which seems to have originated in south China, was a forceful style featuring massive roofs and straightforward structural lines. Though it was not used extensively in Japan, it had a certain influence on later styles. The second style, known as "Chinese" (*Karayō*), was more graceful and ornate; its features included exceedingly elaborate roof-support bracketing, fan rafters, steep roofs with pronounced curves

and windows of a pointed-arch shape. The Chinese style, which became standard for Zen halls of worship, is seen at its purest in the Reliquary hall of the Engakuji in Kamakura.

In opposition to the new styles, modes that had been in use in earlier times came to be described collectively as the "Japanese style" (*Wayō*). Actually, most Buddhist buildings of this period were built in some combination of the three styles. At first Japanese and Indian were mixed and later Japanese and Chinese. Subsequently, elements of all three styles were incorporated into most Buddhist buildings. An excellent example of this eclecticism is the main hall of the Kanshinji in Ōsaka.

The rise of the warrior class led to a new form of residential architecture known as *buke-zukuri,* or "warrior style," which was probably an outgrowth of the *shinden-zukuri* but which may have included certain features from farmhouses. The main building of a typical *buke-zukuri* house resembled the *shinden,* but whereas the *shinden* had few interior partitions the warrior's house had distinct rooms, set off from each other by sliding paper-covered panels (fusuma). Furthermore, some of the lattice doors on the exterior were replaced by shoji (wooden lattice panels covered with translucent paper) and some of the rooms were floored with thick straw mats called *tatami,* which measured about 3 x 6 ft. and which were an outgrowth of the straw cushions used in the *shinden.* These innovations became permanent fixtures of the typical Japanese house. If the *buke-zukuri* house belonged to a fairly substantial warrior it was surrounded by a moat or a wall, or both, and there might be gates and towers where guards could be posted.

The very highest noblemen, warriors and priests continued to build their houses more or less in the *shinden-zukuri* style but with the passage of time the warriors accepted the more practical features of the *buke-zukuri,* while the priests made the important addition of the *shoin.* The *shoin* ("writing room") was originally a study in which there was a window with a broad sill that could serve as a desk. Beside the window there were built-in shelves for books and an alcove, or tokonoma, where a picture could be hung.

The higher members of the warrior class, who were greatly influenced by Zen Buddhism, gradually adopted the *shoin,* but since they were not usually scholars they were inclined to use the room more and more for ceremonies rather than for study. Accordingly, it grew larger and larger and its *décor* became increasingly ornate. Eventually it became so important that its name was given to the whole house. This development occurred during the 14th and 15th centuries.

Famous as examples of residential architecture during this period are the Kinkakuji, or Golden pavilion, and the Ginkakuji, or Silver pavilion. The Kinkakuji, which formed a part of a great mansion built by the shogun Ashikaga Yoshimitsu near the end of the 14th century, was destroyed by an arsonist in 1950 but has since been restored with great exactitude. It is a relatively small building with three stories, of which the lower two are in *shinden-zukuri* style and the uppermost in the "Chinese" style of Zen monasteries. Though the two styles would seem incompatible, they have somehow been brought into beautiful harmony and the building as a whole has an air of elegant lightness. The Ginkakuji, which was part of a palace completed in 1480 by Ashikaga Yoshimasa, a descendant of Yoshimitsu, is smaller and less impressive than the Kinkakuji but it is interesting as an embodiment of the transition from *shinden-zukuri* to *shoin-zukuri.*

During the Muromachi period (1335–1573) the custom of drinking tea, which had been introduced from China much earlier, became widespread among all classes and gradually tea drinking took on a definitely ceremonial aspect (*see* TEA CEREMONY). Of the several types of tea rituals that developed, that of the *wabi* school gained the greatest popularity among the upper classes. Associated with this school is the *chaseki* ("teahouse"), a uniquely Japanese architectural form which owes much to the farmhouse. The typical *chaseki* is very small and rustic in appearance; its roof is of thatch and its posts and beams are comparatively thin (in many cases they are natural logs); its walls are of clay and its windows, like those of many farmhouses, are often no more than holes in the wall in which the lathing is allowed to show. Customarily the only ornamentation consists of a painting, a flower arrangement and an unobtrusive *objet d'art,* all placed in the simplest of tokonoma.

Though the military government, now in Kyōto, managed to retain nominal control over the country until the end of the Muromachi period, the provinces were in fact divided into many tiny feudal states almost constantly at war with each other. Each petty lord surrounded himself with a stronghold and as a result the art of building castles developed greatly. When in the late 16th century the great warrior Toyotomi Hideyoshi succeeded in bringing the whole nation under his control, he proceeded to build a series of multistoried donjons, each of which was surrounded by walls and moats and further protected by numerous lookout towers. Similar establishments were maintained by other feudal barons all over the country; though they ceased after the beginning of the 17th century to have any important military function, they continued to play an important role in Japanese social life, for they served as the nuclei of growing commercial centres. The most impressive example of castle architecture still standing is the Himeji castle, whose white plaster walls and soaring roofs are so beautiful as to belie the original purpose of the building.

Within the walls of the great castles stood magnificent palaces, which represent the final development of the *shoin-zukuri* style. Built for the most part in the Momoyama period (1574–1603), an age of opulence, these buildings were massive in general proportions and their interior decoration was lavish in the extreme. The interior wall and door panels, which were framed by huge square posts and beams, were covered with boldly conceived paintings executed on gold-leaf backgrounds and the ceilings, which were very high, were finished in the most elaborate fashion known. Every effort was made to emphasize the importance and dignity of the owners, such weight being laid on rank that even the level of the floors in the various rooms rose with the status of the person for whose use the rooms were intended.

At the very time when these great palaces were being built, however, a very different style, known as *sukiya-zukuri,* was taking form. This was, in effect, a combination of the general plan of the *shoin* with the architectural features of the teahouse. The typical *sukiya-zukuri* was freer and less rank conscious than the *shoin;* it had lighter posts and beams, simpler roofs and much less ornamentation. The best example is to be found at the Katsura palace in Kyōto, which was built in the first half of the 17th century, and which contains, aside from a very light and graceful main building, a number of smaller buildings of interesting form.

The main palace consists of three *shoin* joined together in a zigzagged arrangement. On the east side all three sections overlook a pond which forms the centre of a magnificent landscape garden. Beyond the pond stands a thatch-roofed teahouse called the Shōkintei (Pine-Lute pavilion), whose rustic lines furnish an almost complete contrast with the palace proper. A winding garden path leads from the north end of the main building around the banks of the pond and over a stone-slab bridge to the teahouse, before and around which there are exquisite arrangements of curious rocks. From here the path continues through a sequestered wooded area past two more teahouses and an ancestral temple to a lawn at the south end of the main palace.

Though the Katsura palace is often taken as exemplary of traditional Japanese architecture, a number of modern Japanese architects have pointed out that its designers broke many of the traditional rules of design, employing thinner columns than one would expect, spacing them rather irregularly and abandoning the weighty dignity that characterizes most *shoin.* It has been argued that these departures resulted in part from plebeian influences. In modern times the palace has been widely admired by western architects, who find in its pristine lines, its openness and its lack of unnecessary adornment much that accords with the principles of 20th-century western architecture.

Second Japanese Reaction.—The Tokugawa shogunate, which came to power at the first of the 17th century, enacted laws which not only cut Japan off from most of the other countries of the world but also attempted to ensure the country against all social and political change. A rigid class system, aimed at preventing social

fluidity, was adopted and the type of house that each class could own was determined by law. As a result, throughout the Tokugawa period (1603–1867) there remained several distinct styles of residential architecture.

Because of continued peace, however, the standard of living rose among all classes and though the outward forms of houses occupied by commoners remained fairly constant the interiors were improved by the addition of many elements from the *shoin,* such as *tatami,* shoji and tokonoma. Furthermore, though urban commoners were required at the first of the Tokugawa period to roof their houses with thatch, the peril of fire and the invention of a cheap grade of tile combined to give city houses tile roofs.

The Tokugawa government undertook a number of major building projects, among them the reconstruction of several important Buddhist temples and the erection of a series of shrines dedicated to dead shoguns, but in general architectural styles remained fairly static throughout the Tokugawa period. (It should perhaps be noted, however, that the art of carpentry developed greatly.) The most noticeable trend was an unfortunate one toward overornamentation. The famous Tōshōgū at Nikkō will serve as an example. Built as a mausoleum for the first Tokugawa shogun, Ieyasu, this shrine was clearly intended to be the ultimate in splendour. Architects and carpenters were summoned from all over the country to participate in the construction and the most expensive materials were used. Still the buildings cannot be considered to represent an architectural advance, for in them the grandeur of the Momoyama is largely concealed by a great profusion of ornamentation. Instead of bold structural lines, there is a great mass of decorative carving, finished in every colour of the rainbow. The gaudiness of the shrine is somewhat tempered by its setting, which is a magnificent forest, but the buildings remain an almost complete antithesis of the simplicity and taste that are usually counted among the characteristics of Japanese architecture.

Modern Period.—After the Meiji restoration of 1868, Japan entered a period of intensive westernization, during which western architectural styles and building materials were adopted for most public buildings. Architects were invited from the west not only to design buildings but to train Japanese apprentices and by 1900 a number of Japanese had established themselves in the architectural profession. Architectural styles were for the most part simply copies from the west but there were many attempts to combine western and Japanese architecture and with the rise of Japanese nationalism in the 20th century there occurred numerous reactions to western architecture. Unfortunately, they usually led to little more than ferroconcrete reproductions of ancient styles or western-style office buildings with heavy tile roofs with curving lines. Though western movements such as *art nouveau* had their counterparts in Japan, there was little real innovation in the field of design prior to World War II. At the same time, the seeds of architectural development were sown and by the 1930s Japan had mastered most of the building methods employed in the west.

The postwar period may be divided into three stages. During the first, which lasted from 1945 to 1950, Japan was virtually destitute and architects, lacking both materials and funds for actual construction, could do little but make plans for the future. With the beginning of the Korean War, however, Japan entered upon an era of economic expansion accompanied by a great increase in construction. Between 1950 and 1955 Japanese architects proceeded to incorporate the technical developments that had occurred in the west during the previous 15 years. By 1954 Tange Kenzō, working then in a vein rather reminiscent of Mies van der Rohe, had gained world-wide recognition for his buoyant work in ferroconcrete at the Hiroshima Peace centre; Horiguchi Sutemi, already known in the west, had won further acclaim for his Hasshō-kan, a hotel in traditional style; and Maekawa Kunio was working on plans which were soon to reveal him as an architect of considerable stature.

After 1955 modern Japanese architecture, having more or less caught up with the west in technical aspects, grew increasingly independent in design and was regarded as an important and influential branch of the contemporary movement. Though the influence of Mies van der Rohe and Le Corbusier continued to be strong, world interest in the progress of Tange, Maekawa and Horiguchi, as well as in the works of Taniguchi Yoshirō, Murano Tōgo, Murata Masachika, Oe Hiroshi and other less-famous men testified to the fact that contemporary Japanese architects had advanced from imitation to creation.

Until the end of World War II residential architecture remained conservative. A few people built purely western-style houses and many more added one western-style room to their houses, but the typical dwelling retained the *tatami,* the sliding doors and windows, the tokonoma, the tiled roof and other elements inherited from traditional architecture, the principal innovations being glass panels for outside openings and modern facilities such as electric lighting and running water. In the postwar period there has been a great increase in the number of ferroconcrete apartment buildings in the cities but the usual apartment is still floored, at least partly, with *tatami* and partitioned with sliding doors, as in Maekawa Kunio's Harumi apartments, Tokyo (1958). Though the modern Japanese work in western-style surroundings, they show few signs of wishing to abandon the ancient customs of removing footgear upon entering the house and of sitting on the *tatami* rather than on chairs. The exterior forms of premodern architecture are gradually disappearing and the flower arrangement in the tokonoma has in many houses been replaced by a television set, but many features of the traditional Japanese house seem destined to remain in use indefinitely.

See also references under "Japanese Architecture" in the Index.

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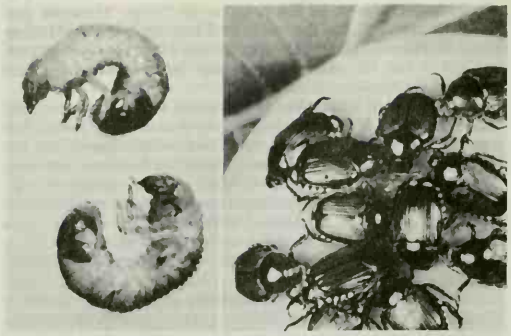
JAPANESE ART: *see* JAPANESE PAINTING AND PRINTS; JAPANESE SCULPTURE; JAPANESE ARCHITECTURE; JAPANESE GARDEN; NŌ DRAMA; KABUKI THEATRE; and sections on Japan in the following articles: FLOWER ARRANGING; IVORY CARVING; ENAMEL; POTTERY AND PORCELAIN; IRONWORK; EMBROIDERY; INTERIOR DECORATION, HISTORY OF: *The Orient.*

JAPANESE BEETLE, an economically important beetle (*Popillia japonica*) of the scarab family (Scarabaeidae) which was accidentally introduced into the United States from Japan, probably as larvae in the soil around imported plants. It was first discovered in the U.S. in 1916 near Riverton, N.J., and thereafter spread to a number of other states along the Atlantic seaboard and as far west as eastern Ohio. It still occurs in varying numbers from Maine southward to North Carolina, and in local colonies westward to the Mississippi river.

Adult Japanese beetles are known to feed upon about 200 species of plants, including practically all the economic crops. They seem to prefer, however, apple, quince, peach, cherry, plum, grape, blackberry, clover and corn. The beetle also attacks the foliage of many shade trees and ornamental shrubs and many weeds, especially knotweed or smartweed (*Polygonum* species). In many cases it completely defoliates trees and feeds upon the earlier-ripening varieties of fruit.

The larvae, living below the surface of the ground and feeding upon the roots of plants, damage lawns, pastures and golf courses. Also damaged are the roots of strawberries, cabbage and other plants that have been set in heavily infested fields. The eggs are deposited in the soil and hatch in about 14 days. The larva is one of the so-called white grubs and passes its entire existence underground. The winter is passed in this stage, and during May the larva transforms to prepupa and then to pupa, the adult beetle emerging any time from the middle of June to the end of July, the exact time depending on the locality.

The adult beetle, about three-eights of an inch in length and about the same in width, is bright metallic green in colour, with coppery-brown wing covers and two prominent white spots on top of the exposed tip of the abdomen. The beetles fly only in the daytime and often mass upon ripened fruits. Females will leave foliage temporarily to lay eggs in burrows in the ground. There is only one generation each year, most of the year being spent in the soil as egg, larva or pupa.



(LEFT) HUGH SPENCER; (RIGHT) LYNWOOD M. CHACE

JAPANESE BEETLE (POPILLIA JAPONICA): (LEFT) LARVAE; (RIGHT) ADULTS FEEDING ON PEACH

Federal and state agencies have made every possible effort to retard the further spread of this pest. DDT, methoxychlor, parathion and other poisonous spray materials, though they give good control of the adult beetles, differ in the duration of their protection against reinfestation. Lawns, golf courses and other turf lands may be protected up to five or more years by certain sprays and dusts. Baited traps help determine the extent and density of infestations but do not control the beetles.

Under the auspices of the U.S. government, intensive studies of the Japanese beetle have been made in its original home. Several of the beetle's natural enemies—species of parasitic wasps and flies—which have been found to destroy it there have been imported into the United States, where several of them have become established.

Of even greater promise as biological controls are disease-inducing microorganisms which are specific for the beetle. A bacterium, *Bacillus popilliae*, which causes milky disease in larvae has markedly reduced infestations in some areas. (*See* also BEETLE; ENTOMOLOGY; INSECT.)

Additional information may be obtained from the U.S. department of agriculture or from state agricultural experiment stations in affected areas.

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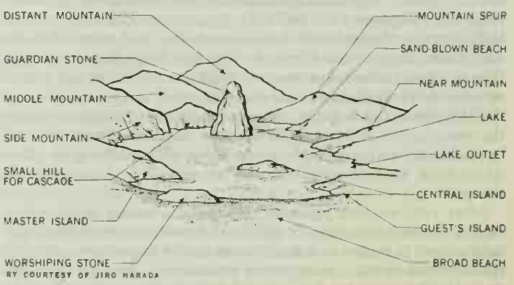
JAPANESE GARDEN. The art of garden making was probably imported into Japan from China or Korea. Records show that the imperial palaces had gardens by the 5th century A.D., their chief characteristic being a pond with an islet connected to the shore by bridges—as is shown by later references to these precedents in Emperor Shōmu's (724–749) three gardens in Nara. During the Heian period (794–1185), when the symmetrical *shinden* style of architecture prevailed, the main garden was laid out on the southern side of the house. With the change of domestic architecture in the Kamakura period (1186–1335), however, came modifications of the garden. Learned Zen priests, who assiduously studied the art of garden making, gave Buddhistic names to different rocks in the design and linked religio-philosophic principles with landscape lore. Other cults and superstitions further complicated garden design. With the Muromachi period (1335–1573) came popularization of gardens, which were designed to be enjoyed not only as views to contemplate, but as microcosms to explore. The subjective mood became dominant and the gardens reflected individuality. People demanded *shibumi* in their gardens—an unassuming quality in which refinement underlies a commonplace appearance, perceptible only to a cultivated taste. Aesthetic priests, "tea men" and connoisseurs created new forms of gardens for *cha-seki*, the little pavilions or rooms built for the *chanoyu* (tea ceremony), and a special style developed which revolutionized Japanese garden art.

The succeeding vogue of designing in the three different degrees of elaboration—*shin, gyo* and *so* (elaborate, intermediate and abbreviated)—was also adopted for gardens. Many splendid gardens were produced in the Momoyama (1574–1603) and Edo (1603–1867) periods. The centre of garden activity gradually shifted, however, from Kyoto to Edo (Tokyo), seat of the Tokugawa shogun. At one stage there was a utilitarian development; *e.g.*, the duck pond in the Hama detached palace in Tokyo and, in the Koraku-yen at Mito, the cultivation of reeds for arrow shafts and plums for military supplies. Feudal lords generally had fine gardens in their provincial homes as well. Quite a number of gardens survived the abolition of the feudal system after the restoration of 1868, yet many celebrated gardens perished through neglect or were sacrificed to modern progress. The establishment of public parks, which were not unknown even in feudal times, has been especially encouraged throughout Japan since 1873. Gardens in western style came in with other western modes but made little headway. The great earthquake and fire of 1923 demonstrated a utilitarian value of the Tokyo gardens; tens of thousands found safety in the parks and in large private gardens scattered throughout the city.

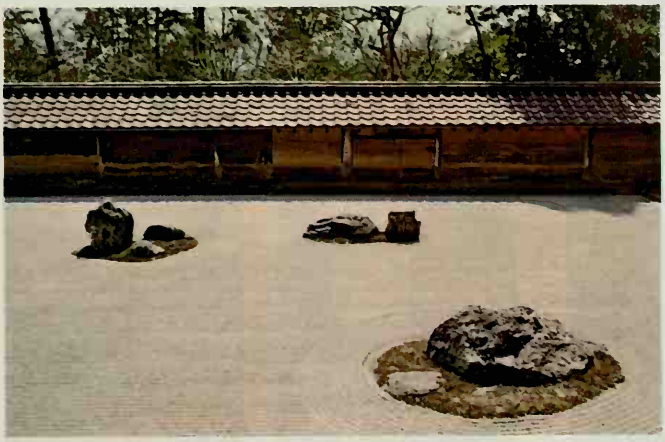
Types of Gardens.—Japanese gardens are generally classified according to the nature of the terrain, either *tsuki-yama* (artificial hills) or *hira-niwa* (level ground), each having particular features. *Tsuki-yama* consists of hills and ponds, *hira-niwa* consists of flat ground designed to represent a valley or moor; *tsuki-yama* may include a portion laid out as *hira-niwa*. Each type may, furthermore, be treated in any one of the three degrees of elaboration mentioned. Hill gardens as a rule include a stream and a pond of real water, but there is a special variation, the *kare-sansui* (dried-up landscape) style, in which rocks are composed to suggest a waterfall and its basin, while in a winding stream or a pond, gravel or sand is used to symbolize water or to suggest seasonally dried-up terrain. There are other styles: *sen-tei* (water garden), *rin-sen* (forest and water) and in level gardens, *bunjin-sukuri* (literary men's style), a simple and small style. The tea garden or *roji* (dewy ground or lane), is another distinct garden style evolved to meet the requirements of the tea ceremony. *Genkan-saki* (front of entrance) have always claimed special treatment—a simple curve in the path is used whenever possible, partly to conceal the door to the house and partly to give character to its front aspect.

Characteristic Features.—Japanese gardens are characterized by: the waterfall, of which there are ten or more different arrangements; the spring, and stream to which it gives rise; the lake; hills, built up from earth excavated from the basin for the lake; islands; bridges of many varieties; and the natural guardian stones. The selection and effective distribution of the stones are a prime consideration in garden design. After endless experiments and deep pondering, the best and most subtle compositions were handed down by means of drawings. A studied irregularity in the arrangement of steppingstones is a noteworthy feature of the *chanoyu* garden, where beauty and use are combined. In modern Japanese gardens, flowers are few and evergreens popular. Simplicity, restraint and consistency are sought rather than gaiety, showiness or the obvious variations of the seasons. Evergreen



CHARACTERISTIC FEATURES OF A JAPANESE GARDEN

The Golden Pavilion (Kinkakuji or Rokuonji temple) originally built for the shogun Yoshimitsu (reigned 1367–95) after his retirement. The garden, which represents characteristic tendencies of the Muromachi period, comprises about 4½ ac., including a pond of 1¾ ac. containing islands representing the tortoise and the crane, symbols of long life. The pavilion, converted to a Buddhist temple after Yoshimitsu's death, was destroyed by an arsonist in 1950 and was rebuilt according to the original plans in 1955



Three views of the garden of Ryoanji temple (15th century), also of the Muromachi period; a famous example of *hira-niwa* (level ground garden). A symbolic composition in black and white, the garden covers a rectangular area of about 360 sq.yd., enclosed by a low wall on three sides, and consists of an arrangement of 15 rocks separated by raked white sand

GARDENS OF KYŌTO

PHOTOGRAPHS, (TOP) MISS LLEWELLYN LIEBER—PHOTO RESEARCHERS, INC., (CENTRE LEFT, CENTRE RIGHT) ERNEST SATOW —RAPHO GUILLUMETTE, (BOTTOM) BOB AND IRA SPRING

JAPANESE GARDEN

Bridges and pathway across a pond in the Katsura Imperial Gardens, a distinguished example of the gardens of the Edo period. The design is traditionally attributed to Kobori Enshū (1579–1647), a master of the tea ceremony

GARDENS OF KYŌTO

Moss-covered bridge across a pond in the Katsura gardens

Two views of the garden of the Sento Gosho, a palace built in 1629 for the retired emperor and destroyed by fire in the 19th century. The garden was laid out by Kobori Enshū in 1634

Subtly arranged stones at the edge of a pond in the Katsura gardens

PHOTOGRAPHS, (TOP) LAWRENCE L. SMITH—PHOTO RESEARCHERS, INC., (CENTRE, RIGHT CENTRE) ERNEST SATOW—RAPHO GUILLUMETTE, (BOTTOM LEFT) WILLIAM G. FROELICH, JR., (BOTTOM RIGHT) MARIANNE STEINER—RAPHO GUILLUMETTE

foliage is preferred to the changing aspect of deciduous trees, although maples and a few others are used. As in the case of stones, trees must be distributed in the garden in harmony with their natural origin and habit of growth. Wells, decorative and useful alike, stone water basins in endless variety, stone lanterns and figures, pagodas, arbours and summer houses are the most characteristic garden furnishings, together with gateways and fences, particularly the widely varying *sode-gaki* (sleeve fences) attached to the side of a house to screen certain portions, harmonize the natural beauty of the garden with the architectural features of the house.

Ideals and Aims of Garden Design.—During its long history, the ideals of Japanese garden designing have been often modified by the prevailing thought of each period. At one time eminent Zen priests designed gardens in accordance with the principles of their philosophic teaching; at another time, painters became deeply interested and designed gardens as though they were landscapes painted on silk.

In the course of history, the objective standpoint in garden making gave way to the subjective impulse. Various philosophic principles and religious doctrines were applied to the making of gardens, not so much to interpret those principles and doctrines as to rationalize the aesthetics of garden design. Natural rocks distributed to illustrate familiar philosophic principles and even superstitions of all sorts still continue to some extent to influence the general design of the garden. The aim is to bring man close to nature and every conceivable means may be employed to realize it. Some master garden designers represented landscapes of China and Japan in miniature. They planned the garden and planted trees to give the illusion of the view extending over and beyond its immediate confines, but at the same time they designed it to be a secluded sylvan retreat, great ingenuity being displayed in both directions. In some instances, only a few stones in the narrow strip of ground suffice to suggest a great expanse of landscape, included as background.

Rikyu, in his garden at Sakai, obstructed the open view of the sea so that only when a guest stooped at the stone basin to wash his hands and rinse his mouth preparatory to entering the *cha-seki* did he catch an unexpected glimpse through the trees of shimmering sea, thus suddenly being made to realize the relation of the dipperful of water lifted from the basin to the vast expanse of sea, and of himself to the universe.

The Japanese have tried to emphasize in their gardens the charm of restraint; beauty is so concealed that it may be discovered individually, thus providing a thrill of joy to the soul like that which comes from doing a good deed in stealth. In its ideal at least, the Japanese garden, which always has been part of the home, is by no means merely an arrangement of beautiful places; it aims at satisfying a human craving for the natural and, by supplying peace and repose, at offering a retreat in which man can find spiritual recreation and sustenance.

See also BON-SAI; JAPANESE ARCHITECTURE; MINIATURE LANDSCAPE.

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JAPANESE LANGUAGE. Japanese is spoken by more than 100,000,000 persons on the main islands of Japan, in the Ryukyus and—often bilingually or as a second language—in Korea and Formosa (Taiwan). A sizable number of speakers also live in Hawaii, California and Brazil. There are many varieties, but Standard Japanese, the language of educated natives of Tokyo, is understood everywhere. The local dialects, especially those of the Ryukyus, are often mutually unintelligible. Proto-Japanese, the ancestor of the modern dialects, was probably spoken by the people of the Yayoi culture, who introduced rice cultivation to Japan around the 1st century A.D. Comparative study indicates that Japanese is probably related to Korean, which has a remarkably similar grammar; the two languages are possibly related also to the Altaic group of languages (Tungus-Manchu, Mongolian and Turkic families) and perhaps to Ainu and Gilyak.

History.—Both Japan and Korea were heavily influenced by Chinese culture. The peoples of the two countries were illiterate until they began learning to read and write Classical Chinese around the 4th century A.D. Though their own languages were completely different in structure, both the Japanese and the Koreans borrowed many Chinese words. The most basic vocabulary of modern Japanese is about 5% Chinese in origin; that of Korean is about 10%. But the majority of all the words in a Japanese or Korean dictionary come from China; the language turned to Chinese for technical and abstract terms, just as English turned to French, Latin and Greek. Since the 17th century, many European words have come into Japanese, for example *pan* "bread" from Portuguese *pão; buriki* "tin" from Dutch *blik; noiroze* "neurosis" from German *Neurose, bata* from English "butter." Borrowed words often changed their meanings: the word *arubaito* comes from German *Arbeit* "work" but in Japan it means "part-time job." Sometimes a word was borrowed in two different forms: *sutoraiku* usually means "strike (in baseball)" but *sutoraiki* means "strike (by workers)"; *garasu* means "glass (the substance)" but *gurasu* means "a glass (to drink from)." Multiple borrowing of the same word also occurred with the earlier loans from Chinese; a single Chinese written character often came to have several different "Chinese" readings. The actual sound of any one of these readings is usually different from the sound in any Chinese dialect today; both languages have been changing during the 1,500 years since Japanese borrowed the Chinese words.

Writing.—After the Japanese had learned Chinese, they tried to adapt the complicated Chinese characters (called *kanji*) to write their own tongue. In inscriptions of the 5th and 6th centuries they began using certain of the characters for their sound value alone, disregarding the Chinese meanings. This resulted in a cumbersome syllabary now known as *Man'yō-gana*. There are two modern syllabaries and each set contains about 50 symbols called *kana*. The ordinary roundish symbols known as *hiragana* developed from the "grass-hand" (shorthand) forms of the characters, and the squarish symbols called *katakana*, used as a kind of italics to write foreign words and unusual terms, were taken from abbreviations of the "square-hand" (printed) forms. On signs and in old-fashioned letters is sometimes found a virtually obsolete form of *kana* known as *hentai-gana* ("queer-shaped *kana*"); these symbols are a kind of fancy *hiragana*. It was quite a burden to learn from 3,000 to 5,000 characters, as well as two sets of *kana* and an antiquated spelling system; the spread of universal education in the 20th century led to demands for simplification. Modernization of the writing system was one of the many educational reforms that followed Japan's defeat in World War II. The ministry of education simplified the difficult shapes of many *kanji* and restricted the number for general use to less than 2,000. The use of *kana* was encouraged for many native Japanese words, technical terms and less common Chinese expressions; the *kana* spelling was standardized according to modern pronunciation. The elementary schools began teaching two kinds of romanization—the Hepburn type favoured by foreigners, which writes the vowels as if Italian and the consonants as if English; and the official Japanese type, which writes the consonants according to structural patterns in the language. The differences between the two types of romanization may be seen from a few place-names: *Fuji—Huzi; Chisima—Tisima; Tsu—Tu; Jawa—Zyawa* "Java"; *Shanhai—Syanhai* "Shanghai"; *Chōsen—Tyôsen* "Korea".

Pronunciation.—Standard Japanese has five vowels: *a* as in *papa* or *ah*, *i* as in *marine* or *Toscanini*, *u* as in *Lulu*, *e* as in *peppy*, *o* as in *go*; in addition there are *ya* as in *yard*, *yu* as in *yule*, *yo* as in *yoyo*. But the vowels are much shorter than their English counterparts and must be carefully distinguished from the long vowels *â* (also written *â* or *aa*), *îi* (*î* or *i*), *û* (or *uu*), *ê* (*ê, ee* or *ei*), *ô* (*ô* or *oo*). The vowels *u* and *i* are often whispered or dropped after a voiceless consonant; *sukiyaki* is usually pronounced *s'kiyaki* and *sukoshi* "a little" often sounds like *s'kosh'*. There is also a syllabic nasal; the exact sound (longish *m, n, ng* or nasalized vowel) depends on the nature of the surrounding sounds. Unlike English, Japanese is spoken with even stress and rhythm, as if a metronome were ticking off each syllable. Standard Japanese has a light pitch accent which differentiates words

and phrases much as English stress does. The following consonants are rather like English sounds; *p, b, m; ch, j; k, g; w; s, sh, h, f.* But *f* is made with both lips, as if lightly snuffing out a candle. And the sound *g* has split into two different sounds in Tokyo Japanese: a hard *g* (as in *go*) that is commonly used at the beginning of words and a nasal *ng* as in *sing*er that is used in the middle of many (but not all) words. Japanese *t, d* and *n* are made against the teeth, unlike the English sounds. Japanese *r* sounds like a combination of *r, l* and *d;* it is a quick tap by the tip of the tongue against the ridge behind the teeth. The closest British sound is heard in *berry*, the closest American sound is heard in *Betty*. Double consonants are held twice as long and sound like less breathy versions of English hi*p-p*ocket, ca*t-t*ail, boo*k-k*ase (-kk-), ra*t-ch*eese, mis-*s*ay, mis-*sh*oot, roo*m-m*ate, pe*n-n*ame.

Grammar.—Roughly speaking, there are three parts of speech: nouns (including some words that would be adjectives in English), verbs or inflected words (including most words that would be adjectives in English) and particles. A typical Japanese sentence is quite complete with only a verb form: *Mimashita* "[it] looked at [it]." If the Japanese wants to give more information about the situation, he puts nouns in front of the verb: *Inu mimashita* "[it] looked at [it]—the DOG was involved," *Inu neko mimashita* "[it] looked at [it]—the dog and the CAT were involved." Unlike English, the order of the words does not reveal the subject–object relationship; the earlier word simply has less emphasis. Particles are little words tacked on to make the grammatical relationship clear: *Inu‿ga neko‿o mimashita* "the dog *as subject*, the CAT *as object*—[it] looked at [it]" = "The dog looked at the CAT"; *Inu‿o neko‿ga mimashita* "The dog *as object*, the CAT *as subject*—[it] looked at [it]" = "The CAT looked at the dog." The particle *wa* de-emphasizes the word or words to which it is attached and highlights the following words; it is often used to set up a logical subject or object as the topic of a sentence or as an item in contrast in order to bring out the point of contrast. There are about 15 other particles with various functions and meanings, corresponding in part to Latin case endings or English word order, in part to prepositions. Most words are general in meaning: *inu* corresponds to six different English expressions—dog, dogs; a dog, some dogs; the dog, the dogs.

The syntax is relatively simple; modifying expressions precede the expressions modified and the order of words follows a subtle system of increasing emphasis, with the verb typically at the end. An important feature of Japanese is the use of speech styles and special status forms. In addition to polite and plain styles of speech, there are honorific expressions used about actions and things involving other persons, especially social superiors. Much of everyday speech is taken up with polite formulas of appreciation such as *dōmo* and *sumimasen* used to mean both "thank you" (*arigatō*) and "excuse me" (*gomen nasai*). Other common formulas are greetings such as *ohayō* (*gozaimasu*) "good morning," *konnichi‿wa* "good afternoon," *komban‿wa* "good evening" and *sayonara* "goodbye." "No" is *iie* and "yes" is *hai, ē, sō* or *nn*, but the reference is often to the truth of the actual question asked and not to the logical situation behind it, so that the Japanese will respond to "Have we no bananas?" with "Yes, we have no bananas." Often Japanese simply repeat the verb: *arimasu* "we have," *arimasen* "we have not."

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JAPANESE LAW. The interaction of two cultural and legal traditions, one indigenous Japanese, the other western, produced modern Japanese law. Before Japan's isolation from the west was ended in 1853 with Commodore Matthew Perry's visit, Japanese law developed independently of western influences. Conciliation was emphasized in response to social pressures exerted through an expanded family unit and a close-knit community. Few rules prescribed how disputes should be resolved. Remarkably little law in the modern sense existed; a static society, which officially discouraged commercial activity, apparently neither desired nor needed a developed legal order.

Western Influences.—Fundamental changes inevitably followed Japan's sudden involvement with the western world. The Meiji restoration of 1868 ended the Tokugawa shogunate and restored effective political power to the emperor. Japan sought to construct an economic, political and legal structure capable of commanding respect internationally, ending extraterritoriality and preserving national independence. The introduction of western law was one element in a wholesale importation of things western.

In legal matters, the Japanese took for models the systems of continental Europe, especially the German. The drafters of the Japanese civil code of 1898 surveyed many legal systems, including the French, Swiss and common laws, taking something from each. Their final product is, however, best characterized as following the first draft of the German civil code. In its subsequent development, the Japanese legal system remained true to these sources. The 1947 revisions of the code provisions dealing with "relatives and succession," which had reflected traditional Japanese attitudes, completed the transition of Japanese civil law to the continental European family of laws.

Legal Education.—Following European models, the law curriculum is part of the undergraduate university program and combines general and professional education. Instruction, by the lecture method, approaches the body of legal rules as essentially complete and largely contained in written codes. Little emphasis is placed on factual analysis. Even more than on the continent, the typical Japanese law graduate makes his career in a government or business bureaucracy. Since World War II, the Legal Training and Research institute has provided a unique kind of postuniversity training for those law graduates who seek careers as judges, procurators or lawyers and can pass the stringent and highly competitive examinations required for admission. Law teachers and law graduates doing legal work in governmental or business offices, however, are almost never graduates of the institute.

The Japanese lawyer, like his law, came with the new civilization; unlike his western brothers, he does not continue an ancient and honoured profession. In Tokugawa Japan, the closest counterpart to the western lawyer was the *kujishi*, an innkeeper who developed a counseling function. The United States, after its occupation of the country following World War II, sought to free lawyers from governmental supervision and improve the bar's social status. The Japanese lawyer is not typically a counselor and general business adviser. Nor does he move in and out of government service.

Impact of U.S. Law.—On some points Japanese law is closer to that of the United States than to European models. This is largely a deposit of the post-World War II occupation and of subsequent contacts with U.S. legal thinking and education. The examination of witnesses in civil cases is now (at least theoretically) modeled after U.S. procedure. The absence of a special hierarchy of administrative courts is consistent with U.S. ideas. Many aspects of labour and corporation law are U.S. inspired. U.S. institutions and procedures have thus affected the character of Japanese law, legal thinking and legal education, though U.S. influence on aspects of social organization and political and economic thinking has been greater.

From the perspective of rules and institutions, the Japanese legal system is closer to the civil law of Europe than to the common law. In many ways, however, the Japanese legal order differs markedly from all western legal orders.

Role of Law in Japanese Society.—A striking aspect of Japan's transition at the turn of the 20th century from an isolated, preindustrial society into a modern, industrial state is that this was accomplished while preserving many of the traditional society's patterns and values. Practices and attitudes unacceptable to contemporary thinking have been abandoned; for example, the inferior position of women and the absolute domination by the family head over the smaller family units making up the "house" no longer have a legal basis. Yet, in accommodating itself to the imperatives of western culture, Japan avoided a sharp break with the past and preserved much of value in its own tradition, including a well-knit social structure.

The fact that Japanese law is not the product of organic evolu-

tion suggests a second point—the role of law in modern Japanese society differs markedly from its role in western societies. In Japan, law plays a far less pervasive role in the resolution of disputes and the creation and adjusting of rules regulating conduct. The paucity of Japanese decisions involving automobile accidents, manufacturer's liability for defective products and nuisance surprises a U.S. observer. He also notes the small size of the Japanese bar and the persistence of extralegal methods of resolving disputes. For many purposes a family transcending man, wife and dependent children still exists. The notion that a business is analogous to a family unit persists and colours all labour relations, especially in small and middle-sized firms. In the relatively homogeneous Japanese society, social status carries heavy obligations and community pressure is extremely powerful.

As Japan becomes westernized, law may come to play in Japan a role fully comparable to its role in the west; the sociological supports essential to the continued vitality of the Japanese conception of law are clearly being undercut by Japan's shift from a rural, agricultural economy to an urban, mechanized society. In all events, current Japanese law in the books still gives a less accurate picture of how Japanese society actually adjusts disputes and harnesses human energy and capacity for mutually beneficial activity than western book law does for western society.

In large areas of Japanese life it is still difficult to predict whether a dispute will be settled under legal standards and it is often impossible to know whether a person will enforce legal rights. A related phenomenon is the use of legal forms, *e.g.*, the signing of a business contract, when the parties do not contemplate regulating their relationships under legal standards, but seek a continuing association allowing for adjustment in response to legally irrelevant considerations.

Facilities for conciliation promote adjustment in terms of nonlegal considerations. Local police stations provide conciliation rooms. Elders act as go-betweens.

Compared with the west, a strong consciousness of rights is lacking; this encourages compromise based on legally irrelevant considerations and the utilization of techniques for resolving disputes outside the formal law. This attitude toward rights underlies Japanese reluctance to embrace fully premises pervasive in western law, namely: the legal consequences of particular conduct should be predictable before the conduct has occurred or any dispute arisen; courts should give full effect to claims, a plaintiff receiving all or nothing at all; individual disputes should be resolved without considering the parties' social and economic backgrounds. These western assumptions reflect thinking about man and his society against a particular background of moral assumptions, cultural traditions, historic experience and economic potentials. The question remains open whether Japanese law will here approximate western law, which may itself be evolving on these points, as it has in more formal matters. *See* also JAPAN: *Administration and Social Conditions.*

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(A. T. v. M.)

JAPANESE LITERATURE. In quantity and quality Japanese literature is one of the major oriental literatures, being less voluminous than the Chinese but comparable with the Arabic, Persian and Sanskrit literatures. It covers the period from the 5th century A.D. to the present. As in European literatures, the novel, the drama and love poetry are of central importance; this contrasts markedly with the literature of China, where such works were considered inferior to those of a philosophical or historical nature. Japanese literature contains some of the world's longest novels and plays, but its genius reveals itself most conspicuously in shorter forms. Despite their beauty the longer works often betray the lack of a sense of over-all structure and break down into episodes related only chronologically. The difficulty experienced by writers in organizing their lyrical impressions and perceptions led to the perfecting of such literary genres, not so highly developed elsewhere, as the diary, the travel account and the book of random thoughts. Charm and a keen sensitivity to beauty are always apparent.

Early Period (to A.D. 794).—Early Japanese culture owed its impetus, if not its inspiration, to China. The Japanese were still comparatively primitive and without writing when, in the first four centuries A.D., knowledge of Chinese civilization gradually reached them through Korea. They rapidly assimilated this civilization and adopted Chinese characters as a writing system. Considerable literary development resulted during the next four centuries.

The earliest Japanese texts were written not in Japanese but in Chinese, partly because Chinese was regarded as more dignified and partly because the Chinese characters were unsuited for writing Japanese. (Japanese could at this stage be written accurately only by using the Chinese characters not for their meaning but phonetically. *See* JAPANESE LANGUAGE.) Nearly all the earlier documents have perished, and the first complete works extant are the *Kojiki* (712) and *Nihongi* (720), both officially commissioned "histories" of Japan (though heavily larded with myths and legends), and the *Fudoki*, local gazetteers dating from 713 and later. These works quote more than 200 folk songs in Japanese, several as old as the 5th century A.D.

The earliest prose works written in Japanese were the *norito*, Shinto prayers (probably 7th century), preserved in the *Engishiki* (927); and the *semmyō*, imperial edicts of the 8th century, preserved in the *Shoku nihongi* (795). Prose style was undeveloped, but the Japanese poetry in the *Manyōshū* (compiled some time after 759; Eng. trans., 1940), a remarkable anthology of over 4,500 poems by more than 450 poets, is most skillful. The poetic form used—the *waka*, deriving from the earlier folk songs—consists of an alternation of five-syllable and seven-syllable lines, without rhyme, stress, metrical pattern or other technical device. The *waka* had two main types: tanka (short poem), of five lines of 5, 7, 5, 7 and 7 syllables respectively, totaling 31, and *chōka* (long poem), an indefinite succession of pairs of 5-syllable and 7-syllable lines, followed by a concluding additional 7-syllable line. The *waka* remained the standard poetic form for over 1,000 years, and is distinctively Japanese, avoiding (at least until the 20th century) words of Chinese origin. Among *Manyōshū* poets, the most famous are Kakinomoto no Hitomaro (*c.* 655–*c.* 710); Yamabe no Akahito (died *c.* 736); Ōtomo no Yakamochi (*c.* 718–785), one of the anthology's chief compilers; Ōtomo no Tabito (665–731); and Yamanoe no Okura (659–*c.* 733). The *Manyōshū* is the symbol of the great cultural advance of the Nara period (710–784). Its poems are direct and filled with genuine emotion, whether they treat the death of a wife or child, the glory of the imperial family or the pleasures of drink. Both in their moving simplicity and in their diversity of themes they reflect something of the spirit of the early period and contrast strikingly with the more polished but narrower verse of later times.

About 750 the imperial court (the centre of literary activity)

turned from composition in Japanese to composition in Chinese; the *Kaifūsō* (751) is an anthology of Chinese poetry by Japanese poets.

Classical Period (794–1192).—The Heian, or Fujiwara, period (794–1192), when the Japanese capital was at Kyōto, was a brilliant period of culture and especially of literature. It began unpromisingly, composition in Chinese still being in vogue, but from about 850 composition in Japanese flourished increasingly, mainly as a result of the invention of the *kana* phonetic syllabary, which enormously facilitated the writing of Japanese.

The development of composition in Japanese was pioneered by a revival of *waka* poetry. The *Kokinshū* (905; Eng. trans., 1922), compiled by the poets Ki no Tsurayuki (d. 946), Ōshikōchi no Mitsune (*c.* 859–*c.* 921), Mibu no Tadamine (*c.* 867–*c.* 965) and Ki no Tomonori (d. 906), was commissioned by the emperor as an anthology of this revival. Poetry writing was an indispensable accomplishment of the aristocracy. Skill in the art was a good means of gaining preferment at court; it was also the requisite of a lover, whose messages to his mistress would be exquisitely penned, dexterously folded and attached to a spray of the blossoms of the season. In this period the tanka almost ousted the *chōka*, because short, elegantly turned poems were more suited to the lover's billet-doux or to competitions for poems on a given theme—a frequent court pastime—than the longer forms. The poetic style, too, changed; simplicity and directness yielded to refinement and complexity, reflecting an advanced sensitivity which valued the aesthetic perception of subtle shades of meaning and appreciated intricate word play, puns and allusions. Certain themes, such as the falling of the cherry blossoms or the reddening of the autumn leaves, became stereotyped, but in the hands of such a master as the priest Saigyō (1118–90) even such hackneyed imagery acquired a movingly symbolic content.

Prose.—Parallel to the 9th-century development of poetry, prose composition in Japanese made steady progress. The earliest surviving prose story is the *Taketori monogatari* ("Tale of the Bamboo Cutter," mid-9th century), a fairy tale about a princess who comes from the moon to dwell on earth in the home of a humble bamboo cutter. Many of the other early works contain similar elements of fantasy or fable, but in poem tales such as the *Ise monogatari* ("Tales of Ise," about 950) are found more realistic stories. The poem tale was a succession of tanka connected by short prose passages, often of considerable narrative interest, which ostensibly give the circumstances of the poems. Diaries and travel accounts also began to flourish. The earliest extant is the *Tosa nikki* (935) by Ki no Tsurayuki, whose prose style has poetic beauty; in it, he assumed the character of a woman—significantly, for in this period fiction writing was largely the achievement of women. As one result, Japanese literature is probably the only one in which the greatest works are by women. These works include the *Kagerō nikki* (974–977), the journal of a noblewoman; the diaries of Izumi Shikibu and Murasaki Shikibu; and the delightful *Makura no sōshi* ("Pillow-Book of Sei Shōnagon," about 1015), a work of the utmost sophistication and charm. The greatest literary product of the period, and indeed of the entire literature, is the *Genji monogatari* ("Tale of Genji," about 1010) by Murasaki Shikibu. It is the first important novel written anywhere in the world. It retains its popularity in Japan and is well known in the English-speaking world, thanks to Arthur Waley's superb translation (6 vol., 1925–1933; 1 vol., 1935).

The success of the *Genji monogatari* was so overpowering that it tended to influence excessively or even to stifle the production of later novels by the court society, which before long was forced by the bitter warfare that marked the close of the period to turn its attention away from elegant and polished romances.

Middle Ages (1192–1603).—The court at Kyoto continued during most of the "middle ages" to be a centre of cultural activity, but military power shifted from one group of war lords to another; at times the country was divided into many virtually independent states. Fifteen more poetic anthologies were commissioned. Most of the poets placidly followed the stereotypes established in happier times, but in the best of the collections, the *Shinkokinshū* (1205), the tone is darkened, and the prevailing note is one of death and separation. The *Shinkokinshū* poets sought to fill their verses with as much symbolic content as they could. This resulted in a display of craftsmanship which has sometimes been denounced as artificiality; nevertheless, their tastes, and particularly those of the compiler Fujiwara no Teika, or Sadaie (1162–1241), have continued to dominate Japanese poetic sensibility.

In the 15th century linked verse (*renga*) became the preferred medium of the leading poets, including the priest Sōgi (1421–1502). Generally three or more poets took part in composing a linked-verse sequence, supplying alternate verses, one in three lines of 5, 7 and 5 syllables, the next in two lines of 7 and 7 syllables each. In other words, the classical tanka was divided into two "links," and these could be strung out to form a "chain" of indefinite length. Elaborate codes were devised to govern the fitting of the links. As in most other works of Japanese literature, much more attention was given to the relations of the successive elements than to the over-all structure. The first three lines of a linked-verse sequence were to become an independent poem under the name of *hokku* or *haiku*.

Verse in Chinese had during this period an importance roughly equivalent to that of Latin poetry during the middle ages in Europe, sometimes reaching the realm of genuine poetry but more often being a mere display of technical proficiency. More significant poetry may be found in the *Nō* dramas, particularly those by Kan'nami Kiyotsugu (1333–84) and his son Seami Motokiyo (1363–1443). (*See* Nō Drama.) These two men by their genius metamorphosed what had been primitive song and dance playlets into one of the noble arts of the world. Their plays were strongly tinged with Buddhist sentiment and were almost uniformly tragic in tone. Comic interludes called *kyōgen* were performed between the *Nō* dramas for relief. Though of popular origins, the *Nō* quickly became associated with the court of the shogun, and the art acquired hieratical trappings which made further developments within the medium difficult.

Prose, previously written in almost pure Japanese, became intermixed with Chinese words. Military stories, mainly having to do with the wars at the end of the Heian period, were prominent. Of these the *Heike monogatari* ("Tale of the Heike," 13th century; Eng. trans., 1918, 1921) is the most celebrated. It is a work of exceptional, if uneven, beauty, and has been a rich quarry for later novelists and dramatists. The *Heike monogatari* opens with a Buddhist declaration of the impermanence of all things, and this statement, so often in the mouths of even the Heian courtiers, had peculiar significance in an age of war and destruction. The same insistence on impermanence is found in the *Hōjōki* (1212) by Kamo no Chōmei (1153–1216), a hermit's description of how he came to abandon the world. It is found also in the random essays, *Tsurezuregusa* ("Essays in Idleness," *c.* 1330–35), by Yoshida Kenkō (1283–1350), though here it is mixed with a sometimes contradictory appreciation of the lovely things of this world.

Unhappiness over the spectacle of a world torn by disorder led writers of every type of literature to attempt to suggest eternal truths in their works by means of a kind of symbolism known as *yūgen*. We find *yūgen* in the *Nō* particularly, but almost equally in the poetry of Teika or in the "Essays in Idleness." Parallel developments occurred in the tea ceremony, the landscape garden and monochrome painting, all arts which suggest or symbolize rather than state.

Rise of Popular Literature (1603–1868).—The Tokugawa period (1603–1868) was one of internal peace and prosperity after the reunification of Japan. Edo (the modern Tokyo) became the cultural capital, and from 1638 to 1853 Japan was closed, by government decree, to normal contact with the outside world.

There was a rapid resurgence of literature, the output of which is remarkable for its extent and variety. It was characterized by liveliness, virility, humour and sensation. The genres were largely changed, for two reasons: first, the writers were no longer court nobles or Buddhist priests, but men of the military class (now free from civil wars) and members of the new, economically powerful commercial class whose tastes were different; second, cheap printing and wider education brought books to a different public.

The tanka, for many centuries an almost fossilized form, under-

went startling changes, first as a result of the rediscovery of the simple strength of the *Manyōshū*, which had been overshadowed by later anthologies, and later with the decision to make the tanka a vehicle for expressing life as it actually was led in early 19th-century Japan. Kamo no Mabuchi (1697–1769) represented the *Manyōshū* scholars and poets; the priest Ryōkan (1757–1831), Ōkuma Kotomichi (1798–1868) and Tachibana Akemi (1812–68) were among those who proved that the tanka was not confined in range to descriptions of blossoms or the autumn moon, but could equally well express joy over fish for dinner or wrath at political events. Some writers who felt that they could not give full vent to their emotions within the tanka turned as in the past to poetry in Chinese. Rai Sanyō (1780–1832) probably wrote Chinese more skillfully than any Japanese writer had ever done.

The chief development in poetry, however, was the emergence of the *haiku* as an important genre. The greatest of the *haiku* masters was Matsuo Bashō (1644–94). Despite their brief compass, his *haiku* can often suggest a whole world, and they range in tone from the lighthearted to the profoundly sorrowful. Some of Bashō's best-known works are travel accounts interspersed with his verses; of these *Oku no Hosomichi* ("The Narrow Road of Oku," 1694) has become one of the most popular and revered works of the literature. Later *haiku* poets added new colouring: Yosa Buson (1716–84) the warmth of romantic love, and Kobayashi Issa (1763–1828) the accents of the common people.

Popular forms of drama more suited than the sombre *Nō* to the rising townsman class developed in the late 16th century: the *jōruri* or puppet theatre, which used chanters to intone the puppets' dialogue, and the *kabuki* (*see* also KABUKI THEATRE; DRAMA: *Japanese Drama*). The *jōruri* theatre prospered because of the brilliance of the playwrights Chikamatsu Monzaemon (1653–1725), Japan's greatest dramatist; Takeda Izumo (1691–1756), the principal author of the immortal *Chūshingura* ("The Treasury of Loyal Retainers," 1748; Eng. trans., 1910); and Chikamatsu Hanji (1725–83). The *jōruri* plays fell into two main categories: those based, however loosely, on historical facts or legends, and those dealing with contemporary life. The domestic plays are rated much higher critically because they avoid the bombast and fantastic displays of heroism which mark the historical dramas, but the latter remain superb acting vehicles in the *kabuki* theatre, for which they have been adapted.

Fiction abounded in many forms. The first important novelist after the Heian period, Ihara Saikaku (1642–93), enchanted his readers with racy accounts of the amorous and financial affairs of the merchant class and of the demimonde. Saikaku's combination of a glittering style and a warm sympathy for the characters he portrayed lifted his tales from the borders of pornography to genuine art. Ueda Akinari (1734–1809) dealt more frequently with supernatural and grotesque events, as in his *Ugetsu monogatari* (1768). Mention must also be made of the novels of Takizawa Bakin (1767–1848), most of them of immense length and crushingly moralistic in manner.

More than half of Tokugawa literature comprises learned, historical and philosophical works of all kinds, often of high value. This learning was encouraged by the Tokugawa shoguns, who sought help in administrative theory from the Chinese Confucian philosophy, which embraced political theory, interpreted by the *kangakusha* (scholars of Chinese learning), who taught and wrote so extensively that Confucianism, including its virtues of loyalty and piety, became an important influence. In reaction there arose another school of writers, *wagakusha* or *kokugakusha*, who upheld all branches of native Japanese civilization and learning. Men of this school did much to revive Shinto beliefs and to prepare for the imperial restoration of 1868.

Modern Period.—The modern period resulted from the inrush of western influence after the reopening of Japan to foreign intercourse in 1853, and may be dated from the imperial restoration (1868) in Tokyo in place of the Tokugawa shogunate. Almost every branch of life, including literature, was rapidly and profoundly affected by imitation of European and United States ways. Some writers wholeheartedly accepted western models; others adhered to Tokugawa styles while making fun of foreign methods; the majority, however, attempted to compromise. Constant changes—political, social and psychological—produced an attendant variety of literature, multiplied in turn by the influence of successive European literary movements.

In poetry there was extraordinary activity. Into the traditional forms of the tanka and *haiku* new ideas and language were poured, not always with entire success; many poets would blush to mention cherry blossoms but revel in such exotic European flowers as the lilac or acacia, and the sighing of the wind was often replaced by the clang of a passing tram. Yosano Akiko (1878–1942), Ishikawa Takuboku (1885–1912) and Saitō Mokichi (1882–1953) were among those most successful with the new tanka, lending the form respectively notes of romantic love, social consciousness and modern psychology. Free verse was popular, though often in fact it reduced itself to patterns of five and seven syllables. Shimazaki Tōson (1872–1943) was the first important poet of this style. His "Song of the Autumn Wind" (1896) is a skillful echo of Shelley; ten years later Japanese poets were writing Symbolist verse. In the *haiku*, Masaoka Shiki (1867–1902) was recognized even in his own day as an immortal poet, and numerous other *haiku* poets ensured that western influence would not destroy this uniquely Japanese form. A body of verse translated so beautifully from foreign tongues as to be considered part of Japanese literature has also been of great importance.

Translations dominated the modern Japanese theatre. The public, however, still preferred the *kabuki* to the modern theatre, and the favourite playwrights were those of the 18th century or men such as Kawatake Mokuami (1816–93) whose works reveal little foreign influence. Perhaps by way of reaction the intellectuals, the chief supporters of the modern theatre, tended to prefer plays derived from European works if not actual translations.

Fiction poured out in thousands of volumes by hundreds of writers, many of whom consciously imitated some western model. In the Meiji period (1868–1912) fiction owed much to Tsubouchi Shōyō (1859–1935), who in *Shōsetsu shinzui* (1885) stressed the need for realistic and rational novel writing; and to Futabatei Shimei (1864–1909), who pioneered the use of everyday speech instead of the difficult literary language. Mori Ōgai (1862–1922) was especially revered by later writers as the creator of the most highly esteemed modern literary style. By general consent, however, the chief novelist was Natsume Sōseki (1867–1916), a reflective writer less concerned with depicting extraordinary events than with day-to-day happenings in the lives of average Japanese.

An amazing burst of creative activity occurred in the decade following the conclusion of the Russo-Japanese War in 1905. Probably never before in the history of Japanese literature were so many important writers working at once. Some of the novelists who first emerged into prominence at this time were Nagai Kafū (1879–1959), Tanizaki Jun-ichirō (1886–) and Akutagawa Ryūnosuke (1892–1927). Their works, which revealed a powerful attraction to the Japanese past, tempered by a modern, essentially western sensibility, dominated Japanese literature through the 1920s and 1930s. Nagai Kafū most frequently found his subjects among the entertainers of the gay quarters of Tokyo, and chronicled with exquisite artistry the passing of the old city. In some of Tanizaki's novels, particularly *Tade Kuu Mushi* (1929; Eng. trans., *Some Prefer Nettles*, 1955), the conflict between traditional and western-inspired ways was the central theme. Problems of another kind—those of social injustice—led the "proletariat literature" school to produce books intended to promote revolutionary changes. Kobayashi Takiji (1903–33) was considered the outstanding figure in this movement. Other writers, convinced that the essential function of literature was artistic rather than propagandistic, formed such opposing schools as the "neosensualists," whose members included Yokomitsu Riichi (1898–1947) and Kawabata Yasunari (1899–). These were two of the finest novelists of the generation after Tanizaki.

Japanese critics have divided the fiction of the period up to 1941 into many schools, each consisting of a leading writer and a cluster of disciples. Probably the most influential author was Shiga Naoya (1883–). His characteristic literary form was a closely autobiographical story, related by him with stylistic

beauty and a sensitive intelligence, but lacking in invention or coherent structure. This "I novel" (*shishōsetsu*) came to occupy a place of almost dominant importance.

The wars of the 1930s and 1940s stifled most literary production, but their conclusion signaled a new period of activity, both by the older generation and by such new men as Dazai Osamu (1909–48) and Mishima Yukio (1925–).

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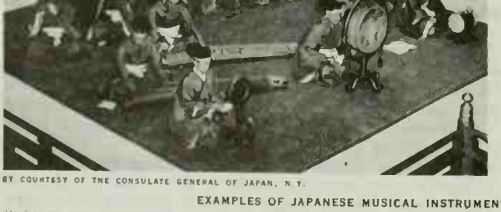
JAPANESE MUSIC. Modern Japanese music can best be described by first tracing its prehistoric and historic antecedents.

Prehistory.—The prehistoric remains on Japan have given rise to many theories concerning the islands' early inhabitants. Twentieth-century scholars generally agree that there was a diffusion of early western cultures reaching Japan in prehistoric times; the percentage of caucasoid or mongol elements, however, is an open question. A small number of the caucasoid Ainu tribe has survived in Hokkaido and preserves the degenerate remains of an autochthonous music. In origin the Japanese are a very mixed race, and their music suggests a fusion of various cultures in the remote past. The excavations of the successive Stone Age periods (Jomon) brought to light some isolated stone whistles found on the west coast of the main island. They are similar to findings in Korea. The most important musical finds of pre-Christian times are the metal bells (*dōtaku*) of the Kwanto plain, Honshu. About 300 specimens were found over a limited district, almost a square. This restricted location of the sites points to an immigrating tribe's entering Japan from the north and penetrating due southward as far as northern Shikoku. It is not known what kind of people these immigrants were; the discoveries suggest a continental culture that the migrating tribe might have tried to preserve.

The period of imperial mounds (*kofun*) dates from the 3rd to the 7th century A.D. Archaeological finds are abundant, and excavated clay figurines (*haniwa*) representing musicians, dancers and musical instruments support early Chinese annals describing Japanese manners and customs. (Wei-chi, *c.* A.D. 298; Hou-Han-shu, *c.* A.D. 445.) Many of the excavated specimens indicate ritual customs. Some of the dancers have wide-open mouths, as if calling on gods or singing in trance; some seem to be beating a rhythm with closed fists against their chests; some carry clappers, bells, hollow oblong zithers with four or five strings, or drums that are beaten with sturdy, knobbed drumsticks. There is evidence of professional dance costumes, and the bell bracelets are of the same shape as those used in 20th-century Shintō shrines. Indications of all these musical activities are found on the east Asian mainland about a millennium earlier. The legendary descriptions of this period contained in the earliest chronicles (*Kojiki*, "Record of Ancient Matters," A.D. 713; *Nihongi*, "Chronicles of Japan," A.D. 720) are largely supported by archaeological evidence. These contain numerous references to music; descriptions of instruments are vague, but many songs are classified according to their content, geographical and social origin and style of performance.

History.—From remote times continental, particularly Korean, music was continuously absorbed in Japan. The first datable fact is that in A.D. 453 the king of Shiragi (Silla), Korea, sent 80 musicians to the funeral of the emperor Inkyō. During the 7th century musicians from the three Korean kingdoms immigrated in greater numbers. With the introduction of Buddhism (officially 552 but rectified as 572 or 579), liturgical chant (*bombai*) and a number of continental instruments, such as bronze bells, cymbals and flutes, were introduced. The employment of the Korean musician Mimashi, who imported music and masque dances (*gi-gaku, kure-gaku*) from Kure, in southern China, is recorded in the court annals of 612. In 685 the foreign court musicians acquired the status of a guild with hereditary privileges. Chinese music became predominant during the (Chinese) T'ang period (618–906) and its practice was controlled by an academy (*gagaku-ryō*) in 702. Two celebrated T'ang compositions, *Go-Shōraku*, "Music of the Five Confucian Virtues," and *Taiheiraku*, "Great-Peace-Music," appeared on court programs of 699 and 702. Toward the middle of the 8th century several distinct musical forms became discernible and may be classified according to their origin, social significance and musical characteristics. Besides *gi-gaku* and *kure-gaku*, there also flourished in Japan T'ang music of the courtly style (*tō-gaku*), popular T'ang music (*tō-sangaku*), music from the three Korean kingdoms and their borderlands (*koma-gaku*), and also dance pantomimes (*Rinyū-gaku*) from Indochina, Annam, Burma and India. "Opening-of-the-Eyes" of the great Tōdaiji-Buddha (752) was celebrated by an impressive musical program, some of the dancers' and musicians' costumes for this occasion having been preserved. The program included the dances *Ryō-wō* and *Sohōhi*, which are still known in modern times. The oldest preserved musical notation is the *Tempyō-biwa-fu*, a lute tablature of the year 768. Under the emperors Saga and Nimmyo (810–850) the interest in national music greatly increased, and a second imperial academy, the *o-uta-dokoro*, was entrusted with its revival. During the Heian and Fujiwara periods (794–897; 897–1185) the various kinds of music, imported or autochthonous, were arranged in an order that remained unchanged until modern times. The general term *tō-gaku* (T'ang music) comprised all music from China, south and central Asia, the standardized instrumentation consisting of bamboo flutes (*ōteki*) and short bamboo double-reed instruments (*hichiriki*) played in unison, mouth organ (*shō*), three percussion instruments providing repeated patterns (gong *shōko*, small double-side drum *kakko*, big suspended drum *taiko*) and two string instruments supplying a drone (*koto, biwa*). All Korean, northeast Asian and Manchurian music was incorporated into *koma-gaku*, the instrumentation consisting of a Korean flute (*koma-fue*) and *hichiriki* in unison and three percussion instruments (*taiko, shōko* and the hourglass-shaped drum *san-no-tsuzumi*). The term *mikagura* comprised the music of the imperial Shintō rites and some song dances of the earliest times, accompanied by a low-pitched flute (*kagura-fue*), *hichiriki* and the six-stringed zither *wagon*. Two new types of composition were incorporated in court music: *saibara*, songs of provincial pack-horse drovers,

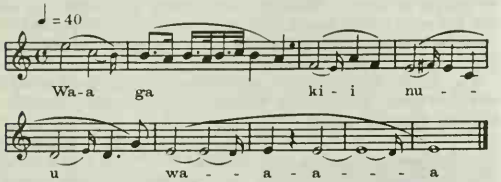


BY COURTESY OF THE CONSULATE GENERAL OF JAPAN, N. Y.

EXAMPLES OF JAPANESE MUSICAL INSTRUMENTS

(Left) Performance of kangen or instrumental *gagaku*. Members of the ensemble are playing (front row) percussion instruments: *shōko, taiko* and *kakko;* (middle row) stringed instruments: *koto* and *biwa*, and (back row) wind instruments: *ryuteki* (*ōteki*), *hichiriki* and *shō*. (Right) close-up of a *koto*, a 13-stringed instrument played by plucking

heard with Chinese instrumentation; and *rōei,* poems in the Chinese style chanted in a sophisticated manner and accompanied only by flute, *hichiriki* and mouth organ. The following is a single phrase from the famous *saibara* "Koromogae":



During the 12th and 13th centuries the music of the Buddhist church was reformed. Hymns in the vernacular, flexible and expressive in character, were added to the old *bombai,* the name of which was changed to *shōmyō.* The feudal periods Kamakura (1185–1336) and Muromachi (1336–1573) saw the rise of the nō theatre (*see* also Nō Drama). *Kure-gaku* and *Tō-sangaku,* popular types of music from the early middle ages, had survived in rural dance pantomimes (*dengaku*) and popular acrobatic performances (*sarugaku-nō*). They were gradually absorbed into the artistic nō theatre by the *sarugaku-nō* dancer Kan-ami (1333–84) and his son Zeami (1363–1443). The originals of Zeami's theoretical works are preserved in the nō guilds, Kanze and Komparu. They were rediscovered in 1909 and published by Tōgo Yoshida. During the centuries of feudal government various itinerant guilds came into existence. Under the influence of the new Zen Buddhist sects the bamboo end-blown flute *shakuhachi,* introduced by the Zen Buddhist monk Kakushin (1255), was played by itinerant monks, the *komusō.* Wandering bards, called *heike-biwa,* recited the exploits of the two rival clans, Taira and Minamoto, to the accompaniment of the four-stringed lute (*biwa*).

The Edo, or Tokugawa, period (1603–1868) flourished under hereditary commanders (shogun) of the house of Tokugawa. The century of transition from the feudal era to the Tokugawa regime was also the time of a strong western influence exerted by Spanish and Portuguese missionaries. In the mission schools on Kyushu, Christian hymns, Gregorian litanies and secular European music were taught to the eager Japanese over a period of at least 80 years. This musical influence and the knowledge of western melody and western musical expression became merged into folk song and the various types of entertainment music of the Tokugawa period. With the growth of cities and the increasing wealth of the merchant class, the puppet theatre (*bunraku; jōruri*) became popular and was sponsored by guilds. The kabuki theatre originated in Kyōto, where the courtesan O Kuni gave rise to both enthusiasm and scandal. The woman's kabuki was succeeded by the *wakashū* kabuki, in which graceful and effeminate young boys impersonated the heroines. The surviving male kabuki has developed since 1640. (*See* also Kabuki Theatre.) The *samisen,* a long-necked, three-stringed instrument played with a plectrum, had been introduced from Okinawa toward the end of the 16th century. It became the principal instrument of kabuki accompaniments. Secular concert music (solo songs and chorus in alternation, accompanied by percussion instruments, *samisen* and *koto* groups) was of three schools: Naga-uta, Tokiwazu and Kyomoto. Instrumental solo music for the 13-stringed *koto* was greatly favoured, as were the many variants of geisha songs and chamber music for voice, *koto* and *shakuhachi.*

Modern Period.—This dates from the opening of the country and the reinstatement of the emperor in 1868. French military music (bugles) had already been introduced by some independent feudal lords (*daimyō*) who maintained armies of their own. In the 1870s the imperial court pressed for the immediate introduction of western music. Under the baton of the Englishman P. Fenton the imperial musicians were the first to perform an all-western orchestral concert (1877). In public education Japanese melody and music theory were abolished, and western nomenclature, notation, harmony and melody were rigidly imposed. After the establishment of the Imperial Academy of Music in Tokyo (1878) western music made headway at an amazing speed. Most cities by the 1960s had one or several modern orchestras. Beginning in 1959 festivals of modern music and competitions of avant-garde composers from all over the world were arranged annually and attended by an international audience. Japanese music of former times survived only in closed guilds. After World War II it became a subject of research for Japanese and western musicologists.

Surviving Japanese Music.—The imperial music department, Gakusho, still functioned in the early 1960s, but the number of imperial musicians steadily decreased although their social status was raised after World War II. Part of the ancient repertory was preserved. As formerly, it was divided into *To-gaku, Koma-gaku, mi-kagura, saibara* and *rōei.* Buddhist music flourished, particularly in the traditional Tendai school on Mt. Hiei near Kyōto. The numerous Buddhist sects had their own musical traditions: the strongly nationalist Nichiren sect used folk-song elements and rapid tempi; the Nishi Hongwanji in Kyōto prided itself on its adoption of modern western harmony and the harmonium. In

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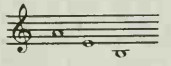
BUDDHIST MONKS PLAYING THE COURT-ORCHESTRA INSTRUMENTS (FROM LEFT TO RIGHT) SHŌ, HICHIRIKI AND ŌTEKI

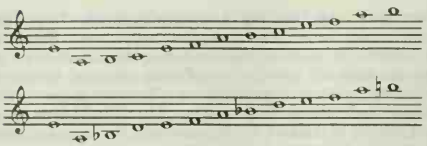
Shintōist music many folk music elements survived and became merged with original Buddhist melodies. The *heike-biwa* and *komusō,* suppressed since 1868, were encouraged after 1945 to seek a revival. Of the many types of theatrical and entertainment music, the renowned nō theatre maintained the highest standard and tradition.

Notation.—There exist three different notation systems in traditional Japanese music: tablature, pitch designations and neumes. Tablature is used for lute (*biwa*) and zithers (*koto, wagon*); flute, *hichiriki* and mouth organ notations indicate the exact pitch but use a different nomenclature and different symbols for each of the instruments. All vocal music is written in florid neumes derived from the *shōmyō* neumes imported from China by the Buddhist monk Ennin (posthumously named Jikaku Daishi; 794–864) and modified or simplified for courtly songs and nō recitation. The Meiji restoration in 1868 produced an increasing tendency to replace classical notations by the inadequate western notation system, leading inevitably to westernization of the music itself.

Japanese Scale System and Musical Theory.—These differ with each type of music. Court music uses the two pentatonic modes *ryo* (d e f♯ a b d) and *ritsu* (d e g a b d) and a number of auxiliary notes. Buddhist chant is built on a small number of melodic nuclei of restricted range, hardly ever exceeding the range of a perfect fourth or a diminished fifth and provided with elaborate embellishments and microtone shadings. Nō melody moves around three tonal centres, high, middle and low (*jō, chū, ge*), at intervals of the fourth:



Koto music of the Tokugawa period makes use of the two secular (*zokugaku*) scales, *hira-joshi* and *kumoi-joshi:*



Found in all kinds of Japanese music is an open or veiled pentatonic basis, the drone element, prominence being given to the tritone, to onomatopoeic effects, to embellishments and microtone deviations, and to a prolonged trailing sound at the end of phrases. Colouristic elements replace harmony, which is unknown in the western sense to Japanese music.

Instruments.—Rattles, clappers and other percussion instruments belong to the beginnings of Japanese music. In Buddhist chant, the sections are distinguished from each other by the *bangi,* two rectangular pieces of wood, struck together. The *shakubyōshi,* of slightly different shape, serves the same purpose in vocal court music and Shintō songs. Bells are used exclusively in Buddhist service. The oldest high-quality bronze bell was imported in A.D. 698. Drums, both suspended and standing, are indispensable to most kinds of music; they are used in court music, Buddhist and Shintō services as well as in rural dances. The small hand drum is characteristic of the nō theatre. Gongs exist in wood, bronze or cheaper metals. The wooden gong (*han*) is a Buddhist instrument. Large cymbals are reserved for Buddhist funeral services. A small-size pair of cymbals, of Buddhist origin, has become a favourite instrument of rural, semireligious dance pantomimes. Wind instruments are made of stone, shell, clay, wood, bamboo, lacquer and ivory. The most typical are the bamboo end-blown flute *shakuhachi,* the bamboo *hichiriki* (a small instrument with a very large-lipped reed), the free-reed mouth organ *shō* and the three sizes of bamboo transverse flutes *ōteki, komā-fue* and *kagura-fue.* String instruments are mostly played with a plectrum. Among them are the large four-stringed lute *gaku-biwa,* a court music instrument, and the well-known geisha *samisen.* The obsolescent *kokyū* is one of the rare instruments played with a bow. Among the various types of zithers with movable bridges, the noble court music instrument *wagon* (six strings) is played with bare fingers; the popular 13-stringed *koto* is played with plectra attached to the fingers.

See also ORIENTAL MUSIC.

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JAPANESE MYTHOLOGY. Japanese myths are not highly organized, and it is not easy to separate the ancient from the later legends. In general, they are both sensitive and coarse, lacking a sense of tragedy; the prevailing attitude is one of compromise, of peaceful resolution of conflict. The reader never breathes the atmosphere of catastrophe that is typical of certain other mythologies. A strong sense of harmony with nature and natural surroundings has always been characteristic of the Japanese people, and this may be partly responsible not only for the generally serene mythical atmosphere but also for the qualities of productivity and purity that are stressed in the personifications of aspects of nature. Around the beginning of the 8th century A.D. the early myths were collected in the *Kojiki,* or "Records of Ancient Matters," and the *Nihongi,* or "Written Chronicles of Japan" (*see* KOJIKI; NIHONGI).

The central myth is solar, built around the Sun goddess, who was the tutelary deity of the Yamato (*q.v.*) clan which first unified the Japanese islands. She dominates the mythological accounts because the Yamato clan presided over their organization. However, other accounts existed. Izumo, for example, had its own main divinity, Ōkuninushi, and the official *Kojiki* narrative is obliged to take him into consideration, although it accords him a relatively secondary place. The early primacy of the Yamato clan meant that the Sun goddess throughout Japanese history has been placed at the head of the gods, and her symbols constantly recall her relation to the country and its origins—the mirror as an object of worship in Shintō shrines and the red disk of the sun appearing on the national flag, to name but two.

BY COURTESY OF THE MUSEUM OF FINE ARTS, BOSTON

IZANAGI AND IZANAMI STIRRING THE PRIMEVAL BRINE. TO FORM THE FIRST LAND MASS: 19TH-CENTURY PAINTING. WATERCOLOUR ON SILK. BY EITOKU. IN THE BIGELOW COLLECTION. MUSEUM OF FINE ARTS, BOSTON

Central Cosmogonic Myth.—In the beginning was chaos, compared to floating oil or to an egg, without form but containing the germs of life. From it sprang a "thing," something like a reed shoot but conceived of as a divinity (or *kami; see* SHINTŌ: *Primitive Shintō*). Seven generations of other, minor divinities appeared in brother and sister couples whose careers are unrecorded. The eighth and last pair are Izanagi, the Male Who Invites, and his sister Izanami, the Female Who Invites.

Izanagi and Izanami, ordered by the divinities produced before them, created the first land. Standing together on the Floating Bridge of Heaven, they stirred the chaotic brine with a heavenly spear till the liquid curdled and thickened. When they drew up the spear, the drops of brine falling back into the ocean formed the island of Onogoro (Self-Curdling [Island]). The two divinities descended to the island, where they erected a Central Pillar. From their union (different stories describe how they learned the art of sexual intercourse) were created numerous islands and deities. One of them, a deformed child, unable to stand erect even at the age of three, was called "Leech Child" and because of his imperfection was abandoned in a reed boat and left to float away. Another failure was Foam Island, which also is not recognized as one of their children. Izanami continued to produce divinities, including the eight islands of Japan and the divinities of the earth, sea, seasons, wind, trees, mountains, and moors, until she brought forth the god of Fire. In this act her private parts were so burned that she became fatally ill; from her vomit, mountains came into being, from her feces clay, and from her urine water. She died, and Izanagi, weeping in despair, generated from his tears still more divinities; he buried his wife on Mt. Hiba, on the border between Izumo and Hahoki, and then drew his sword and slew the Fire god, from whose blood other deities were created. Izanagi longed for his

wife. She, now dwelling in the Land of Darkness, had built a palace there, and thither Izanagi went to visit her and to plead with her to return with him to the upper world: their creative work was not finished. But "I have eaten the food of this place," she told him, and therefore could not leave it. Whereupon she retreated into her palace, begging him not to follow her. But her impatient husband made a light and entered, there to find her in an appalling condition, maggot-covered and rotting, her body housing the eight Spirit Thunders. He turned and fled.

Izanami, angry at being discovered in such a horrible condition, sent the hags of the Land of Darkness after him. By various stratagems he managed to evade all pursuers and finally arrived at the Even Pass between the world of light and darkness, which he blocked with a huge rock. From either side of it he and his sister threatened each other: Izanami said she would strangle a thousand beings a day in the land of light; Izanagi replied that he would set up 1,500 parturition houses each day, thereby keeping a suitable balance between births and deaths. He also formally divorced his sister.

The cycles of light and dark, of birth and death, found in the myth of Izanagi-Izanami have obvious points of resemblance to the Greek myths of Orpheus and Eurydice and of Persephone (*see* ORPHEUS; PERSEPHONE). Izanami, like Persephone, cannot return to the land of light because she has tasted of the food of the Land of Darkness. Unlike the Greek myths, however, this one has no tragic consequences; it merely ends in divorce, a rational compromise.

The Sun Goddess and the Storm God.—Izanagi then proceeded to purify himself from his defilement through contact with death. As he bathed in a river a number of deities came into being. At last from his left eye was born the Sun goddess, Amaterasu (Heaven Shining; Amaterasu Ōmikami); from his right eye the Moon god, Tsukiyomi; and from his nose the Storm god, Susanowo, the Impetuous Male. From this point, the activities of Amaterasu and Susanowo occupy the central place in the myth, and the Moon god is heard of no more.

Amaterasu, resplendent and shining, ruled over the Plain of High Heaven. Susanowo was impetuous and dark, and his empire was the Sea Plain. To the bafflement of the other divinities, he appeared to be grief-stricken, weeping and lamenting loudly. When Izanagi asked the reason for his sorrow, Susanowo told of his desire to visit his mother, Izanami, in the Land of Darkness. Izanagi was furious and, as punishment, banished him. Then the Impetuous Male ran amok, broke down the divisions in the ricefields that Amaterasu had laid out, filled the irrigation ditches, and defiled her dwelling place. The goddess at first excused him, attributing his vulgar actions to drunkenness. But she finally became exasperated and to emphasize her displeasure withdrew into a cave and secured the entrance.

Light thus left the world, and the alternation of day and night ceased. This worried the other 8,000,000 deities, who tried various methods of luring the goddess out. What was ultimately effective was a kind of striptease by the deity Ama-no-uzume, which so delighted the assembled gods that they laughed heartily. The Sun goddess, curious, looked out of the cave. The other divinities held a mirror before her (the first she had seen), and, intrigued with her own image, she stepped out. A rope was passed behind her and she was forbidden to retreat beyond it. With the reappearance of the sun, light returned to the world, the alternation of night and day began again, and the happy laughter of the 8,000,000 gods rings through the universe.

Here the legend breaks down into a series of episodes and incidents among which it is difficult to establish a fully satisfying sequence.

The Impetuous Male, stripped of his beard and of his possessions and banished for his outrageous behaviour, descended into the land of Izumo in western Japan. At the headwaters of the Hii River he saw a pair of chopsticks floating downstream. Deducing that there must be people dwelling upstream, he followed the course of the water and soon came upon an old man, his wife, and daughter, all weeping bitterly. The old man told their sad tale: a monstrous eight-headed, eight-tailed serpent had been terrorizing the country for eight years. It had devoured eight daughters of the old couple and was now ready to claim the ninth. Susanowo offered to help the sorrowing family, in return for the daughter's hand in marriage. He then made the serpent drunk on sake; when the creature was asleep, he drew his sword and cut it to pieces. In the monster's middle tail Susanowo found the Herb-Quelling (*Kusanagi*) Sword, which he sent to his sister goddess and which has an important role later.

Ōkuninushi.—Susanowo built a palace at Suga, in Izumo, married the girl he had saved from the dragon, and together they produced several generations of gods. The most famous of these was Ōkuninushi, Master of the Great Land (Izumo). At this point begins the new cycle of Izumo myths, dealing largely with Ōkuninushi's career. This, although not in opposition to the preceding Yamato group, is distinct from it.

Ōkuninushi's brother gods desired to marry the princess Yakami, who lived in the province of Inaba, near Izumo; on a visit to Inaba they took Ōkuninushi as their servant, to carry their baggage. En route, they encountered a hare lying by the roadside, stripped of its fur. The simple hare followed the cruel deities' suggestion that, to heal himself, he bathe in salt water and then let the wind dry him off. When the sea water dried, of course, his skin split, and he lay writhing in pain when Ōkuninushi arrived at the spot. In response to Ōkuninushi's questions, the animal told this story: He had been on the island of Oki, near the Izumo-Inaba coast, and had wanted to cross over to the mainland but could find no way. So he gathered the crocodiles of the sea and proposed a competition to determine whether hares or crocodiles were the more numerous. The crocodiles were to lie end to end while the hare counted them as he trod over their backs. Just as he reached the last crocodile, which had caught on to the trick, the reptile reached up and stripped away his fur. The naughty deities' trick had only worsened his plight. Ōkuninushi took pity; on his advice the hare bathed in fresh water and dusted his body with sedge pollen, upon which he was promptly restored to good health. Now it so happened that the hare was in reality the Hare deity of Inaba, and in return for Ōkuninushi's kindness he promised that the princess Yakami should marry Ōkuninushi himself. (This is one of many stories of a grateful—in other cases, vengeful—animal found in Japanese legend.)

Ōkuninushi's brothers, irked at their failure to obtain the princess' hand, conspired to murder the Master of the Great Land. First they burned him to death: he had agreed to a boar hunt (on Mt. Tema) in which he would catch the beast as they drove it down the mountain; instead they rolled down an enormous stone which they had previously heated. But heaven sent to Ōkuninushi's aid a cockleshell and a clam, the joint efforts of which brought the god back to life as a beautiful young man. Then the brothers crushed him to death: they cut down a large tree, split and inserted a wedge in the trunk, stuck Ōkuninushi in the crack, and then removed the wedge. This time he was revived by his parent, who prudently recommended that Ōkuninushi flee the country.

Ōkuninushi then departed for the netherland, where Susanowo lived, to seek the Storm god's advice. As he approached the palace, Forward Princess, the Impetuous Male's daughter, saw him. The two looked at each other and were thus married. The princess told her father of the arrival of the beautiful young deity, whom the Impetuous Male spitefully called Ugly Male of the Reed Plains and sent to sleep in a snake house. But Ōkuninushi's wife saved him from the snakes by slipping him a protecting scarf. After several attempts by Susanowo to destroy him, Ōkuninushi decided to leave.

While the Impetuous Male slept, Ōkuninushi was able to tie the god's hair to the rafters of the house. Seizing Susanowo's most precious possessions (his sword, bow and arrows, and lute), Ōkuninushi fled, carrying Forward Princess on his back. The lute brushed against a tree, awakening Susanowo. When he leaped up, his hair pulled the rafters loose and the palace collapsed. Nevertheless he pursued the Master of the Great Land as far as the Even Pass between the lands of light and darkness, where at last he gave up the chase. In a sportsmanlike spirit he recom-

mended that Ōkuninushi make use of the sword and bow to destroy his hostile brothers, and Ōkuninushi took the advice. Thus he became the ruler of Izumo.

Ōkuninushi now began construction of the world, helped by a dwarf deity, Sukuna-bikona, who had knowledge of medicine and who came, clad in goose skins, riding the waves on a small boat of bark to Izumo. Ōkuninushi took him up in his hand to look at him, and as he was examining him the little god bit him on the cheek. Ōkuninushi reported this barbarous action to the heavenly divinity, who recognized the tiny god as one of his own children, an evil one, whom the heavenly divinity had accidentally dropped on earth.

Together Sukuna-bikona and Ōkuninushi constructed the world and formulated the medical arts and the methods of protection from wild animals. Sukuna-bikona is last heard of when he climbs to the top of a millet stalk, which, rebounding, projects him into the Everlasting Land. Many later folktales about dwarves and fairies are derived from stories about him.

The August Grandchild of the Sun Goddess.—Finally the Sun goddess determined to send her grandson, Ninigi, to become ruler of the Central Land of Reed Plains (Japan). Ōkuninushi was naturally reluctant to give up his own right to rule, but he eventually submitted to the inevitable when, in recognition of his power and position, he was permitted to retain control over "secret" (religious) affairs, while the Divine Grandchild assumed sway over "public" (political) matters. Significantly, the Divine Grandchild, on his descent to the earth, landed not in Izumo (in the north) but in Kyūshū, southernmost of the main islands. Amaterasu granted to Ninigi three treasures as a sign of his charge: a jeweled necklace (symbolizing benevolence), a mirror (purity), and the Herb-Quelling Sword (courage). These articles are still the Japanese imperial symbols and are kept in the inner sanctuaries of the chief Shintō shrines.

Fireshine and Fireshade.—Among the children of the Divine Grandchild were the princes Fireshine and Fireshade, the elder of whom, Fireshine, worked the sea, catching all kinds of marine animals, while Fireshade lived on the land, hunting all manner of beasts. One day Fireshade proposed that they exchange their luck: the sea-luck would go to him, who worked the land, and the land-luck to Fireshine, who worked the sea. Fireshine accepted. But the sea-luck is not effective in the mountains, nor the land-luck on the sea. Fireshade not only caught no fish with his elder brother's hook but, worse, he lost the hook. He offered 500 hooks in its place, but his brother would accept only the original. From this awkward position Fireshade was rescued by a sea divinity, who made a boat and sent him to live in the palace of the Sea god. Fireshade married the daughter of the Sea god and dwelt happily with her.

After three years, however, he began to long for his home. Noticing his dejection, the Sea god interrogated him, and Fireshade told the story of Fireshine's hook and the reason for his journey to the sea palace. The Sea god thereupon questioned the fishes and soon found the lost hook in the sea bream's gullet. The Sea god instructed Fireshade to restore the hook to his brother, gave him two water-ruling jewels, and sent him back to land on a crocodile's back.

Fireshine, when his hook was returned to him, became poorer and poorer. Blaming his brother, he made an attempt to kill him. But Fireshade used one of the jewels given him by the Sea god, which brought the tide to such a height that Fireshine was nearly drowned. Facing death, Fireshine repented his evil action. Fireshade then took pity and used the second jewel, which caused the tides to recede. Moved by this compassionate act, Fireshine promised eternal allegiance to his brother.

The sea princess now discovered herself to be pregnant and came to the land to build a parturition house so that she might be near her husband during her delivery. But she warned him not to look at her during the moment of childbirth because at this time she must change into her original form. Fireshade of course peeked and found that she had turned into a crocodile. Shamed, the princess left him and returned to the sea.

Folk Heroes.—Similar to the legend of Fireshine and Fireshade is the folktale of Urashima of Mizunoe.

Urashima had fished for three days and nights without catching anything, until at length he snared a turtle. Upon capture, the turtle changed into a beautiful maiden, who led Urashima to a wonderful island where the ground was paved with pearls and the trees bedecked with jewels. For three years Urashima lived happily in the palace of his mistress' father, completely forgetting his former existence. But when he began at last to grieve for his home the princess pitied him and agreed to his departure. As a parting gift she gave him a comb box set with jewels, warning him that if he opened it they would be separated forever. On his return home, Urashima could find no one he knew. He was told a village legend about a certain Urashima, who 300 years ago had vanished into the sea. Griefstricken, Urashima opened the box, from which a white mist arose and dissipated in the breeze. He realized that he would never again meet his sea princess. Finally he died, no longer young but a very old man, with wrinkled skin and hair streaked with white.

Another folk hero is Yamato-takeru, the Brave of Yamato. In his youth, requested by his father to discipline his elder brother for his absence at meals, the Brave caught the boy during a visit to the privy, killed and dismembered him, and threw the parts of the body away. He was equally efficient in dispatching the two braggart and uncouth Kumaso braves. Dressed in woman's clothing, he tantalized the brothers with feminine seductiveness, drinking with them at a banquet until they were soddenly drunk. Then, drawing a hidden sword, he stabbed the one and, plunging the weapon between the buttocks of the other, ripped him up like a ripe melon.

Nor did Yamato-takeru hesitate to use treachery to gain his ends. Becoming friendly with an Izumo warrior he planned to defeat, he made a sword of wood. After bathing with the warrior in a river, he proposed that they exchange weapons and then, when the man was defenseless, challenged and promptly killed him.

The Brave of Yamato then set out toward the eastern provinces, where the aboriginal Ainu still dwelt unsubdued. On the way he discovered the sword Susanowo had taken from the eight-headed serpent, and with its aid he survived an attack by the Ainu. They set fire to the grass when he was on a wide plain, and he used the sword to cut down the brush around him and saved himself from being burned; hence the name *Kusanagi*, Herb-Quelling, or Grass-Mower. During his travels the Brave also met the princess Miyasu, whom he later married. Among other adventures, they were threatened during a sea crossing by monstrous waves; the princess offered herself as a sacrifice to the sea, and her selfless act saved the life of her lord.

The Brave came to the end of his career on the plain of Tagi (rudder), where his legs became like rudders and he could not walk. Yamato-takeru changed into a white plover and vanished into the heavens, and the great tomb built for him at Ise was called the Mausoleum of the White Plover.

Conclusion.—Japanese myths are fundamentally accounts of the origins and descent of the gods. They show little anthropomorphization, although the manifestations of nature are deified. A good part of the myth tries to establish a relationship between the birth of gods and corresponding natural objects and categories. Creation is not the result of a force operating from without, but rather is a kind of spontaneous generation, the exact workings of which are obscure. Japanese myths are composite, bearing a striking resemblance to Polynesian legends; but many of them—as Izanagi's descent into the Land of Darkness, the creation of the Sun goddess from Izanagi's eye, and the stories of Fireshine and Urashima—are of a universal type to be found in other mythologies.

The story of Amaterasu and Susanowo, the central myth, is manifestly solar; and although, as in many other mythologies, deities are conceived of as a male-female pair, chief emphasis is on the inherent polarity of their natures, the extremes of light and dark, purity and impurity, tranquility and impetuosity. Amaterasu, the Sun goddess, is assigned the central role, but her character remains vague and symbolic while that of Susanowo is

the most sharply defined of all the divinities. The solar Yamato cycle dominates the account because of the political bias of the compilers, who were interested in embellishing the reputation and pedigree of the Yamato clan. The provincial tales of Ōkuninushi and his career in Izumo should be considered as parallel rather than secondary accounts, because the distribution of power related by the myths—temporal to Yamato and religious to Izumo—reflects the existence of at least two chief cultural centres from which the myths arose. Nonetheless, contrary to what one might expect, Japanese mythology is not dualistic. Instead, a compromise was reached, and the deities and their descendants occupy separate spheres of interest.

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JAPANESE PAINTING AND PRINTS. Although it originated in China, Japanese painting has not been merely imitative. The impact of Chinese civilization on Japan was even greater than that of Italy and Greece on western Europe, but periods of Chinese influence, which were often transmitted by way of Korea, alternated with periods in which the Japanese genius, insular and unified, asserted its special gifts and qualities. Since the Meiji restoration in 1868 Japanese painting has undergone a metamorphosis as a result of the impact of western civilization.

General Characteristics.—Japanese painting before the Meiji restoration was based on the typical Japanese attitude of perceiving the self, not in opposition to the outer world, but as part of it. The world was apprehended intuitively from within. This attitude created art of unique beauty—an art with no conflict between image and perception, an art of complete empathy and, at the same time, of abstraction. Japanese painting ignores the cast shadows of nature. It attempts no sculptural effects. It attempts very little relief and only a suggestion of modeling. It attempts to represent not a three-dimensional physical space, but an internally apprehended space. It aims not at the complete representation of a scene, but a selection of the significant elements, using blank space as a factor in the design. It employs a subjective system of perspective instead of one with a fixed viewpoint. Bird's-eye views are even more prevalent than in Chinese painting. Japanese artists study nature with ardent attention; their aim is to train the memory so that they will be able to record a mental image with the utmost vividness and truth. They concentrate on life, movement and character, but always with an eye to decorative effect. Their technique follows that of the Chinese. The medium is Chinese ink called *sumi*, which yields tones ranging from deep lustrous black to silvery gray, and opaque water colours, which are usually mixed with diluted bone glue. Paintings are either in *sumi* alone or coloured, often very slightly. The material is silk or absorbent paper, generally sized with alum or a substance made from beans. The strokes of the brush are valued as a direct communication of personality, as they are in handwriting, which is also done with the brush instead of a pen and is valuable training for the painter. Japanese painters learned from China an art of line drawing which can express strong emotion or reveal the intrinsic beauty, as well as the elemental forces, of nature. They developed delicate lines capable of communicating the painter's most subtle sentiments. Mural painting was practised in early times, but never to the extent that it was in China. More popular was painting on screens, usually six-fold but sometimes two-fold, and sliding doors. Another popular form of painting was the *makimono*, the horizontal scroll which was sometimes of immense length. Since the 13th century, however, the most common form of painting has been the *kakemono*, the hanging painting. The *kakemono*, mounted on fine brocade or other textile fabrics, is kept rolled up and, when shown, is hung in a sort of alcove called the tokonoma, reserved for this purpose.

The subjects of Japanese painting are often similar to those of Chinese art, but, in periods when Chinese influence was not paramount, the life of action has been a far more prominent and fruitful theme. In many paintings of native style there is an emotional feeling which tends to be sentimental. High spirits and a frank gaiety are also distinctive qualities that find expression in Japanese art. The national instinct for fastidious order is reflected in art. This tendency, in conjunction with the extraordinary sensitivity of the Japanese, resulted in paintings which represent the beauty of nature in extremely refined, simple forms. This tendency, however, has sometimes become a weakness, causing some Japanese painters, especially when striving for decorative effects, to miss the inner reality of the subject. Another bane of Japanese painters has been the sacrifice of inner significance for clever brush manipulation. Nevertheless it must be emphasized that the Japanese have shown an instinctive taste that amounts to genius; and perhaps in no other country has fine taste been so widely diffused. The colour prints of the 18th century, which were produced by men of the artisan class solely for a public of the same class, have been appreciated as miracles of refinement and exquisite design in the western world. China has nothing comparable.

Although in general Japanese art may be less profound than Chinese art, there are among the early religious paintings some sublime masterpieces. In the portrayal of swift and vehement action Japanese draftsmen of medieval times are unsurpassed. Nor have the Chinese ever produced anything like the superb array of screen paintings by great masters of the 16th and 17th centuries which are among the greatest glories of Japanese painting. Japanese painting represents a continuous tradition of 1,300 years, perpetually renewing itself. But since nearly all its great masterpieces have remained in Japan, the range of its achievement has not been appreciated by the rest of the world.

PAINTING

Early Buddhist Art (6th–8th centuries).—Paintings of the protohistoric period are so primitive as hardly to merit mention. The real tradition of Japanese painting began with the introduction of Buddhism, which, in its successful progress from India, reached Japan by way of Korea in the 6th century. Of its earliest phase the one existing relic is the Tamamushi shrine, a miniature temple, on a high pedestal, with doors and panels painted with Buddhist figures and scenes in colours on lacquered ground in the Chinese Buddhist style of the Six Dynasties period. The shrine was probably made in Japan about the mid-7th century.

The earliest independent painting is the portrait of "Crown Prince Shōtoku and His Two Sons." Prince Shōtoku (574–622) was a great and enlightened prince, who as regent under the empress Suiko (reigned 592–628) energetically propagated Buddhism and fostered the arts. Painted after his death, probably about 700, the portrait reflects Chinese early T'ang painting, especially the style now associated with Yen Li-pen. Another style of T'ang painting, said to have been originated by Wei-ch'ih I-sêng, is reflected in the paintings decorating the piece called "Lady Tachibana's Shrine." Painted in the same style, but in much grander scale and with more spiritual loftiness, are the frescoes in the Golden hall of the Hōryūji monastery near Nara, which are believed to have been painted about A.D. 700 or a little later. Unfortunately, this grandest monument of early Japanese painting was gravely damaged by fire and water in 1949. In the Nara period (710–794), during which, except for the last ten years, Japan's capital was located at Nara, the matured style of Chinese middle T'ang painting was closely followed, as may be seen in the "Beauties Under the Trees" in the Shōsōin and the exquisite "Kichijō-ten" (Srī-Mahā-devī) owned by the Yakushiji monastery at Nara. In 756 the consort of the emperor Shōmu dedicated the belongings of her dead husband to Buddha. These treasures have been preserved in the Shōsōin at Nara; they vividly show the outward signs of the Chinese civilization of the period. It would be difficult to say to what extent these exquisite objects were a product of Japanese workmanship. But it is certain that the Japanese adopted the arts and graces, the costume and ceremony, and the literary and aesthetic pastimes of Chinese life with a responsive appreciation. Fine taste and sensitive docility are characteristic

of the Japanese.

Early Heian Period (794–897).—In 794 the capital was moved to Kyōto, then called Heian, and from that date to 1185 extends the Heian period, the latter three centuries of which are often called the Fujiwara period (897–1185) after the great clan of Fujiwara. Buddhist painting gained even greater importance in the Heian period as a result of the introduction of esoteric Buddhism; its direct follower Kūkai (774–835) established the Shingon sect in Japan, and the priest Saichō (767–822) started a Japanese version of the Tendai sect. These two sects flourished all through the Heian period and deeply influenced its art. Both emphasized mystic rituals in which religious pictures played especially important parts. From the early Heian period a small number of paintings have survived. All were used for esoteric Buddhist rites and are filled with mystic solemnity. They are painted after the Chinese late T'ang style, but some reveal certain Japanese characteristics. Five pictures of the "Portraits of Seven Patriarchs of Shingon Sect" in the Kyōō-Gokokuji monastery, Kyōto, are Chinese T'ang paintings but the two others were painted in Japan. The lines of these two are less severe and strong but more abstract and graceful than the Chinese originals. The Twelve Devas, a series of twelve paintings owned by the Saidaiji monastery, show the tenderness and grace which are characteristic of the next, Fujiwara, period. In secular painting, which consisted mainly of decorated screens and panels, the Chinese style also seems to have been closely followed. As contemporary records indicate, only in subject matter did Japanese taste begin to show itself; Japanese, as well as Chinese, themes including intimate Japanese landscapes were painted. This tendency brought a gradual nationalization of style, which was fully developed in the ensuing period. Among the 9th-century painters whose works and deeds are recorded, Kudara-no-Kawanari (782–853) and Kose Kanaoka (active in the late 9th century) are the most famous. (In this article the family name precedes the first name or nom de plume, according to Japanese custom.)

Latè Heian Period (897–1185).—The Late Heian or Fujiwara period was the period when the characteristic style of Japanese art was created. From the end of the 9th century to the 12th century, official relations with China were suspended, although there was some private trading and communication with the continent. Shut up within herself Japan began to assimilate the marvelous inheritance she had received from the continent, and at the same time developed her art according to her own genius. The emperor's power gradually devolved to a regency and allied nobles, mostly of the Fujiwara clan, and an aristocratic culture flourished. The courtiers' hedonism coupled with a typically Japanese sensitivity and love of nature fostered an extremely refined aesthetic culture which made this period the golden age of Japanese art and literature.

Reflecting their culture, Buddhist paintings of this period have not only religious loftiness but also sensuous beauty. The monumental "Death of Sakyamuni" in the Kongōbuji monastery on Mt. Kōya, and the magnificent "Resurrection of Sakyamuni," owned by the Chōhōji monastery near Kyōto, are of sublime beauty. In the graceful "Image of Fugen" (Samantabhadra) in the National museum, Tokyo, is reflected the refined, effeminate culture of the late Fujiwara period. Esoteric Buddhism exercised its authority among the courtiers, who relied on its mystic rites to secure ends in this and other worlds. It brought forth many masterpieces which, though painted according to strict iconographical rules, have at once sensuous beauty and mystic solemnity, as in the "Twelve Devas," painted in 1127, in the Kyōō-Gokokuji, Kyōto, or overwhelming mystic power as in the "Green Fudo" (Acalanatha) in the Seiren-in temple, Kyōto.

The romantic aestheticism of the time found characteristic expression in the pictures of *Raigō*, "Coming to Welcome," which represent beatific visions of Amitabha descending to welcome the blessed soul. These pictures were born from the doctrine of Jōdo (Holy Land or Paradise), which taught the worship of Amitabha, who was believed to welcome in his Western Paradise the souls of faithful dead. This worship was advocated by the priest Eshin (d. 1017) of the Tendai sect, who found many followers. The sumptuous picture of the *Raigō* owned by the Hachiman-ko on Mt. Kōya is traditionally associated with Eshin, one of the great religious painters of Japan, but it seems to date from a little later time. The beautiful evening landscape painted in bird's-eye view below the descending Amitabha of this picture is a typical Japanese scene, and betrays characteristic Japanese sentiment and taste for colourful nature and decorative beauty. The same can be said about the landscapes in the pictures representing various aspects of the *Raigō* painted in 1053 on the walls and doors of the Hōō-dō or Phoenix hall in the Byōdōin monastery, Uji.

Yamato-e.—National feeling was further developed in secular painting and produced pictures which represent Japanese themes with Japanese taste and sentiment and in a style which became consequently different from the Chinese. This kind of painting was called *Yamato-e* meaning Japanese picture. It was fashionable in the Fujiwara period to decorate screens and panels with *Yamato-e*. Even more popular were *E-makimono, i.e.*, picture scrolls. There are two styles of *Yamato-e* from this period. One is predominantly linear, using vigorous lines capable of expressing strong emotion and movement. Colour plays a subordinate role. It is more or less realistic and can be described as masculine in comparison with the other style which is feminine. This second style is decorative and abstract, aiming chiefly at expressing sentiment rather than reality. It uses at once line and colour, the two elements being complemental to each other. Its lines are delicate and graceful, communicating subtle sentiment. Its colours are pretty and symbolic. The early stage of this style can be traced in the series of five 2-fold screens with the illustrated biography of Prince Shōtoku by Hata Chitei, painted originally as a mural in 1069.

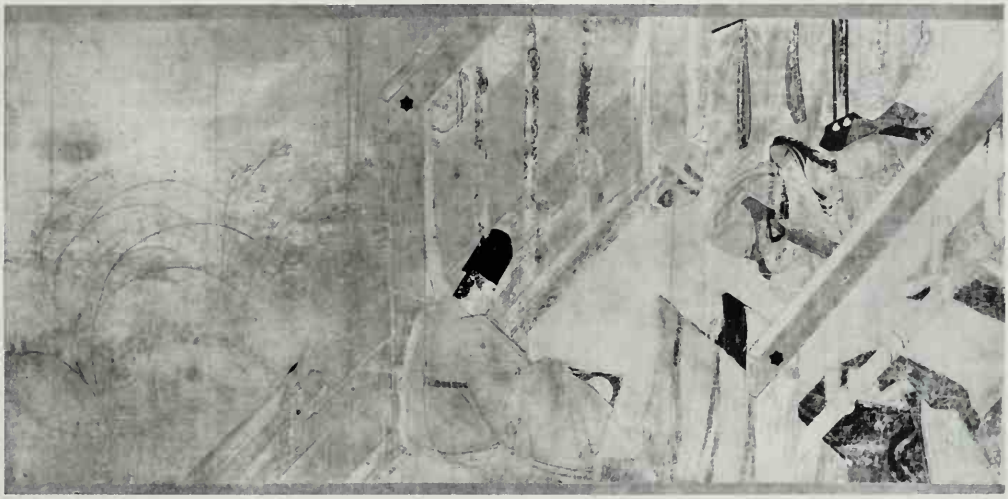
Three masterpieces of the first, linear style date, in all probability, from the latter half of the 12th century. One is the "Legends of Mt. Shigi" painted in three long scrolls. They vividly depict miracles performed by a virtuous priest in five long continuous paintings, the one in the first scroll being almost 30 ft. long. The composition develops continuously from right to left, and tells a story. The internally apprehended space of Japanese painting, with which even the time element can be merged, is demonstrated here to much advantage.

Another masterpiece of continuous composition is the "Story of Tomo-no-Dainagon" in three scrolls attributed to Tokiwa Mitsunaga. Painted in the same linear style but of a different nature are the four scrolls of "Animal Caricatures." They seem to have been painted by more than one painter, although tradition ascribes them to Kakuyū (1053–1140), the famous priest-painter popularly known by the title Toba Sōjō. These scrolls catch the lively movements of animals in witty and animated drawings in *sumi*.

In contrast, the beautiful picture scrolls illustrating the *Genji monogatari*, the novel by the Lady Murasaki, show the fully developed second style of *Yamato-e* at its most splendid and original. The cult of beauty and the courtiers' conception of life as a continuous ceremony are reflected in the symbolistic stylization of exquisite design, in which the play of curving forms against straight lines and angles is enriched by the contrast of delicate but glowing colours. It is chiefly an art of representing the sentiment and atmosphere of life indoors, which is shown in bird's-eye view by omitting roof and ceiling. The profuse beauties of nature are symbolized by trees and flowers painted sometimes in delicate isolation but always in harmony with the atmosphere of the scene. Traditionally ascribed to Fujiwara Takayoshi, the Genji scrolls do seem to date from his time, the first half of the 12th century. About the middle of the 12th century the long rivalry of the great samurai clans of Taira and Minamoto came to a head, and Japan was engaged in civil war, during which, however, art continued to flourish.

Kamakura Period (1186–1335).—In the end the Minamoto triumphed, and Yoritomo took the title of shogun, military governor. He established his government at Kamakura. It was a period dominated by warriors who took a realistic attitude toward life. This attitude and their virile spirit are reflected in the art of this period. The swift and summary power of stroke, and the

A section of one of the four scrolls of "Animal Caricatures" traditionally attributed to Priest Kakuyū (1053–1140); Fujiwara period, 12th century. Owned by the Kozan-ji monastery, Kyōto, Japan



"Prince Genji consoling sick Murasaki-no-ue," a section of the picture scrolls of the *Genji monogatari* attributed to Fujiwara Takayoshi; Fujiwara period; first half of the 12th century. In the Goto museum, Tokyo; formerly owned by Y. Masuda, Tokyo, Japan

"The Burning of the Sanjo Palace," from the picture scrolls of the Heiji insurrection; Kamakura period, 13th century. In the Museum of Fine Arts, Boston, Mass.

JAPANESE PAINTING OF THE 12TH AND 13TH CENTURIES

BY COURTESY OF (CENTRE) Y. MASUDA, TOKYO (BOTTOM) MUSEUM OF FINE ARTS, BOSTON. PHOTOGRAPHS (TOP) BENRIDO CO., (CENTRE) M. SAKAMOTO, TOKYO

JAPANESE PAINTING AND PRINTS

Picture of the *Raigo*, "Coming to Welcome," representing Amitābha descending to welcome the blessed soul; Fujiwara period, 11th or 12th century. Owned by the Hachiman-ko, Mt. Kōya, Japan

"Summer Landscape," painting in *sumi* wash by Sesshū (1420–1506); Muromachi period. In the National museum, Tokyo, Japan

"Image of Fugen" (Samantabhadra); Fujiwara period, 12th century. In the National museum, Tokyo, Japan

JAPANESE PAINTING OF THE FUJIWARA AND MUROMACHI PERIODS

BY COURTESY OF (BOTTOM) THE NATIONAL MUSEUM, TOKYO; PHOTOGRAPHS, BENRIDO CO., KYŌTO, JAPAN

One of a pair of six-fold screens from Matsushima by Sōtatsu; early Edo period, first half of the 17th century. Freer Gallery of Art, Washington, D.C.

Two of the series of sliding panels in the Chishaku-in temple, Kyōto. Momoyama period, late 16th or early 17th century. Possibly the work of Hasegawa Tōhaku (1539–1610)

PAINTINGS OF THE MOMOYAMA AND EDO PERIODS

BY COURTESY OF (TOP) SMITHSONIAN INSTITUTION, FREER GALLERY OF ART, WASHINGTON, D.C.; (BOTTOM) PHOTOGRAPHED ESPECIALLY FOR "ENCYCLOPÆDIA BRITANNICA" BY BENRIDO COMPANY, LTD., KYŌTO, JAPAN

JAPANESE PAINTING AND PRINTS

"Red and White Plums," a pair of two-fold screens by Ogata Kōrin (1658–1716). Atami Museum of Art, Japan

"The Broken Shoestring," by Suzuki Harunobu (1725–70), the first painter to employ full colours in wood-block printing

"Beauty in the Mirror," by Kitagawa Utamaro (1753–1806) one of Japan's greatest masters of figure design

PAINTING AND PRINTS OF THE EDO PERIOD

BY COURTESY OF (BOTTOM LEFT, BOTTOM RIGHT) THE TRUSTEES OF THE BRITISH MUSEUM; (TOP) PHOTOGRAPHED ESPECIALLY FOR "ENCYCLOPÆDIA BRITANNICA" BY BENRIDO COMPANY, LTD., KYŌTO, JAPAN

animated intensity of the linear style of *Yamato-e* were now applied to the scenes of action and excitement in scroll paintings narrating military romances, the stories of virtuous priests, the legends concerning Buddhist temples and Shinto shrines, etc. Many of these scrolls display the astonishing ability of the artists to group figures in long rhythms of excited action. Three picture scrolls of scenes from the Heiji insurrection, one of which is in the Boston museum, comprise the apex of this style in dramatic design, energy of movement and vehemence of action. Besides the battle scenes and the interiors with their glimpses of court life and amorous intrigue, episodes and incidents taken from the ordinary life of the people are depicted, with intimacy, truth, humour and pathos. The virile spirit of the period was not favourable for the second, decorative style of *Yamato-e*, but it did produce several masterpieces still extant. It also influenced the linear style which became, as a result, more colourful than before. These two styles are successfully merged in the nine scrolls of the "History of Kitano Tenjin Shrine" dating from the early 13th century.

As a result of the renewed relations with the continent, Chinese art under the Sung dynasty began to influence Japanese painting. The Chinese influence, coupled with the realistic spirit of the time, gave Buddhist paintings of this period a certain naturalistic quality and much movement, as may be seen in the "Monju (Manjusri) Travelling Over the Sea" owned by the Kodai-in temple and the "Running Fudo" in the Inouye collection. The doctrine of Jōdo, now developed into several new sects, became popular among ordinary people. Many beautiful pictures of the *Raigō*, including paintings of a new version showing Amitabha rising in glory behind the mountain, date from this period. The realistic attitude toward life led also to the development of portrait painting. Two great masterpieces of the beginning of this period are the portrait of Yoritomo and that of Shigemori of Taira, both in the Jingoji monastery and both attributed to Takanobu (1142–1205).

Muromachi Period (1335–1573).—The Ashikaga line of shoguns was established in 1335 and lasted until 1573. Kyōto once again became the actual capital, the headquarters being at Muromachi. The *Yamato-e* tradition of making illustrated scrolls was weakened by changes in taste and in mode of life, such as the introduction of the tokonoma. The *Yamato-e* school, henceforth called the Tosa school because it was led by a family bearing this name, degenerated into a mannerism, though Tosa Mitsunobu did some excellent works in the late 15th and early 16th centuries. During the 14th century a complete change came over the spirit of Japanese painting. During the latter half of the Kamakura period the doctrines of the Zen sect of Buddhism had taken a deep hold on the samurai, the warrior class, as well as on the monks. Zen despised ceremony, the worship of images and dogmas; it relied on wordless communication, on contemplation of the absolute in oneself. Zen had been the dominant inspiration of the art of the latter part of the Sung period in China; and it was to Chinese painting of that period that the Japanese now turned. The Japanese accepted as the archetypes of this new movement the great masters Hsia Kuei and Ma Yüan and a master of ink sketch, Mu Ch'i. The *sumi* paintings inspired by Zen doctrine during the Sung and Yüan periods were eagerly collected, a fact which naturally influenced Japanese painting and helped inaugurate a new era in art.

This movement had a few precursors in the 14th century, notably the priest Mokuan, an early exponent of the new technique, and then Kaō and Ryōzen, both Zen priests. In the latter half of the century there appeared the great priest-painter Minchō (1352–1431), who painted Buddhist subjects, and possibly landscapes, with powerful brush strokes in the new Chinese style. By the beginning of the 15th century the rising generation was drawn more and more to the Chinese style, producing swift sketches in *sumi* wash, charged with concentrated energy. A spray of blossom, a bird poised on a reed, a glimpse of mountains among the mists, a sage absorbed in thought—the theme, whatever it was, was not so much the thing represented as what the theme evoked in the spectator's mind: fact, transmuted to symbol and idea. To find the spiritual reality in oneself was the Zen aim; an insight into the universe, embodied by the painter's brush in a hinted scene, could be more potent than all the teaching of the sages. The central figure of the new school was Shūbun (fl. early 15th century), a priest of the Shōkokuji monastery in Kyōto, who was appointed a court painter to the shogun. He was preceded by Josetsu (fl. early 15th century) and followed by Bunsei (fl. mid-15th century), Sōtan (1413–81) and Geiami (1431–85).

A still greater artist, Sesshū (1420–1506), created a more personal art, which is distinguished for its force and intensity of conception and vehemence of brush stroke, though he painted in several different styles. He had numerous disciples and followers, among whom Sesson (1504–89?) was the greatest. Another school was originated by Kanō Masanobu (1434–1530), the first of the long line of Kanō artists, which lasted into modern times. The family, of military stock, was soon patronized by the shoguns. The Kanō tradition would not have become so powerful had it not been for the genius of Masanobu's son Motonobu (1476–1559), who was one of the greatest masters of Japanese painting. Being not a priest but a professional painter he freed the Chinese style of painting from the predominant influence of Zen Buddhism, and made aesthetic satisfaction its only object. As a result his own Japanese taste asserted itself in his work. He learned not only from Chinese Sung and Ming paintings but also from traditional *Yamato-e*, and established a new nationalized Chinese style, which came to be known as the Kanō style. The Kanō masters dominated painting for several generations.

Momoyama Period (1574–1603).—Motonobu's grandson, Eitoku (1543–90) gave a new character to the Kanō style. At the end of the civil war which ended with the downfall of the Ashikaga shogunate, there was a revulsion in taste from the reticent severity of the Muromachi period toward material splendour. Great war lords like Nobunaga and Hideyoshi, who finally unified Japan, built huge castles with vast apartments. These were sumptuously decorated with gorgeous sliding panels and folding screens painted by Eitoku, Sanraku (1559–1635) and their pupils. Among the screen and panel paintings of this period are some of the finest creations of Japanese art. They combine energy and breadth with monumental design and are often painted with splendid colours on a ground of gold leaf. The lines drawn in vigorous brushwork have the imaginative feeling which expresses high artistic sensitiveness and finely developed taste. This style followed the Chinese example in its synthetic power, emotional concentration and massive grandeur, while taking over some of the *Yamato-e* conventions, especially its decorative use of colour.

Besides the Kanō masters, some other excellent painters also produced monumental masterpieces. Hasegawa Tōhaku (1539–1610) was the most prominent among them. He created his own style of *sumi* painting under the strong influence of Mu Ch'i. Some scholars think he also did such sumptuous paintings in colour as the celebrated series of sliding doors in the Chishaku-in temple, Kyōto. Even in the pure *Yamato-e* tradition there evolved a monumental style, out of which was to grow the decorative style of Sōtatsu and Kōrin.

Edo Period (1603–1867).—The civil wars ended at last with the establishment of the Tokugawa shogunate government in Edo (the present Tokyo). The hereditary position of court painters to the shogun was held by the Kanō family. Tanyū (1602–74), grandson of Eitoku, returned to the simple taste of the early Kanō masters, and became the model which the Kanō school was to follow. Ink painting, usually with light tints added, was the favourite medium. The Kanō school remained influential as the official school of painting throughout the period, but their art degenerated into mannerism by the late 17th century.

The Tosa school maintained itself, but in general its painters depended on its past, repeating a consecrated formula, except Mitsuoki (1617–91) who broke new ground by adopting the keen realism of Chinese Sung academicians. In strength of colour the Tosa school was outmoded by a new decorative style which was created in the early part of the 17th century by Sōtatsu, an extraordinary genius whose biography is obscure. Apparently under the strong influence of Kōetsu (1558–1637), who was a distinguished aesthete, a man of many talents and most of all an incomparable calligrapher, Sōtatsu developed his decorative style

on the ground of *Yamato-e* tradition, taking over also the technique of Chinese *sumi*-wash painting, which he also applied to painting in colour. His painting is a highly decorative transformation of nature apprehended by the artist's characteristic Japanese sensibility. Sometimes Sōtatsu collaborated with Kōetsu, the latter writing poems on paper decorated by the former with floral and animal designs treated in flat washes of gold and silver. Ogata Kōrin (1658–1716) carried the decorative style to yet further audacities. His bold abstraction of nature in a colourful decorative pattern is unique. His brother Kenzan (1663–1743) was a fine painter in the same style, but even more distinguished as a potter. The style was to be revived later by the exquisite but rather cold Sakai Hōitsu (1761–1828).

Ukiyo-e.—Another school was that of *Ukiyo-e*, the picture of the transient world of daily life. In the Momoyama and early Edo periods there had been painters of the traditional schools, notably the Kanō school, who ventured on subject matter drawn from contemporary everyday life. They produced splendid genre paintings representing such themes as people at their occupations, gaiety in the amusement quarters or at the festivals, and picnics in the countryside. In the first half of the 17th century pretty girls also became a favourite theme. These pictures reflect the artists' new interest in everyday life, but were painted mostly for rich patrons, not for the people. It was in the second half of the 17th century that *Ukiyo-e* arose in Edo as popular art to meet the new artistic demand of the lower classes. The leading painter was Hishikawa Moronobu (1618?–94?), a genius who established the basic style of *Ukiyo-e* both in painting and prints. Working as an illustrator for storybooks, he exploited the woodcut as an inexpensive means for mirroring the contemporary life of the people; and the woodcut became the medium of a truly popular art which was yet of singular refinement. It is in wood-block prints (*see* below) that most of the *Ukiyo-e* masters did their best work. But they were also painters, and a few of the best *Ukiyo-e* artists, like Chōshun, designed no prints. *Ukiyo-e* was almost exclusively the art of the populace of Edo. Meanwhile, during the 18th century, other movements were stirring in Kyōto and elsewhere.

First, there was the rise of a new Chinese movement called *Bunjin-ga* or literary men's painting, which was fostered by intellectuals. Its models were the light, freely handled landscapes in *sumi* of the so-called Southern school of painting advanced by Chinese literati in the Ming and Ch'ing periods. Ike-no-Taiga (1723–76) and Yosa Buson (1716–83) established *Bunjin-ga* in Japan. Each developed a highly individual style, but both used the light, soft brushwork of the Southern school to great advantage in expressing poetic sentiment. They were followed by another great genius, Uragami Gyokudō (1745–1820). Another Chinese movement was stirred by beautifully coloured, rather naturalistic, flower painting introduced by a Chinese painter, Shên Nan-p'in, who came to Nagasaki in 1731. Although he did not have any distinguished followers, his influence was great; it reinforced the naturalistic tendency of the time, of which Maruyama Ōkyo (1733–95) was the protagonist. Under the influence of Shên's naturalistic painting and Dutch copperplate prints Ōkyo painted with an unerring brush more directly from nature than earlier Japanese, though he never deserted the main conventions of his country's art. He soon found many followers both in Kyōto and Edo, including several painters of some importance. The poetic *Bunjin-ga* and the fastidious naturalism of Ōkyo's Maruyama school were successfully merged by Matsumura Goshun (1752–1811) in his refined, graceful painting, full of life and poetry. His Shijō school proved popular through the rest of the Edo period.

European painting introduced by Jesuit missionaries in the late 16th century had surprisingly little influence. Although adopted at the time by a small group, the technique of European painting disappeared almost completely after the prohibition of Christianity. The realism of European painting, reintroduced by the Dutch, began to influence Japanese painting, though only slightly, in the 18th century, as in the case of Ōkyo. European perspective was attempted by some *Ukiyo-e* masters. Watanabe Kazan (1793–1841), a pupil of fashionable eclectic painter, Tani Bunchō (1763–1840), took advantage of European realism to give his paintings, particularly portraits, lifelike effect. Some painters tried oil, some others copperplate prints, but their work was nothing more than experiment.

Modern Development (1868–).—With the Meiji restoration (1868) Japan entered into the international world. It hurriedly imported western civilization in every field, resulting in the co-existence of two different cultures, traditional Japanese and modern western. With this dual civilization as its background, modern Japanese painting is extremely diverse in its appearance. It is customarily classified, after the medium used, into two categories, Japanese style and western style. As a result of the introduction of European culture, especially its natural science and 19th-century realism, the Japanese learned the European way of seeing things. They learned of various rules of objective realism such as linear and aerial perspective, and shading. This knowledge lured Japanese artists; a conflict between image and perception arose in the mind of Japanese painters. To overcome this conflict many different approaches have been tried. The first attempt was realism. The western-minded took up realistic oil painting, and later imported Impressionism. The traditionally-minded advanced the realistic element of traditional Japanese painting, especially the Maruyama and Shijō schools; Takeuchi Seihō (1864–1942) and Kawai Gyokudō (1873–1957) are the representative artists of this trend. Meanwhile, Okakura Kakuzō (1862–1913), a gifted art critic who inspired young Japanese-style painters with his romantic idealism, called for a modern revival of traditional, subjective painting. The early exponents of this movement were Yokoyama Taikan (1868–1958) and Hishida Shunso (1874–1911). The artists of the next generation, such as Kobayashi Kokei (1883–1957) and Hayami Gyoshū (1894–1935), worked further to find a new way of representing the intrinsic beauty of nature as a higher synthesis of modern realism and characteristic Japanese subjectivism. The younger generation followed them. Among the western-style painters, too, a reaction against realism set in after World War I. In their case the influence of European modern art movements was particularly strong. Some painters, however, succeeded in using European technique in a Japanese way. After World War II life became too complex, mental tensions and agonies too acute, to be dealt with in a traditional art form, Japanese or western. The subjectivistic movement in the western art world, which expanded the field of representation to the full range of human mental activities, significantly influenced young artists in their effort to find adequate visual forms for expressing their complicated inward life. Even Japanese-style painters have taken advantage of this recent development. It still does not seem likely, however, that Japan's ancient inheritance in art will ever be wholly superseded.

WOOD-BLOCK PRINTS

The art of the copperplate print which was introduced in the 16th century by the Jesuits and was reintroduced in the 18th century by the Dutch, did not prove congenial. The woodcut is the national mode of engraving and has been carried to a pitch of marvelous perfection. The art of the woodcut was introduced into Japan from China in the wake of Buddhism. It was used for printing both texts and pictures. Actually, the earliest surviving specimens of printed texts in the world are Japanese, dating from the 8th century, and are in the form of Buddhist charms. For a long period the woodcut was confined to the production of popular images of piety. The earliest extant woodcuts of genre subjects date from the late 12th century. They are designs on fan-shaped papers on which sacred texts were written. In 1391 and again in 1414 some remarkable woodcuts were made to illustrate a block-printed history of the Yūzū Nembutsu sect, but there was no real development of the art until the 17th century.

In 1608 an illustrated edition of the *Ise monogatari*, a classic story, appeared with woodcuts. Other illustrated editions of classic and popular stories followed. But it was Hishikawa Moronobu who transformed the art and made possible all the brilliant work of the *Ukiyo-e* artists of the 18th century. A desire for the pleasure of art had sprung up among the lower classes, now that

they at last enjoyed the peace of a settled government. Paintings were too expensive. Moronobu saw the enormous possibilities of the woodcut and adapted his style to the limitations and possibilities of the medium. There was soon a demand for colour. Moronobu and his pupils produced broadsheets as well as books, and these were often coloured by hand, *tan*, or red lead, being the dominant colour (hence the name *tan-e* for these prints).

The theatre was a passion of the Edo populace. An actor named Torii Kiyomoto, who designed posters for the Osaka theatre, came to Edo in 1687 and though his own work has not survived, he founded a famous dynasty of artists. His son Kiyonobu (1664–1729) was the first to design portraits of actors, which were to remain one of the staple themes of print artists. Kiyonobu's son Kiyomasu I (1694–1716?) rivaled his father. Competing in popularity with portraits of actors were portraits of fashionable beauties, especially courtesans. The Kaigetsudō group of artists during the early years of the 18th century produced some stately prints of women. But in this field Okumura Masanobu (1686–1764) was much more inventive and productive.

In the early 1740s *Ukiyo-e* came to be printed in two or three colours. Colour printing, invented in China in the 16th century, was introduced into Japan as early as 1634: the frontispiece of the 1634 edition of the *Jingo-ki* was printed in colours. But the technique was not applied to popular prints until about 1740. The cherry wood used was carved on the plank, as in Europe until the days of Thomas Bewick. A separate block was cut for each colour. Accurate register was obtained by the simple means of a guide mark in the form of a right angle at the lower right corner of each block and a straight line parallel to the lower edge near the left corner. The two- or three-colour prints were called *beni-e*. (The same name was used for hand-coloured prints more elaborate than *tan-e*.) Masanobu, Kiyonobu II, Kiyomasu II and Ishikawa Toyonobu (1711–85) worked in this medium. The number of colours was soon increased to five. In 1765 the first elaborate polychrome prints, called *nishiki-e*, were published by Suzuki Harunobu (1725–70), an enchanting colourist, who until his death was to reign over *Ukiyo-e*. He created a fashion for pictures of lyrical scenes with figures of exquisite grace. Harunobu's closest follower was Koryusai. Katsukawa Shunshō (1726–92) revived the prestige of the theatrical prints, neglected by Harunobu, by representing the actors in a less stylized manner than the early Torii masters. From about 1780 to 1790 *Ukiyo-e* was again dominated by a single master, Torii Kiyonaga (1752–1815), in whose designs the almost childlike grace of Harunobu's types was supplanted by tall and stately figures. There is an unrivaled poise and dignity in his groups. Utamaro (1753?–1806) was an even greater master of figure design. In the discovery of beautiful relations between figures, in a sort of intensity of design, and in revealing the sensuous beauty of women, he is incomparable. During the 1790s Eishi and Toyokuni competed with Utamaro for popular favour. Sharaku published in 1794–95 a series of actor prints surpassing in power all his predecessors in this line. After Utamaro's death in 1806, *Ukiyo-e* as an art for representing beauties and actors declined, but the school was regenerated by Hokusai (1760–1849) who found new inspiration in landscape. His "Thirty-six Views of Mt. Fuji" and other sets contain some of the finest landscape designs ever made. A little later Hiroshige (1797–1858) in countless sets of prints depicted every aspect of his own country in every weather, with extraordinary intimacy and freshness. His contemporaries, Kuniyoshi and Kunisada, were the last *Ukiyo-e* masters of figure design. The school which had mirrored the popular life of Edo for two centuries virtually came to an end with Hiroshige's death.

The revival of the art of woodcut began in the late 1920s as part of the modern art movement. The precursor was Yamamoto Kanae (1882–1946). Onchi Kōshirō (1891–1955) and Hiratsuka Un-ichi (1895–) were early exponents who, though working in entirely different styles, did most for the renaissance of this national art, which thrived after World War II.

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JAPANESE PHILOSOPHY. The term philosophy in the sense of "love of knowledge" is somewhat misleading in referring to Japanese thought before it came under the influence of the West; nor is the expression *philo-ousia* ("love of essence"), preferred by some scholars, altogether appropriate, since Japanese thinking tends to be directed more toward the realm of existence than toward that of essence. "Philosophy" and "philosophical" are used merely for lack of better terms in referring to the period before the mid-19th century. Further, the Japanese philosophical tradition has never produced great original thinkers and system makers comparable to some Indian, Chinese, and Greek philosophers. Japanese thinkers have always freely appropriated foreign philosophical systems and insights to express their own understanding of the meaning of life and the world. Their creativity has been expressed in the assimilation of alien philosophical categories to develop their own systems.

In attempting to preserve a balance among different traditions, Japanese thinkers have produced a multivalued system. Traditionally, for example, the Japanese philosopher found no contradiction in holding simultaneously Buddhist metaphysics and Confucian ethics. The unifying factor underlying this multivalued system was the indigenous Japanese world view, which was grounded in an implicit metaphysico-social principle exemplified in the Shintō tradition (*see* SHINTŌ).

Historically, philosophical thinking in Japan was closely related to various religious and semireligious traditions. Only since the middle of the 19th century has philosophy, as an independent discipline for the investigation of general principles concerning reality and human nature, been established under the influence of Western philosophy.

PHILOSOPHY BEFORE THE MODERN PERIOD

Early Shintō.—The early Japanese world view, like its counterparts in other sections of the world, was based on mythic modes of apprehension of the origin and nature of man, *kami* (deities), world, and cosmos. These myths tell how cosmos came out of chaos in primordial time, how *kami* were born, and how the ancestors of the Japanese people came into existence (*see* further JAPANESE MYTHOLOGY). To the early Japanese the mythical world and the natural world interpenetrated one another to the extent that human activities are explained and sanctioned in terms of what *kami*, ancestors or heroes, did in primordial time. There is much truth in the characterization of early Shintō as a cosmic religion, because it accepted the whole of life and the cosmos as sacred, permeated as it was by the *kami* nature.

One of the important qualities of early Shintō was its stress on aesthetic values. While life had elements of evil, sorrow, and tragedy, it was nevertheless fundamentally good and beautiful. Actions of the early Japanese people were motivated not so much by ideas as by the spontaneous and sympathetic response of the heart to the rhythms of nature. They did not lack rationality, and they were aware of the meaning of things; but they were not inclined to reflect about the meaning of the meaning, which is the basis of philosophical thinking. Rather, their intellectual and emotional faculties were utilized for art and the appreciation of aesthetic values. Shintō, "the artist's way of life" as Langdon Warner called it, taught succeeding generations of Japanese to control and revere natural forces, and this was the foundation of Japanese artistic creativity. In later years, theories as well as forms of Japanese art came under Chinese and Buddhist influences. Nevertheless, the aesthetic sensitivity of the Japanese originated in early Shintō tradition.

Early Shintō also provided a basic framework for the political structure of Japan, through the myths of the solar ancestry of the imperial family and of the divine origin of the nation, and through the notion of the unity of religion and government (*saisei-itchi*). Actually, the early Japanese kingdom, which came into

existence around the 4th century A.D., was in effect a confederation of powerful clans, among which the strongest was the clan that claimed to possess the imperial *charisma* by virtue of its descent from the Sun goddess (Amaterasu Ōmikami), the central deity in the Shintō pantheon. Accordingly, it was considered the duty as well as the prerogative of the emperor to exercise both political and religious authority. While in the course of time the imperial clan lost political power, its religious authority was rarely questioned. Shintō was indifferent to systematization, and political philosophy as such came to be articulated eventually by Confucian scholars. Nevertheless, the basic features of the political structure were deeply grounded in Shintō tradition.

Universal *v.* Particular.—With the penetration of Chinese civilization and the introduction of Buddhism in the 5th and 6th centuries, the Japanese encountered philosophical systems that claimed to be based on universal laws and principles and not on the experience of particular peoples. The Yin-Yang school, for example, offered cosmological theories based on the concepts of two principles (*yin* and *yang*), the five elements (metal, wood, water, fire, and earth), and the orderly rotation of these principles and elements in the formation of nature, man, and seasons (*see* CHINESE PHILOSOPHY). These concepts were quickly appropriated by Shintō, which lacked cosmological theories. Meanwhile, Confucian ethics, political theory, legal and educational institutions, all based on the universal principle of Tao (*michi* in Japanese), exerted tremendous influence on Japan. Likewise, Buddhist metaphysics, psychology, epistemology, and logic, which were philosophical explications of the universal law (*dharma*), found eager acceptance. The Japanese intelligentsia then faced the task of reconciling the particular historic experience of the Japanese people with universal truths and principles.

The first significant effort in this direction was made by Prince Shōtoku Taishi (574–622), who is credited with having formulated a multivalued system in the so-called *Seventeen Articles Constitution*. In this constitution, reverence for Buddhism is advocated on the ground that it is the universal truth and the norm of all living creatures (Art. II). At the same time, the *raison d'être* of the nation is presented in terms of universal or cosmic principle, following Confucian insights:

> The lord is Heaven, the vassal is Earth. Heaven overspreads, Earth upbears. When this is so, the four seasons follow their due course, and the powers of Nature develop their efficacy (Art. III).

Evidently, Shōtoku was determined to preserve the divine prerogative of the throne, sanctioned by the Shintō tradition, but he also envisaged the establishment of a centralized state with a rational structure, and he attempted to train a class of educated bureaucrats, after the Chinese model. His multivalued system, however, was more aspired to than achieved.

During the second half of the 7th century, Japan was guided by a series of imperial rescripts (*ritsu-ryō*) prepared by the bureaucrats who were motivated by Confucian learning to apply universal laws and legal concepts to practical human affairs. Their efforts culminated in the *Taihō Code*, promulgated in 701–702 and consisting of 11 volumes of general laws and 6 volumes of criminal laws. The rescripts set forth minute regulations governing the activities of Shintō and Buddhist clergy. Land was declared to be national property, of which portions were allotted to each household, the allocation being revised every six years. The educational system was based on Confucian ideas, and Chinese classics, including ethics, literature, mathematics, and medicine, constituted the entire curriculum. In a real sense, the popularity of Buddhism during the Nara period (*i.e.*, when the capital was at Nara; 710–784) was an inevitable reaction against the excessive Confucian emphasis of the 7th century.

Sinification *v.* Indigenization.—During the Nara period, the intellectual horizon of the Japanese was greatly widened under Chinese influence. Chinese culture and Buddhist learning were eagerly sought, and indigenous tradition was reexamined and reassessed from new perspectives. A significant development was the growth of historical consciousness, as evidenced by the compilation of the *Kojiki* and *Nihongi* (*qq.v.*) and the "Gleanings from Ancient Stories" (*Kogoshūi*), as well as the "Records of Local Surveys" (*Fudoki*). In poetry, the "Anthology of a Myriad Leaves" (*Manyōshū*) and the "Fond Recollection of Poetry" (*Kaifūsō*) made their appearance during this period (*see* also JAPANESE LITERATURE).

The Six Schools.—The Nara period also witnessed the establishment of six Buddhist schools transplanted from China, all of which (except for the Ritsu school, which dealt primarily with monastic discipline) made contributions, in varying degrees, to philosophical thinking in Japan (*see* also BUDDHISM: *Regional Variations in Buddhism: Japan*). The two Hinayanistic schools, the Kusha and the Jōjitsu, were devoted to analysis of cosmological and psychological problems, the former maintaining that all elements of the universe are real and that self (ego) alone is illusory, the latter insisting that both the self and the elements are unreal. The Sanron school, usually characterized as either a negativistic or a transcendental idealism, presented a thoroughgoing dialectical analysis of concepts in order to suppress all polarity; the object of such analysis is the realization of perfect wisdom, which, on the one hand, is opposed to all partial knowledge but, on the other, is inclusive of all partial knowledge. The Kegon school, a form of cosmotheism, affirmed that even on one grain of dust there are innumerable Buddhas. According to the Kegon philosophy, "every existence is a reality in itself with its own nature and activity; but these realities, though diverse in individual qualities, can perfect themselves by realizing their ultimate communion with the cosmic soul embodied in Buddha's person, and thereby make up the grand system of the universe" (M. Anesaki, *History of Japanese Religion*, p. 93; Routledge & Kegan Paul Ltd, London, 1930).

To philosophy, however, by far the most important of the six schools was the Hossō, which offered a physical and psychological analysis of the characters of things (*dharmas*). Its philosophy can be succinctly stated: "All *dharmas* are mere ideation." The Hossō school brought with it a sophisticated form of the "science of cause" (*hetu-vidyā*), a combination of logic and epistemology, which left a lasting mark on Japanese philosophical tradition.

In the Heian period (794–1185), the trend toward sinification that had characterized Japanese intellectual life of the Nara period was greatly modified. While Chinese influence continued to be felt, China ceased to be regarded as the final authority and the source of all wisdom and learning. A *rapprochement* was reached between the Chinese and the Japanese traditions. Chinese elements were assimilated into the Japanese intellectual framework. Authentification of the universal truths and principles was undertaken in terms of the particular (Japanese) historic and cultural experience.

Two schools of Buddhism, introduced from China during the early Heian period, illustrate this trend.

Tendai School.—The Tendai school, transmitted by Saichō or Dengyō Daishi (767–822), adopted *in toto* the philosophical insights of the Chinese T'ien-t'ai school, whose basic doctrine was the principle of harmony of the threefold truth. According to this principle, all things (*dharmas*) have no ontological reality but only temporary existence; the fact that they are simultaneously unreal and temporarily existing is the middle (true) state or truth. What attracted Saichō was the T'ien-t'ai school's philosophical syncretism, its universalistic soteriology, and its reliance on the Lotus Sutra as the most complete and final teaching of the Buddha. The Tendai school aspired to become a grand national religion, incorporating within itself not only all other Buddhist schools but Shintō as well in the syncretistic religion called Sannō Ichi-jitsu ("One Reality") Shintō.

Shingon School.—The Shingon (Ch'en-yen in Chinese) school was transmitted by Kūkai or Kōbō Daishi (774–835), one of the most erudite and creative thinkers of his time. Kūkai accepted the claim that the Shingon tradition is the only esoteric (secret or private) teaching of the Buddha, and as such is superior to all other schools, based on merely exoteric (public) teachings. The Shingon philosophy rests on the notion that the whole universe is the body of Vairocana or Mahavairocana (the Great Sun Buddha). From this starting point, it offers a cosmological, physical, and psychological analysis in terms of the six elements

(five material elements plus one mental element, consciousness). The genius of Kūkai lay in his appropriation of the philosophical insights of Ch'en-yen for the formulation of his own world view, which is explicated in his theory of the ten stages of spiritual development. Significantly, his scheme included not only all the major Buddhist schools but also Hinduism, Confucianism, and Taoism as well. Understandably, the Shingon school took a conciliatory attitude toward Shintō, and it provided the theoretical basis for Ryōbu ("Two Aspects") Shintō, a Shintō-Buddhist amalgamation. This development brought about a popular belief that the Shintō *kami* are manifestations (*suijaku*) of the Buddhas who are the original realities (*honji*).

Faith *v.* Reason.—The cultural climate of the late Heian period was not conducive to philosophical inquiry. Metaphysics gave way to aesthetics, at least in the upper stratum of society, as may be seen in such literary works as Lady Murasaki's *Tale of Genji* and Lady Sei Shōnagon's *Pillow-Book*. In religion, no new philosophical speculation emerged. Instead, faith was emphasized, in the cult of Amida (*see* AMITABHA), which found eager adherents. The popularity of the Amida cult was greatly stimulated by the Buddhist eschatological notion called *mappō*, based on a legend that divides history into three periods: the first thousand years after the Buddha's death, the period of perfect law; the second thousand, the period of copied law, in which true faith declines but piety is preserved; and the last thousand, the period of the latter end of law (*mappō*), in which the Buddha's teaching declines and the world is overwhelmed by vice and strife. In the age of *mappō*, so it was widely believed, man can be saved only by the mercy of Buddha Amida.

The faith principle continued to play a significant role during the Kamakura period (1185–1333). Hōnen (1133–1212), founder of the Pure Land (Jōdo) school, and Shinran (1173–1262; see *Modern Japanese Philosophy: Tanabe's Philosophy of Metanoetics*, below), founder of the True Pure Land (Jōdo Shin) school, both advocated faith in Amida, while Nichiren (*q.v.*) stressed faith in the Lotus Sutra. To them faith, decision, and commitment were more important than intellectual understanding of objective truth. Similarly, to both the Zen schools—the Rinzai, transmitted by Eisai (1141–1215), and the Sōtō, systematized by Dōgen (1200–53)—faith in the Zen experience was considered the essential prerequisite for religious life.

Kamakura Buddhism, by stressing faith and experience rather than intellectual and moral exercise or traditional mysteries, eliminated the distinction between the religious and the secular domains of life and pointed to the realm of phenomenal existence as the sole source of enlightenment or salvation. This radical shift in outlook was not articulated in philosophical terms, but it exerted significant influence on art and literature and on the Code of Warriors (Bushidō; *q.v.*).

An important by-product of the concern for the realm of phenomenal existence was a new interest in historiography. Some thinkers—living as they did in a turbulent era, plagued by a series of natural calamities and threatened by the meaninglessness of life itself—were driven to find in history the locus of meaning. An outstanding example of such an attempt was the *Gukanshō* (literally, "Miscellany of Personal Views of an Ignorant Fool"), written in 1220 by the learned Tendai priest Jien (1145–1225), posthumously named Jichin. Jien sought an inner thread running through the historic period of Japan, without any reference to the so-called age of the *kami* which had provided divine sanction to traditional Japanese chronicles. He regarded the historic period of Japan as one of deterioration, following the three-stage pattern of Buddhist history. For the evaluation of historic events, however, Jien depended on the criterion of *dōri* (*justice immanente des choses*), a concept greatly influenced by the ideas of the Chinese historian Liu Hsin.

In sharp contrast to Jien's historiography was the *Jinnō Shōtōki* ("Records of the Valid Succession of Divine Emperors") of Kitabatake Chikafusa (*q.v.*). Kitabatake, though well acquainted with the writings of the Chinese historian Ssu-ma Kuang and of the leading Neo-Confucianist, Chu Hsi, stressed the unique meaning of Japanese historical experience by resorting to Shintō myths. His historical perspective was greatly influenced by the so-called Ise Shintō movement, which attempted to emancipate Shintō from the Shintō-Buddhist amalgamation. Thus, Kitabatake's writing revealed more of faith in Shintō than of a philosophy of history.

Search for a New Universal Principle.—The Kamakura period was followed by the period of the Ashikaga shōgunate (1338–1573), during which a semblance of political unity was maintained but the traditional social fabric broke down. Shintō and the various schools of Buddhism failed to exert intellectual and religious influence, the only notable exception being Zen (*q.v.*) Buddhism, which was favoured by the Ashikaga shōgunate. It was Zen that inspired various forms of art and culture during this period. It was also Zen Buddhists who were instrumental in transplanting Neo-Confucianism from China.

Neo-Confucianism, a complex philosophical system incorporating some of the features of Chinese Buddhism and Taoism, provided the coherent metaphysical system which the Japanese intellectual world was looking for during the Ashikaga period. (For an analysis of Neo-Confucianism as it developed in China, *see* CONFUCIANISM: *History: Neo-Confucianism;* CHINESE PHILOSOPHY: *Modern Period: Neo-Confucianism* [*906–1900*].) The system of Chu Hsi (*q.v.;* Shushi in Japanese), combining metaphysics, physics, psychology, and ethics, especially was destined to leave a strong imprint on Japanese philosophy. His influence was felt even by Ichijō Kanera (1402–81), who attempted to reconstruct Shintō along the line of an idealistic monism based on the identification of the cosmic soul with the individual; although he accepted the existence of many *kami*, he considered them as manifestations of the cosmic soul. Similarly, Yoshida Kanetomo (1435–1511), spokesman of Yui-itsu ("One and Only") Shintō, postulated the existence of the one unique *kami*-nature as the source of the universe.

During the Tokugawa period (1603–1867), Neo-Confucianism, especially the tradition of Chu Hsi, played an important role as the official guiding philosophy of the ruling regime. Japanese Confucian scholars (*jusha*) had been emancipated from the Buddhist framework by the turn of the 17th century. Many of them idealized the ancient sage-kings of China. In the words of Ogyū Sorai (1666–1728), "The way of the ancient sage-kings is the highest good. Under the sun, there is no principle more excellent than this one." Japanese Confucianists—confronted by the difficult task of relating the universalistic metaphysico-ethical principle embodied in the way of the sage-kings to the particular historic situation in Japan—attempted, on the one hand, to reinterpret Confucian tradition to fit the Japanese situation and, on the other, to reinterpret indigenous Japanese tradition in terms of Confucian ethical universalism. Thus, Hayashi Razan (1583–1657), the leading Confucian adviser to the Tokugawa regime, representing the pro-Shintō trend that was conspicuous among many Japanese Confucianists of the Tokugawa period, advocated the view that the way of the *kami* (Shintō) was nothing but *li* (reason) as articulated in China by Chu Hsi.

There were three schools of Confucian studies during the Tokugawa period.

Shushi-gaku.—The most influential was the school of Chu Hsi (Shushi-gaku in Japanese), which produced many able scholars, among them Yamazaki Ansai (1618–82), Arai Hakuseki (1657–1725), Muro Kyūsō (1658–1734), and Kaibara Ekken (1630–1714). Mention should also be made of Tokugawa Mitsukuni (1628–1701), the lord of Mito, an enthusiastic patron of Chu Hsi philosophy, who gathered around him learned men, including the Chinese scholar Chu Shun-shui (1600–82), then in exile in Japan. Thus developed the so-called Mito school, whose scholars compiled an important work of history, the *Dai-Nihon-shi* ("The History of Great Japan"), which provided the theoretical basis for the royalist movement in the 19th century.

Ko-gaku.—The school of the Old Learning or Antiquity (Ko-gaku) was in a sense a protest movement against the tradition of Chu Hsi and other Neo-Confucianists, which had, so the Ko-gaku scholars felt, distorted the Confucian sages' dynamic view of the world and life. The main characteristic of the Ko-gaku was its

monistic philosophy, based on the identification of *li* (principle or reason) and *ch'i* (material force). According to this school, everything and every person is a direct manifestation of the vitality of the cosmos. Thus relating metaphysics to ethics, the Ko-gaku scholars advocated a universalistic philosophical principle as the basis for practical life. In other words, the aim of life is the realization and fulfillment of one's potentialities by following the law of cosmic existence. According to Itō Jinsai (1627–1705), the leading philosopher of this tradition, "the moral order is not a mere haphazard law, but a providential rule, based upon the inherent nature of things. The ruling of Heaven is in all things, punishing evil and rewarding good" (Joseph J. Spae, *Itō Jinsai*, p. 205; Catholic University of Peking; Peiping, 1948). It was not accidental that another Ko-gakun scholar, Yamaga Sokō (1622–85), made great contribution to the systematization of the Code of Warriors (*see* BUSHIDO). Parenthetically, it might be added that the popular hero, Ōishi Yoshio (1659–1703), was a disciple of Yamaga (*see* FORTY-SEVEN RŌNIN). Besides Itō Jinsai and Yamaga Sokō, scholars of this school included Ogyū Sorai, Itō Tōgai (1670–1736; son of Jinsai), and Dazai Shundai (1680–1747).

Ōyōmei-gaku.—The third school of Confucian studies was the Ōyōmei-gaku, based on the teachings of Wang Yang-ming (*q.v.*; Wang Shou-jen), who, rejecting Chu Hsi's view of the *li*, had rather equated it with mind and interpreted the individual mind as the concrete particularization of the universal mind. Moral cultivation of the type represented by Wang Yang-ming's concept of the Prime Conscience appealed to many Japanese, to the extent that Ōyōmei-gaku developed into a semireligious system. Notable thinkers of this school included Nakae Tōju (1608–48), Kumazawa Banzan (1619–91), Miwa Shissai (d. 1744), Satō Issai (d. 1859), and Ōshio Heihachirō (1796–1837). Some of the late Tokugawa reformers were greatly influenced by the Ōyōmei-gaku.

Eastern *v.* Western.—During the time when Japanese thinkers were looking for a new universal principle, Roman Catholicism, then known as Kirishitan, claimed to present to Japan the gospel of universal salvation. Catholic missionary work in Japan was inaugurated by St. Francis Xavier (*q.v.*) in 1549. While Catholicism gained many converts (approximately 150,000 toward the end of the 16th century), it appears to have had very little effect on the intellectual life of the nation except perhaps in the fields of medicine, astronomy, and geography. Following the Kirishitan uprising in 1637, Catholicism was systematically exterminated by order of the Tokugawa regime, which also ended trade with all foreign nations except the Dutch and the Chinese (*see* JAPAN: *History: The Tokugawa Period*). Nevertheless, thanks to these contacts Japan was not totally uninformed about world events.

The 18th century marked an important epoch in the intellectual history of the country because of the growth of rationalism, the establishment of Dutch learning (Ran-gaku or the learning of Holland, pronounced *O-Randa* in Japanese), and the revival of national learning (Koku-gaku) and Shintō.

Rationalism.—Rationalistic thought was both the cause and the result of the search for universal principles, and its growth was aided by the rationalistic elements inherent in Confucian tradition. It created an attitude that would not take for granted even the most sacred traditions and institutions without testing by reason, an attitude represented, for example, by Arai Hakuseki in his critical approach to Japanese history; by Tominaga Nakamoto (1715–46) in his textual study and relativistic analysis in ethics and religion; and by Miura Baien (1723–89) in his search for an objective metaphysics.

Dutch Learning.—Dutch learning developed during the early 18th century with the encouragement of the Tokugawa regime, which by that time had become receptive to Western knowledge, especially in medical and other scientific and technological spheres. The pioneers of Dutch learning, also well grounded in Confucian training, took it for granted that knowledge had both essential and practical dimensions. They considered that Confucian teachings were essential for the moral cultivation of man, whereas Dutch learning, covering such subjects as medicine and botany, was practical or real learning (*jitsu-gaku*), and that there was no basic contradiction between the two. This attitude was epitomized by the motto of Sakuma Shōzan: "Eastern Ethics and Western Science." He and others like him were convinced that the *li* (principle) of Confucianism and the principle of Western knowledge were one and the same. It was this Confucian-inspired rationale that enabled the late Tokugawa intellectuals to welcome various aspects of Western thought and learning.

National Learning.—Meanwhile, the combined effect of the pro-Shintō activities of the Confucian scholars and the renewed interest in national learning—which was based on philological and philosophical studies of Japanese classics undertaken by such men as Keichū (1640–1701), Kada Azumamaro (1669–1736), Kamo no Mabuchi (1697–1769), and Motoori Norinaga (1730–1801)—resulted in the revival of Shintō. The new Shintō activity was influenced in part by the rationalistic temperament and also by the twofold epistemology based on the essential and the practical dimensions of knowledge. Hirata Atsutane (1776–1843), physician and leader of the so-called Neo-Shintō movement, embodied such a spirit. While he was dedicated to affirming the superiority of Shintō over other religions and philosophies, he did not hesitate to utilize the insights derived from Dutch learning or even from Roman Catholic theological writings published in Chinese. (*See* further SHINTŌ: *Shintō Revival.*)

Transition to the Modern World.—During the first half of the 19th century, the decline of the power and the prestige of the Tokugawa feudal regime created an ideological vacuum. In this situation, Confucian scholars of the Mito school and the leaders of Neo-Shintō attempted to apply their learning to the practical end of reshaping society and the nation. The two schools, despite some basic differences in philosophical outlook, agreed on a practical objective, the royalist cause. The combined energy of their leaders provided the moral and intellectual fervour that guided the nation through its critical transition from the feudal to the modern phase.

The modern period of Japan began in 1868, when imperial rule was resumed, at least in principle, under the reign of the emperor Meiji. The initial policy of the Meiji regime was to welcome the Western knowledge and technology needed for modernization, even though the government intended to depend on Shintō and Chinese (Confucian) learning to provide a foundation for national moral and cultural life. However, many young intellectuals were singularly attracted by Western learning, and European philosophy overshadowed the traditional Eastern philosophies. As early as the 1870s, Comte, Mill, Darwin, and Spencer were introduced, and in the 1880s the French thinkers—Voltaire and Rousseau—were taught in the universities. In the 1890s, however, German philosophers, such as Kant, Hegel, and Schopenhauer, became the idols of the college students. Nietzsche, Eucken, Bergson, Tolstoi, and William James were also widely read.

Meanwhile, the impact of western civilization stimulated, among other things, the reawakening of Buddhist, Confucian, and Shintō learning, so that by the turn of the 20th century what might be characterized as a new form of multivalued system began to emerge in Japan. The philosophical situation in the 20th century (*see* below) has fostered a considerable degree of interpenetration and mutual influence among various Eastern and Western philosophical traditions, whereby Japanese thoughts are expressed by freely utilizing Western categories, and Western philosophies are interpreted through Eastern insights. The characteristics of Japanese philosophy in the modern period, its strengths as well as its weaknesses, should be understood in this light. (J. M. KA.)

MODERN JAPANESE PHILOSOPHY

Many scholars prefer to restrict the term "Japanese philosophy" to the work of thinkers who have formulated their systems under the influence of Western philosophy. Adopting Western methods, utilizing Western categories, and at the same time criticizing both, they endeavour to find a new way to express their original philosophical insights and often, in view of the results so far achieved, their own life and world views, nurtured in the

tradition of Oriental thought.

The whole span of Japanese philosophy in this sense of the term covers only a little more than a century—from the opening of the country to the West in the 1850s—the first half of which had to be spent in assimilating Western thought. As if into the basin of a waterfall, Western philosophical trends of different ages and of different countries came crashing down, sometimes simultaneously, sometimes successively, upon Japanese intellectuals of the latter half of the 19th century. Stimulated and intoxicated, they eagerly gained a superficial grasp of contemporary European and U.S. philosophy. But by the beginning of the 20th century a reaction had set in against this tendency. There were some who sought to create a synthesis of Western and Oriental thought; others endeavoured to become more deeply versed in the history of Western philosophy. The early works of Hatano Seiichi (1877–1950), especially *A Study of Spinoza* (1904; written originally in German and translated into Japanese in 1910), led the way in this intensive study of Western thought, which has continued up to the present.

Side by side with the creating of academic traditions, however, the flowering of an independent philosophy, which can properly be called Japanese, can be seen in Nishida Kitarō's *A Study of Good* (1911). It is no exaggeration to say that in Nishida Kitarō (1870–1945) Japan found its first philosophical genius, a man who built a system permeated with the spirit of Oriental tradition, especially that of Buddhist meditation, by employing the Western method of thinking.

Nishida began his philosophical activity around the turn of the century, and it was with the appearance of this book that he became the leading figure in his field. It is hardly possible to talk about Japanese philosophy apart from Nishida's influence. Tanabe Hajime (1885–1962), at first a disciple of Nishida, established his own philosophy through his criticism of Nishida's, and after Nishida's death became the most notable thinker in Japanese philosophical circles. It may indeed be said that the path of Japanese philosophical thinking was beaten mainly by these two men, who criticized and stimulated each other so that each developed his own thought further and more profoundly. Not only did they learn from each other, but they kept abreast of philosophical trends in the West, receiving incentive to delve deeper.

Besides Nishida and Tanabe, Hatano Seiichi was a great systematic philosopher who wrote excellent works on the philosophy of religion in his later years. Other original thinkers worthy of mention include Daisetz Teitarō Suzuki (*q.v.*), Nishida's friend from childhood; Watsuji Tetsurō (1889–1960); and Takahashi Satomi (1886–1964), an important systematic philosopher and sharp critic of Nishida and Tanabe.

These philosophers had all completed their work by the middle of the 20th century. Since their work already belongs to history, a fairly clear-cut outline of their thought may be drawn for appraisal from our present perspective. After them came others who built their structures on the foundations laid by the first group. Many of them were inspired by Nishida, whom they studied carefully and commented on—a task difficult even for a Japanese. They also applied his philosophical principles to many problems untouched by Nishida himself. "As Nishida restricted himself rather to the pursuit of basic principles, so the development of the special areas became their work. They developed logic, ethics, aesthetics, and the philosophies of religion, history, and science based on his thought," as Shimomura Toratarō says (in an appendix to Nishida's *A Study of Good*, p. 199, published by the Japanese National Commission for UNESCO, Tokyo, 1960).

In the third place stands a group of philosophers of a still younger generation, some of them influenced by Tanabe, others by Hatano. Other influences, including those of more recent philosophies in Europe and America, are also felt. It is difficult as yet to judge the value and merit of the work of this group.

Nishida's Philosophy as Representative of Japanese Philosophy

It is impossible to touch the core of Nishida's philosophical system without referring to the Oriental tradition of culture and religion. His characteristic idea of the *topos* of Nothingness (*topos*, the Greek "place," used with a more extended meaning), for example, is derived from the intuition of Zen Buddhism, which he designated "pure experience." In his mature stage he suggested an attitude toward the real nature of things that differs widely from that taken by Westerners: it is the attitude of seeing the form of the formless and hearing the voice of the voiceless. This, according to Nishida, is what has been cultivated in the tradition of the East. He wrote:

> By intuition (or seeing) I mean our way of seeing the being of things in the world, through which we see a being and also our own act of seeing, as a shadow of the Self-reflection of Nothingness—I mean the shadow of Self-reflection of Nothingness which performs its function by projecting itself on one point within its *topos*.

Illustrations of this may be useful.

1. Between the *haiku* poetry of Matsuo Bashō (*q.v.*) and Zen Buddhism there is a noteworthy relationship. For appreciation of this *haiku:*

> The old pond—a frog jumps in; the water-sound,

if one imagined oneself to be a frog jumping into the old pond and making a splashing sound one would have missed the point. The poem describes rather the silence that prevails. Bashō always pictures his theme with a touch of vivid action, but only in order to emphasize stillness by contrast—to form a synthesis of both, so to speak. The sound made by the frog suddenly, and only for an instant, breaks the tranquility of the place; the quiet is all the more heightened by the sound. Of similar import is an old Chinese poem, which may be translated:

> A bird gives a cry—the mountains quiet all the more.

Analysis of this experience shows that for the one who has, through the voice of a bird, realized the stillness of the mountains, the voice is felt first as disturbing; then, by contrast, the first stillness is recollected; and by integrating all three moments of stillness, voice, and Stillness into one single impression, a deepened feeling of stillness prevails in the listener's mind. The voice of the bird becomes the voice of the Stillness itself.

In the light of Nishida's pure experience as the truth of experience, from the outset the voice of the bird expresses the feeling of Stillness. For the voice of the bird is as a "shadow of Stillness," or rather a mirror that reflects the quiet mountains. The audible thing acquires its existential background, from which it appears in a transfigured form.

Thus the hearer himself participates in the stillness. One's hearing a bird, and the fact of the bird's existing, are one and the same thing, since in the pure experience the reality of a thing includes one's realization of it. It means, on the one hand, that the poet who sees and describes the scene belongs to the scene in its entirety: the whole act of description is done from within the scene itself. He himself is the point of self-reflection of the world from within itself, in the Stillness of which he wholeheartedly participates. This Stillness or *sabi*, as Bashō calls it, is the spirit of his *haiku*. On the other hand, stillness (of the old pond) is there in contrast with an action (the motion of the frog jumping in) in which the poet himself participates. But, at the same time, the stillness and the action work on each other, and out of their interaction and interrelation in the deepest dimensions comes the "sound of stillness," the sound of the still water prevailing ripple by ripple over the whole length and breadth of the pond as a wave of voiceless voice. Therefore, the description of a motion may be considered as a part of the stillness itself.

2. Another example may be taken from archery. From olden times the discipline of archery in Japan has cultivated an attitude of mind which approaches the serenity of a sage. If one's arrow fails to hit the mark, one should reflect on oneself and reform one's own attitude instead of looking for the cause of the failure in externals.

In Japan, the beginner in archery learns the use of bow and arrow in front of a simple bundle of straw as target, set three or four feet away from him. He is trained to get his posture right and to keep his mind in good order. After a long preliminary training of this sort, he is permitted to confront a real target—not yet to aim at it, but simply to acquire the knack of meeting the bull's-eye by intuition. If an archer simply aims at the bull's-

eye, there is a chance of his hitting it, but he may also miss it. But if the bull's-eye and the bowman become one, so that the arrow by itself arrives at the bull's-eye, he will never miss it. The bowman must forget that he is standing in front of the bull's-eye and must let the arrow leave the bowstring by itself without any effort on his part. This absorption in archery is similar to the self-concentration practised in Zen.

To make clear the *topos* character of Nothingness philosophically, Nishida introduces the three key ideas of action-intuition, the Eternal Now, and the historical world in its identity of contradictories.

Action-Intuition.—The problem of action-intuition can be comprehended in the light of the pattern discussed in connection with archery and *haiku*. As the bull's-eye and the archer—or rather, his act of shooting and his seeing the bull's-eye—become one, the event of arrow shooting takes place as the self-determination of the distance. Therefore, the event itself may be said to be the self-concentrated expression of the field, the shooter (himself a part of the event) being nothing but a self-conscious focus of it. The event as a self-reflection of the world attains self-consciousness in the disciplined mind of the archer. Bashō's *haiku*, his making the poem and being moved to it by the scene itself, provides a similar example of seeing and acting in dialectical unity (action-intuition).

According to Nishida, action-intuition is the structure and dynamics of all creative activity. When a sculptor carves a statue, he sees its form anew at each attack of his chisel; the seeing of the form thus induces him to further chiseling. This reciprocal process of acting $\rightleftarrows$ seeing, in the dynamic unity of action-intuition, is repeated to the end of his work. Thus Nishida often used the phrase "from the created to the creative" to express the creative function of action-intuition. This reverses the ordinary conception of art as a move from the creative to the created, but Nishida's formula seems to explain creative activity much more adequately. For any creation through human action becomes possible only if the self-reflecting world expresses itself in a human being, while he on his part expresses and reflects himself, by his work, in the mirror of the world; both of them together performing their creative synthesis in the historical world.

The Eternal Now.—The being of everything in the world has its "presence in time," in the present, in contrast to the past and the future. In the present, one is aware of oneself as an *individuum*. This way of being present in time—where one's entire being, as well as the being of other things in the world, is involved—is a fact of immediacy, from which one begins the search for truth. But this kind of presence is momentary and transitory: "It appears to be, only to disappear, and disappears, only to let a new present appear." Being and nonbeing are mixed in their very structure. The present, therefore, is a unity of contradictory moments.

Further, although it is momentary, the present envelops the whole of the temporal order, because past, present, and future all belong to the present. As St. Augustine said in his *Confessions*, "The past is the present of the past, the present is the present of the present, and the future is the present of the future." All of them are measured from the standard of the present, without which we could never understand their meaning. So the infinite series of moments in the temporal order, from the incalculable past to the incalculable future, depends on the momentary present of "here and now." The present is the monad of time which represents in itself the infinite span of past-present-future, although it itself belongs to this series as an infinitesimal part of the whole. It follows that the present determines itself. It is the present of the present. From this centre of "self-determination of the present," time flows—flows, as it were, from the present to the present. It is this quality of time that explains the character of man's immediate self-consciousness. It is a fact of man's being and sense of freedom. But his consciousness of being and freedom is closely bound up with the sense of his transiency. How is it then possible that the transient moment, the infinitesimal atom of time, should include in itself the infinite time series, a property of Eternity?

According to Nishida, it is because the present is rooted in the Eternal. The Eternal reflects itself, and the focus of its self-reflection is the present of the present. Thus into the present, as well as into the past-present-future series, the Eternal projects itself.

This clarification of the character of the present, as the centre of the "topological" self-determination, is a most important contribution made by Nishida to our understanding of time. That the present is Eternity is not to be understood as simple identity in an ordinary mystical sense. Nishida's conception of time is more dialectical. To him, the present and Eternity are in contradictory opposition to each other, on the one hand; while, on the other hand, the one may be regarded as the other, seeing that they are related to each other through their ultimate self-identity. These two points need further explanation.

Although from the present there is no road leading to the Absolute (Eternity), and the whole series of time, to say nothing of the transient present instant, is a mere nothing in the face of Eternity, yet Eternity, as the *topos* of Nothingness, can envelop within itself every individual instant, giving life to it. Eternity establishes the instant as a true (independent and self-determining) *individuum; i.e.*, as the present. Therefore, Eternity and the present are related to each other in an identity of contradictories.

This means that Eternity is reflected in the present, while at the same time the present itself is reflected in the mirror of Eternity. If the meaning of Eternity is sought objectively, no trace of it will be found; there will be nothing but a stream of time. For time and Eternity are as far apart from each other as the sky in the clearest moonlight is from the stream below. But to the one who rows along the stream, every ripple reflects the moon, every moment reflects the light of Eternity. Further, Eternity, in its turn, reflects in its mirror every instant of time. All the monads are included in the world (Leibniz); as Nishida interprets it, the world, the mirror of Eternity, reflects in itself all the monads within it. All things in the world, though they pass into the past (nonexistence), do so not in vain. They are all recollected by Eternity. Thus the being "whose name is written in the water" is at the same time "registered in the presence of Eternity."

While the independent, self-determining *individua* relate to each other in the self-determination of the *topos* of Nothingness, linear time is also made up of the instants in their "identity of contradictories." Time is thus a continuity in discontinuity. Each instant leaping into the next is woven into the creative synthesis of the Eternal Now, and the past-present-future time is a trace left by the Creative Now.

The Historical World in Its Identity of Contradictories.—The Creative Now is a synthesis not only in time but also in space. As observed above, every present moment is the present of individual life. But the present in its proper sense must be considered as the Present of world history. So the Present of the world, refracting itself into the myriads of individual life-times (present moments), gathers these, at the same time, into the original unity of time, the Present of world history. For, according to Nishida, the world is itself the self-reflecting living being in which all the individuals are comprehended. The world is the body of the Eternal Self, or rather, Non-Self, as individual existence in the body is the manifestation of the individual self.

Now, every present moment is a monad of time. It re-collects (reassembles) all the instants of past-present-future. And every instant, as a reflection of Eternity, is unique and independent. So apart from the linear time order, there must also be a temporal synthesis in space at every present moment. Joining the ends of past and future time forms an infinite circle in the *topos* of Nothingness, where all the instants are situated in the centre, because the circle is infinitely large. Therefore, every present has the character of temporal synthesis in space. And the Present, refracting itself into the myriads of present moments of individual lives in the world, shows exactly the same structure, whether as the present of the whole or as that of the individual. The world and the individual, the Present and the present, correspond to each other as in the macrocosm-microcosm relationship.

Thus time is determined in two ways, linear and circular (spatial). These two dimensions of time are interwoven at every moment, whether of individual life or of the world. This historical world is the same as the world of religion in one sense, since, for Nishida, Absolute Nothingness is the principle of both the historical world and religion. As Absolute Nothingness is the living principle in the world, it must be realized in the world, to which it comes without losing its true essence in the least. Its beyondness in relation to the world can be realized only through its immanence in the world. Therefore through the always new manifestations of Absolute Nothingness in the world, the real historical world becomes sacred.

This does not mean that the world, as the place where culture develops itself, is at once the realm of religion. To the contrary, Nishida makes a sharp distinction between culture and religion. He thinks dialectical theology is legitimate to the extent that it corrects the arrogance of humanistic liberal theology, which mingled the transcendent in religion with cultural activity in the world. Religion must be considered to be qualitatively different from all value-creating action on the part of human beings.

For Nishida the world in its very ground is religious, just as our existence in the world is. But what does it mean when we say we are religious? The religious question is a question of the whereabouts of our self. This is expressed in St. Augustine very clearly: "Thou [God] hast created us toward thee, and our heart cannot be quieted till it may find repose in thee." Indeed, it is only through realizing our restlessness of soul that we find religion as a fact in our spirit. Otherwise we are misled elsewhere and fail in the religious quest.

This characteristic of Nishida's view of religion is made manifest in his so-called "disjunction-conjunction" between God and man. God stands against man as Will to will. He is transcendent to man. At the same time, he is immanent, but we cannot see, encounter, or experience him directly, as the mystics ordinarily hold. He is Absolute Being and Absolute Nothingness in his true identity of contradiction. In every place and at every time he is, and is not, in the sense that his absence is for the keen eye the true evidence of his omnipresence. Nishida often quotes the verse by the 14th-century Zen master Daitō Kokushi:

From eternity to eternity Buddha [the Absolute] and I [the relative] are separated from each other, yet, at the same time he and I do not fall apart even for a single moment. All day long Buddha and I live facing each other, yet he and I have never a chance to meet each other.

To Nishida God is *deus absconditus* and *deus revelatus* at the same time. The true miracle in the world is that there is no special miracle. The world as well as a human being is holy, insofar as it is full of "facts of spirituality," which are an open secret to everyone. In another direction, this means that the religious will in relation to the religious decision is eschatological, but it must be considered also as a fact of everyday life. Every day, every instant is critical to one's decision, but, at the same time, one must learn to let these instants pass, as the spring wind blows through the willow's branches.

Tanabe's Philosophy of Metanoetics

According to Tanabe Hajime's view, the only way to transcend *noetics* (that is, metaphysics as speculative philosophy in the realm of the subject-object relationship) is to go through a complete *metanoia* in the "death and resurrection" experience of conversion. Therefore, the true dialectic is neither the "as well as" of the speculative synthesis of Hegel nor the "either/or" of the ethical earnestness of Kierkegaard. It is "neither/nor": a thorough-going negation of our immediacy (repentance of one's radical sin) by the mercy of the Absolute, who also negates himself for the sake of love and mercy. Our repentance of sin means the forgiveness and negation of it by the grace of the Absolute. For the very reason that God or Buddha is the Absolute Nothingness, he is the power and mercy of absolute self-surrender.

For Tanabe, the absolute is absolute only as Nothingness. Absolute Nothingness is qualitatively different from and therefore transcendent to the relative world. It is through the mediatory function of the teacher, who has come to faith through his death and resurrection in Absolute Nothingness, that the love of Absolute Nothingness can be realized in this world. Christ in Christianity and the Bodhisattva (*q.v.*) in Mahayana Buddhism are both charged with this mission. For the divine Love of the Absolute is realized in this world only through the love of the Bodhisattva, who brings the message of metanoetic truth into this world and brings his disciples to the flame of the absolute truth by means of his own fire—*i.e.*, through his own experience of death and resurrection in his *action-faith*. Thus the Love of Absolute Nothingness is transmitted from teacher to disciples.

Tanabe made use of Shinran's (1173–1262) doctrine of faith. This is most clearly described in Shinran's chief work, *Kyō-gyō-shin-shō* ("Doctrine, Action, Faith, Evidence"), according to which the believer who receives his faith by the grace of Amida Buddha will go to the Pure Land after death. The doctrine, the religious action of reciting Amida's name, the faith in Amida Buddha, and the revelation of absolute truth in the Pure Land after resurrection makes up the "going to the Pure Land." This idea is partially demythologized by Shinran himself, who believes that at the instant of conversion the essential fact of death and resurrection is almost accomplished, although owing to our finitude the evidence of Buddhahood (viz., Absolute Truth) face to face still belongs to the future life. Tanabe interprets his action-faith through this idea, modifying the terms into "historical world-action-faith-the evidence of Absolute Nothingness." Further changing slightly the meaning of Shinran's "returning from the Pure Land," Tanabe stresses the significance of the activity of the Bodhisattva as compassionate love in the faith. For in the relation of teacher to disciple the divine Love as Absolute Nothingness is realized. Thus in the relation is projected the double reciprocal movement in the absolute, as it is expressed by Hegel, *egressus est regressus*.

Tanabe uses the metaphor of a Bodhisattva who makes all his preparations to meet Buddha—finishes his journey and is about to reach the level of Buddha, and now actually visits him in his room. But he finds that Buddha is absent from his residence (the room is void). Then he realizes that Buddha is now in the world to redeem it, so he returns to the world to cooperate with him. Precisely in this return to the world he will finish in reverse his journey toward the level of Buddha. For although the only purpose of the Bodhisattva is to make himself a Buddha, this is in fact an unattainable goal in the ordinary sense, since it is a paradoxical aim: Buddhahood is the state in which all our clinging to things is overcome, and there must be indifference to, or detachment from, even the ideal goal of becoming Buddha.

Here the core of "disjunction-conjunction" of the dialectic of Absolute Nothingness can be seen. And indeed the most difficult point in philosophical thinking is just this relation of indifference and love. With this understanding of *egressus est regressus*, Tanabe, uniting Hegel and the later Schelling in his own basic religious thought, made an effort to bring into unity the innermost cores of Christianity and Buddhism (his *Dialectic in Christianity*, 1947, and *Existence, Love and Action*, 1948).

Tanabe lays stress on action-faith as against Nishida's philosophy of action-intuition and the *topos* of Nothingness, which, for Tanabe, is a retreat to contemplative speculation. Like Hegel, Nishida thinks that truth is a whole, and therefore becomes the object of our philosophical system. For Tanabe religious truth in this life is fragmental, in the Kierkegaardian sense. If it is a whole, it must be Being and therefore it is not necessary to call it Nothingness. The Absolute Truth penetrates us in an intensive way, not in extensive wholeness; therefore our attitude to this truth must be "action-faith." Kierkegaard stresses the significance of repetition. The believer is a swimmer upon a sea that is a thousand feet deep. There is no place to rest. If he ceases to swim, he sinks. Tanabe uses the simile of a skater who keeps his balance only by sliding on the ice. There is always some uncertainty and anxiety in faith, but the more uncertainty there is, the more certain is our finitude and our sin (*i.e.*, our nothingness), which will be redeemed only by metanoesis. Faith, as a transformation from our nothingness to the Absolute Nothingness, is uncertain certainty. It is established in the repetition of de-

cision-action. In the *hic et nunc* of this religious action, therefore, is also present the evidence of Absolute Truth, not as the truth revealed face to face but as the truth veiled. This is our way to and from the Absolute Truth.

Nishida and Tanabe Compared

Through Tanabe's criticism of Nishida the differences between them may be seen clearly:

1. Nishida emphasizes action-intuition, while Tanabe stresses the significance of action-faith in religious existence.

2. Action-intuition presupposes our existence as a creative element in the creative (historical) world. Tanabe thinks of the problem of dialectic only in connection with the historical world. But Nishida's creative element in the creative world tries to take a vantage point in the historical world, where, in every moment anew, the perspective of the whole can be seen from a different angle. For Tanabe, the road in the historical world is, at every point, like a blind alley, which with decision and courage one must break through. In a word, against the integrative aspect stressed by Nishida, Tanabe stresses the infinitesimal.

3. For Tanabe, the ethical viewpoint is predominant, and from his ethico-social viewpoint he devoted himself to the study of many religions, seeking to unify the truth of the Buddhist Pure Land and Zen sects as well as the truth of Christianity. The fundamental experience of all Nishida's thought, from the beginning to the end, is the immediate realization of Absolute Nothingness, derived from Zen Buddhism.

But in spite of their differences, their common standpoints in philosophy are more conspicuous:

1. The philosophy of Absolute Nothingness is their common concern; *i.e.*, the absolute must be considered first as Absolute Nothingness.

2. The essence of philosophy consists in our religious action; their philosophies differ only in how to interpret this action in the realm of philosophical reflection.

3. The idea of the Eternal Now, and Nothingness in its function of disjunction-conjunction, are the peaks at which the two philosophers can meet and join hands.

The present point of departure in Japanese philosophy is the tradition in the philosophy of religion contributed by both thinkers. Their work prepared the way for the Japanese approach to the problems of philosophy in the future, which will be concerned with the synthesis of Western and Eastern thought.

See also Buddhism; Shintō; Japan: *The People: Religion and History*. (T. Y.)

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JAPANESE SCULPTURE. The sculpture of Japan presents an unbroken tradition of three-dimensional image making from prehistoric to modern times. Art historians use the term to cover figures of clay, wood, bronze, lacquer and other materials as well as stone.

Early History (Before A.D. 552).—The earliest examples of Japanese sculpture are clay figures of the Jōmon period, perhaps akin to fertility goddesses found elsewhere in the world. From prehistoric into early historic times, or roughly from the third into the seventh century, Japan produced a unique type of sculpture in the form of hollow reddish clay figures called *haniwa*, which were partially imbedded in an erect position about important grave mounds. The distinctive tubular character of the early purely geometric examples is maintained even as they develop into recognizable subjects. The subjects include armed warriors, female musicians and harnessed horses, in broadest abstraction, combined with the accurate rendering of such appurtenances as helmets, knives, belts, necklaces, saddles and bridles. Dogs, pigs, monkeys and birds capture the peculiar essence of each creature without losing their characteristic hollow plastic form. Models of boats and houses are also found. Attempts to associate the *haniwa* with the contemporaneous tomb figures of China (*ming ch'i*) serve rather to emphasize differences. Since they are products of the indigenous Shintō tradition, parallels are better sought on Japanese soil, as, for example, in folk-toy survivals. A striking feature of the *haniwa* not found in the Chinese *ming ch'i* is the hollow eye, or other aperture, interpreted as the point of entrance for an indwelling spirit.

Asuka Period (A.D. 552–645).—When foreign gods in anthropomorphic guise were introduced with Buddhism in 552 (or a few decades earlier), the concept of a man-made image designed to hold a spirit was clearly one with which the Japanese were already familiar. The earliest Buddhist images to arrive, Chinese or Korean, were given a mixed reception and some were destroyed because of their understood threat as real gods, rather than as mere idols. The new religion was not to gain a foothold without bitter strife which the pro-Buddhist Soga clan eventually won—aided, according to legend, by the Guardian Kings of the Four Quarters of the Cosmos (Shi-tenno). Thereafter, these four deities were especially venerated and often were subjects for the image makers.

Suiko Style.—The subjects of the early Buddhist sculptors sprang from the hierarchy of the gods of Mahayana or Northern Buddhism, and came full-fledged with that religion from the mainland. An important factor in the acceptance of these foreign deities was undoubtedly the abstract simplicity of the primitive Wei style then flourishing in China. The naïve, sincere and joyful qualities which that style gave to Chinese Buddhist sculpture must have aided the Japanese in their ready acceptance of the religion. Certainly those very qualities reappeared in the early Buddhist sculpture of the Suiko style (593–628), a number of which have been preserved in the kondo—main hall of worship—at the Hōryūji, a temple built in A.D. 607. The central image, a bronze Shaka, the Buddha known to history as Sakyamuni, portrayed as a superhuman sage in meditation, forms a triad with a pair of Bodhisattvas, beings in the hierarchy second only to Buddhas. Although known to have been made under the direction of Tori Busshi, a man of Korean descent, the three recall many of the figures hewn in the cliffs of Yün Kang, China, a scant four decades earlier. These and other treasured images are guarded by the only surviving Suiko set of Guardian Kings—still lower in the hierarchy—four solid woods with gilt bronze crowns, each supported by crouching demonic monsters. They are identified as Jikoku-ten and Komoku-ten, protectors of east and west, and Zocho-ten and Tamon-ten, protectors of south and north, being the *lokapalas* of Indian lore. Overhead hang three original baldachins, on which are many youthful Apsarases, one of the minor categories of celestials, seated or kneeling on lotus flowers, clad in skirts and flying scarves, playing musical instruments and praising Buddha. These delightful wooden miniatures and the rows of accompanying phoenixes still bear traces of original paint. The arrangement of the whole (suggested here by a partial selection of objects now kept on the main dais) is important as preserving more or less intact examples of the earliest sculptures in their proper relationship to each other.

Also kept in the kondo is the slender six-foot Kwannon, the Bodhisattva of Compassion (known in China as Kuan-yin); according to tradition, it was a gift from the Korean kingdom of Kudara (Paekche). Much original colour and a gilt bronze crown remain. An equally famous wooden Kwannon, also possibly Korean, is enshrined in the nearby Yume-dono (Dream hall), where it was

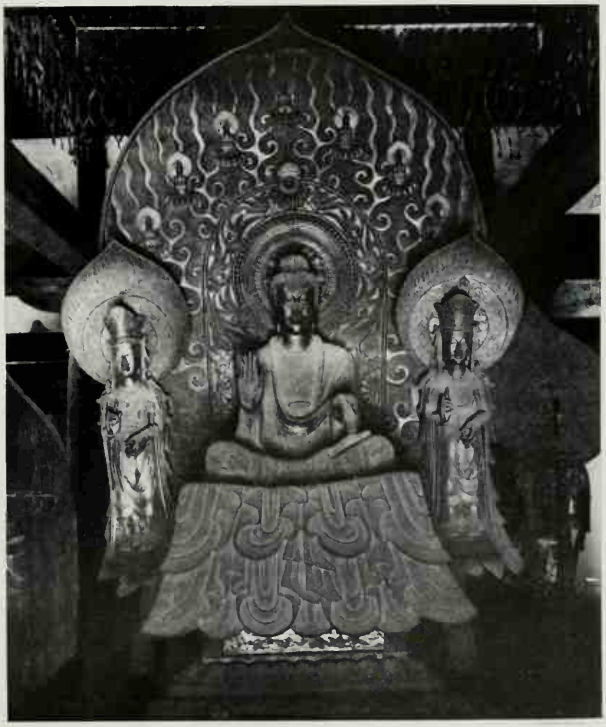
Above: Two *haniwa*, clay figures found associated with grave mounds dating before A.D. 552

Above, left: Wood Kwannon, Horyu-ji temple. Asuka period. *Centre:* Tamon-ten, one of the four Guardian Kings; wood, with gilt bronze crown. Horyu-ji temple. Asuka period. *Right:* "Kudara" Kwannon of wood, six ft. high. Horyu-ji temple. Asuka period

SCULPTURE OF THE JOMON (BEFORE A.D. 552) AND ASUKA (A.D. 552–645) PERIODS

Detail of the head of the so-called Nyoirin Kwannon, Miroku. Chugu-ji nunnery, Nara. Wood. Asuka period

Shaka trinity, Horyu-ji temple. Entirely in bronze, the group is comprised of the Buddha Sakyamuni and a pair of Bodhisattvas. Asuka period



PHOTOGRAPHS (PAIR AT TOP LEFT AND BOTTOM LEFT) ASUKA EN, JAPAN

JAPANESE SCULPTURE

Buddha head, Kofuku-ji temple, Nara. Bronze; three feet high

Six-foot bronze Sho-kwannon, Yakushi-ji

HAKUHO PERIOD (A.D. 645–710)

Details of Lady Tachibana's shrine, Horyu-ji. *Above left*, the Amida trinity: Buddha, Kwannon and Seishi. *Below left*, detail of the screen behind the trinity. *Below right*, detail of the "lake" from which rise the lotuses on which the trinity sit. The shrine is of gilt bronze; less than two feet high

PHOTOGRAPHS: ASUKA-EN, JAPAN

Detail of the figure of Gakko, 11 ft. high, from the triad at Yakushi-ji

NARA (TEMPYO) PERIOD (A.D. 710–784)

Panel depicting one of the heavenly musicians from a bronze lantern at Todai-ji

The bronze triad at Yakushi-ji: Buddha flanked by Nikko and Gakko

Incised bronze image of Buddha on one of the lotus leaves from the Buddha Roshana (Vairocana), Todai-ji, Nara

PHOTOGRAPHS, (TOP LEFT, TOP RIGHT, BOTTOM RIGHT) ASUKA-EN, JAPAN

JAPANESE SCULPTURE

Eight-armed Fuku-kenjaku Kwannon at the Sangatsu-do, Todai-ji, Nara. Dry lacquer

The attendant figures of Taishaku-ten and Bon-ten in front of the Fuku-kenjaku Kwannon, Sangatsu-do. Dry lacquer

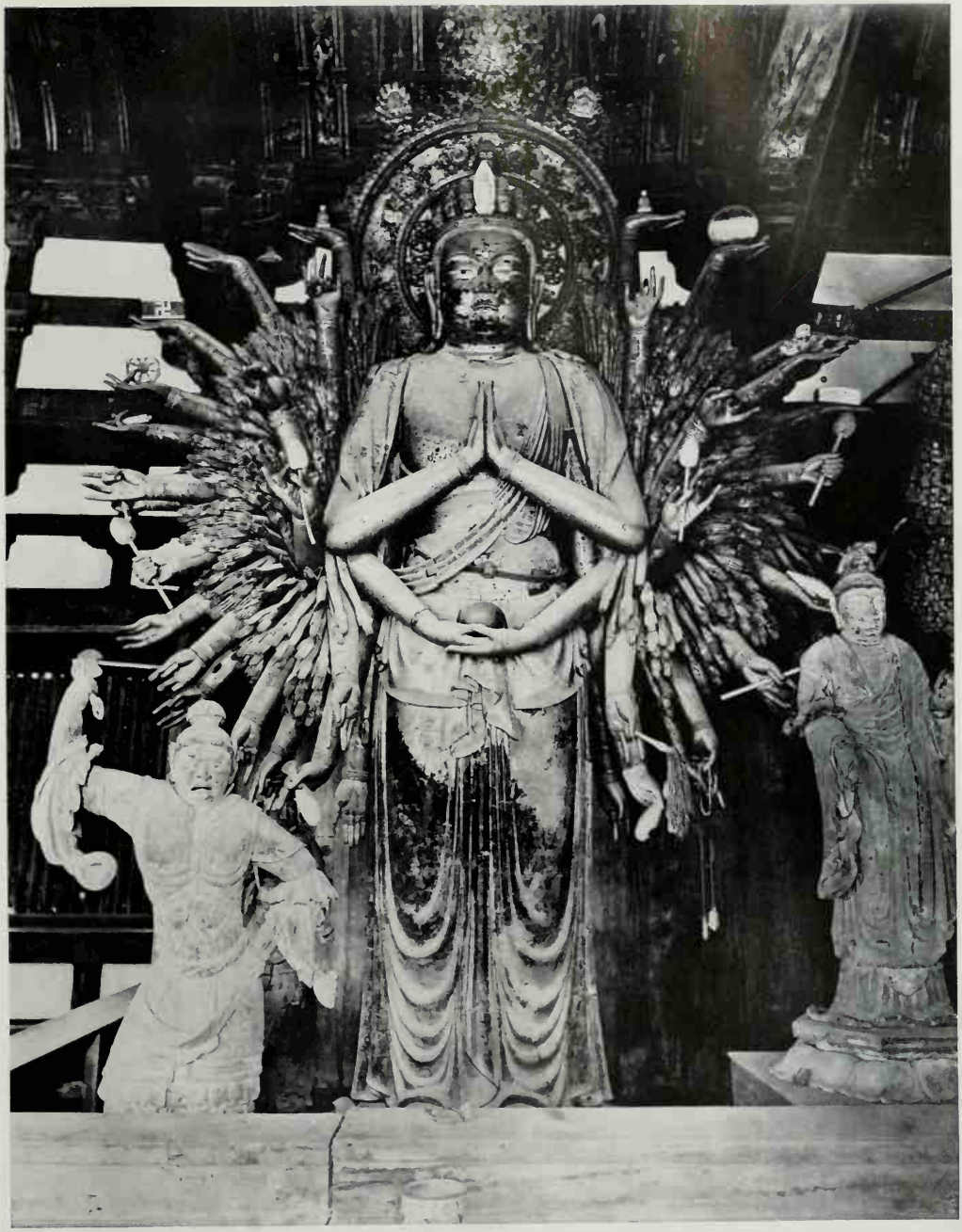
Head of one of the four Heavenly Kings, Sangatsu-do, Todai-ji. Dry lacquer

NARA PERIOD

Below left: Shukkongo-jin, the Thunderbolt Bearer (Vajrapani), Sangatsu-do, Todai-ji; unbaked clay. *Below centre:* Komoku-ten, one of the four Heavenly Guardians in the Kaidan-in, Todai-ji; clay

Jikoku-ten, another of the Heavenly Guardians of the Kaidan-in

PHOTOGRAPHS (ALL EXCEPT BOTTOM CENTRE) ASUKA-EN, JAPAN



THOUSAND-ARMED (SENJU) KWANNON, TOSHODAI-JI MONASTERY

Dry lacquer, 17½ ft. high. Nara period

JAPANESE SCULPTURE

Left: Juichi-men (Eleven-faced) Kwannon, Shorin-ji, Nara. Dry lacquer, 6½ ft. high. *Centre, above:* Detail of the head of Ashura. *Centre, below:* Detail of the hand of Juichi-men. *Right:* Ashura, a three-faced, six-armed dry lacquer sculpture from the Kofuku-ji, Nara

NARA PERIOD

The priest Ganjin, a life-size lacquer. Toshodai-ji monastery

Roshana Buddha and attendant figures, Toshodai-ji. Dry lacquer, 11 ft. high

PHOTOGRAPHS ASUKA-EN, JAPAN

Left: Eleven-faced Kwannon, Hokke-ji, Kyoto. Unpainted sandalwood. Early Heian. *Right:* Buddha, larger than life size, Gango-ji, Nara. Wood. Early Heian

Amida of the Howo-do (Phoenix hall), Byodo-in, Uji. Nine ft., wood overlaid with gold leaf. Late Heian

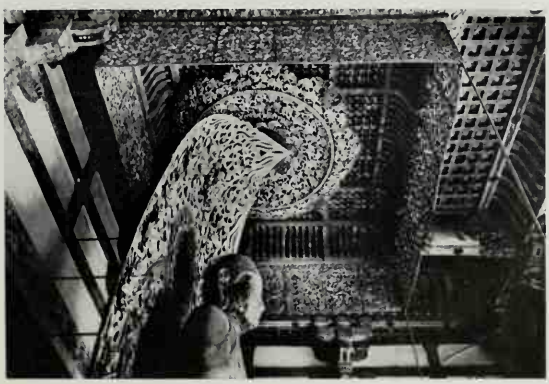
EARLY HEIAN (JOGAN) (A.D. 784–897) AND LATE HEIAN (FUJIWARA), (A.D. 898–1185)

Kichijo-ten (Goddess of Good Luck) at Joruru-ji temple, near Nara. Painted wood. Late Heian

Ichiji Kinrin, Chuson-ji, Iwate prefecture. Wood. Late Heian

Meikira, one of the 12 generals, Kofuku-ji, Nara. Wood in low relief. Late Heian

Canopy and ceiling of the Howo-do, Byodo-in. Wood. Late Heian



JAPANESE SCULPTURE

Demon lantern-bearer, Kofuku-ji, Nara. Wood

Left: The old mendicant Basu, Sanjusan-gen-do, Kyoto; wood. *Right:* The patriarch Muchaku, Kofuku-ji; wood, 6 ft. high

Portrait of Uesugi Shigefusa, Kamakura city. Wood

The goddess Ben-ten, Kamakura city. Wood

KAMAKURA PERIOD (A.D. 1185–1392)

Dainichi at Enjo-ji, Nara. Wood

The great bronze Amida of Kamakura. Cast in 1252, it is 49 ft. high including dais

kept in secret, wrapped up in yards of cloth, for centuries. A huge and elaborate openwork crown appropriately graces this, one of the most appealing images of this Merciful Bodhisattva.

Half a dozen lesser wooden Suiko figures, "the six Kwannon," also belonging to this temple were apparently fashioned in wood after bronze prototypes—with gilded surfaces completing the illusion of the dearer material. A further group of nearly 50 small bronzes from the Hōryūji, a gift to the Imperial Household in the 19th century and now in the Tokyo National museum, includes many Suiko Buddhas, Bodhisattvas and a unique image of Maya, mother of the Buddha, at the moment of his miraculous birth. The holy child is shown emerging from her right sleeve. Two flying Apsarases from a set of attendants to this figure are also preserved. Among the few Suiko sculptures outside the Hōryūji is a large and dignified wooden Bodhisattva at Horinji.

All Suiko images bear the unmistakable signs of primitive art reflecting the known early Chinese styles, or the Korean equivalents, and embodying occasional Japanese variations difficult to detect. Large heads, gentle smiles, almond-shaped eyes, wedge-shaped necks, crossed scarves, cloth folds that resemble running script "r's," and serrate scarf ends are typical features in a school of sculpture that anticipates much of the appearance and spirituality of the Romanesque in the west. The style flourished with the Buddhist church as a result of three important factors: the initial leadership of continental monks and nuns, the patronage of Prince Shōtoku (572–621) and the Empress Suiko (593–628), and the faith of the multitude who were never required to renounce their own loved Shintō gods.

Hakuhō Period (A.D. 645–710).—Confucianism, coming in with the Taikwa Reforms of A.D. 645, had no deterring effect on Buddhism. The Suiko style in sculpture continued into Hakuhō with no sudden changes, so that borderline examples are irregularly attributed to either period. Three notable wooden Bodhisattvas identified by scholars as Miroku Bosatsu (Sanskrit, Maitreya), the Buddha of the Future, are often classified under Hakuhō. They sit on lotus pedestals in the Pose of Royal Ease, *lalita asana*, with one leg resting horizontally, the other pendant, one hand against cheek, smiling and thoughtful. The earliest is the highly polished image, distinctive for its double top-knot and subtle charm, at Chūgūji nunnery near Hōryūji. It is worshipped there today as Kwannon. The other two are kept at Kōryūji, Kyōto. One is noted for the freshness of its condition, a calculated twist to one wrist, and an attribution, apparently anachronistic, to the hand of Shōtoku. The last has some of its carved draperies eked out with lacquered leather, a unique feature for the period.

Sophistication crept into Hakuhō style almost imperceptibly as the child-like simplicity inherited from Suiko eventually felt the impact of early T'ang developments in China. Faces are slightly rounder; arms are longer and "pipelike" without hint of muscle; bodies tend toward human proportion; parallel drapery lines give in to the converging; stiff drapery folds take on fluidity. Hands are smaller, hieratic gestures more carefully observed. The formal Suiko vision is tempered by a few new craftsman's devices, but retains its essentially wondrous nature. Several examples in bronze remain—*e.g.*, the so-called "Fragrant Yakushi," Buddha of Healing at the Shinyakushiji, standing erect, his austere form enhanced by a monk's robe with folds modeled like rippling waves. An equally fine example for the Bodhisattva type is the Hōryūji's Kwannon called "Yumetagae" or "Dream Conjuror" for its understood power to transform bad dreams into good. The royal bearing of the type is expertly emphasized with crown, jewelry, scarves and closely draped skirt or *dhoti*.

The greatest treasure from the period, however, is the Lady Tachibana's shrine at Hōryūji. In this, Amida Buddha, with an intricate openwork halo, and the attendants Kwannon and Seishi rise on three lotuses that spiral upward from a wind-blown lake. A background screen portrays in delicate relief five lotus-borne heavenly beings with scarves swirling up toward tiny Buddhas. The shrine, less than two feet high, is of gilt bronze. The six-foot bronze Sho-kwannon at Yakushiji that curiously combines primitive serrate drapery with subtly looped scarves and other conflicting features, is the largest of the period—if it is not a later archaistic piece. That a much larger bronze once existed is shown by the three-foot Buddha head found in 1937 at Kōfukuji. Scholars date this head between A.D. 678 and 685.

Nara (Tempyo) Period (A.D. 710–784).—Buddhism, actively encouraged by the great Emperor Shōmu (724–749) and other royal patrons, attained unbelievable power and prosperity. The founding of new temples increased the demand for sacred images and the image makers, centred about Nara, the new capital, flourished as never before. This was Japan's golden age of sculpture. The craft guilds and Buddhist workshops included bronze casters, gilders, clay modelers, lacquerers, wood carvers and others, equal to the craftsmen of contemporary T'ang China. They produced one of the world's finest bronze groups in the triad at Yakushiji, a noble seated Yakushi Buddha, nine feet high, flanked by eleven-foot figures of Nikko and Gakko. Standards of the Tempyō style, they are done in the full round almost fleshly style of T'ang with calligraphic line wedded to plastically conceived flowing drapery. The nobility of their canonical proportions assures for them a godly stature and saves them from the stigma of "idealized anatomy." Faces are full and eyebrows highly arched. Except for the Buddha, whose tonsure is suggested in the traditional snail-like curls, headdresses are realistic, as are ears. Necklaces and bracelets grace broadly modeled chests and supple wrists. Hands and rounded fingers display knowledge of precise gestures that were focal points to worshippers.

Mightiest of bronze deities cast in Japan was the original 53-ft. seated Buddha Roshana (Vairocana), dedicated at Tōdaiji, Nara, in A.D. 752. Identified with the solar power, a Buddha above all Buddhas, presiding over a cosmos formed of countless worlds, the image must have commanded the highest skill. Fires destroyed it, but its perfection may be inferred from the few original lotus petals that remain beneath the present image, restored in later centuries and known now as "Daibutsu." A bronze lantern of the same date and at the same temple, with elaborately clad heavenly musicians and hurtling lions in relief on lattice panels, is held equal to the best casting of the Italian Renaissance. The swishing draperies and shaggy manes embody elaborateness and sophistication of three-dimensional style such as Japan had never known before. Other important bronzes of this period are the Kanimanji Shaka, 8 ft. 8 in. high, known for the sculptural beauty of its gestures and drapery folds, and the Tōdaiji's 1 ft. 8 in. Infant Buddha, shown as recorded in the scriptures, pointing to Heaven and Earth at the moment of birth.

Paradoxically for so prosperous an era, common clay was also a medium for sculpture. Over 60 small clay saints and divinities made in A.D. 711 remain in four niches in the Hōryūji pagoda. The Bodhisattvas closely resemble T'ang clays far away at Tunhuang, China. About 30 larger examples—some over life-size—are also found in and about Nara. The majority of these appear to be from a single workshop; 20 are closely related iconographically. There are two sets of the Four Heavenly Guardians, at Tōdaiji's initiation hall (Kaidan-in), and at Hōryūji's refectory (Jiki-do); there are 11 of the god Yakushi's 12 protecting generals (Juni-jinsho) at Shinyakushiji; and finally there is the fiercest of them all, Shukkongo-jin—Vajrapani or Thunderbolt Bearer kept in secret in the Tōdaiji's Sangatsu-do. Of the four others in this 8th-century hall, the best known are Bon-ten and Taishaku-ten (the Indian gods Brahma and Indra), benign figures in long robes and royal hairdress, standing with hands clasped in reverence. All these clays were once fully coloured with bright pigments of which there are still traces. The necessary stiffness of the figures of the unbaked clay guardians is more than made up for by the masterful, rugged handling of the faces—so that the general appearance is one of action. The last-mentioned pair are subtly modeled in face and garb, being lifelike yet strongly aloof from the world.

Lacquer sculpture was the great specialty of the period. About 50 extant examples are of the hollow variety in which lacquer-soaked cloth was modeled over wooden armatures, lattice supports or removable clay cores. Remarkable for gigantic size are the nine hollow lacquers of the Sangatsu-do: Bon-ten and Taishaku-ten, the Four Heavenly Kings, the Niō (guardian pair named Misshaku

and Kongo), and the central eight-armed Fuku-kenjaku Kwannon. They range from 10 to more than 14 ft. high. The Kwannon retains its original many-rayed nimbus, halo and open-work crown graced by a nine-inch Amida Buddha—the only Nara period sculpture done in silver.

Two sets of figures, the Eight Deva types, *hachi-bushu*, and six of an original Ten Disciples of Buddha—an amazing total of 14 slender hollow lacquer figures—near life-size, have survived unseparated since they were made for the Kōfukuji 12 centuries ago. The stiffly erect bodies, clad in armour or priests' robes embellished in colour, are given life by keenly observed facial features. This is true even of the cock-faced general or the three-faced, six-armed Ashura.

Of particular importance to the study of lacquer sculpture is the great monastery, Tōshodaiji, founded in 759 by the Chinese priest Ganjin. Chinese craftsmen who came with him worked with Japanese on construction of the temple and its images. Here may be seen lacquer figures of all techniques, among which is an intensely moving portrait in hollow lacquer, life-size, of the old and blind Ganjin seated in contemplation. The main image of the kondo is a colossal seated Roshana Buddha, hollow lacquer with inside lattice support. This is more than 11 ft. high not counting its dais, nor its nimbus with a thousand tiny Buddhas in relief. In the same hall stands the 17½-ft. Senju (Thousand-armed) Kwannon, 953 of its original arms still in place. Tradition attributes this to a spirit who took up temporary residence in the sculptor's body. It was made by modeling in lacquer-soaked materials over a wood core, and is the largest example in that technique.

Under the same roof is also the largest sculpture in the related technique of carved wood surfaced with lacquer—a 12-ft. standing Yakushi. Other famous sculptures of the wood-core variety are the 6½-ft. figure of Juichi-men (Eleven-faced) Kwannon at Shōrinji—the tangible vision of a Buddhist saviour at once gentle and magnificent—and the life-size and strikingly lifelike figure of Buddha's friend, the sage Yuima (*Vimalakirti*) at Hokkeji nunnery.

Wood sculpture, polychromed over thinly applied kaolin and glue, seems not to have been common until the latter part of the period. An interesting and perhaps an early group of five preserved at Daianji shows Kwannon in different aspects. Exquisite renderings of scarves and jewelry on these would seem to bear out temple records of contacts with the T'ang capital. Tōshōdaiji owns the largest group, a dozen or more, all apparently of the later decades of the 8th century. In these is seen the gradual transition toward the massive forms of Jogan. Buddhist sculpture, which in Tempyō came close to realism, was saved from that danger by new spiritual trends that demanded greater formalism and abstraction.

Early Heian (Jogan) Period (A.D. 784–897).—The shifting of the capital from Nara to Kyōto in the decade 784–794 marks a change in style, for which there were three main reasons: reduction of the influence of the court, iconographic needs of the monasteries of the esoteric Shingon and Tendai sects, and a preference for wood. Buddhist deities took on varied and complicated shapes to represent highly evolved spiritual concepts in tangible form, for the contemplation of mystics. Thus there was neither decadence nor archaism and Japanese sculpture in the realm of wood carving reached its finest flower. Heads are heavy-set on shoulders; chests and abdomens are rounded; draperies cascade from mighty torsos; navels are cut deep. The Jogan style is one of massiveness and power.

The sculptors, blocking out massive forms from solid tree trunks, were masters with wood, following the grain in long, swift knife strokes or chiseling boldly across it. New force was given to the familiar Buddha face, figure and robe, as seen in the over life-size erect examples at Jingoji, Gangōji and Muroji. At the last temple alone, the original setting, with 9th-century architecture and painting, is preserved. Muroji is also known for a fine seated Shaka, whose robe shows the typical "rolling wave" convention, sharp ridges alternating with curved. The Hokkeji's small eleven-faced Kwannon of unpainted, fragrant sandalwood is a tribute to the Jogan sculptor's ability to combine solidity with the impression of lightness. Few images made for worship are more appealing. By contrast, the six-armed Nyoirin Kwannon of Kwanshinji, superhuman and maternal—for all the beauty of original colour on lotus throne, nimbus and figure—is difficult of approach. Here the image maker has made a symbol of Divine Power and Divine Love for revelation only to the specially learned initiate, and it is therefore ordinarily kept in concealment.

Human likeness is never found in Jogan sculpture except as a point of departure. Witness the Five Kokuzo ("Sky-wombs") at Jingoji. All assume the yoga posture with face in contemplation. Arms and hands of all are set in calculated gesture holding thunderbolts and other symbols. By rare chance several male and female Shintō images have survived. Simple but nonetheless splendid abstractions, they affect formal seated postures and costumes of the ancient Chinese Han tradition and have no connection with Buddhist iconography. A total of six survive at Yakushiji: Ozu Jinja, Shiga; and Matsuno-o Jinja, Kyōto.

Late Heian (Fujiwara) Period (A.D. 898–1185).—The court once again exerted its influence over Buddhism as the powerful Fujiwara aristocracy lavished its wealth to the glory of Buddha. Amida's paradise, the blissful goal of the Pure Realm sect, was frequently portrayed—with the combined efforts of all manner of craftsmen. At Uji is the Howo-do (Phoenix hall) of Byōdōin, dating from 1053, with Jōchō's 9-ft. image of Amida, wood heavily overlaid with gold leaf. Its great carved openwork nimbus and overhead canopy are original. Mounted high on the surrounding walls are 52 separate wood reliefs so subtly carved as to look full round—Bodhisattvas dancing and playing music each on individual clouds—originally brightly coloured. A large pair of bronze phoenixes surmount the roof. Next in fame is the smaller Konjikidō (well-named "Hall of Golden Splendour") of Chūsonji in northern Honshu, built in 1124. In an interior decorated all over with painted lacquer and mother-of-pearl inlay and gilt bronze hangings are three altars containing each an Amida triad attended by six images of Jizo and the Four Heavenly Guardians.

The Fujiwara style, generally speaking, retained some devices of Jogan such as eddying drapery swirls, while it reverted to the comparative slenderness of Tempyō, and added sweetness and softness of its own. Subtle refinements are found in postures, facial expressions and colour. Along with an intensive demand for Buddhist images there developed an essentially new technique of assembly from parts. Head, chest and abdomen, sides, knees and lap, arms, and hands were sometimes made separately. The technique with the two advantages of economy in lumber and speed of production was to remain standard for large sculptures in Japan.

Scattered widely over Japan are many Fujiwara sculptures, invariably of exquisite workmanship. Interesting for iconography and for structure is the Chūsonji's two-foot ten-inch Ichiji Kinrin, an almost feminine rendering of Dainichi as Revealer of Truth. It is half-round, having no back, and is hollowed out; it is one of the earliest examples with eyes of crystals. Another unusual piece is the figure of Fugen on an elephant, kept in the Okura museum in Tokyo. At Joruriji near Nara, typifying the charm and refinement of the age, is the little figure of Kichijo-ten (Goddess of Good Luck) in the guise of a young court lady in bright flowing garments, seeming to float on an elaborately painted lotus flower. Only a shade more human is the portrait of the young Prince Shōtokū treasured at Hōryūji.

On the level of caricature, with muscular legs and wrinkled faces, twisting, squinting and grimacing, are the Kōfukuji's 12 generals in the same low relief as the Howo-do Bodhisattvas. There appears to be no limit to the range of the Fujiwara sculptor.

Kamakura Period (A.D. 1185–1392).—The concentration of power in military hands under Minamoto Yoritomo at the outset of this period, and the moving of the administrative functions from Kyōto to Kamakura, were symbols of sharp cultural changes. It is not surprising that there were coinciding changes in Buddhist sculpture. Some of the spirituality of Fujiwara and some of its aristocratic flavour were lost. Yet under stimulus of the new age, the arts of the image makers saw even greater activity than before. Although there was no immediate break with Fujiwara style, as many borderline sculptures show, there were important new trends. Humanism affected religious thinking so that while the Jodo sect

was still popular, the vision of Amida's paradise was brought closer to earth. The tendency was for divine figures to be more humanly rendered and for human figures to be more realistic. Along with the inevitable drift toward materialism, however, there was a powerful resurgence of the 8th-century spirit, the Shogun in fact becoming the moving force behind a veritable Tempyō renaissance.

Temples at Nara were repaired or rebuilt; sacred images were commissioned in quantity and on massive scale. Yoritomo, for instance, ordered a set of six images 32 ft. high: the Four Guardian Kings, Kwannon and Kokuzo for the Nara Daibutsu-den which had burned. After two and a half years of planning, production of scale models, assembly of parts, and application of colours, these were completed in A.D. 1196. The project had required the efforts of 4 master sculptors headed by Unkei, 80 assistants, and 160 carpenters and woodcutters. Though these images were lost in a 15th-century fire, the 26-ft. pair of guardians, Niō, at the South Gate still stand. Unkei and Kaikei with 16 artisans had completed the mighty pair in only ten weeks. These powerful figures hark back to Tempyō and T'ang prototypes, but the joinery, the bulging muscles, the threatening faces, all speak of a living Kamakura tradition in which the skills of many were employed as in the medieval guilds of Europe. A smaller project, the Kōfukuji's octagonal Hokuen-do, complete with nine images, was the work of Unkei and several of his sons, Tankei, Koun, Koben, and Kosho. Famous, here, for their extraordinary realism are the 6-ft. pair of patriarchs Seishin and Muchaku, attendant on Maitreya. They typify Kamakura carving at its cleverest—presenting in painted wood the illusion of modeling, if not indeed of actual drapery and flesh. But Unkei's work was abstract when iconography required, as in his spirit-infused Dainichi at Enjoji, Nara.

The extent to which the craft guild system of Kamakura could be carried may be seen at the Sanjusan-gen-do, Kyōto, with its 1,000 gilt wood images of Kwannon, each eleven-headed and many-armed. While still in his teens, Unkei worked on one of these images with his father, Kokei—even as his own son Tankei did after him. From father to son as from master to pupil the traditions were handed down. The same hall owns other images, including the vivid individual figure of the half naked old mendicant Basu with staff and scroll and bony chest. And in Rokuhara Mitsuji is Kosho's wandering monk Kuya with staff and gong, calling the name of Amida Buddha. So realistic is this that six tiny images of the deity project on a wire from his mouth. Kosho's brother Koben could be terribly realistic even with demons, as seen in his squat, muscular lantern-bearers, horned and three-eyed, done for Kōfukuji, Nara.

The sculptures of Kamakura city were likewise superb, as is evidenced there in three well-known examples of very different types. The first is a seated lay portrait of Uesugi Shigefusa with lifelike face set off by formal starched coat, full-blown "trousers" and tall hat. The second is a tender goddess, Ben-ten, unclad and in the easy posture of one playing a musical instrument. Her proper beauty is seen when, as intended, she wears silk garments and holds a *biwa*. Finally there is the great, calm, world-famous colossal bronze Amida, rising, with stone dais, 49 ft.; cast in 1252, and seated for all but two and a half centuries in the open air.

The period was one of prolific output and varied repertory. It was also a period that mixed the formal conservatism of traditional craftsmanship with innovations of the moment.

After Kamakura.—While some hold that the realism of Kamakura sculpture spelled its death knell, it is to be noted that the 14th century was one of almost constant warfare. Social equilibrium was disturbed and craftsmen were pressed into service. By the 15th century the new Zen Buddhist impact from China, already felt in Kamakura times, had taken strong hold. Aniconic, though not iconoclastic, it hardly provided the stimulus for sculpture. Formal Buddhist images have continued to be made right up to the present without varying too greatly from or quite measuring up to the works of the last great period. Searching far and wide, however, it is still possible to find evidences of a strong undercurrent of indigenous folk image making. Kozanji, in the hills behind Kyōto, owns a splendid pair of deer, perhaps from Ashikaga period (1392–1568); Seto and Bizen by the 16th century produced ceramic lions; all through Tokugawa (1615–1867) there were casual carvings in wood or chiseled stone figures of monkeys and foxes, or roadside deities, or the Seven Lucky Gods. These were the products of the genius of Shintō—that had indeed contributed to Japan's carvers all through the ages.

See also JAPANESE PAINTING AND PRINTS; JAPANESE ARCHITECTURE; JAPANESE GARDEN; CHINESE SCULPTURE; INDIAN ART.

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(J. M. P.)

JAPANNING, a process for decorating and protecting the surfaces of metal articles with finishes that are hardened by heating in ovens. The term originated in the 18th century when it included all sorts of glossy decorations on wood, leather, tin and papier-mâché, which emulated the celebrated lacquer work of the Japanese (*see* LACQUER; ENAMEL). Black japan, a mixture of molten asphalt, natural-resin varnishes, drying oils and turpentine has a clear, brownish undertone. The japans have largely been displaced by modern baking enamels; tough, durable coatings composed of pigments ground in synthetic-resin varnishes. They are made in a variety of finishes—gloss, mat and textural—and are used on typewriters, bicycles, military items, etc. After spraying or dipping, the articles are heated in ovens at a temperature between 250° and 350° F. Besides this batch system, coated articles may also be passed through heated tunnels in a continuous production system.

Certain air-drying enamels also in use are less resistant to wear; brush-applied varieties of this type are also available in cans for household use. Liquid enamels are so called because of their resemblance to true porcelain or vitreous enamel; the name distinguishes them from ordinary oil paints. Japanning has also been displaced by the cellulose lacquer-enamels (*see* VARNISH), far less durable than the synthetic-varnish enamels but widely used because of their extreme rapidity of drying, lower cost and other considerations. The term japan survives more actively in an altogether different product, japan colours. These are quick-drying lustreless paints miscible with turpentine and universally sold in tubes and cans for sign painting and decorative work.

(RH. M.)

JAPHETH, one of the three sons of Noah, was, according to the tradition of the "Priestly" stratum of the Old Testament (*see* PENTATEUCH), the third "son"; but the older tradition of Gen. ix, 20–27 represents him as the second son. The oracle of blessing, Gen. ix, 27 ("God enlarge Japheth, and let him dwell in the tents of Shem; and let Canaan be his slave"), displays hostility against Canaan (*q.v.*), and looks favourably upon Japheth, but is not easy to interpret clearly. "Dwell in the tents of" is usually understood to mean "have friendly intercourse with," the passage thus indicating friendly relations between the descendants of Japheth and the Semites.

(W. L. W.; X.)

JAQUES-DALCROZE, ÉMILE (1865–1950), Swiss composer and educationist, was a pioneer in the teaching of eurhythmics (*q.v.*), a term used to designate the representation of musical rhythms by bodily movements. Born in Vienna on July 6, 1865, he studied composition in his youth and was professor of harmony at the Geneva conservatory in 1892. In 1910 he founded his first institute at Hellerau, near Dresden. In 1914 he transferred his school to Geneva, where it became known as the Institut Jaques-Dalcroze, and other schools of eurhythmics were set up in London, Paris, Berlin, Vienna, Stockholm and New York. His aim was "to create by the help of rhythm a rapid and regular current of

communication between brain and body," and his pupils were taught to indicate note-values by movements of the feet and time-values by the arms. The Dalcroze method was frequently used to give plastic expression to fugues and symphonies and even operas. Jaques-Dalcroze, who had studied with Bruckner and R. Fuchs in Vienna and with Delibes in Paris, wrote three string quartets and two violin concertos, as well as numerous pieces for the piano. His arrangements of popular songs, children's rounds and *chansons de geste* were used for the teaching of eurhythmics in schools. He also published the *Méthode Jaques-Dalcroze* (1907–14) and *Eurhythmics, Art and Education*, Eng. trans. by F. Rothwell (1930). He died at Geneva on July 1, 1950.

See H. Brunet-Lecomte, *Jaques-Dalcroze, sa vie, son œuvre* (1950). (R. H. My.)

JARARACA, a poisonous crotaline snake of tropical South America. *See* FER-DE-LANCE.

JARGON (JARGOON), a name applied to those zircons which are fine enough to be cut as gem stones, but are not of the red colour which characterizes the hyacinth (*q.v.*). The name is related to Arab *zargun* (zircon). Some of the finest jargons are green, others brown and yellow, while some are colourless. The colourless jargon may be obtained by heating certain coloured stones. *See* ZIRCON.

JARIR IBN 'ATIYAH AL-KHATFI (d. 728) was one of a famous trio of rival Arab poets. He is renowned for the exchange with these rivals, al-Farazdaq and al-Akhtal (*qq.v.*), of a series of satirical poems (*naka 'id*, edited by A. A. Bevan, three volumes, 1905–09 and published, 1922, with notes by A. Salhani, respectively). He lived mainly in Iraq and won favour at the court of the caliph Omar II. His collected works, comprising panegyric and laments in addition to satire, were published in Cairo (1896).

JARMO. The low mound known as Jarmo—in full, Qalat Jarmo—is a prehistoric archaeological site in the Kurdish hills of northeastern Iraq, about 35 mi. east of the modern city of Kirkuk. The importance of the site rests on the archaeological traces it reveals of a very early aspect of the first village-farming communities. The approximate dozen layers of architectural building and renovation also yield traces of domesticated wheats, barley and the dog and goat, suggesting the achievement of a settled agricultural way of life. Other artifacts in the Jarmo catalogue, such as flint sickle blades, milling stones and—in the uppermost levels of the site only—pottery, hint at the technological adjustments made to the new food-producing way of life. The estimated age of the site, by radioactive-carbon dating, is about 7000 B.C.

See also ARCHAEOLOGY: *Prehistory: The Old World of the Recent Period.*

See R. J. Braidwood *et al., Prehistoric Investigations in Iraqi Kurdistan* (1960). (R. J. B.)

JARNACH, PHILIPP (1892–), German composer who was a follower of Busoni, was born July 26, 1892, at Noisy, near Paris. He was the son of the Spanish sculptor, Esteban Jarnach. He studied the piano under Edouard Risler and harmony under Albert Lavignac in Paris. In 1915, at Zürich, he met Busoni whose operas, *Arlecchino* and *Turandot*, he arranged for piano, and under whose influence he wrote his String Quintet, Opus 10. In 1927 he was appointed professor of composition at the Cologne conservatory. He was naturalized in 1931, and in 1949 became director of the Hamburg conservatory. Among his chamber works, which show an affinity with Hindemith, are two sonatas for unaccompanied violin. His orchestral works include *Musik mit Mozart* and *Morgenklangspiel*. He completed Busoni's opera *Doktor Faustus* after the composer's death.

JÄRNEFELT, EDVARD ARMAS (1869–1958), Finnish-born composer and conductor who introduced Wagner's operas to Finland and who is known for his works for small orchestra. Born at Viipuri, Aug. 14, 1869, he studied at Helsinki, Berlin and Paris with, among others, Busoni and Massenet. He conducted at Viipuri (1898–1903), and in 1904 gave first performances of Wagner's operas at Helsinki. He was appointed conductor of the Stockholm opera in 1905, naturalized Swedish in 1910 and in 1932 returned to Finland as director of the Helsinki opera. Järnefelt was known as a conductor of Beethoven and Wagner, and also of the works of his brother-in-law, Sibelius. He wrote choral works, symphonic poems, about 50 songs, incidental music and piano pieces, but became known chiefly by his *Berceuse* and *Praeludium*. He was married to the Finnish Wagnerian soprano, Maikki Pakarinen, and later to the soprano, Liva Edström. He died, June 23, 1958, at Stockholm.

JAROSITE, a mineral species similar to alunite (*q.v.*) consisting of hydrous potassium and aluminum sulfate, and often occurring as incrustations of minute indistinct crystals with a yellowish-brown colour and brilliant lustre.

The best specimens, consisting of crystalline crusts on limonite, are from the Jaroso ravine in the Sierra Almagrera, in the province of Almería, Spain, from which locality the mineral receives its name. It appears to be a common product of decomposition of sulfides in mineral veins, and one variety from Nevada and New Mexico, plumbojarosite, contains lead.

JARRAH WOOD, the product of a large tree (*Eucalyptus marginata*) found in southwestern Australia. The trees grow straight and often to a great size, and yield squared timber up to 40 ft. long and 24 in. in diameter. The wood is hard, heavy and close-grained, with a mahogany-red colour, and sometimes sufficient grain to render it suitable for cabinetmakers' use. Frequently, however, it shows longitudinal blisters, or lacunae, filled with resin, such as may be observed in spruce fir timber; and it is deficient in fibre, breaking with a short fracture under moderate pressure. Its greatest merit for marine purposes is due to the fact that it resists, better than any other timber, the attacks of shipworms (*Teredo*-species) and other marine borers, and on land it is equally exempt, in tropical countries, from the ravages of termites. When felled with the sap at its lowest point and well seasoned, the wood withstands exposure to the air, earth or sea remarkably well, on which account it has been used locally for railway sleepers (ties), telegraph poles and piles.

JARRATT, DEVEREUX (1733–1801), American Anglican clergyman, was born on Jan. 17, 1733, in Kent county, Va. He received little schooling but developed a fondness for reading, and in this way prepared himself for tutoring. One of the families with whom he found employment as a tutor were devout Presbyterians, and as a result Jarratt's mind was turned toward religion. He soon felt a call to enter the Presbyterian ministry, but finally decided to seek ordination in the Anglican communion. In Oct. 1762 he sailed for England where he was ordained a deacon by the bishop of London and a priest by the bishop of Chester. He was detained for three months by smallpox, and after his recovery he heard John Wesley and George Whitefield preach. Returning to Virginia in 1763, Jarratt was installed in a parish in Dinwiddie county, and there he remained, a faithful spiritual shepherd, until his death on Jan. 29, 1801.

Jarratt extended his ministry over many counties in Virginia and North Carolina, and when the first Methodist preachers appeared, he was one of the few Anglican clergymen who gave them full cooperation, entertaining them in his home and administering the sacraments to their new converts. (*See* METHODISM.) The fullest account of the Methodist revival is Jarratt's, which he sent to John Wesley and which Francis Asbury (*q.v.*) placed in his *Journal*. When the American Methodists separated from the Anglicans in 1784 and formed the Methodist Episcopal Church, Jarratt was alienated. As a slave owner, he was further estranged by the stringent rules adopted by the Methodists condemning slavery.

See W. W. Sweet, *Men of Zeal* (1935). (W. W. S.)

JARROW, a port and municipal borough (1875) in the Jarrow parliamentary division of Durham, Eng., on the right bank of the Tyne, 6½ mi. below Newcastle Upon Tyne. Pop. (1961) 28,811. The parish church of St. Paul was dedicated in 685, and close by are the scattered ruins of the monastery begun by St. Benedict Biscop in 681 and consecrated by Ceolfrid in 685. Within the walls of this monastery the Venerable Bede spent most of his life. The town's industries include ship repairing, iron and steel processing and fabrication, and various light industries. A great quantity of coal is shipped. Jarrow owed its development largely to Sir Charles Mark Palmer, whose shipyards and steelworks provided employment for the majority of the townsmen until the collapse

of the company after World War I. Widespread unemployment resulted in "hunger marches" on London in the early 1930s. A return to prosperity began in 1939; new industries were introduced, followed by the creation of a trading estate in 1946. There is a large oil installation with wharf facilities available at all tides. A tunnel under the Tyne was opened in 1951. Near St. Paul's church is the Jarrow Slake, a large timber pool.

JARRY, ALFRED (1873–1907), French writer, remembered for the extravagance of his personality as well as for that of his writings, was born at Laval (Mayenne), on Sept. 8, 1873. He led a chaotic and anarchical existence in which he met the demands of day-to-day life with self-conscious buffoonery, and which ended in alcoholism. He published stories and poems (*e.g., Les Minutes de sable, Mémorial,* 1894; *L'Amour en visites,* 1898; *L'Amour absolu,* 1899; *Le Sur-mâle,* 1902), but the work which won him notoriety was a dramatic sketch, *Ubu-Roi,* first conceived when he was 15; it was subsequently rewritten and produced at the Théâtre de l'Œuvre in 1896. Ubu, the hero, was originally a caricature of Jarry's schoolmaster at the *lycée* at Rennes, but came to symbolize the crass stupidity of the bourgeois exacerbated to atrocious cruelties by his lust for power. Jarry invented a logic of the absurd, which he christened *pataphysique,* and which threw into ridiculous relief the grotesque and shocking side of human nature. The founders of the Dada and Surrealist movements hailed him as a forerunner. He died in Paris on Nov. 15, 1907.

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JARVIS ISLAND, a sand and coral atoll in the central Pacific ocean, about 2 mi. long by 1 mi. wide. Jarvis was first reported by the British ship "Eliza Francis" under the command of Captain Brown in 1821, and has been variously called Bunker, Volunteer, Jervis and Brook. The American Guano company claimed it in 1857 and worked it until 1879. Great Britain annexed the island in 1889, but did not exploit it. The U.S. established a small colony there in 1935 without British opposition and on May 13, 1936, Pres. Franklin D. Roosevelt placed it under the jurisdiction of the secretary of the interior. Later it was placed under jurisdiction of the department of the navy. The colonists were evacuated in Feb. 1942, and the settlement was not re-established after World War II. (J. H. K.)

JASHAR, BOOK OF, the "Book of the Upright" (*i.e.,* of Israel), a lost work compiled not earlier than the time of David and quoted in the Bible. The two known extracts from it are a victory hymn (a fragment?) describing how the sun and moon stood still while Israel defeated its enemies (Josh. x, 12b, 13); and a lament over fallen heroes, David's elegy over Saul and Jonathan (II Sam. i, 19–27; the source is indicated in verse 18 in a gloss that distorts the text). In addition, Solomon's poem at the Temple dedication (1 Kings viii, 12) is ascribed by the Greek (Septuagint) version to the "Book of Song." Many scholars believe that this reflects a scribal corruption of the "Book of Jashar" (*Šyr,* "song," for *Yšr,* Jashar) in a Hebrew text, but unlike the other two examples Solomon's poem is cultic rather than heroic.

Two rabbinical works and an anonymous Jewish work of the 12th century A.D. bear the title "Book of Jashar," as well as a forged 18th-century writing which pretends to be an English translation of the book mentioned in the Bible. (H. G. MA.)

JASMIN, JACQUES (pen name of JACQUES BOÉ) (1798–1864), French poet, one of the pioneers in the revival of southern French dialect poetry in the 19th century, was born on March 6, 1798, at Agen, where his father was a poor tailor and where Jasmin, for the greater part of his life, kept a barber's shop. In 1825 he published *Charivari,* and this was followed in 1835 by the first of the four volumes of *Papillotos* ("Curlpapers"). This contained a poem of great pathos—*L'Abuglo de Castel-Culié* ("The Blind Girl of Castelculier")—a poem which, having captured the popular emotion in Toulouse and Bordeaux when the poet recited in those cities, was enthusiastically noticed by Charles Nodier in *Le Temps.* Paris was thus prepared to welcome Jasmin; he was received at court by King Louis Philippe and in 1852 he was awarded a special prize by the Académie Française. His exquisite *Soubenis* ("Souvenirs") enhanced his reputation but he was not tempted to relinquish his barber's trade. He was called "the commercial traveler of charity" as a result of the public recitations he gave throughout France in aid of good works. The small estate he bought for himself near Agen and named "Papillotos" became as well known as its owner; it inspired him to write *Ma binho* ("My Vine"). He died on Oct. 4, 1864.

Jacques Jasmin was a good man and a good poet. Although he was praised by Sainte-Beuve and Lamartine he was essentially a poet of his own people and the patois he used restricts his best work to a local audience. (A. A. F. B.)

JASMINE (JASMIN, JESSAMINE), traditionally, the name for species of *Jasminum,* shrubs or climbers of the olive family (Oleaceae). They are mostly natives of the warmer regions of the old world, with one South American species, and many have fragrant flowers. Other plants called jasmine or jessamine are dealt with after the *Jasminum* species.

True Jasmines.—Of the about 200 species, several are widely cultivated outdoors in mild climates for their blossoms and one especially is important in perfumery. In colder climates jasmines make excellent greenhouse plants, of easy cultivation. The leaves are pinnate or ternate, or sometimes apparently simple, consisting of one leaflet. The common white jasmine or poets' jessamine (*Jasminum officinale*), one of the best known and most highly esteemed of hardy cultivated woody climbers, is a native of northern India and Persia. In the centre and south of Europe it is thoroughly acclimatized. Although it grows to the height of 12 and sometimes 20 ft., its stem is feeble and requires support. The fragrant white flowers bloom from June to October.

The zambac or Arabian jasmine (*J. sambac*) is an evergreen, white-flowered climber, six feet high. The Spanish or Catalonian jasmine (*J. officinale* var. *grandiflorum*), a native of the northwest Himalayas, cultivated in both the old and new world, is very like *J. officinale* but differs in the leaflet size; the branches are shorter and stouter, the flowers larger and reddish underneath. By grafting it on two-year-old plants of *J. officinale,* an erect bush about three feet high is obtained, requiring no supports.

Perfume is extracted chiefly from the flowers of the Spanish jasmine by the process known as enfleurage, *i.e.,* absorption by fats to form pomades, from which the essence may be extracted with volatile solvents (*see* PERFUME).

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SPANISH JASMINE (J. OFFICINALE VAR. GRANDIFLORUM)

The distinguishing characters of sweet jasmine (*J. odoratissimum*), a native of the Canary Islands and Madeira, consist principally in the alternate, ternate and pinnate leaves, the three-flowered terminal peduncles and the five-cleft yellow corolla with obtuse segments. The flowers have the advantage of retaining when dry their natural perfume, which is suggestive of a mixture of jasmine, jonquil and orange blossom. In China *J. paniculatum* is cultivated as an erect shrub, known as *sieu-hing-hwa;* it is valued for its flowers, which are used with those of *J. sambac,* for scenting jasmine tea. *J. angustifolium* is a beautiful evergreen climber, 10 to 12 ft. high, found in the Coromandel forests, and introduced into cultivation.

A hardy species commonly cultivated in gardens is the low or Italian yellow-flowered jasmine (*J. humile*), an East Indian species introduced and now found wild in the south of Europe, an erect shrub, three to four feet high, with angular branches, alternate and mostly ternate leaves, blossoming from June to September. The common yellow jasmine (*J. fruticans*), a native of southern Europe and the Mediterranean region, is a less hardy evergreen shrub, 10 to 12 ft. high, with weak, slender stems requiring support, and bearing yellow, odourless flowers from spring to autumn. The winter jasmine (*J. nudiflorum*) of China, which bears its bright

yellow flowers in winter or early spring before the leaves appear, is hardy in the United States from New York southward.

Other Jasmines.—Unrelated plants with "jasmine" in their names include: the Carolina jessamine or jasmine (*see* GELSEMIUM); the night, day and willow-leaved jasmines (*Cestrum* species), native to Central and South America and cultivated in warm regions; the Cape jasmine or gardenia (*q.v.*) of the florists; the Chilean, crape and star jasmines, species in the dogbane family (Apocynaceae; *q.v.*); the rock jasmines (*Androsace* species), of the primrose family (Primulaceae); the jasmine tobacco (*see* NICOTIANA); and others less well known.

JASON, in Greek mythology, leader of the Argonauts, was the son of Aeson, king of Iolcos in Thessaly. His father's half brother Pelias (*q.v.*) seized Iolcos, so Jason was sent to be brought up in safety by the centaur Chiron. Returning as a young man, he lost a sandal on the way, which rendered him suspicious to Pelias who had been warned by an oracle to beware of a one-sandaled man. Pelias then promised to give Jason back his inheritance if he fetched the golden fleece, a seemingly impossible task. After many adventures (*see* ARGONAUTS) Jason abstracted the fleece from Aeetes with the help of the latter's daughter, the enchantress Medea (*q.v.*), whom he married. On their return Medea murdered Pelias, whose son drove out Jason and Medea to take refuge with King Creon of Corinth. Later Jason deserted Medea for Creon's daughter; the consequences of this desertion form the subject of Euripides' tragedy *Medea*. Jason died at Corinth.

JASPAR, HENRI (1870–1939), Belgian statesman, was born at Schaerbeek, Brussels, on July 28, 1870. He became a member of the Catholic party and was appointed minister of economic affairs in Nov. 1918. He organized the reconstruction of Belgian industries and became deputy for Liège in 1919. In 1920, having been appointed minister of the interior and afterward minister of foreign affairs, he endeavoured, during the Inter-Allied Conference in which he took part, to strengthen the entente between England, France, and Belgium, and to secure reparations and security for his own country. In 1922 he negotiated a pact of security and guarantee with England, but, because of the defeat of the French government, it failed to come into operation. Belgium's entry into the League of Nations was largely due to the efforts of Jaspar, as was its representation on the Permanent Court of International Justice at The Hague. In July 1921 he concluded an economic agreement between Belgium and Luxembourg. He took part in the Dawes Plan negotiations in 1924, but resigned as minister for foreign affairs on March 11, on the rejection by the Chamber of the Franco-Belgian Convention. From 1926 to 1931 he was prime minister in a ministry originally formed as one of "national unity." He had to face a serious financial crisis, and his policy led to dissidence in the cabinet, which was reconstructed in 1927. From 1932 to 1934 Jaspar was minister of finance, and in 1934 minister for foreign affairs. He died on Feb. 15, 1939, just after he had been asked to form another ministry.

JASPER, an impure variety of chalcedonic to cryptocrystalline quartz (*q.v.*), in composition essentially SiO_2 (silica), long used in jewelry. The colour varies from red, yellow, brown and dark green to grayish blue. Some varieties are banded in layers of different colours, others are striped or irregularly spotted. Most jasper is opaque in the hand specimen, and much that is used as a semiprecious stone is red or brown, owing to included hematite. Most of it is cut cabochon. The hardness is essentially that of quartz (7). The ancient term jaspis included not only the present-day jasper but also probably chrysoprase and other types of chalcedony. Medicinal values were long attributed to jasper, including a belief that its wearing strengthened the stomach.

Jasper is common and widely distributed, occurring chiefly as veinlets, concretions and replacements in a variety of sedimentary and metamorphic rocks and also less commonly as nodules in volcanic rocks. It may be deposited either by meteoric (atmospheric) or ground waters or by hydrothermal solutions.

Fine material has long been known from the Libyan desert and the Nile valley. The variety riband jasper is colour banded, as for example the red-green striped Siberian material. Beautiful examples of jasperized fossil wood are found in Arizona. Jasper also is common as detrital pebbles. Swiss or German lapis is an artificially coloured jasper made to imitate lapis lazuli. *See* also CHERT AND FLINT; GEM: *History*.

See E. H. Kraus and C. B. Slawson, *Gems and Gem Materials*, 5th ed. (1947); K. Schlossmacher, *Edelsteine und Perlen* (1954).

(E. W. HE.)

JASPER NATIONAL PARK, in southwestern Alberta, Can., established in 1907, is the largest of Canada's national parks, having an area of 4,200 sq.mi. Lying northwest of Banff National park, with which it is linked by the Banff-Jasper highway, it encompasses the Athabasca valley and surrounding mountains. A region of majestic snow-capped mountains, beautiful alpine valleys, cascading streams and waterfalls, and deep canyons, it is one of the great wildlife sanctuaries of North America. Among the species of big game animals to be found there are Rocky Mountain sheep, mule deer, elk, black, brown and grizzly bear, moose, caribou and puma or cougar.

Part of the great Columbia ice field lies within the park boundaries and from it issue numerous glaciers whose melting ice gives birth to rivers that eventually flow into three oceans: the Atlantic, the Pacific and the Arctic. Hot springs, with a temperature of 126° F., occur at Miette. An underground river runs through Maligne canyon, which is 188 ft. deep but in places only a few yards wide. Other attractions include Angel glacier on Mt. Edith Cavell, Athabasca falls, Amethyst lakes in the Tonquin valley, Sunwapta pass and the Athabasca glacier.

The park is well supplied with accommodations and campgrounds. Jasper Park lodge is operated by the Canadian National railways; its golf course is among the most picturesque in the world. (J. G. P.)

JASPERS, KARL (1883–), German existentialist philosopher, was born at Oldenburg on Feb. 23, 1883. He studied medicine and became *Privatdozent* in psychiatry at the University of Heidelberg in 1913. Later his interests changed and in 1920 he became professor of philosophy at Heidelberg. In 1937 the Nazi government dismissed him; in 1945 he was reinstated. In 1948 he became professor of philosophy at the University of Basel.

Jaspers' work is influenced partly by his early training in psychopathology and partly by the doctrines of Kierkegaard and Nietzsche. His existentialism seeks to extend the scope of reason to the problem of existence. By existence he means, first, the human condition as revealed in "limiting situations" such as being tied to a body and to an outlook of this world, suffering, death, guilt, struggle and the like. To exist is to live in a setting which I have not chosen but which is not alien to me; I am my situation, but I cannot make it objective. Secondly, existence implies freedom to choose, which makes the existent responsible for itself. An authentic choice cannot be reduced to rational argument, but it is not arbitrary; its internal necessity allows me to say both that I choose what I am and that I choose from the nature of what I am. It is this necessity that allows me to understand and express a choice. Thirdly, existence implies communication between existents, by language or other means. Though there is no absolute point of view that encompasses all points of view, no one is confined to his own perspective, each is somewhat accessible to all. Truth is then the outcome of a man's striving to communicate in order to transcend his own perspective.

Existentialist philosophy tries to link situation, choice and communication with logic and science on the one hand, and with metaphysics on the other. Existence, in any of its three aspects, is not an object; to clarify it we must therefore first oppose objective thought. But we must also try to understand, since to objectify is itself a part of existence; only a thought of existence can grasp its own fiercest enemy: objective knowledge. On the side of metaphysics we must show how existence is linked with its ground. For though there can be no science of being, existence is somewhat transcendent (it is not its own ground).

The threefold scheme of *Philosophie* (1932) reflects all this: an illumination of existence (embodied, selective and communicating), facing objective thought on one side and transcendence on the other. The central problem is how to think existence without making it an object, and yet avoid lapsing into irrational-

ity, poetry or silence. (*See* also EXISTENTIALISM.)

Among other works of Jaspers are *Von der Wahrheit* (1948), *Vom Ursprung und Ziel der Geschichte* (1949) and *Einführung in die Philosophie* (1950).

See M. Dufrenne and P. Ricoeur, *Karl Jaspers et la philosophie de l'existence* (1947); P. A. Schilpp (ed.), *Philosophy of Karl Jaspers* (1957). (P. RI.)

JASTROW, MORRIS (1861–1921), U.S. orientalist, was born in Warsaw, Pol., on Aug. 13, 1861, but at five was taken to Philadelphia where his father, a rabbi, had been called. He was educated at the University of Pennsylvania and at French and German universities. In 1885 he returned to Pennsylvania as instructor, but soon became professor of Semitic languages and literature and also librarian. He died on June 22, 1921, at Jenkintown, Pa.

His early work dealt with archaeological and historical subjects, including *Aspects of Religious Belief and Practice in Babylonia and Assyria* (1911), and *The Civilization of Babylonia and Assyria* (1915). World War I caused him to apply his knowledge of the Near East to contemporary problems, as in *Zionism and the Future of Palestine* (1919), and *The Eastern Question and Its Solution* (1920).

JÁSZBERÉNY, a typical "village town" of central Hungary in Szolnok *megye* (county), lies about 64 km. (40 mi.) E. of Budapest on the Zagyva river, a tributary of the Tisza. Pop. (1960) 30,211 (mun.). It is the chief of many places in the district which have the prefix "Jász," derived from the Jazygen, a steppe tribe who penetrated into Danubia from north of the Black sea in the later years of the Roman empire. In medieval times the Jazyges appear to have mixed with the Kumans (*q.v.*) and their special privileges, gained by their military value, ended only with the administrative changes of 1876. At Jászberény Attila's Hunnish followers are said to have sunk his coffin of gold, silver and iron in the bed of the Zagyva.

See I. T. Gyárfs, *The History of Jazygen and Cumania*, 4 vol. (1875). (H. G. S.)

JAT. Jats are the principal agriculturists of northern India and Pakistan. In the 1960s they constituted about one-fifth of the population of Punjab, nearly one-tenth of the population of Baluchistan, Rajasthan and Delhi, and from two to five per cent of the population of Sind, Northwest Frontier and Uttar Pradesh. The 4,000,000 Jats of West Pakistan are mainly Muslim by faith; the nearly 6,000,000 Jats of India are mostly divided into two large castes of about equal strength: one Sikh (concentrated in Punjab), the other Hindu.

Muslims classed as "Jat" in the western regions are mostly camel herders (*Jat*) or labourers (*Jaṭ*), often subordinate to Balochis or Pathans (*see* PATHAN). They are organized in hundreds of patrilineages that may intermarry. The Jat (*Jāṭ*) castes of India and of the Punjabi areas of West Pakistan are more often peasant proprietors and themselves dominate many of the districts where they are numerous. Sikh and Hindu Jats observe a wide pattern of village and clan exogamy; ideally, women move in marriage from south and east to north and west.

Jats of Punjab are of medium to tall height, longheaded, hairy and prominent of nose. Like Rajputs (*see* RAJPUT), they have been linked speculatively with various invaders and with central Asian tribes known to antiquity. Jats first emerged politically in the 17th century and later with military kingdoms such as Mursan in Uttar Pradesh, Bharatpur in Rajasthan and Patiala in Punjab. While some Jats have emulated the Rajput aristocracy, and while persons have moved both ways between the two groups, most Jats permit remarriage of widows and otherwise deviate from the purely Kshatriya (*q.v.*) way of life. *See* also CASTE (INDIAN).

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JATAKA, the technical name in Buddhist literature for a story of one of the Buddha's previous births, animal or human. Several Buddhist schools, in a fairly old list, enumerate "birth stories" among the 9, or respectively 12, branches of the scriptures. In the Pali canon of the Theravadin school they are collected in a separate book of 547 stories. A few of the tales also occur in the Vinaya Pitaka of the Theravadins. The Vinaya of the Lokottaravadin school, the Mahavastu, in its turn contains 36 Jatakas. A few Sanskrit collections are preserved in Chinese or Tibetan translations, though in the northern tradition the distinction from Avadanas is often blurred. About A.D. 200 the poet Arya Sura in his *Jatakamala* wrote up 34 stories in polished prose and verse. Finally, there is a 4th-century Pali work, the Cariya Pitaka, which summarizes 35 stories in rather bald verses. In the 5th century A.D. the introduction to the Pali Jataka book (*Nidana-katha*) was compiled in Ceylon. It contains a biography of the Buddha from the period, eons previously, when he first decided to attain Buddhahood, down to the beginning of his preaching. The date at which the Jataka stories were first worked out cannot be determined, but it must have been at some time before the Christian era, perhaps the 3rd century B.C. These tales were addressed to the laity and had less authority than the more metaphysical teachings on which the meditations of the monks were based. Their message concerns chiefly the virtues of secular life, and moral retribution is constantly stressed by the doctrine of *karma* (*q.v.*) and rebirth. In addition these tales foster a tenderness toward all that lives. Stories of the Buddha's self-sacrifice are particularly popular: as a prince he killed himself to feed a starving tigress, as a hare he offered his body to appease the hunger of a wandering ascetic (hence the figure of a hare can now be seen in the moon), and as a monkey or deer he saved his herd by giving up his own life.

Many of the Jataka tales have been illustrated on ancient monuments, in sculpture at Bharhut (near Satna), Buddh Gaya, Sanchi and Nagarjunikonda (near Guruzala) in India, Borobudur (in Indonesia) and Pagan (in Burma); in paintings at Ajanta, in Tunhuang (Kansu province, China) and on Tibetan *thang-kas*. Some of the longer romances, like the famous story of Vessantara, who gave away all he had, are favourite subjects of dramatic performances in Burma and Tibet. Although the Jatakas purport to relate events in the lives of the Buddha when he was a Bodhisattva (*q.v.*), the tales themselves were originally the work of Indian storytellers, and are fables, fairytales, anecdotes, etc., taken from the vast fund of Indian folklore. Many of them also recur in Hindu collections such as the *Panchatantra*, and others are identical with the beast fables attributed to Aesop. These tales were adapted to Buddhist uses by representing them as incidents in the lives of the historical Buddha. They always begin with a story of the present, which becomes the occasion for telling a story of the past, and this in turn is followed by the identification, in which the chief characters are declared to be previous births of the persons who appear in the story of the present. The Bodhisattva idea, however, is probably a late development in Buddhist thought. Even among the Buddhists these tales were originally told merely to illustrate the Buddha's moral precepts.

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JAUCOURT, ARNAIL FRANÇOIS, MARQUIS DE (1757–1852), French politician, was born on Nov. 14, 1757, at Tournan-en-Brie. He adopted revolutionary ideas, became colonel of his regiment, and represented Seine-et-Marne in the Assembly. As his views were too moderate for his colleagues he resigned in 1792 and was arrested on suspicion of being a reactionary. Mme de Staël procured his release just before the September massacres. He accompanied Talleyrand to England, returning after the execution of Louis XVI. Under the Consulate he was for some time president of the Tribunate. In 1803 he entered the Senate, and in 1804 was attached to the household of Joseph Bonaparte. His im-

perialist views cooled, and at the Restoration he became minister of state and a peer of France. At the second Restoration he was for a brief period minister of marine. He devoted himself to the Protestant interest in France. A member of the upper house in the reign of Louis Philippe, he was driven into private life by the establishment of the Second Republic, but lived to rally to the government of Louis Napoleon. He died in Presles, Feb. 5, 1852.

JAUNDICE (Icterus) is the visible expression of an increased concentration of bilirubin in the blood. Thus accumulating, it imparts a yellow colour first to the whites of the eyes, then to the mucous membranes and skin. Bilirubin is the principal pigment of the normal bile derived from the hemoglobin (colouring material) of red blood cells which have undergone destruction. Of the three main groups of jaundice, one is due to a greater than normal destruction of red cells with overproduction of bilirubin, exceeding the ability of the liver to transfer it to the bile. A second group includes various disturbances of liver function and liver disease such as hepatitis (inflammation) or cirrhosis (diffuse scarring). The third group embraces mechanical obstructive causes in which the main ducts transferring bile from the liver to the intestine are obstructed by tumour, gallstone or scar. In the second and third groups, elements of bile other than bilirubin also gain access to the blood in abnormal amount and may be detected by chemical methods. This is in some way responsible for the generalized itching of the skin often noted in these groups, but not in hemolytic (overproduction) jaundice. Treatment is different in the three groups: in the first the increased blood destruction is often terminated by removal of a greatly enlarged spleen; in the second protective medical management is indicated, while in the third group surgical removal or bypassing of the obstruction is required whenever feasible. *See* also references under "Jaundice" in the Index. (C. J. Wa.)

JAUNPUR, a city and district in the Varanasi (Benaras) division of Uttar Pradesh, India. The city is situated on both banks of the Gumti river, 36 mi. N.W. of Varanasi. Pop. (1961) 61,851.

Jaunpur is believed to have been founded in the 11th century by the Gaharwar rulers. The city was probably washed away by severe floods of the Gumti, and was rebuilt about 1359–64 by Firuz Shah. With the weakening of the Delhi sultanate there arose an independent Sharqi dynasty with its Muslim kingdom extending from Budaun and Etawah to Bihar, and Jaunpur remained its capital for about a century (1394–1479). The main interest of the city lies in its antiquarian remains: the fort, originally built by the Gaharwar princes and reshaped by Firuz Shah (1360), is mostly a ruin; the Atala Masjid, a mosque converted from the Hindu temple of the Atala goddess in 1408; the ruined Jhanjhari Masjid and the Dariba mosque constructed during Ibrahim Lodi's rule; the Lal Darwaza mosque erected by the queen of Sultan Mahmud; the Jamma Masjid (1438–78), mainly built by Sultan Husain Sharqi; and the splendid Shahi bridge over the Gumti built by Munim Khan, the Mogul governor, in 1569–73. Jaunpur has two degree-granting colleges affiliated to Gorakhpur university.

The city has lost its former glory, the only industries surviving from the past being the manufacture of perfumes and papier-mâché articles. With modern means of transport by rail and road, however, its commercial activities have grown. The city is noted for its market gardening, over 50% of its land being tilled.

Jaunpur District (area, 1,543 sq.mi.; pop. [1961] 1,727,264), forms the central part of the Ganges-Gogra doab or divide and is drained by the Gumti, Sai, Basuhi, Barna and Pili rivers. The Gumti is known for its floods, the greatest being in Sept. 1871 when 13,000 houses were swept away. Frequent floods and droughts have saddled the district with a long-term debt. The whole country is closely tilled and 90% of the cultivated area, which is irrigated by canals and tube wells, is under food crops. There is a sugar factory at Shahganj.

In ancient times the district formed a portion of Ayodhya (Ajodhya) principality and later it was subject to the rulers of Benaras until 1194, when it passed into Muslim hands. British rule was established there in 1775 by the treaty of Fyzabad.

(R. L. Si.)

JÁUREGUI Y AGUILAR, JUAN DE (1583–1641), Spanish critic, poet and painter, who, after initial reservations, expressed in his temperate and well-argued *Discurso poético* (1624) and elsewhere, became a tacit convert to Gongorism (*see* Góngora y Argote, Luis de) in his own verses, especially *Orfeo* (1624), and an overt defender of the extravagantly *culterano* preacher Hortensio Félix Paravicino. In addition to his *Rimas* (1618), he produced excellent translations of Tasso's *Aminta* (1607; modern edition, 1906) and the *Pharsalia* of Lucan (published 1684). A well-known portrait of Cervantes formerly attributed to him is no longer believed to be his. Jáuregui was born at Seville in 1583 and died at Madrid in 1641.

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JAURÈS, JEAN (1859–1914), one of the leaders of the French Socialist party in its formative years, a patriot and a great orator and journalist under the third republic, was born at Castres (Tarn), on Sept. 3, 1859, into a family of middle-class country people. After a brilliantly successful secondary education, he went to the École Normale Supérieure in Paris, which he left with the title of *agrégé de philosophie*. He next worked as a teacher at the *lycée* of Albi (1881–83) and then as a lecturer at the University of Toulouse (1883–85). His interest, however, turned to politics, and in 1885 he was elected to the chamber of deputies as a member for the Tarn *département*. For the moment he did not adhere to any party and sat in the centre. Defeated in the elections of 1889, he returned to the university and in 1891 presented his two theses for the doctorate: *De la réalité du monde sensible* and *De primis socialismi Germanici lineamentis apud Lutherum, Kant, Fichte et Hegel*. Having supported the strike of the miners of Carmaux in 1892, he was returned to the chamber at a by-election in that constituency in 1893. Though he was defeated in 1898, he was to represent it again in 1902, 1906, 1910 and 1914.

Jaurès' conversion to socialism, which took place under the influence of Lucien Herr, librarian at the École Normale Supérieure, could already be felt in the articles he began to write in 1892 for the *Dépêche de Toulouse*, and it became official in 1893. Even so, his socialism was never to coincide exactly with Marxism: though he accepted the principal Marxist propositions, he emended them in his own way. He accepted Marx's theories on surplus value, on industrial concentration and on crises, but rejected the theory of "pauperization" and appreciated the resistance shown by artisans, tradesmen and farmers to concentration. While agreeing that the class struggle is one of the motivating forces in historical evolution and that economic changes prepare the way for political and intellectual changes, he gave prime importance to the idealistic aspirations of men in the movement of society and propounded a synthesis of historical materialism with historical idealism. For him socialism was to be the continuation and the fulfillment of the French Revolution, satisfying the need for liberty and justice. The idea of the dictatorship of the proletariat was quite foreign to him, and he was a strong opponent of the antipatriotism of the *Communist Manifesto*, for, he said, "The poor have nothing but their fatherland." His conception of history and society is most forcefully presented in his *Histoire socialiste de la Révolution française*, 8 vol. (1901–07), written "under the triple inspiration" of Karl Marx, of Jules Michelet and of Plutarch; and in *L'Armée nouvelle* (1910), in which, as a preface to a draft of a law on "the organization of the armed nation," he gives a masterly analysis of the idea of fatherland.

Of the five schools into which French socialism was then divided, Jaurès chose that of the Independent Socialists, whose organ was *La Petite République* and whose leader, Alexandre Millerand, was to define their reformist policy in the "St. Mandé program" of 1896. When the Dreyfus affair broke out in 1897, Jaurès, who had already made himself known in parliament and the press, fought for a revision of the trial and the rehabilitation of Alfred Dreyfus. His book, *Les Preuves*, which appeared in 1898, caused his failure in the elections of that year; and his attitude put him in opposition to Jules Guesde and to certain Marxists who could

not understand a Socialist's defending an officer and a bourgeois.

Despite this conflict, the various socialist organizations forgot their differences and held a first general congress in Paris in 1899. After this, however, they were divided again over a new issue, as a result of Millerand's entering the government formed by René Waldeck-Rousseau in June 1899. Thus in 1900, at the second congress, the "ministerialists" and the "anti-ministerialists" separated, the former to constitute the Parti Socialiste Français (with Jaurès), the latter to constitute the Parti Socialiste de France (with Guesde and Edouard Vaillant). Jaurès wrote articles for the press in support of Waldeck-Rousseau's reforming policy and, after his re-election in 1902, upheld the continuation of that policy by the "Left bloc" and by Émile Combes.

In 1904 the congress of the Socialist International in Amsterdam condemned Socialists who took part in a bourgeois government. This was a decision in favour of Guesde against Jaurès, who in the same year, with Aristide Briand, René Viviani and others, had founded the newspaper *L'Humanité*. Jaurès accepted the decision of the congress, so that it was possible, in 1905, for the two parties to be amalgamated into a unified Socialist party, the Section Française de l'Internationale Ouvrière (S.F.I.O.). This party remained in the opposition, with the result that the reformist program that Waldeck-Rousseau had initiated was held back. At the same time Jaurès became increasingly influential in the S.F.I.O., which on the eve of World War I had been largely won over to reformist ideas. Likewise Jaurès opposed the supremacy of the German Social Democratic party in the International and, in order to challenge its revolutionary prestige, set himself up against it as the defender of the formula "insurrection rather than war" (congress of Stuttgart, 1907). This formula, however, did not summarize all his thought, and he strove for the adoption of a system to ensure "peace through arbitration," advising a prudent policy of "limitation of conflicts." He was opposed to colonialist expeditions chiefly because he saw in them sources of international conflict.

Hostile to the Franco-Russian alliance and mistrustful of the Franco-British entente in so far as it seemed to be aimed against Germany, Jaurès became the champion of Franco-German reconciliation, which earned him the hatred of the French nationalists. In the crisis leading from the assassination at Sarajevo, Yugos., up to the outbreak of World War I he persisted to the last in urging the governments to find a peaceful solution. Jaurès was assassinated in Paris on July 31, 1914, by Raoul Villain, a young aesthete of 29 who was tinged with insanity. His body was transferred to the Panthéon in 1924.

Jaurès could draw on a vast classical, philosophical and historical culture, and his eloquence was comparable to that of the greatest orators. Apart from the works already cited, he published two volumes of collected articles, *Action socialiste* (1899) and *Études socialistes* (1901), as well as a collected volume of speeches, *Discours parlementaires* (1904). Nine volumes of selected works appeared between 1931 and 1939, with the title *Oeuvres de Jean Jaurès*, edited by Max Bonnafous.

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(CL. H.)

JAVA (DJAWA), an island in the Republic of Indonesia, lies south of Malaya and east of Sumatra. Java is the fourth in area of the islands although politically it is the most important. It is separated from Sumatra by the Sunda strait and from Bali by the Bali strait. It is 661 mi. long and 124 mi. wide, and its area, including that of the island of Madura, is 51,032 sq.mi. In 1961 the population was 63,059,575. The capital of Java and of the republic is Jakarta (*q.v.*).

PHYSICAL GEOGRAPHY

Geology.—In Java the Cretaceous occurs in one small inlier, strongly upfolded near the centre of the island; the Eocene appears as coal seams, sandstones and limestones, and the later Tertiary strata yield marls, breccias and limestones and cover 38% of the island. The Miocene strata are very thick. Fresh-water Pliocene strata in the east, or the Pleistocene immediately above them, yielded the famous "ape man" or "dawn man" fossil called *Pithecanthropus* (see *Archaeology*, below), and there is much marine Pleistocene material, some of it 350 ft. above sea level. The oldest rocks are serpentine and mica schists, in part perhaps Cretaceous. Faults separate the central volcanic highlands from the northern lowlands and from the broken country to the south, so that the island is formed of strips. The central volcanic mountains rest on highly folded Tertiary rocks with indications of underlying Cretaceous sandstones and Paleozoic schists; they are interrupted by an extension of sediments southward across the island from Semarang. Vulcanicity developed in the mid-Tertiary and attained its maximum in Pleistocene times; volcanic rocks, especially andesites and basalts, cover 28% of the island.

Relief and Drainage.—A longitudinal mountain chain from west to east, surmounted by volcanoes, is flanked by limestone ridges and lowlands. In the east the portion west of Pasuruan (with volcanic highlands and peaks up to 10,968 ft.) is wider, while a peninsula with the volcanic Tengger, Ijang and Idjen highlands tapers out eastward. Java's highest volcano, the Semeru (12,060 ft.), is there. Central Java, between Semarang and Cheribon (Tjirebon), has a chain formation of mountains (Slamet, 11,260 ft.); there the watershed is central, rather than near the south coast as it is in the east. Between the central mountains and the limestone ridge in the south is the Kedu valley, the most densely populated part of the island. West Java has the Preanger mountains in the southeast (Tjikuraj, 9,255 ft.; the twin peaks Gede, 9,680 ft.; and Pangrango, 9,882 ft.) with extensive upland basins of which that of Bandung is the most important; westward the heights are less but in northwest Bantam another group rises to 5,730 ft. The strip along the north coast of the island varies in width from 1 to 40 mi. Java is highly volcanic, yet serious eruptions are few; 35 of the 112 volcanoes are active. The Tangkubanprahu, Papandajan, Merapi, Kelud, Lamongan, Semeru and Kawah Idjen are under constant observation. Bromo (7,841 ft.), always steaming, rises from a huge crater bed of sand in the Tengger highlands. Papandajan is capped by sulfur deposits, and the volcanic centres show *solfatara* (steam jets), boiling wells and mud caldrons, with the ground coloured bright red, yellow and green. In some places poisonous gases are ejected. The Idjen plateau (82 sq.mi.) is one of the largest of the extinct craters.

Most rivers in Java run northward, down the longer slope, but a few go to the south coast; the largest, the Solo and the Brantas in East Java, are turned east by northern limestone ridges before they reach the coast. The Solo river is 336 mi. long. The southern streams are rapid and rough. In the west the Tjitarum and Tjimanuk are the most important. In the wet season most of the rivers are navigable for small boats, but they are mainly used to supply water for irrigation.

In the east the northern Djapara plain is formed from volcanic deposits; the Djuwana, Rembang and Surabaja plains are of marine sand and clay. Most interior plains are volcanic; those of the south coast consist of marsh and sand hills. In Central and West Java the northern plain is alluvial, with marsh and coral remains about the lowest levels. The rivers flowing into the shallow northern sea have built up a changing flat belt of sand and mud. The northeast coast is often wooded and of varied contour; westward past Cheribon the coast line is low and rich in mangrove and nipa palm. There has been reclamation for villages. The currents of the deep ocean on the south sweep away river mud but heap up shifting sand ridges which, during the southeast monsoon, may block river mouths. The limestone ranges thrust out headlands with cliffs rising 1,600 ft. from the sea.

Climate.—In spite of its subequatorial location, Java is not extremely hot; equal lengths of day and night, mountains, sea breezes and thundershowers in the wet monsoon relieve the heat. Maximum temperatures are found in the plains along the north coast but in the mountains it is much cooler. At about 2,000 ft. conditions are temperate, and a temperature of −2.8° C. (27° F.) has been recorded on the heights. The mean daily range at Jakarta (Djakarta) is 6.6° (11.8°); in the mountains, 21.1° (38°). Abso-

lute maxima and minima are 35.8° (96.4°) and 18.9° (66°) at Jakarta; 37.2° (99°) and 16.9° (62.4°) at Asembagus (south coast); and 22.2° (71.9°) and 8.6° (47.5°) at Tosari (5,692 ft.). The coastal districts are coolest at 6 A.M. and warmest at 1 P.M. High humidity is general (75%–90%) and in the transition period between dry and wet monsoon makes the climate debilitating.

Java has a northwest monsoon from December to March, bringing much rain and cloud especially in the north, while from April to October it has a southeast monsoon bringing some rain to the south coast but making August the sunniest month at Jakarta. Strong cyclones and typhoons are unknown, but afternoon thunderstorms are common in the mountains and at night during the wet northwest monsoon. Jakarta has an average of 122 thunderstorms a year. The northwest monsoon extends up to about 12,000 ft.

Rainfall varies. January is usually the wettest month. Jakarta averages 70.7 in., Cheribon 90.38, Banjuwangi 53.72, Bogor 165.94, Bandung (2,395 ft.) 77.2, Tjilatjap (south coast) 152.25, Kalisat (3,609 ft.) 62.4 and Asembagus, the driest station, 35.39 in. Regions of maximum rainfall are west Bantam, around Mt. Tjaremai in Cheribon, north central Java south of Pekalongan, around Mt. Murjo in central Java and in the highlands of eastern Java. Periods of drought last from 12 to 53 days in the west, and from 14 to 116 in the east, the record being 227 days at Situbondo.

Vegetation.—More than 5,000 species of plants are known and the botanic gardens of Bogor are world famed. The vegetation is south Asian, with Australian affinities in the southeast and east. Dense rain forest abounds in Java on the damp slopes of the mountains. The rasamala (*Altingia excelsa*), a tall timber tree, common in the west, is absent from the east, where mountain casuarina flourishes. Thick bamboo woods occur in the west; the teak or *djati* forests are scattered along the northern plain but are mainly on the limestone hills of Rembang, Semarang, Madiun and Kediri. The most important fruit trees are banana, mango (*Mangifera indica*), nangca (*Artocarpus heterophyllus*) and durian (*Durio zibethinus*). The lowlands are entirely cultivated.

Soil composition and degree of fertility vary considerably, depending on whether the sediments are of recent volcanic origin or limestone. There are four plant zones. From sea level to 1,750 ft. is the coastal zone, the most extensive of the four; some trees, such as *Barringtonia speciosa* and *Terminalia catappa*, grow only near the sea. Epiphytic plants are rare; fleshy-leaved plants abound on salty soil. A short distance inland, palms and bamboo begin. Where limestone is found in the hills, acacias, sterculias, rattans, pepper vines and jasmine are common. Acacia forms fine woods between 400 and 1,300 ft., and teak thrives between 100 and 2,000 ft., forming one-fourth of the government forests. Higher up, in the second zone, are the rain forests with brilliantly flowering epiphytes, notably orchids, as well as ferns and fungi, growing on the tree trunks. Magnolia and annonaceous trees are general, while rasamala grows 130 ft. high in central Java; casuarina and also bamboo are found almost everywhere there. The second zone has a temperature range of 17.8°–23.3° C. (64°–74° F.). In the third zone (temperature 12.2°–17.8° [54° to 64°]) azaleas and rhododendrons abound, as well as oaks, chestnuts, maples and laurels; *Trema orientalis* is found on Mt. Merapi and Mt. Kelud. Many trees are covered with mosses and lichens, and there are crowfoots, horsetails, meadow rue, whortleberries (*Vaccinium*), raspberries and blackberries. On about 20 peaks, forming the fourth zone, conditions are alpine or subalpine, and frosts occur. Ironwood, myrtle, elder, rhododendron, honeysuckle, heather and the so-called Javanese edelweiss (*Anaphalis javanica*) are common. The royal cowslip (*Primula imperialis*) is said to grow only on the summit of Pangrango, where wood sorrel, lily of the valley, foxglove, lobelia and yew also grow.

The main value of the forests is in their hydrologic function. Teak is the chief tree economically exploited, principally by the state, which owns the teak forests. About 5% is exported. A forestry school and experimental station are in Bogor. The service of forestry controls all national forests in order to protect the soil on the slopes from erosion and to maintain a supply of water for irrigation purposes in the dry monsoon.

Animal Life.—The Javanese one-horned rhinoceros, closely allied to a form in southeastern Asia, is dying out. The tiger occurs in Java and also the banteng or wild ox (*Bibos* [*Bos*] *sondaicus*), akin to the gaur of India. There are two species of wild pig, both very destructive to crops, leopard, wildcat, deer, notably the little muntjac (*Muntiacus muntjac*) and the graceful musk deer (*Tragulus javanicus*), several species of ape, *Cynocephalus temminckii* (a flying lemuroid), many bats, squirrels, flying squirrels, porcupines, rats, mice, shrews, ichneumons, civet cats, hares, badgers and the scaly anteater (*Manis javanica*). The dugong, a large aquatic mammal, visits the coasts of Java.

The green peacock (*Pavo muticus*), a rare and beautiful jungle fowl (*Gallus varius*) and also *Gallus gallus*, the red jungle fowl, are found in Java. The bird population includes 400 species. Snipe and other waterfowl abound; weaverbirds and ricebirds prey upon the crops. Only two parrots occur. The swift (*Collocalia*) which produces the edible bird's nest is found along the coast. Large crocodiles (*Crocodylus porosus*) are common, and lizards swarm; the monitors *Varanus salvator* (*minyawak*) and *V. bivitatus* (*beawak*) are large enough to attack poultry. Snakes, numbering more than 100 species, include the great python (*Python reticulatus*), reverenced because it destroys field mice, the cobra and an adder.

Seas, rivers and ponds swarm with gorgeously coloured fish which form a large element in the food supply. Crabs, lobsters and crayfish are abundant. More than 500 species of butterflies occur, and moths, beetles, mosquitoes, ants, termites and hornets are common. Scorpions, centipedes and spiders abound; one spider snares small birds. (J. O. M. B.)

ARCHAEOLOGY

Prehistory.—The earliest chapter of Java's prehistory is concerned with the very beginnings of mankind. In 1891 Eugène Dubois's discovery of a fossil skullcap and femur, to which he gave the name *Pithecanthropus* (*q.v.*) or "ape man," placed the region of Trinil in central Java among the world's classical sites concerned with man's evolutionary history. In 1936 and the three following years G. H. R. von Koenigswald made further discoveries of *Pithecanthropus* comprising part of a lower jaw with several of the teeth in position, three adult skull fragments, one of which includes part of the upper jaw, and the skull of an infant. From these remains a fairly complete picture of the cranial anatomy of *Pithecanthropus* can be constructed, and it is now considered by many anthropologists that the Java ape man is congeneric with the Chinese Peking man, the two being designated *Pithecanthropus erectus* and *P.* (or *Sinanthropus*) *pekinensis*, respectively.

Although he is not regarded as being in the direct line of human descent, *Pithecanthropus* shows a combination of features intermediate between ape and man. The prognathous jaws, lack of chin and heavy brow ridges are simian characters; the dentition is intermediate in type and the cranial capacity is estimated at about 900 c.c.; that of the largest apes is about 500 c.c. and that of modern man, 1,350 c.c. The limb bones are very human and definitely indicate an erect posture; evidence from China suggests that *Pithecanthropus* made stone tools and used fire. He probably lived about the middle of the Pleistocene period.

In 1941 a portion of a lower jaw with three teeth was found, resembling *Pithecanthropus* but of enormous size. It was named *Meganthropus*, but the remains were insufficient to permit any further account of this remarkable hominid.

In 1931, 11 fossil skullcaps were found in a terrace of the Solo river near Ngandong. The being they represent was named *Homo soloensis* and is generally regarded as of Neanderthaloid type. They are of Upper Pleistocene age. Also believed to be late Pleistocene are the Wadjak skulls, found in 1889 and 1890 in the Zuider mountains. Their close resemblance to the skull found at Keilor in South Australia in 1940 supports Dubois's original opinion that they are of Australoid type.

The earliest Javanese Paleolithic Stone culture was discovered in 1935 by Koenigswald and M. W. F. Tweedie near Patjitan. The most typical tools are large, roughly made choppers and

the industry is regarded as belonging to the same Middle Pleistocene complex of cultures as the Soan of northwest India, the Anyathian of Burma, the Malayan Tampanian and the Choukoutienian Stone culture associated with *P. pekinensis*. From this it may be inferred that *Pithecanthropus* was the author of the Javanese Patjitanian, but no positive association has been demonstrated.

In 1934 Koenigswald discovered a culture represented by flake implements in the Upper Pleistocene Notopuro deposits. This has been called the Sangiran Flake culture, and may well be the work of the Neanderthaloid *Homo soloensis*. Here again, however, no positive correlation has been made.

The Sampung Bone culture seems to be the main feature of the Mesolithic in Java, and is developed in the eastern part of the island. It was discovered in a cave called Gua Lawa near Sampung, and subsequently a number of other sites in caves were found. Artifacts include tools of bone and antler, shells and mammalian teeth pierced as ornaments, and stone flakes and blades. Human remains have been found and appear to be of Melanesian or Australian type. Small implements of obsidian, some so small as to be classed as microliths, have been found in quantity on the surface of the ground round the site of a dried-up lake near Bandung. This may be a local development of the Sampung flake and blade industry.

The Neolithic is represented by the widely distributed Quadrangular Adze culture, whose characteristic artifact is a well-finished polished stone adze with quadrangular cross section. Several localities have been found where stone implements of this kind were manufactured in quantity. These are situated in regions where suitable stone, usually a sort of flint resulting from the silicification of limestones, is available. There thousands of so-called "Neolithic blanks," implements roughly blocked out by flaking, can be found lying on the surface of the ground. Occasional specimens occur partly or entirely finished by grinding and polishing, and it would appear that these sites are the factories or workshops which supplied the material for an extensive trade in stone tools. Well-finished triangular stone arrowheads are also a feature of the Neolithic in Java. Some unornamented Neolithic pottery was found at a site in east Java by H. R. van Heekeren.

The Quadrangular Adze culture appears to have originated in southern China and to have spread to the south and into the Indonesian archipelago via Indochina and the Malay peninsula. In its later stages it probably evolved into the so-called Megalithic culture, characterized by stone dolmens.

The Early Metal age is represented by a southward extension of the Dongson culture, named after a site in north Annam. Its chief characteristic is the use of metal (bronze and, in its later stages, iron) by craftsmen skilled in the art of casting. Like the Quadrangular Adze culture it developed on the Asian mainland and diffused southward; it appears to have reached the Indonesian archipelago about 300 B.C. The most elaborate objects produced by the Dongson craftsmen were large bronze drums richly decorated with designs of human figures, flying birds and geometrical patterns. Another characteristic artifact is the socketed bronze axhead or celt. Specimens of both these types of artifact have been found in Java. (M. W. F. T.)

Indo-Javanese Period.—Indo-Javanese history is usually divided into three periods corresponding to the geographical focuses of the main political power: the Western, the Central and the Eastern Javanese. Of the Western Javanese period (3rd–6th century A.D.) there are few archaeological remains in contrast to the Central Javanese period (7th–early 10th century) of which there are many sculptural and architectural survivals.

The most important Central Javanese monuments were built during or just after the reign of the Buddhist dynasty of the Shailendras (Sailendras; Cailendras) in the 8th and 9th centuries. One of their finest architectural achievements is the gigantic stupa of Borobudur, dating from the early 9th century. It is outstanding in southeast Asia, both because of its deeply symbolic conception and because of the large number of high-quality reliefs illustrating various Buddhist texts.

Borobudur was probably linked by a processional route with the temple of Mendut in which three large stone images—Buddha between Vajrapani and Avalokiteshvara—have been preserved. Although Mendut with its almost square ground plan is architecturally rather simple, its images are among the finest Central Javanese sculptures.

In contrast to Mendut, Candi Sari is rectangular, and instead of one cella it has three interconnected rooms. Entrance to these three halls is gained by a porch leading to the middle cella. The importance of this shrine lies in its sculptural decoration, especially the relief panels on the outer walls depicting various classes of heavenly beings in graceful attitudes. The date of Candi Sari is uncertain, but it is probably early 9th century.

An important monument is the Buddhist temple Candi Sewu, which dates from the first half of the 9th century. It is an enormous complex consisting of a central shrine in the form of a Greek cross surrounded by numerous chapels arranged in four concentric squares round the main temple. This central shrine has large chapels on all four sides, one serving as the entrance. In the past the many niches in these chapels must have contained images representing a complete Buddhist pantheon, probably executed in bronze as not a single piece has survived.

The last female scion of the Shailendra dynasty married the Shaiva king of Mataram, and this royal couple founded several important religious centres, such as the Buddhist complex of Candi Plaosan (mid-9th century). Another Buddhist shrine of about the same age is Candi Kalasan. An inscription recording the foundation of this temple in 778 was discovered nearby, but as older constructions have been found in the core of the building, the inscription probably refers to the first temple on the site.

The magnificent group of Lara Jonggrang—sometimes called Candi Prambanan—is the finest Shaiva temple in the whole of Java. The monument, the date of which is somewhat uncertain, is another architectural complex, this time with six temples in the inner courtyard and four rows of chapels (224 in all) surrounding the central group. The main shrine, containing a beautifully restored Shiva image of stone, was reconstructed during 1918–53 and now once more demonstrates the great skill of the Central Javanese architects. The sculptors of this period achieved a remarkably high degree of artistic and technical perfection; the hallmark of their work in both stone and metal is graceful harmony combined with elegance and charm.

During the Eastern Javanese period (early 10th–early 16th century) the artistic influence of India, so obvious during the preceding period, diminished, and local Javanese elements became increasingly more important. Of the early Eastern Javanese period only a few buildings have survived. The most important are the holy bathing places of Jalatunda (late 10th century) and Belahan (mid-11th century) which served as funeral monuments of Prince Udayana and his son King Erlangga, respectively. Formerly a large image of the latter represented as Vishnu on Garuda dominated the construction at Belahan.

The later Eastern Javanese period has produced far more monuments. Candi Kidal, a square building on a square terrace, illustrates the gradual development of the temple roof into a spire. Both Kidal and Candi Jago are royal funeral monuments dating from about the mid-13th century, but judging from its decoration the latter's present form is probably much later. An important architectural change in the ground plan of Jago is that the square temple is now placed on a number of rectangular bases which recede toward the back, thus giving the whole monument the impression of a terraced mountain shrine. These sacred terraces, which can be found on the slopes of many Javanese mountains, probably contain an autochthonic element of mountain worship which was fitted into the Hindu worship of Shiva Girisha, Lord of the World Mountain. The images that once stood in the cella of Candi Jago represent the Bodhisattva Amoghapasha and his divine retinue. Another important group of sculptures are the Shaiva images found in the so-called Tower temple at Singosari, the capital between 1222 and 1292. In this shrine the ashes of the famous king Kertanagara were buried. The images of Jago and Singosari are among the finest surviving Eastern Javanese sculptures. They possess a serenity which is quite breath-taking.

The religious centre of Palah, now called Candi Panataran, seems

to have been something like a state temple. Its various buildings date from many centuries, though the greater part belongs to the 14th. The main shrine is a terraced temple but the additional buildings in the various courtyards, which are not laid out concentrically, do not seem to have been planned in any architectural relationship to the main shrine. The fixed concentric ground plan of the Central Javanese monuments has been given up completely and the group is rather similar to the modern Balinese temples. An exceptional building dating from about 1350 is the round Candi Jabung, a royal funeral monument.

During the Majapahit period (1292–1526), to which most of the Eastern Javanese temples belong, decoration in terra cotta became quite popular and many terra-cotta sculptures have survived, often molded as freestanding images.

Toward the end of the Indo-Javanese period the sculptural style became more and more rigid. In addition, there exists an obvious *horror vacui* and an exaggerated love for detail which finally choked all artistic feeling. This development accompanied the gradual decline of Indo-Javanese art and the end came with the introduction of Islam which prohibited every iconographic form of sculpture. The first phase of Javanese Muslim architecture, however, is a continuation of the style of building current during the 15th century and so in this branch of art there is no artistic break at the end of the Indo-Javanese period. *See* also INDONESIAN ARCHAEOLOGY AND ART. (J. E. v. L.)

HISTORY

Trade between India and China, which began about 2,000 years ago, must have brought both countries some knowledge of Java. The Indian epic *Ramayana* mentions "Yavadvipa" as an island where gold and silver are found. Ptolemy, in the 2nd century A.D., calls it "Iabadiu," and about the same time it appears as "Yetiao" in a Chinese report. While relations with China remained largely commercial, those with India had a strong cultural influence. Although Indian traders led the way, groups of colonists, particularly Brahmans, followed, probably at the invitation of local rulers, and in the course of centuries set the stamp of Indian culture on Java, although initially only on the court aristocracy. The mass of the people continued their indigenous way of life in communal villages under a matriarchal family system, worshiping the souls of their ancestors, pacifying evil spirits and erecting simple stone monuments for their rites. This native heritage gradually blended with the imported Indian forms into a new Javanese culture. The sources of information for early Javanese history are mainly inscriptions on stone and metal tablets, found on the island, and reports in Chinese chronicles. The outlines are clear but many details remain unknown.

Indo-Javanese Period.—The early history of Java is obscure. The first certain information concerns the Indo-Javanese kingdom of Mataram, in the 8th century A.D. This was in Kedu, south central Java, and was ruled by the Shailendra dynasty, who were related to the Fu-nan rulers of southern Indochina. Although originally followers of the Shivaistic rites of Brahmanism, later kings accepted Mahayana Buddhism, and one of them married the heiress of the mighty Sri Vijaya empire of south Sumatra (Palembang). From this era, in the late 9th and early 10th centuries, date the impressive religious monuments of Borobudur, Mendut and many others.

As the power of Mataram declined, a state in east Java, once a vassal of Mataram, took the limelight. The rulers of this kingdom had their residence in the lower Brantas plain, south of present Surabaja. They seem to have promoted commerce with the Moluccas as well as Sumatra. In the ensuing conflict with the Sri Vijaya empire over control of the sea straits, the Sumatrans invaded east Java, killing the royal family and destroying its capital (1006). The kingdom then disintegrated into many small principalities, but Erlangga, son-in-law of the last ruler, who had escaped the onslaught, reunited and strengthened the state during his reign (1019–49). He, as well as Dharmavanca, his predecessor, built Shiva-Brahmanic temples, encouraged art and literature and promoted social order. In their reigns a law code appeared in Javanese as did Javanese versions of Hindu epics, available till then only in Sanskrit, thus opening the way for the diffusion of Hindu thought among the common people. Erlangga divided his kingdom between his two sons, of whom the ruler of Kediri (on the middle Brantas river) became the more powerful. This area was the centre of Javanese culture until early in the 13th century. It was the age of chivalry, according to Javanese legends, and of flourishing arts. The kingdom became an entrepôt for the spice trade, and Muslim traders from India as well as Chinese merchants visited its ports.

The political centre of Java then moved to Singosari (Singhasari) in the Malang highlands. The great king of this dynasty was Kertanagara (1268–92). He expanded his power beyond Java, receiving tribute from south Borneo, Bali and other eastern islands, and created a vassal state in Malayu (Jambi or Djambi, Sumatra), to put pressure on his Sri Vijaya rivals. He dared to insult Kublai Khan, the emperor of China, who thereupon sent a great fleet to Java to punish the king. The leader of the Chinese invasion (1293), unaware of the death of Kertanagara, thought his mission accomplished when he defeated one of the contenders to the throne, but he was in turn put to flight by the other candidate, Wijaya, who became the founder of the Majapahit dynasty, which ruled until early in the 16th century. These kings had their residence (*kraton*) near Modjokerto in the Brantas plain. They gained hegemony over the greater part of the archipelago, even including Sri Vijaya territories in Sumatra. The architect of this mighty empire was the prime minister Gajah Mada (1331–64), rather than the queen and her son Hayam Wuruk, whom he served. The great poem *Nagarakertagama*, completed in 1365, is a panegyric, but it contains much valuable information on the period. Many temples were built at this time but, since they were of brick, most have disappeared. Internal strife followed Hayam Wuruk's death (1389), and Java's power gradually declined. Javanese tradition names 1478 as the year of the fall of the Majapahit dynasty, but it is more likely that it fell early in the 16th century, when the last vestige of Indo-Javanese rule was destroyed by the followers of Islam.

West Java, the land of the Sundanese, was also influenced by Hindu colonization, but far less so than central and east Java. Sanskrit inscriptions there date back to the 5th century, indicating a Shivaistic kingdom in the Tjitarum area. In later centuries west Java was either under the influence of the Sri Vijaya empire or of east Java. No significant monuments of the Indo-Javanese period have been found. The common people never became hinduized, which may explain why Islam made quicker progress and found more solid acceptance among the Sundanese than in eastern Java.

The Islamic Period.—Muslim traders had visited the archipelago for centuries, but it was in the 15th century that the Majapahit kingdom began to feel the competition of Malacca, the new Muslim emporium on the straits. There, as well as in the towns of Java's north coast, were many merchants from Gujarat, the powerful Islamic state in western India. As the Muslim international network of trade grew, the coastal Indo-Javanese administrators and merchants faced the choice between fighting or joining the Muslims, and many eventually did the latter. The Portuguese conquest of Malacca (1511) stimulated the efforts of other Muslim communities to take its place, and a number of Javanese ports broke away completely from the Majapahit kingdom to join the race, among them Ngampel (Surabaja), Grissee, Djapara and Demak, all in east Java. In west Java Bantam became an independent Muslim city-state. The Majapahit kingdom, deprived of its sea-borne commerce, broke up into warring elements. At first the sultan of Demak rose to power, but Javanese sea commerce suffered from the Portuguese and soon Padjang, a Muslim state in the interior, became the political centre and took on the old name of Mataram, with Kotagede (near present Jogjakarta) as its capital. Sutawijaya, better known as Senapati, founded a dynasty there. Under his rule (1575–1601) Mataram gained suzerainty over central and east Java, with the exception of the far eastern corner (Blambangan) where Shivaistic rulers held out till the end of the 17th century. In west Java, Bantam became an important Muslim state, prospering as an international entrepôt, close to the

straits of Malacca and Sunda. When the Dutch arrived at the end of the 16th century the centre of commerce was in the western part of the island. The east and central sections had lapsed into a largely agrarian economy.

Although much of the Indo-Javanese culture pattern persists, Islam brought many changes. The temple festivals and ceremonies, the authority of the priests, the cult of the god-king and the caste system disappeared or survived only in attenuated and altered forms. Temple architecture came to an abrupt end and the lively reliefs and other artistic representations of human life were frowned upon. To obtain an impression of what pre-Islamic Java must have been like, it is necessary to go to neighbouring Bali, where the Indo-Javanese way of life found refuge after the fall of the Majapahit kingdom.

The European Era.—Portuguese traders visited Java's ports, but established no settlements there. The first Dutch ships, under Cornelis de Houtman, arrived at Bantam in 1596. In 1602 the Dutch East India company (*q.v.*) was formed and in the following years some trading posts were established on Java's coast, the most important being the one at Bantam. In 1619, after several disputes with the ruler of that country, the governor general Jan Pieterszoon Coen took the town of Jacatra and there founded Batavia, the present Jakarta. For 50 years the company kept aloof from internal Javanese affairs. Then a revolt in Mataram and an appeal for aid by the ruler opened the way for Dutch control, and much the same pattern was repeated in Bantam. The states of west Java (Bantam, Preanger and Cheribon) recognized the sovereignty of the East India company in the last quarter of the 17th century; the northern districts of central and east Java followed in 1743. What remained of Mataram was divided in 1755 between two contenders to the throne. One became the Susuhunan of Surakarta, the other the sultan of Jogjakarta, both recognizing Dutch overlordship. The company exercised its control through residents at the courts of the local princes. The Javanese peasant was hard pressed by the native aristocracy and by Dutch commercial agents for the delivery of rice for the towns, and of indigo, sugar, pepper and coffee (the latter introduced by the Dutch about 1700) for export.

The East India company ceased to exist in 1799 and the Dutch government took over the bankrupt enterprise. Herman W. Daendels, governor general from 1808 to 1811, initiated a more efficient administration in Java and reorganized the judiciary, but in other respects his rule was far from progressive. The British interregnum (1811–16) brought Sir Thomas Stamford Raffles to Java as lieutenant governor for the British East India company. He built partly on the positive measures of his predecessor but, what was more important, he sought to substitute free enterprise for the traditional system of forced deliveries. The Dutch government on its return initially followed the same policy, but when the expected increase in production for export did not materialize, doubt arose as to whether the system could be made to work in Javanese feudal society. At this time a serious revolt (1825–30) in central Java led by Dipa Negara was put down at great expense. The governor general (later minister of colonies), Johannes van den Bosch, then resumed the policy of forced deliveries as a form of taxation, applying it mainly to Java. This so-called "culture system" remained in effect from 1830 until about 1860, and brought great profits to the Dutch treasury. The steady increase of imports into Java in this period suggests that the local economy expanded in spite of the heavy burdens imposed on the peasants. The liberal policy of the later part of the 19th century, coupled with efficient administration and welfare measures and large-scale investment of Dutch capital, led to great economic development of the island. At the same time, the population increased rapidly and there was little improvement in the living standards of the people.

(J. O. M. B.)

From this period, the history of Java is largely that of the Netherlands Indies and the Republic of Indonesia (*see* MALAY ARCHIPELAGO; INDONESIA, REPUBLIC OF). Beginning in 1903 the Javanese were admitted to a steadily increasing part in local affairs and in 1925 Indonesians were given a majority in the *volksraad* or people's council. Java, the political centre of the Indonesian islands, played a prominent part in the nationalist movement.

During World War II the Dutch administration, assisted by the United States, attempted to strengthen Java's defenses, but the fall of Singapore and its adjacent islands, coupled with the disastrous Allied naval defeat in the battle of the Java sea (Feb. 27–28, 1942), left the island open to attack. Japanese troops made their initial landings on the night of Feb. 28, and within a short time the island was entirely occupied (*see* WORLD WAR II: *The War in the Pacific*). A Japanese-sponsored nationalist movement was active during the occupation and a republic of Indonesia was proclaimed two days after the fall of Japan. When the British arrived on Sept. 29, 1945, to accept the surrender of the Japanese forces there, they found a republican government actively functioning.

East and West Java were autonomous states under the federated United States of Indonesia set up in 1949, with only central Java directly under the republic. However, they were quickly absorbed when the federation was transformed into the unitary Republic of Indonesia in 1950. Inauguration of the new state was followed by some disturbances, especially in West Java. (X.)

POPULATION

The inhabitants of Java belong to the oceanic or southern branch of the Mongoloid race. They have light golden-brown skin, straight black hair, generally a broad skull and are of small, slender stature; not infrequently they have the typical Mongoloid eyefold. All speak Malay languages (*q.v.*), but there are considerable differences between Sundanese, spoken in the western uplands, Madurese, on Madura and adjacent coastal regions of East Java, and Javanese, the language of the remainder of the island. The standard language (Bahasa Indonesia), taught in the schools, is based on the Malay speech of the east coast of Sumatra. All these people are Muslims, but the Sundanese are much more strict in the faith. The highlands are the stronghold of the Darul Islam rebels; many others more peacefully support the Muslim political parties who desire an Indonesian state guided by the tenets of Islam. However, everywhere on Java there are many folk ways and superstitions rooted in the past when animism and magic were accepted forms of religious activity. Also, there are many remains of Hindu influence (see *History*, above) in shadow plays and court dances based on Indian epics and legends and accompanied by the Javanese orchestra or *gamelan*. The old handicrafts show a high degree of artistry and skill, seen in batik textiles and in silver-, brass- and ironwork, but they are suffering from the competition of cheaper machine-made products. Most women have retained the traditional dress of sarong and kabaya (blouse), but the men, especially in urban communities, tend to the western type of clothes instead of the jacket and sarong. The main food is rice, eaten with spices, vegetables, fish, eggs or a little meat, but the poor people often have maize, yams, sweet potatoes and tapioca (cassava). The typical Javanese house is rectangular and stands on the ground, in contrast to dwellings elsewhere in the archipelago, which are on stilts. The rural population lives in small, sprawling villages in the highlands and large, compact villages in the plains, where they stand out as wooded islands amid the cultivated fields. The traditional Javanese town has a plan derived from the royal capitals, with a grid pattern oriented on the cardinal points of the compass. The mosque, public buildings and homes of the administrators and magistrates surround the central grassy square (alun-alun) with its banyan trees. Some distance from the centre is the market place (*pasar*), and frequently the Chinese quarter.

Java is one of the world's most densely populated areas. It has a population of more than 63,000,000, or two-thirds of the entire Indonesian population, on 7% of the total land area of the republic. The average density is 1,235 persons per square mile. Fertile soils and a favourable climate were the necessary prerequisites, but native agricultural skills, the early impact of Hindu civilization and the intensification of production under Dutch rule must account for the exceptional density. In 1815 the population of Java was estimated at 5,000,000, in 1880 at 20,000,000 and at the census of 1930 it was 41,719,000, comprising 40,891,000 Javanese, 193,000 Europeans (mostly Dutch), 582,000 Chinese, 42,000 Arabs

and 11,000 other Asians. In the first third of the 20th century the average annual rate of growth was 1.7% to 2%, the result of a decreasing death rate combined with a high birth rate. Deprivations during World War II and subsequent disturbances slowed down the growth.

Before the war there were about 200,000 Dutch citizens in Java, over half of mixed Dutch-Indonesian parentage. Starvation in Japanese concentration camps and returns to the Netherlands after Indonesian independence reduced their number considerably. In 1957 the Indonesian government expelled all Dutch citizens as a retaliation for Dutch unwillingness to hand over West New Guinea to the Republic of Indonesia. The number of Chinese on Java was then estimated at about 1,000,000. They too have felt the pressure of Indonesian nationalism by various forms of discrimination. In 1959 the government banned all alien retail traders (virtually all of them Chinese) from rural areas. Before the war the Dutch administration promoted Javanese resettlement in the Lampongs district of south Sumatra and the Indonesian government continued this policy, but the number of emigrants (60,000) is too small to afford relief for Java's population pressure.

The rural density is highest (1,500 to 2,200 per square mile) in the south central plains of Banjumas, Kedu and Jogjakarta, connecting via the Magelenga plateau with the almost equally crowded northern plain between Semarang and Cheribon. Other areas of high density (1,000–1,500) are around Jakarta, the Brantas river valley southwest of Surabaja and the coastal plains north and south of that city. High rural density shows a close correlation with soils derived from neutral or basic volcanic materials. On the other hand the more acid soils of western Java have the lowest density (250 per square mile). The rough mountain country of the southwestern coast and the limestone ridges of the east are also relatively sparsely populated.

Nine-tenths of Java's population is rural, but the cities have grown at a rapid rate since 1939. Jakarta in 1961 had a population of 2,973,052. Bandung (*q.v.*) in the Preanger highlands, capital of West Java province and favoured by a cool climate, had 972,566. Semarang (*q.v.*), capital of Central Java and main port of that province, was 503,153, while Surabaja (*q.v.*), capital of East Java and second ranking port of the island, was 1,007,945. Large cities in the interior are the old cultural centres of Jogjakarta and Surakarta (*qq.v.*).

ADMINISTRATION AND ECONOMY

Administration.—Under the Dutch regime Java was divided into three provinces. Each province comprised a number of residencies which in turn were divided into regencies, further subdivided into districts. Reorganization after independence has done away with the residencies and the districts. There are, in the main, three levels of local government: province (*propinsi*), regency (*kabupaten*) and small town or village (*desa*). Special areas have been equalized with one or another level. Java consists of the provinces of West, Central and East Java (similar to those of the Dutch rule), plus Greater Jakarta and Jogjakarta, the latter two being considered separate provinces. The former principality of Surakarta was eliminated and its territory added to Central Java. The three provinces are well matched in size, each having about 18,000,000 people. The provinces and Jogjakarta together comprise 92 *kabupatens,* including 12 urban municipalities with the rank of *kabupaten.* Each province has autonomy in internal affairs. Its governor was, until 1957, a functionary appointed by the central government, but subsequently provision was made for his election. He is president of the elected provincial legislature and chairman of the executive board, chosen from the provincial legislature which carries out the daily government of the province. (*See* also INDONESIA, REPUBLIC OF: *Administration and Social Conditions.*)

Agriculture.—The agricultural pattern developed in Java under the Netherlands did not change basically after Indonesia became independent. The following characteristics distinguish Indonesian smallholder from European estate agriculture in Java: (1) smallholder agriculture is directed primarily to the production of food crops for domestic consumption while estate agriculture produces for export; (2) smallholders' plots average 2–7 ac., while the western entrepreneur holds, on long-term lease, areas averaging 1,500 ac.; (3) western enterprises represent large capital investments contrasted with a small investment of the Indonesian smallholder; and (4) estate agriculture engages in the final processing of the product—sugar, tea, quinine, etc.—while the Indonesian smallholder usually sells the grown product immediately, leaving the final processing to others.

Before World War II estates used 9% of the cultivated land, but this declined to about 6% after independence. Most estates were Dutch-owned. These were seized by the Indonesian government in late 1957 and placed under government management. Estate production dropped sharply compared with prewar years. Food production rose but not enough to meet the needs of the steadily increasing population.

Smallholder Agriculture.—Java's primary crop is rice, the average yield of which (8.2 cwt. per acre) is second within Southeast Asia to that of Malaya. In 1950, 47% of the area devoted to smallholder agriculture produced rice. Although irrigated rice is grown throughout the island, the greatest production is in West Java. For centuries the Javanese people have irrigated their fields. Before the Japanese invasion of 1942 the construction of an elaborate system of canals, dams, aqueducts, siphons and reservoirs at a cost of 200,000,000 guldens improved more than 3,000,000 ac. of sawahs. As a result of improved irrigation and the constant care of the agricultural service, rice imports decreased from 13,000 tons in 1930 until Java became a rice-exporting area in 1939, the exports being sent primarily to other islands of the archipelago. In the 1950s production increased, but imports were necessary. Food crops other than rice, including maize, cassava, peanuts, soybeans and sweet potatoes, are increasingly important, because they can be grown on dry fields, either on sawahs in rotation with rice, or on lands where irrigation is not available. In East Java, where the climate is relatively dry, more land was devoted to these dry land crops than to rice. Cassava grows even on poor soils. Formerly Java supplied a large part of the world's supply of cassava flour (tapioca) for industrial starch, gums and sizes, but more and more is locally used for food, although its nutritive value is low.

The Indonesian smallholder also produces practically the entire output for the island of kapok, peanuts, sesame, potatoes, vegetables, bananas, mangoes, durian and other citrus fruits and a large proportion of essential oils. Tea is also cultivated by the farmers in the neighbourhood of the large tea estates in West Java; coffee is grown in Malang and Besuki and tobacco in Bodjonegoro, Kediri, Besuki and Banjumas. Coconut is grown intensively in Bantam.

Estates.—Production on the estates declined under the adverse conditions of World War II and the years following. Sugar, once a major export, was severely hit by the economic depression of the

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SHADE TREES PLANTED TO PROTECT YOUNG TEA SHRUBS IN THE JAVANESE HIGH-COUNTRY PLANTATIONS

1930s, causing Java's share of the world market to drop from 11% in 1929 to 6% (1,576,159 tons) in 1939. In the mid-1950s annual exports were about 170,000 tons; in 1958, after seizure of the Dutch estates, output fell to 87,167 tons. Sugar cane is produced in the plains of Central and East Java, on irrigated land in rotation with rice. While sugar cane does best where little rain falls in the ripening period, rubber grows most successfully under uniformly wet conditions; *e.g.*, in West Java and the rain-exposed southern slopes in the east. Since no land was available in Java's crowded plains when rubber plantations started (about 1908), estates are generally located between 300 and 1,500 ft. above sea level. Output of estates was declining in the 1960s. The most favourable altitude for tea cultivation is from 2,000 to 6,000 ft. above sea level, where rainfall is plentiful and falls uniformly through the year. Since 1829 the centre of tea cultivation has been on the volcanic slopes of the Preanger, but there are also estates in the moister parts of Central and East Java. Tobacco is grown round Jogjakarta and Surakarta where excellent leaf tobacco for cigar filler is produced, mostly on estates. Besuki, in East Java, yields the same type of tobacco, but there the growing is carried out by smallholders, estates supplying the seedlings and doing the curing and processing. The third area is Bodjonegoro, where Virginia tobacco for cigarettes is grown. Coffee declined after the 19th century as a result of serious leaf diseases. Its cultivation on estates is centred in eastern Java and in the mountains south of Semarang, but smallholders produce a little in other regions. Cinchona was introduced from South America in 1854 and planting was at first confined to a government estate. In 1872 private enterprise began production from a new variety, *Cinchona ledgeriana*, with great success, giving Java almost a monopoly (91%) on world production. In the 20th century synthetics reduced the importance of natural quinine and production declined sharply. The chief centre of cinchona plantations is in the Preanger highlands.

Livestock.—The concentration on crops leaves little room for livestock, except as draft animals, mainly cattle and water buffalo. However, the island of Madura produces cattle for slaughter, with Java its main market. Because of religious restrictions pigs are virtually absent.

Fisheries.—A large part of the animal protein in the Javanese diet is provided by fish, either reared in ponds or caught in coastal waters and rivers. Along the marshy north coast are tidal ponds, in which spawn and young fish, gathered from the sea, are raised, mainly the *bandeng* or *benteng* (*Chanos chanos*). Inland freshwater ponds and flooded rice fields also produce fish, chiefly of the carp type. Large amounts of salted and dried fish are imported.

Mining.—The mining industry is of relatively small importance in Java. Only petroleum extraction has been developed on a large scale. The most important centre is Tjepu, on the border of East and Central Java; oil is also drilled near Surabaja at Wonokromo. Manganese ore is found and exploited near Jogjakarta. Sulfur is obtained from the Putih crater near Bandung and from Mt. Welirang near Malang. Gold and silver are found in Bantam. Iodine springs occur south of Surabaja. Salt is produced, as a government monopoly, on the island of Madura.

Industries.—Although some native handicrafts have always existed on Java, and processing plants were a part of the estate agriculture, it was during and after World War I that modern development started. The economic depression of the 1930s brought home the need for diversification; moreover, the expanding population had to find new opportunities for employment. The Dutch administration encouraged small-scale manufacture of consumer goods on the indigenous level by *centrales*, a kind of cooperative which established factories for final processing. The Indonesian government continued and intensified this endeavour. In this sphere are such industries as weaving, iron founding, agricultural-tool making, tanning, tile and ceramics production. Large- and medium-sized industries also greatly increased. From 1935 to 1942 about 500 of these plants were established, including textile mills, rubber manufacturing (Bogor), an auto assembly plant (Tandjungpriok, the port of Jakarta), breweries, shoe factories (Jakarta and Surabaja), paper and soap factories. After 1950 a number of new factories were added, such as a cement plant at Grissee (near Surabaja) and cigarette factories at Malang. Lack of skilled administrators and technicians and shortages in raw materials and power have deterred growth. A substantial increase in energy production was expected from the Djatiluhur project on the Tjitarum in the Preanger highlands. The projected capacity of its power plant was 150,000 kw., with an annual output of 700,000,000 kw.hr., doubling Java's power supply. (J. O. M. B.)

AVA HAMILTON

MAKING BATIK CLOTH, JOGJAKARTA

Transport and Communications.—Java has by far the most highly developed internal transportation and communications system in Indonesia. In the early 1960s it was estimated that about 75% of the railway track in the republic was on Java, and it was the only one of the islands with a well-developed rail network. As in the rest of the republic, however, much of the trackage and rolling stock was old and in poor condition. Approximately 40% of the highways in Indonesia were on Java and almost three-quarters of the registered motor vehicles were on Java and Madura. The government-owned radio network has its headquarters in Jakarta, which also has an international airport. *See* also references under "Java" in the Index.

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JAVANESE LANGUAGE is spoken as a native language by more people (over 40,000,000) than any other Malayo-Polynesian language. The vast majority of its speakers are on Java, occupying all except the western third and a section of the northern coast opposite Madura. Others are in the large cities of western Indonesia and the plantations and oil fields of Sumatra.

Central Javanese, the dialect of Surakarta (Solo) and Jogjakarta (Djokjakarta), has the highest prestige. Other dialects are Western Javanese, with its centre in Tegal, and Eastern Javanese, with its centre in Surabaja. Javanese has a number of well-defined status styles. Most elaborate is the difference between the ngoko (informal) and the krama (deferential) styles. When neither of these is suitable, the *madya* ("middle") style is used. Other styles are the *krama inggil* (highly deferential) and the *basa kedaton* ("palace language"). The Javanese alphabet is a modification of a Pallava (south Indian) alphabet.

Javanese literature is extensive and varied. In the Old Javanese period (*c.* 750 to *c.* 1400) Indic influence was paramount; the oldest inscriptions, the translations of the Mahabharata and Ramayana, and other poetry and prose date from this time. The coming of Islam in the Middle Javanese period (1400–1550) introduced changes of content rather than of form. In the New Javanese period (1550 to present) there has been a slow transition toward

modern western literature. Javanese literature has strongly influenced the Balinese, Sundanese, Madurese and Malay literatures. The amount of publication in Javanese is small because of the concentration on developing an Indonesian literature. *See* also MALAYO-POLYNESIAN LANGUAGES. (I. DN.)

JAVARÍ (Spanish YAVARÍ), a river which rises about 7° S. on the border between Brazil and Peru and flows northeast for about 656 mi. to join the Amazon (*q.v.*) near the Brazilian outpost of Benjamin Constant. It separates the Loreto department in Peru from the state of Amazonas in Brazil.

The river flows through unbroken tropical rain forest in which there are only a few very small riverbank clearings and is navigable for launches almost to its source. The old Brazilian spelling was Javary. (P. E. J.)

JAVELIN THROWING, the art of throwing a spear as a sport, was first introduced in the ancient Olympic games competitions as one of the events of the pentathlon in 708 B.C. (For the use of the javelin in war *see* WEAPONS, PRIMITIVE.)

The modern javelin used in Olympic and national competitions throughout the world is a spear of wood or metal with a sharp metal point. It must be constructed in such a way that the space between the foremost point and the centre of gravity is not longer than 3 ft. 7½ in. (110 cm.) or shorter than 2 ft. 11⅝ in. (90 cm.). It must have about the centre of gravity a grip formed by a binding 6.3 in. (16 cm.) broad, of whipcord, without thongs or notches in the shaft, and must have no other holding than the above-mentioned binding, the circumference at either edge not exceeding the circumference of the shaft by more than .984 in. (25 mm.). The length must not be less than 8 ft. 6⅜ in. (260 cm.) complete as thrown. The weight must not be less than 1.76 lb. (800 g.) complete as thrown.

Until the second half of the 20th century javelins from Finland and Sweden were used almost exclusively in international competition. But radical developments were made by a California manufacturer, Richard Held, and at the 1956 Olympics almost all the competitors used spears based on the new principles, chief of which is a larger surface area producing gliderlike qualities.

In the first half of the 20th century Scandinavian athletes dominated the event. Sweden was the first nation to hold a championship in 1896, and at the initial international competition at the unofficial 1906 Olympics in Athens, Greece, Eric Lemming of Sweden won with a throw of 175 ft. 6 in. Lemming went on to win official Olympic crowns in 1908 and 1912 and he was followed by Jonni Myrrä of Finland in 1920 and 1924. (For Olympic records of the event *see* OLYMPIC GAMES.)

Until the 1950s two Finnish stars, Matti Jarvinen and Yrjo Nikkanen, dwarfed all other throwers; Nikkanen in 1938 set a record of 258 ft. 2⅜ in., which was broken in 1953 by Richard Held's brother Franklin (Bud) Held, who did 263 ft. 10 in. Other modern stars have been Cy Young (1952 Olympic champion) and William Miller of the United States, Janusz Sidlo of Poland and Egil Danielsen of Norway, who set a world's record at the 1956 Olympics. Just before those games Danielsen did 304 ft. 1½ in. using an illegal, discuslike spin. In 1964 Terje Pedersen of Norway exceeded the 300-ft. mark with 300 ft. 11½ in.

Method of Throwing.—The javelin is held overhead with the front tip down at an angle of 45° from the horizontal, the fingers grasping the javelin loosely but firmly. For most throwers, a run of 60 to 70 ft. to the final check mark (which lies about 30 ft. from the throwing line) is sufficient. The run must be very relaxed; there must be perfect co-ordination between the rhythm of the legs and the back-and-forth motion of the javelin. The body should lean very slightly forward during the run, primarily from the hips. As the final check mark is reached, the thrower should begin to straighten up preparatory to releasing the javelin with an explosive effort, the result of which will be determined by whether the preliminary phases were smoothly balanced and whether the javelin was moving forward at the instant the main explosive force was applied. The final delivery of the javelin is made with a snap of the wrist at an angle ranging from 45° to 50°.

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JAW, in anatomy, the term for the upper maxillary bone and the mandible or lower maxillary bone of the skull; it is sometimes loosely applied to all the lower front parts of the skull. The upper maxillary bone holds the upper teeth and contains the large maxillary sinus. The lower teeth are attached to the mandible, which moves on the skull, articulating with it in the fossae of the temporal bones.

See SKULL. (F. L. A.)

JAWF, AL (JAUF), a region of Yemen lying to its north and northeast. It is watered by the Wadi Kharid, said to be perennial in parts. The region consists of upper, middle and lower Jawf. The people of upper Jawf are of the Dhu Husain tribe of Sharifial descent. They are great fighters who played an important part in the history of Yemen; their connections extend into the Protectorate of South Arabia. They are intimate with the Hashid and Baqil tribes but have not always supported the imams. They are better educated than most south Arabian tribes, and their capital, Mat'an, is a well-known centre of learning. Zahir has an important fair. The Dhu Husain breed the best horses in southwest Arabia and have minor industries. Middle and lower Jawf, with their respective capitals Al Hazm and Al Ghayl, are occupied by the Beled Hamdan tribes. The once numerous Jews in the region have mostly migrated to Israel. Al Jawf was the centre of the Minaeans. In 1870 the explorer Joseph Halévy discovered the ruins of Ma'in and brought back numerous inscriptions. *See* ARABIA: *History.* (W. H. Is.)

JAY, JOHN (1745–1829), U.S. statesman, diplomat and jurist, an active participant in the formation of the United States and first chief justice of the United States, was born in New York city on Dec. 12, 1745, the sixth son of Peter and Mary Van Cortlandt Jay. His father, a prosperous and prominent merchant of French Protestant descent, reared him in the rigorous doctrines of his Calvinist faith and sent him to King's college (now Columbia university). John graduated in May 1764 and three years later, after studying and working as a clerk in a law office, obtained the degree of master of arts. In Oct. 1768 he received his licence to practise law in the province of New York and in the next six years built a lucrative practice. Through his marriage to Sarah Van Brugh Livingston in April 1774 he joined another of New York's first families.

An opponent of radicalism, Jay deplored the violence in the quarrel between Great Britain and its American colonies, hoping, until the eve of independence, for a reconciliation with the mother country. Nonetheless, he supported the colonial cause. As a member of the first continental congress of 1774 he drafted *The Address to the People of Great Britain,* stating the rights of the colonists. That document gained him a wide reputation. At the second congress of 1775 he wrote a letter to the "Oppressed Inhabitants of Canada" and was probably the author of addresses to the peoples of Jamaica and Ireland.

While still a delegate to the continental congress Jay was elected to the New York provincial congress and in May 1776 attended its meetings. Thus he did not sign the Declaration of Independence in Philadelphia. But he drafted the resolutions by which New York, in July 1776, approved it. In March of the following year he also drafted New York's first state constitution, and in May was elected the state's first chief justice. He returned to the continental congress on Dec. 7, 1778, and three days later won election as its president.

After Spain entered the War of the American Revolution as France's ally, in June 1779, congress sought to persuade it to join the Franco-American alliance of 1778, advance a loan of $5,000,000 and allow Americans free navigation of the Mississippi river. In exchange the United States offered to guarantee the Floridas to Spain. To gain those objectives congress appointed Jay minister plenipotentiary to Spain in Sept. 1779. There he met with frustration and evasion; Spain, fearing that open aid to the American rebels would set a dangerous precedent for the dissatisfied in its own colonies, refused to receive him officially and thus recognize

American independence. Desperately eager for the Spanish treaty, congress in Feb. 1781 ordered Jay to give up U.S. claims to navigation of the Mississippi. Although opposed to the concession, Jay made the offer. Still his mission failed. All that Jay obtained from the Spaniards was a small loan of about $150,000.

After congress had appointed him one of the commissioners to make peace with Great Britain, Jay left Madrid for Paris in May 1782. There, according to his instructions, he was to do nothing without the "knowledge and concurrence" of the United States' French allies. Distrusting the French, Jay, on his own initiative and contrary to his instructions, opened separate undercover negotiations with the British. As a result, Jay and his fellow commissioners Benjamin Franklin, John Adams and Henry Laurens on Nov. 30, 1782, signed preliminary articles of peace in which Britain granted surprisingly liberal terms. Without significant change they became the final peace settlement in the treaty of Paris of Sept. 3, 1783.

When Jay returned to New York in July 1784 he learned that congress had elected him secretary for foreign affairs. Since he was uncertain of the power of the office and in October was also elected a delegate to congress, he delayed acceptance until December. Jay made the most of his limited powers and raised the office to a position of prominence and prestige. But he also ran into difficulties with congress. In 1786 he negotiated a treaty with Don Diego de Gardoqui of Spain committing the United States to forbear use of the Mississippi for 25 years in return for commercial concessions. Southerners blocked it, believing that Jay had sacrificed the navigational interests of the southwest for benefits to traders in the northeast. The sectional suspicions aroused by the Jay-Gardoqui treaty were largely responsible for the later constitutional provision requiring a two-thirds vote of the senate for approval of treaties.

Jay's difficulties convinced him that the nation needed a more strongly centralized government than the Articles of Confederation provided. Although he failed to be elected to the Constitutional Convention of 1787, he plunged into the fight for ratification of the federal constitution it framed. Using the pseudonym "Publius" he collaborated with Alexander Hamilton and James Madison on *The Federalist* (*q.v.*), the classical defense of the constitution, writing five of the essays. In addition, he wrote a widely read constitutional tract, published anonymously, called an *Address to the People of New York*. At the New York convention for ratification of the federal constitution at Poughkeepsie in July 1788, he moved its adoption by his state.

When George Washington in 1789 became president under the new federal government, he appointed Jay the first chief justice of the United States. Jay's most notable case was *Chisholm* v. *Georgia*, dealing with the issue of whether or not a citizen of one state could bring an original suit in the supreme court against another state for breach of contract. By deciding against Georgia, Jay and the court dealt a blow to state sovereignty. The decision led to adoption of the 11th amendment to the constitution, denying federal courts authority in suits by citizens against a state.

In 1792 Jay lost a bitterly contested election for the governorship of New York to George Clinton. But the most controversial episode in his career came when he negotiated a commercial agreement with Great Britain, signed on Nov. 19, 1794, and known as the Jay treaty. Although it failed to redress accumulated grievances, it helped avert a war with the British. It also became a bitter issue between Jay's own Federalist party and the opposition Republican party, led by Thomas Jefferson and James Madison. Mobs burned Jay in effigy and opponents denounced him as a "damned arch-traitor." At one time before the negotiation Jay had been considered a leading candidate to succeed Washington but the unpopular treaty ruined whatever chances he had for the presidency. New York Federalists, however, elected him governor, a post he assumed on July 1, 1795, three days after resigning as chief justice, and held until 1801 when he retired from public life. His remaining 27 years, spent on his farm at Bedford, N.Y., where he died on May 17, 1829, were calm and uneventful.

A vain and haughty aristocrat and a conservative Federalist in politics, Jay distrusted popular democracy. Yet he was also a humanitarian, a strong nationalist and patriot who believed in republican principles, one of the learned and accomplished statesmen of his day and an outstanding founding father of the nation.

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JAY, the common name of many species of birds that, with magpies and choughs, comprise the subfamily Garrulinae of the crow family (Corvidae). They are best represented in the northern hemisphere, but many species inhabit tropical America and several range southward to northern Argentina. Most are of medium size (8–14 in.) and have powerful bills and rather large legs and feet. The plumage may be either drab or brightly coloured, and the sexes are similar in appearance. Many species are crested and some have very long tail feathers. Jays are typically gregarious, bold and aggressive. They commonly "mob" birds of prey and when disturbed may noisily harass human intruders. The voice is usually loud and harsh but may include melodious calls.

JOHN H. GERARD

BLUE JAY (CYANOCITTA CRISTATA)

Jays are omnivorous and many prey on the eggs or young of other birds. Some, as the common jay (*Garrulus glandarius*) of Eurasia and northern Africa, assiduously store food in the autumn for use in winter, and a single bird may garner thousands of acorns over a period of weeks. The nest is usually constructed of coarse twigs, lined with rootlets and placed in trees. The three to ten greenish or white eggs are generally thickly speckled with olive. They are incubated by the female alone, but the nestlings are fed by both parents.

Perhaps the best-known American species is the blue jay (*Cyanocitta cristata*) of eastern North America south to the Gulf coast. A crested bird, larger than the American robin, it is bright blue above and grayish below, with a conspicuous black collar and black and white markings on the blue wings and tail. The Canada jay (*Perisoreus canadensis*), or "whisky-jack," of Canada and mountainous regions south to California and New Mexico, has sombre gray and white plumage and lacks a crest; notably tame, it is often called "camp robber," for good reason. Other well-known American species include the crested Steller's jay (*C. stelleri*) and the crestless scrub jay (*Aphelocoma coerulescens*) and green jay (*Cyanocorax yncas*), the last perhaps the most colourful of all, with bright blue head, black throat, green upper parts and yellow sides of the tail. (E. R. Be.)

JAY TREATY, a treaty of commerce, navigation and amity signed in London on Nov. 19, 1794, by Lord Grenville, the British foreign minister, and John Jay, chief justice of the United States and envoy extraordinary. Jay's mission grew out of the fears of Federalist leaders that disputes with Great Britain would lead to war. The main grievances on the part of the United States were that the British persisted in holding forts in U.S. territory on the northwest frontier in violation of the peace treaty of 1783, incited the Indians there to attack American settlements, refused to pay for slaves their soldiers had carried off at the close of the American Revolution, discriminated against U.S. commerce, and confiscated U.S. ships and impressed U.S. seamen, mainly in the Caribbean.

In March 1794 congress pressed for retaliatory measures and in April Pres. George Washington appointed Jay to his special mission. Jay's instructions, while allowing considerable freedom,

directed him to adjust the grievances, if possible negotiate a commercial treaty, but to make no agreement contrary to United States obligations to France under treaties signed with that country in 1778. Jay exceeded his instructions. His treaty called for evacuation of the northwest posts by June 1, 1796; compensation for Britain's spoliations against American shipping; American payment of pre-Revolution debts to British merchants (the amounts to be fixed by joint commissions); and for joint commissions to determine the boundaries between the United States and British North America in the northwest and northeast. The four commissions provided for by this treaty gave such an impetus to the principle of arbitration that modern international arbitration has generally been dated from the ratification of the treaty. The pact declared the navigation of the Mississippi river open to both countries and prohibited the outfitting of privateers for Britain's enemies in U.S. waters. The commercial clauses granted the United States trading privileges in England and the British East Indies but offered only limited concessions in the British West Indies. There, Americans could send only ships that did not exceed 70 tons in carrying capacity. Americans bound themselves, moreover, not to export sugar, molasses, coffee, cocoa and cotton in their own ships. The treaty said nothing about compensation for abducted slaves, neutral rights, impressment of U.S. seamen or the incitement of Indians.

In the United States the treaty aroused a storm of protest. Republicans (members of the opposition party) denounced it as a surrender to England by the pro-British Federalists. Nonetheless, with the exception of art. 12, dealing with the West Indian trade, the senate on June 24, 1795, with not a single vote to spare, approved the treaty by the necessary two-thirds majority. Despite his own distaste for it, the president ratified it on Aug. 14, 1795. Ratifications were exchanged in London on Oct. 28 and on Feb. 29, 1796, Washington proclaimed it the law of the land. When the house of representatives in March 1796 requested certain documents pertaining to the negotiation of the treaty, Washington refused and thus set an important precedent in executive-legislative relations. Since the treaty acquiesced in certain British maritime practices, such as allowing the British to confiscate French property on U.S. ships, France, then at war with England, interpreted the treaty as a violation of its own commercial treaty of 1778 with the United States. This resentment led to French maritime retaliation against the United States and between 1798 and 1800 to an undeclared naval war. Despite its shortcomings, the Jay mission gave the United States the commercial treaty it desired and, most important, it preserved peace with Great Britain.

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JAZIRAH, AL: *see* Al Jazirah.

JAZZ. The word has been applied to all sorts of American popular music and to some derivative "light" and concert pieces. It is more usefully and more commonly applied to a kind of improvisational American music with an empirically identifiable history, evolution and body of work from the past that is preserved on phonograph records. Jazz has other characteristics that have persisted, but it is difficult to be definitive about them since jazz is a living and still-evolving form of music. Various attempts at definition have included the ideas that jazz is played with a fixed and constant rhythmic pulse, that it uses only a limited number of time signatures, that the use of so-called "blue notes" will make any piece jazz—even that it is a kind of cacophonous noise and not really music at all. None of these ideas will serve as part of a valid definition. Throughout its history jazz has borrowed melody and harmony—and even larger forms—from European music, but only certain European characteristics have taken root. For example, although the modern jazz musician seems to be turning to atonal improvising, it is in a manner perhaps more characteristic of his own heritage than of the Schoenberg school. Also, the jazz musician finds incompatible certain harmonic inversions that have been common in western concert music for centuries.

Origin and Early Development.—Jazz was first of all the secular music of the Negro people of the United States. The evolution of jazz has been looked at geographically, by styles and as the gradual adoption and transmutation of various vocal, instrumental, formal and orchestral techniques. Perhaps the most meaningful way to see it historically is as a swing toward composition and form alternating with an opposite tendency toward major innovations in basic musical language brought about by great individual improvisers. The trend toward composition and orchestration has shown itself in the very early minstrel and cakewalk popularizations, in the ragtime style in the orchestral work of Ferdinand "Jelly Roll" Morton (1885–1941) in the 1920s, in the compositional orchestral works of Edward "Duke" Ellington (b. 1899) in the 1930s and 1940s and in the 1950s in the work of Thelonious Monk (b. 1920) and John Lewis (b. 1920). The great innovators were trumpeter (and singer) Louis Armstrong (b. 1900) in the late 1920s and 1930s and alto saxophonist Charlie Parker (1920–1955) in the 1940s. Jazz is probably unique in native American popular art in that it has retained its identity and life while expanding its range as it adopts new techniques. Another fact that emerges from such a view of jazz is that each of its important innovative steps has a unique rhythmic basis, along with the constant and integrated harmonic and linear changes.

African music has a rhythmic complexity that the western ear often cannot grasp, and such music must have been somehow transplanted by Negro slaves in the United States. But a rhythmically complex, highly percussive music does not necessarily remain complex after its practitioners gradually adopt European ideas of melody, harmony and rhythm. Afro-Cuban music has retained a percussive complexity; in Afro-American music some earlier forms are less rhythmically complex than later ones and the tendency seems to have been to try to get the rhythmic complexity into the melodic lines. And when these lines were transferred from voice to instrument, they retained vocal characteristics. Furthermore, at the same time in the middle 19th century that Negro singers or players were making simple cakewalks out of broad assimilations of European folk melodies or marches for the popular minstrel stage, a complex voodoo drum ceremony might be taking place in New Orleans. And elsewhere a kind of *ur*blues or spiritual might be shaping up from the influence of Baptist hymns on more or less specifically African ideas of melody and rhythm and on the African idea of harmony, that is, nonunison singing by several voices. All of those levels of musical culture might exist and interplay simultaneously; in a sense several of them still do.

At any rate, the difficult and subtle task of adapting simplified, popularized but apparently African ideas of rhythm to certain European folk standards produced in the cakewalk a rhythmic pulse based (as nearly as can be determined) on a whole note. In the compositional, pianistic style of the turn-of-the-century ragtime, the rhythm was based on a half note with syncopation. Between 1910 and 1930 this was broken up (sometimes with tangolike syncopations) in the first improvisational, orchestral jazz style that had evolved in New Orleans by 1900. By the late 1920s Louis Armstrong had made a quarter-note idea of rhythm irrevocable. And in the middle '40s the jazzman had subdivided this beat into an eighth-note melodic rhythm. By the late '50s a new rhythmic change (both a sixteenth-note melodic phrasing and a uniquely free use of metre) was definitely taking shape. Throughout most of its history, and certainly since the '20s, the complex jazz rhythm (the rhythm in its melodies as well as in its percussion) has been characterized by a particular flowing movement or momentum for which the term swing has been appropriated; this movement has never been defined, but it persists empirically.

Blues.—The history of jazz cannot be discussed without commenting on the fundamental, flexible, musical-poetic form called the blues. For all the discussions of spirituals, work songs and the chants called field hollers, the blues form is undeniably a crucial fact in jazz. It is not known where the blues form came from or how or when it evolved. It can only be said, on the basis of what happened to become described or notated, that an interplay of apparently African and European musical traditions gradually produced a definite musical and verse form, the blues. It probably

was at first a free, poetic-musical expression whose stanzas consisted of a sentence or phrase chanted several times and another sentence or phrase completing or complementing the first repeated thought and with its last word rhyming with the last word of the repeated first line. As the blues became more formal, the first line was chanted or sung only twice, both lines became approximately pentameter in verse form and the musical form of each stanza usually was 12 measures. To take an example from an even more formal and later day:

Don't the moon look lonesome, shining through the trees?
Don't the moon look lonesome, shining through the trees?
Don't a man seem lonesome when his woman packs to leave?

Gradually a blues stanza came to have a standard 12-measure musical form, although a freely modified use of it still persists among some performers who may finish an idea at 10½ measures, or at 14. Also there are less common blues forms of 8 and 16 measures. The blues form has often been described according to the manner in which it was later written down and formally harmonized in piano scores. Thus, the so-called blue tonalities were given in terms of flatting the third and seventh (and sometimes fifth) notes in a scale. But these devices are actually attempts to approximate vocal sounds—the bent, blue notes or, as they may be called, bent quarter tones of the voice, later of the stringed instruments and still later of the wind instruments. It has also been said that the vocal-instrumental blues scale is a diatonic scale with mobile third and seventh steps that are these blue notes. That is true enough as an approximation, but the blue notes may appear at any interval. And in more formal instrumental versions of authentic blues, the "blue" effects also may appear in various forms. A comparable use of such approximate quarter tones is found, in performance, in almost all the world's music except in western concert music.

Like most folk musical-poetic forms, the blues was played with a certain amount of improvisation. And as instrumental jazz developed and became more sophisticated, the idea of improvisation not only was retained but also became more sophisticated and more important. In addition, the musical principles that evolved from the improvised blues came to be applied to materials from other sources.

Archetypical, elementary blues, then, is a poetic-musical form freely sung within an approximate length of 12 measures, consisting of three rhyming, iambic pentameter (approximate) lines, the first two of which are identical. If the singer accompanies himself he will play blue notes in the general pitch area of his voice, most probably on a stringed instrument. In the late 1920s, and after it was more formal and harmonized, the blues form could sustain the songs of a Bessie Smith (1894–1937) and also, in its uniquely percussive piano form later called boogie woogie, such a fine piece of descriptive impressionism as *Honky Tonk Train* by Meade Lux Lewis (b. 1905).

Ragtime.—At an almost opposite pole from such a free and expressive development was ragtime. It was a formal, almost neoclassic, compositional piano music with very limited rhythmic resources. It gave jazz a crucial sense of melody, of form and, probably, of harmony. Ragtime was "in the air" in various places by 1880, but its creative centres were first Sedalia, Mo., and then St. Louis and its first major composer was Scott Joplin (1868–1917), whose best-known work was "Maple Leaf Rag." Rags are built like marches—or like the more popular piano "classics" their composers undoubtedly heard—on several themes. Improvisation (or at least embellishment) and some written variation were present, but composition was more important. There were several important rag composers, but after Joplin the next most important was probably James Scott (1886–1938). The music became enormously popular by 1895 and was quickly exploited and commercialized, but Joplin continued to experiment within it and Joseph Lamb (1887–1960) was still writing rags in the 1950s.

W. C. Handy.—Between ragtime and the later emergence of orchestral jazz came the important work of W. C. Handy (*see* HANDY, WILLIAM CHRISTOPHER). Fundamentally a kind of folklorist-orchestrator, Handy often took his themes from the blues performers he heard around him, wrote them down and harmonized them with tonic, dominant and subdominant "church" chords, using the flattened third and seventh intervals to approximate the blue notes. He also showed excellent taste in selecting and building his multithematic blues ("Memphis Blues," "St. Louis Blues," "Beale Street Blues") on the multithematic model of rags; his formal contribution to jazz was large. Some blues were published before Handy's but, as a result of his dissemination of formally harmonized blues, jazz players by the late 1920s were freely improvising and spontaneously inventing melodies (in the European sense of invention) on blues chord sequences. By the 1930s the typical form of such improvisational blues would consist, for a chorus in B flat, of B flat (four measures), E flat (two measures), B flat (two measures), F (two measures), B flat (two measures), but both simpler and more complex blues chord sequences appear in all jazz styles.

Orchestral Style.—The first orchestral jazz style that developed was the so-called New Orleans style, first popularized by the Original Dixieland Jazz Band in 1917 and best preserved on records by the 1923 groups of Joseph "King" Oliver (1885–1938) and by "Jelly Roll" Morton's Red Hot Peppers in 1926–30.

King Oliver's band was a group of improvisers who played blues pieces and pieces modeled on rags and marches. Their music, one might say, is an orchestral ragtime improvised on by good blues players, using primary triads (I, IV, V) and some secondary ones, and with a rhythm both more free and more complex than in ragtime. There are closely harmonized passages, but the general characteristic is a kind of polyphony (more properly, heterophony) with the two trumpets playing lead melodies, clarinet improvising embellishments and fills (arpeggio or countermelody), trombone in a kind of ground bass, and rhythm instruments (banjo or guitar, string bass or tuba, piano, drums) in an integrated accompaniment. There was also an occasional solo chorus (single horn with rhythm accompaniment) that pointed to future developments.

Morton's music was more formal. He had a larger perspective that led him to integrate heterophony, harmony, solo, written music, sketched parts and improvisation into a total form and development. By the time he was recording such orchestral jazz, however, a revolution was in effect. It was being staged by Louis Armstrong, who earlier had been a member of Oliver's group.

By the late 1920s, Armstrong had developed into a virtuoso trumpet soloist with innovative ideas about rhythm, melody, harmony and, by implication, the future of the improvisational aspect of jazz as a soloist's art. He is, to many commentators, the greatest single figure in jazz. Among the other avant-garde players of the period were pianist Earl "Fatha" Hines, soprano saxophonist Sidney Bechet and trombonist Jack Teagarden. There was also cornetist Leon "Bix" Beiderbecke, who was originally inspired by the Original Dixieland Band's cornetist, Dominick "Nick" La Rocca (among others). His impressionistic ideas of melody and harmony also made a contribution to the future development of jazz.

At the same time jazz soloists were emerging, efforts were being made to orchestrate for larger groups and to set off the solo improviser. First, arranger Don Redman and the orchestra of Fletcher Henderson sought to convert a conventional American dance band with its brass, reed and rhythm sections into a jazz band. Henderson had fully succeeded by the early 1930s and it was chiefly his scores that sustained Benny Goodman's orchestra when swing style found public popularity a few years later.

Duke Ellington began with a dance band but, because he had to provide rather theatrical backgrounds for a night club floor show, and because of his own outstanding compositional and orchestral talents, he led his group and his fine improvising soloists, *e.g.*, trumpeter James "Bubber" Miley, into what is sometimes regarded as the highest formal achievements in jazz up to that time, reaching a peak between 1938 and 1941. (His band's interpretations of Ellington's own compositions, such as *Ko Ko, Sepia Panorama, Harlem Airshaft* and *Concerto for Cootie*, are often mentioned as being among his best works, but there are high achievements from all periods of his career.)

By the 1930s jazz improvising was taking on the form of in-

vention of new melodic lines on preset chord sequences of the blues and of popular songs. (The latter device might be called playing in a blues style on the chords of "I Got Rhythm," "You're Driving Me Crazy," "Sweet Sue," etc., instead of inventing on blues chords.) In the avant-garde of such invention were, chiefly, trumpeter Roy Eldridge; pianist Teddy Wilson; vibraphonist Lionel Hampton; Ellington's alto saxophonist, Johnny Hodges; alto saxophonist Benny Carter; tenor saxophonist Coleman Hawkins and trombonist William "Dickie" Wells; tenor saxophonist Ben Webster; tenor saxophonist Lester Young, perhaps the most original soloist after Armstrong; drummer Sidney Catlett; singer Billie Holiday; and guitarist Charlie Christian. Counter to the movement to invention was the work of Pianist Art Tatum, who developed a style of keyboard virtuosity, melodic embellishment and astonishing harmonic alteration. At this time also appeared the rhythmic perfection of the Count Basie orchestra, a product of Kansas City and the southwest. Basie was the first pianist to drop timekeeping with his left hand on all the beats.

The mid-1940s saw the crisis of rhythmic perfection overcome by a change that also involved an attempt to make jazz—by then again played mostly by small ensembles—far less a dance (or atmosphere) music and more a listener's music. The most brilliant member of the new movement (at first called be bop after a rhythmic device) was alto saxophonist Charlie Parker, who, like Armstrong before him, had new ideas of jazz rhythm, melody and phrase length and had a great harmonic imagination in improvisation. Following the lead of Basie, of his drummer Jo Jones, of bassist Walter Page and of Ellington's bassist, Jimmy Blanton, the new rhythm sections dispensed with the rhythm (timekeeping) guitar and discontinued timekeeping by the drummer's foot on the bass drum pedal so that the drummer could more freely accent the new rhythms the soloists were making. Other leaders of the movement besides Parker were trumpeter John "Dizzy" Gillespie; drummers Kenny Clarke and Max Roach; pianist Earl "Bud" Powell; and, later, trombonist J. J. Johnson. Pianist Thelonious Monk often is mentioned with this group, but his intentions became more formal (*see* below).

Efforts were made during the 1950s to formalize the new jazz language. One of the first efforts to attract attention was the so-called cool style. Its main achievement was a series of orchestral recordings for a medium-sized group led by trumpeter Miles Davis. One of the participants was pianist and composer-arranger John Lewis, who later sought musical form for the Modern Jazz quartet (with vibraphonist Milt Jackson) partly by adopting and assimilating aspects of classical counterpoint for collective jazz improvisation. Another formal development was the unique work of Thelonious Monk, whose compositions for small groups—*Four in One* and *Criss Cross* are good examples—and thematically developed improvisations found musical form within the jazz tradition; his rhythmic and metric virtuosity suggested further innovation. Under such inspiration, tenor saxophonist Theodore "Sonny" Rollins became the first horn player in jazz to play an extremely long improvisation with thematic development and cohesion. A further effort was that of virtuoso bassist Charlie Mingus, who combined composition and group improvisation in a manner suggesting the earliest jazz styles.

In the 1960s, Gunther Schuller wrote a so-called "third stream" work called *Conversations* that succeeded in integrating both jazz and concert music. He did not sprinkle a classical form with blue notes or write a blues movement in a sonata; instead he pitted writing for and improvising by jazzmen against writing for a string quartet and produced an integrated work.

Although it had immediate percursors as well as grounding in the jazz tradition as a whole, the music of Ornette Coleman (b. 1930), even in its formative stage, possessed striking originality. As with Armstrong and Parker, Coleman's most important innovations were rhythmic, not only in the percussion in his groups (drummer and bass player even provided different rhythms simultaneously) but also in the phrasing of his improvised melodic lines. Intonation was also frequently free, as if Coleman had elevated the "blue" notes and vocalized inflections so that they encompassed whole melodic phrases and lines. Improvisation, for the first time in jazz, was based not on a chord structure implied by a theme melody but on invention within the general area of pitch that the theme outlined. Coleman's improvising was predominantly modal, although certain atonal notes were also brought in. Coleman's solos were organized around the development and fragmentation of key phrases so that they became sequential melodies—often ingenious permutations and alterations of a brief opening phrase. Musicians began to refer during the late 1950s to such modal jazz music, and to some more academically oriented experiments with atonality, as "the new thing."

DISCOGRAPHY.—The most historically significant jazz recordings include the following: King Oliver, Riverside 12–122; Jelly Roll Morton, RCA Victor LPM 1649; Bessie Smith, Columbia CL857; Louis Armstrong, Columbia CL851–854, RCA Victor LPM 2322; Bix Beiderbecke, Columbia CL844–845; Art Tatum, 20th Fox TC1-102; Duke Ellington, RCA Victor LPM 1364, 1715; Count Basie, Epic LN3107; Teddy Wilson-Billie Holiday, Columbia CL627; Roy Eldridge and others, Epic LN3252; Charlie Parker and Dizzy Gillespie, Savoy 12007, Roost 2210; Thelonious Monk, Blue Note 1509, 1510; Miles Davis, Capitol T762; Modern Jazz Quartet, Atlantic 2-603; Sonny Rollins, Prestige 7079; Charlie Mingus, Atlantic 1237; Ornette Coleman, Atlantic 1327.

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(M. T. WI.)

JEAN D'ARRAS, 15th-century French author, with Antoine du Val and Fouquart de Cambrai, of the *Évangile des quenouilles*, a collection of stories, told by ladies at the spinning wheel, relating current theories on a wide variety of subjects and throwing much light on medieval manners. There were numerous 15th- and 16th-century editions, including one printed by Wynkyn de Worde in English as the *Gospelles of Dystaves*. A 19th-century edition (Collection Jannet, 1885) has a preface by Anatole France.

For the 14th-century Jean d'Arras, *see* the article MÉLUSINE.

JEAN DE MEUN (MEUNG) (*c.* 1240–before 1305), French poet, famous for his continuation of the *Roman de la Rose* (*q.v.*). His original name was Clopinel, or Chopinel, but he was born at Meung-sur-Loire, and became known by the name of his birthplace. He appears to have possessed a house in Paris, and other property, and may have been archdeacon of the Beauce, but little is known of his life except what may be deduced from his works. A product of the schools of the region between Tours and Paris, he has been described as a man who had learned everything and forgotten nothing. His works do not reveal an attractive personality—satirical, coarse of fibre, at times immoral, but at the same time fearless and outspoken in attacking the abuses of the age. A strong antifeminist, he was bitterly reviled by Christine de Pisan (*q.v.*) and others for his many attacks on women, and his censures on the vices of the church were equally resented. His success must be ascribed to his considerable, if occasionally faulty, erudition, to the encyclopaedic information that he made available to the increasingly important bourgeois class and to the way he typified the changing spirit of society. Though not a great poet, his verse and French style have considerable merit, and all that he wrote is eminently readable.

His works include translations of the *De re Militari* of Vegetius (1284; ed. by U. Robert as *Le livre de Végèce de l'art de la chevalerie*, 1897) and of the *De Consolatione Philosophiae* of Boëthius and the *Epistles* of Abélard to Héloïse (*Epistle I*, ed. by C. Charrier, 1934). He also wrote a *Testament* (ed. by G. D. Méon, 1814) and *Codicille*, but his fame will always rest upon his continuation of the *Roman de la Rose*. (G. ME.)

JEANNIN, PIERRE (*c.* 1541–1623), French statesman, one of Henry IV's most influential advisers after the civil war, was born at Autun. A pupil of Jacques Cujas at Bourges, he was an advocate in the *parlement* of Burgundy in 1569 and became councilor in it (1579) and then president (1580). He opposed in vain the massacre of St. Bartholomew's day in his province. As a Catholic, he supported the duc de Mayenne, Charles de Lorraine, against Henry of Navarre (Henry IV of France) and even went to Spain as the League's envoy (1591). He worked, however, for

the reconciliation of Mayenne and Henry and transferred his loyalty to Henry after the victory of Fontaine-Française (1595). A member of the *conseil des affaires*, he took a leading part in the politics of the new reign, for example, in negotiating the treaty of Lyons with Savoy (1601) and as ambassador to the United Provinces (1607–09). After the assassination of Henry IV (1610), he was *contrôleur-général des finances* till his dismissal in 1616; but after the murder of the marshal d'Ancre and the disgrace of Marie de Médicis (1617), he was recalled to the administration sponsored by the future duc de Luynes.

Jeannin died in Paris on March 22, 1623.

See N. Garnier, "Le President Jeannin," *Mémoires de la Société de géographie et d'histoire bourguignonne* (1913).

JEANS, SIR JAMES HOPWOOD (1877–1946), English mathematician and physicist, best known for his popular books on science, particularly astronomy. Born in London on Sept. 11, 1877, he was educated at Cambridge, where he was second wrangler in 1898 and Smith's prizeman in 1900. He held the posts of university lecturer in applied mathematics at Cambridge (1904) and professor of applied mathematics at Princeton university. Jeans applied mathematics to many branches of physics and astronomy with marked success. In the kinetic theory of gases he gave proofs for the law of equipartition of energy and for Maxwell's law of distribution of the velocity of molecules. Jeans developed a formula for the distribution of energy emitted by a black body; he used classical methods and arrived at a formula similar to that of Lord Rayleigh which only holds for long wave lengths. He also wrote on other aspects of radiation such as the interaction between radiation and free electrons. In astronomy Jeans applied mathematics to such good effect that a number of original theories on cosmogony resulted. As an example, his work on the stability of pear-shaped figures may be taken; he considered such bodies rotating in an incompressible fluid, later he considered the fluid to be compressible. The same mathematical analysis was then applied to problems of splitting caused by tides produced by the approach of a second body, and this in its turn was applied to the break-up of stars. Jeans also showed that Laplace's theory of the origin of the solar system was incorrect. He studied the effect of gravitational attraction on the motion of stars. He wrote papers on the formation of binary stars; the nature of spiral nebulae; his theory of giant and dwarf stars; the source of stellar energy; and the evolution and radiation of gaseous stars. Knighted in 1928, Jeans was awarded the Order of Merit in 1939. He died on Sept. 17, 1946.

Jeans was the author of *Dynamical Theory of Gases* (1904; 4th ed., 1925), *Mathematical Theory of Electricity and Magnetism* (1908; 5th ed., 1933), *Problems of Cosmogony and Stellar Dynamics* (1919), *Radiation and the Quantum Theory* (1914; 1924), *Atomicity and Quanta* (1926), *Astronomy and Cosmogony* (1928), *The Universe Around Us* (1929), *The Stars in Their Courses* (1931), *New Background of Science* (1933), *Through Space and Time* (1934) and *An Introduction to the Kinetic Theory of Gases* (1940).

See E. A. Milne, *Sir James Jeans* (1952).

JEBB, SIR RICHARD CLAVERHOUSE (1841–1905), British classical scholar, was, above all, an outstanding interpreter of the plays of Sophocles. Born at Dundee on Aug. 27, 1841, and educated at Charterhouse and at Trinity college, Cambridge, he was fellow and lecturer of his college until 1875 when he became professor of Greek at Glasgow university. In 1889 he returned to Cambridge on his appointment as regius professor of Greek there. He was M.P. for Cambridge university during 1891–1905. He was knighted in 1900 and he received the Order of Merit in 1905. He died at Cambridge on Dec. 9, 1905.

A scholar of wide range, Jebb combined that intuitive sense of Greek style which made him an excellent composer of Greek verse with the learning and critical outlook of the 19th century. His chief works are: an edition of the *Characters of Theophrastus* (1870; re-edited by J. E. Sandys, 1909); *The Attic Orators From Antiphon to Isaeos* (1876; 2nd ed., 1893); *Selections From the Attic Orators* (1880; 2nd ed., 1888); *Bentley* (1882), in the "English Men of Letters series"; *Homer* (1887; 6th ed., 1898); *The Growth and Influence of Classical Greek Poetry* (1893); an edition of the poems of Bacchylides (1905); and, most important, the valuable edition of the plays of Sophocles, from the *Oedipus Tyrannus* (1883) to the *Ajax* (1896).

Jebb's *Essays and Addresses* and *Life and Letters* were published by his widow in 1907. *See* also J. E. Sandys, *History of Classical Scholarship*, vol. iii (1908). (M. L. Ce.)

JEBEIL: *see* Byblos.

JEDBURGH, royal and small burgh and county town, Roxburgh, Scotland. Pop. (1961) 3,647. It stands on the Jed Water, a tributary of the Teviot, 47½ mi. S.E. of Edinburgh by road. There have been many variants of the name (*e.g.*, Jedworth, Jethart), and locally it is frequently pronounced Jeddart. The original site of the town was at Old Jeddart, about 4 mi. S. The chief industry is the manufacture of rayon. Corn milling, tanning and glove making are carried on and fruit (especially pears) and garden produce flourish.

The principal feature is the ruined abbey, the stateliest of the renowned group of Border abbeys—Jedburgh, Melrose, Dryburgh and Kelso. In 1118 David I, when earl of Cumbria, founded a priory at Jedburgh for Augustinian monks from the abbey of St. Quentin at Beauvais in France. In 1147, after he had become king, he erected it into an abbey dedicated to the Virgin. Repeatedly damaged in Border warfare it was burned in 1523 and ruined in 1544–45 during the English invasion led by the earl of Hertford. The establishment was suppressed in 1559, the revenues being temporarily annexed to the crown. After changing owners more than once, the lands were purchased in 1637 by the 3rd earl of Lothian. Latterly five of the bays at the west end had been utilized as the parish church, but the 9th marquess of Lothian built a church and presented it to the heritors in exchange for the ruined abbey. In 1913 it was taken over for the nation by the Ancient Monuments commission and is now cared for by the ministry of works.

The abbey was built of Old Red Sandstone and is a magnificent example of the Norman and Transition styles. The west front contains a great Norman porch and a fine wheel window. The tower, at the intersection of the nave and transepts, is of unusually massive proportions. With the exception of the north piers and a small portion of the wall above, which are Norman, the tower dates from the end of the 15th century. The whole of the south transept has perished. The north transept, with early Decorated windows, has been covered in and walled off and is the burial ground of the Kers of Ferniehirst, ancestors of the marquess of Lothian. The earliest tombstone is dated 1524. All that is left of the choir, which contains some very early Norman work, is two bays, corresponding to the design of the nave. It is supposed that the aisle, with decorated window and groined roof, south of the chancel, formed the grammar school (removed from the abbey in 1751) in which Samuel Rutherford (1600–61), principal of St. Mary's college, St. Andrews, and James Thomson, author of *The Seasons*, were educated. The richly carved doorway from the south aisle into what was formerly the cloister is a modern copy of one which had decayed. Foundations of several old abbey buildings have been uncovered in the gardens sloping down to the river.

The castle stood on high ground above the river at the south end of the burgh, or "town-head." Erected by David I, it was one of the five strongholds ceded to England in 1174, under the treaty of Falaise, for the ransom of William the Lion. It was, however, so often captured by the English that it became a menace rather than a protection, and the townsfolk demolished it in 1409. It was occasionally used as a royal residence. The site was occupied in 1823 by the county prison, now known as the castle, which gradually fell into disuse and was acquired by the corporation in 1890. A house in Queen street, in which Mary, queen of Scots, resided in 1566, was bought by the corporation and is now arranged as a museum with many relics relating to the queen. It was from and to this house that she made her sensational 40-mi. ride to visit Bothwell at Hermitage castle. A house in Castlegate was occupied by Prince Charles Edward in 1745.

The grammar school (built in 1883 to replace the successor of

the school in the abbey) was founded by William Turnbull, bishop of Glasgow (d. 1454). The old market cross still exists. Jedburgh was made a royal burgh in the reign of David I and received a charter from Robert I and another in 1566.

"Jeddart justice," according to which a man was hanged first and tried afterward, seems to have been a hasty generalization from a solitary fact—the summary execution in James VI's reign of a gang of rogues at the instance of Sir George Home—but nevertheless passed into a proverb.

JEEP, the popular name for the U.S. army's ¼-ton truck widely used in World War II, and, when capitalized, a registered trademark. No really satisfactory explanation of the origin of the term has ever been given; some have related it to a comic-strip character created by E. C. Segar and others to a slurring of the letters GP (general purpose).

The jeep was developed originally as a fast military reconnaissance car to replace the motorcycle. It was the smallest of the U.S. army's trucks in World War II—only about 11 ft. long and 4 ft. high—but it had remarkable power, stamina and maneuverability. It could haul troops, ammunition or light cargo, tow airplanes or small artillery pieces and, with special fittings, serve as an ambulance, fire-fighting vehicle, mobile machine-gun mount or radio patrol car. "Good Lord," wrote war correspondent Ernie Pyle, "I don't think we could continue the war without the jeep. It does everything." (Scripps-Howard Newspapers.) The jeep could cross bridges too weak to support other motorized equipment and could easily be transported by airplane. The secret of its ground mobility lay in its light weight (between 2,200–2,500 lb., depending upon the model), its four-wheel drive and powerful four-cylinder gasoline engine. Its top highway speed was 60 m.p.h.

Development of the jeep began in the 1930s as part of a broad program for motorization of the U.S. army. The first successful pilot model was built by the American Bantam Car company in 1940. A model submitted by the Willys-Overland company was officially adopted by the U.S. army in Aug. 1941. Production of jeeps during World War II by Willys-Overland and the Ford Motor company totaled 634,569.

A much smaller companion vehicle known as the "mechanical mule" came into use by the U.S. army in the late 1950s. Officially known as an infantry light weapons carrier, it was a four-wheel, flat-bed vehicle that weighed only 830 lb. and was about 9 ft. long and 27 in. high. It could carry as much as 800 lb. of cargo over rough terrain at slow speeds or could be mounted with a 106 mm. recoilless rifle. *See* also TRANSPORT, MILITARY.

See H. C. Thomson and Lida Mayo, *The Ordnance Department: Procurement and Supply,* ch. 12 (1960). (H. C. T.)

JEFFERIES, (JOHN) RICHARD (1848–1887), English naturalist, novelist, and essayist, whose prophetic vision, unappreciated by the world of Victorian materialism, has been increasingly recognized since his death. Combining detailed observation with mystic apprehension of nature, he is master of both a straightforward descriptive, and a sensuous poetic, prose.

The son of a struggling yeoman farmer, he was born on Nov. 6, 1848, at Coate Farm (now a Jefferies' Museum), near Swindon, Wiltshire. Behind it was Coate Water (maintained by Swindon council as a memorial to him); his memories of this place, with its reeds and wildfowl and fish, are included in *Bevis: the Story of a Boy* (1882), one of the best boys' books in English.

In 1866 he became a reporter on the *North Wilts Herald,* escaping whenever possible to the Downs: "Never was there such a worshipper of earth," as he wrote in his autobiography, *The Story of My Heart* (1883), the theme of which is a dream of a fairer way of life than that he had seen in the slums of Swindon and London. From his experiences as a reporter came *Hodge and His Masters* (2 vol., 1880), a classic record of Victorian countrymen, from the landowner to the labourer; during these years also he wrote novels—among them the beautiful *The Dewy Morn* (2 vol., 1884) and *Greene Ferne Farm* (1880). In 1872 he became famous with a letter of more than 4,000 words on the Wiltshire agricultural labourer, containing detail so arresting that *The Times* published it in full. Soon, periodicals and papers (notably the evening *Pall Mall Gazette*), were printing his sketches and articles—collected in *The Gamekeeper at Home* (1878), and the *Amateur Poacher* and *Wild Life in a Southern County* (both 1879). In 1877 he moved nearer to London, living at Surbiton, Surrey; Eltham, Kent; Crowborough, Sussex; and near Brighton, and supporting a wife (married 1874) and two children on what he made by writing. In his last years before his death (at Goring-on-Sea, Sussex, on Aug. 14, 1887) he was ill as well as poor. Yet this was his most creative period: between 1882 and 1887 he wrote the moving essays in his later, introspective style, collected in *The Life of the Fields* (1884), *The Open Air* (1885), and *Field and Hedgerow* (1889); and dictated the novel, *Amaryllis at the Fair* (1887), thought by Edward Garnett superior to the best of Thomas Hardy.

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JEFFERS, (JOHN) ROBINSON (1887–1962), one of the most controversial U.S. poets of the 20th century, was born Jan. 10, 1887, at Pittsburgh, Pa. In over a dozen volumes he explored the disillusionment characteristic of literature after World War I. His first two were of slight interest, but his third book, *Tamar and Other Poems* (1924), which brought him immediate fame, revealed the unique style and eccentric ideas developed in such later volumes as *Cawdor* (1928), *Thurso's Landing* (1932), *Be Angry at the Sun* (1941). The shorter lyrics as well as his sprawling narrative poems celebrate the splendour of the coastal scenery near Carmel, Calif., where Jeffers and his wife Una moved in 1916. The narratives preach Jeffers' cosmic religion, based on a complex interplay of certain ideas: civilizations inevitably decline, becoming "self-conscious" or "introverted," a condition which Jeffers symbolizes in his narratives by incest. Indeed, all things except his pantheistically conceived God are transient, and human life is viewed as a frantic, often contemptible struggle within a "net" of passions. Jeffers therefore argues that man should become an "inhumanist"; that is, he should turn his attention from man and train it instead upon God. This basic philosophical scheme, along with his violence, his long verse line and unabashed rhetoric, have been attacked by some critics. Although the attacks somewhat eroded Jeffers' reputation, they did not endanger his place in American literature as a poet of power and originality, as well as a brilliant adapter of Euripides' *Medea* (produced in 1946). He died Jan. 20, 1962, at Carmel, Calif.

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JEFFERSON, JOSEPH (1829–1905), U.S. actor, one of the best-loved in U.S. theatrical history, was born in Philadelphia, Pa., on Feb. 20, 1829. The third actor of this name in a family of actors and managers, Jefferson completely eclipsed his forebears. He made his stage debut at the age of three, as the boy in Kotzebue's *Pizarro,* and after years of struggle as a traveling actor and manager achieved his first important success as Asa Trenchard in Tom Taylor's *Our American Cousin* (1858). This play was the turning point in his career, as it was in that of E. A. Sothern, who created the role of Lord Dundreary. Other parts played by Jefferson in those years were Dr. Pangloss in *The Heir at Law* (1857), Newman Noggs in *Nicholas Nickleby* (1859) and Salem Scudder in Dion Boucicault's *The Octoroon* (1859). His Bob Acres in *The Rivals,* although very successful, was more Jefferson's creation than Sheridan's.

In 1859 Jefferson made a stage adaptation of Washington Irving's *Rip Van Winkle,* which was only moderately successful. While in England in 1865 he commissioned Boucicault to write another version and this, along with minor improvements incorporated over the years, was the final one. As Rip, Jefferson delighted

London audiences for 170 consecutive nights. After 1865 he created no new roles, as his public never tired of the delightful and sensitive characterization of Rip. Through the last third of the 19th century Jefferson remained at a peak of popularity. The friend of many leading figures in politics, art and literature, he brought dignity to the stage. Jefferson was awarded the lifetime honour of the presidency of the Players' club, succeeding Edwin Booth and preceding John Drew. His first wife was the actress Margaret Clements Lockyer, and his second was Sarah Warren, niece of the actor William Warren. He died in Palm Beach, Fla., on April 23, 1905.

Jefferson's *Autobiography* (1889) is written with admirable spirit and humour, and its judgments with regard to the art of the actor and the playwright entitle it to a place beside Colley Cibber's *Apology*.

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JEFFERSON, THOMAS (1743–1826), third president of the United States, principal author of the Declaration of Independence and influential political philosopher, was born on April 13, 1743, at Shadwell, Albemarle county, Va. His father, Peter Jefferson (1707–57), was a civil engineer who became a justice of the peace, colonel of the county militia and member of the house of burgesses; he married a daughter of one of the most prominent colonial families, the Randolphs.

Youth.—Thomas Jefferson's early years were much like those of any Virginia planter's son, though the location of Shadwell near the frontier exposed him to influences more democratic than those of the aristocratic tidewater area. At the age of 16 he entered William and Mary college at Williamsburg. This period marked the emergence of those qualities of personal and intellectual distinction that set him apart both from his peers among the Virginia aristocracy and from the extraordinary group of statesmen from other sections of the country with whom he soon became associated. In spite of his youth, he became, with William Small of the college faculty and George Wythe, scholar and leading member of the Virginia bar, a member of an intimate circle headed by the popular and accomplished lieutenant governor of Virginia, Francis Fauquier. While in college Jefferson also acquired an interest in mathematics and the natural sciences which he never abandoned, and continued his progress in the study of foreign and classical languages. Either at this period or sometime thereafter he came to regard the law and its study not merely as a profession in the occupational sense, but as a powerful force shaping the institution and culture of a people, and therefore as a potent instrument of social reform. After five years of study in Wythe's law office he was admitted to the bar in 1767 and practised successfully for seven years. Like his great contemporaries in England, Jeremy Bentham and Edmund Burke, he had little taste for this practice, however, and abandoned it to devote his time to political action and philosophy.

Early Political Career.—As was customary for the aristocracy in colonial Virginia, Jefferson began his political career as a justice of the peace and then, in 1769, took his seat in the house of burgesses, the lower house of the colonial legislature. He served in this and in the later revolutionary conventions until 1775, when he was sent as one of the Virginia delegates to the continental congress in Philadelphia. He was prominent in these deliberative bodies, yet he can fairly be said never to have made a speech. He hated the "morbid rage of debate," believing men were never convinced by argument, but only by reflection, reading or unprovocative conversation; and this belief guided him through life. He was, however, as John Adams described him in the continental congress, so "prompt, frank, explicit and decisive upon committees and in conversation (not even Samuel Adams was more so)" that he was soon acknowledged as one of the strongest members. A lucid, graceful literary style added greatly to his influence. His first major essay, *A Summary View of the Rights of British America* (1774), was a forceful denial of the authority of parliament over the colonies, and a criticism of the policies pursued by the king. Jefferson maintained that "the relation between Great Britain and these colonies was exactly the same as that of England and Scotland after the accession of James and until the Union; and that our emigration to this country gave England no more rights over us than the emigration of the Danes and Saxons gave to the present authorities of their mother country over England." This argument was too extreme for the majority of colonial leaders at the time, but the essay exerted considerable influence as relations between Great Britain and the colonies worsened during 1774 and 1775. When the second continental congress made its decision for independence in June 1776, Jefferson was appointed to the committee assigned to prepare the formal statement of reasons for the decision. The other members recognized his skill as a stylist and left the task primarily to him. Thus he became the author of the Declaration of Independence.

Interest in State Affairs.—During the late spring of 1776 Jefferson had asked repeatedly for permission to leave the continental congress and return to Virginia in order that he might take part in framing the constitution for the new state, and in revising its laws in accordance with the requirements of republican government. The request was not granted, and although he drafted a constitution and sent it to Williamsburg, it arrived too late for serious consideration. The episode is significant, for it reveals Jefferson's confidence in the future, his realization that the American Revolution provided an opportunity for constructive statesmanship, and his determination to use this opportunity to effect sweeping reforms in the laws and institutions of his own state. He was at this time an undoubted revolutionary, and not a particularly conservative one.

The Virginia constitution was written and adopted in Jefferson's absence, but upon his return to the legislature in Oct. 1776 he set about revising the statutory law. His aim was to eradicate traces "of ancient or future aristocracy" and to lay the foundation "for a government truly republican." He placed particular emphasis on four reforms: (1) repeal of the laws of entail that kept property in the hands of an owner or his descendants forever; (2) abolition of primogeniture, by which the eldest son received all of an estate; (3) the guarantee of freedom of conscience and the disestablishment of the Church of England as the state church; and (4) a state-supported system of education including elementary, grammar and classical schools, a library and a college or university. The first three were adopted within a period of ten years, but of the fourth he obtained only the university, and that not until very late in his career.

During this period as a revolutionary Virginia legislator, Jefferson was also one of the central figures in attempted revision of the state's penal code, finally adopted in 1796. Capital punishment was abolished for all crimes except murder and treason, and other changes embodied the humanitarian spirit of the late 18th and the 19th centuries. His efforts toward the eventual abolition of slavery were not successful, though in 1778 he did succeed in having a law passed prohibiting the importation of slaves. The record of legislative achievement, though it fell short of his own wishes, was very substantial and attested not only to his skill as a legal draftsman but also to his effectiveness as a politician. The record also reveals, in its failures as well as its successes, a great deal about the true character of the American Revolution.

In 1779 Jefferson began a short and unhappy tenure as governor of Virginia, succeeding Patrick Henry. In his second term (1780–81) the state was overrun by British expeditions, and he himself barely escaped capture. He was blamed for the colony's ineffectual resistance, and though he was not eminently fitted for the task that devolved upon him in such a crisis, most of the criticism of his administration was unjust. He declined renomination as governor, but was elected to the Virginia legislature and received by vote of that body a declaration of thanks and confidence.

Return to National Service.—There followed a short interval of retirement from public life, during which occurred the death of his wife, Martha Wayles Skelton Jefferson (1749–82), whom he had married on Jan. 1, 1772. In 1783 Jefferson was back in Philadelphia as a member of the congress under the Articles of Confederation. He headed the committee appointed to consider the treaty of peace with Great Britain and contributed to a report

that resulted in the establishment of a decimal monetary system for the United States. His major achievement was the formulation of a plan of government for the western territories, the area northwest of the Ohio river ceded by Virginia to the United States in 1784. The importance of this cession for national union can scarcely be exaggerated, and Jefferson's support of it marks him as a strong nationalist. His plan of government provided that slavery should not exist in these territories after 1800, and this provision was included in the Northwest Ordinance of 1787. It established a precedent for federal authority over slavery in the territories and virtually insured that the states formed out of the original area should be free.

In 1784 Jefferson accepted from congress an appointment as special envoy to assist Benjamin Franklin and John Adams in the negotiation of commercial treaties with European states, and in 1785 succeeded Franklin as U.S. minister to France. His experience in this capacity convinced him of the need for a stronger central government, and his observations of European culture confirmed his belief in the superiority of American manners, morals and government. While in Paris he published his *Notes on Virginia* (1785), a description of his native state. He was extremely popular as a minister, and the enactment by Virginia of a statute of religious freedom in 1786 increased his prestige as a cosmopolitan spokesman of freedom. His advice was sought by a committee of the French national assembly in the summer of 1789, but his official position made it necessary for him to decline. Shortly thereafter he returned to the United States and became secretary of state in Pres. George Washington's administration.

Influence on Political Parties.—During the debate over ratification of the new federal constitution, Jefferson (who, like many of its authors, approved parts of it and was critical of others) had been informed that his name and authority were being used by one of the parties to the controversy and had replied angrily, "If I could not get to heaven but with a party, I would not go there at all." Yet soon after he assumed his new office he became deeply involved in a party controversy with Alexander Hamilton, secretary of the treasury. Together with James Madison, he soon became the leader of what was later called the Democratic-Republican party. (Hamilton's followers eventually came to be known as the Federalist party.) Jefferson opposed Hamilton's financial policies on the grounds that they exceeded the power delegated to the central government by the constitution, that they were contrary to the interests of the majority of the people, and that they represented a threat to republican institutions. Jefferson and Hamilton were also divided on questions of foreign policy, with Jefferson leaning toward France while Hamilton and the Federalists leaned toward Great Britain.

Although both men retired from the cabinet near the end of Washington's first term, the questions and principles that had divided them continued to be the focus of extremely acrimonious debate throughout the 1790s and each man continued to be both the leader and the symbol of his party. Jefferson regarded Hamilton as an enemy of republican government; Hamilton regarded Jefferson as a demagogic radical. Apart from the issues involved, the controversy was important for its effect on political organization, for it set the pattern for a two-party system. Thus Jefferson, who had already demonstrated his skill as a parliamentary politician in the Virginia legislature, now proved his talents on the national level. Although he held no official position immediately after retiring from Washington's cabinet at the end of 1793, he was active in politics, and was elected vice-president in 1796 at the same time that John Adams, a Federalist, became president.

As a result of the increasingly bitter debate over U.S. relations with Great Britain and France, the Federalists in 1798 enacted the Alien and Sedition laws, which were regarded by many as serious abridgments of the freedoms of speech and the press and therefore as contrary to the constitution. In answer to these measures, Jefferson and Madison prepared and procured the passage of the Kentucky and Virginia resolutions, asserting the right of the states to nullify congressional laws on the ground of unconstitutionality. These resolutions have often been appealed to by minority groups who have resorted to the doctrine of states' rights in opposing policies of the national government.

Presidency.—The Federalist candidates lost the election of 1800, but under the electoral system then prevailing neither of the Republican candidates, Jefferson and Aaron Burr, could claim the victory, for both had received the same number of electoral votes. The choice between them was therefore made in the house of representatives. Partly because of the influence of Hamilton, who distrusted Burr even more than he disliked Jefferson, the latter was chosen president and inaugurated March 4, 1801.

The spirit and content of Jefferson's inaugural address were conciliatory, and so, to a considerable extent, were the policies of his administration. There was no attempt at wholesale reversal of Federalist policies of the preceding 12 years, and in at least two instances, the Louisiana Purchase and the Embargo act, he was said to be even more Federalist than the Federalists themselves. There was, however, an effort to nullify the Federalist attempt to fill federal judgeships with partisan appointees holding office, for life, and there was sufficient turnover in other federal offices to give some substance to the accusation that Jefferson introduced the spoils system. There was also an effort to reduce the formality of both official and social occasions in Washington, D.C., Jefferson associating formality with aristocracy, and informality with republicanism. But in spite of the very bitter controversy of the preceding years, Jefferson's inauguration ushered in no really drastic or radical changes. This has led to an apparently unending debate as to whether he was or was not inconsistent, and to what degree. Had Jefferson been more doctrinaire, or less aware of the danger of unrestrained political passion, the future of American politics might have been characterized by less stability than has been the case. The precedent he deliberately set must rank with the Louisiana Purchase as one of the major achievements of his presidency.

The acquisition of the Louisiana territory in 1803 was of incalculable importance, nearly doubling the size of the United States. Jefferson's original plan was to purchase merely a small area at the mouth of the Mississippi river in order to guarantee U.S. rights of navigation on that river. When Napoleon offered to sell the entire territory, Jefferson saw his chance and took it, even though, as he frankly admitted, he had no constitutional authority to do so. He believed that the purchase would contribute to the security of the United States by removing from the continent a major foreign power, and that it would insure the stability of republican government for generations to come by providing a vast reservoir of land for settlers. (*See* LOUISIANA PURCHASE.)

Jefferson was re-elected in 1804; George Clinton became vice-president. Jefferson's second administration was notable for his unsuccessful efforts to convict his former vice-president, Burr, of treasonable acts in the southwest, and for his efforts to pursue a policy of neutrality during the Napoleonic Wars and maintain the rights of neutrals on the high seas. His overwhelming desire to avoid war with either side led to charges of timidity and vacillation, and his Embargo act (1807) was criticized as inconsistent with the principles of individual freedom and his former opposition to a strong national government. The act was, however, securely based on the power given to congress to regulate commerce with foreign nations, a power of which Jefferson heartily approved long before he became president.

Retirement.—Jefferson might have been elected president for a third term, but he chose to follow Washington's example of withdrawing after two terms. On March 4, 1809, he turned the office over to his successor, James Madison, and went home to Monticello. He was then nearly 66 and had been in politics almost continuously for 40 years. His influence continued to be substantial, most directly through Madison and then James Monroe, but also through the scores of friends and strangers who sought his advice by letter or visited him in person at Monticello. There was, moreover, one more official act he sought to accomplish, and that was the establishment of the University of Virginia. "A system of public instruction . . . ," he wrote, "as it was the earliest so it will be the latest of all the public concerns in which I shall permit myself to take an interest." He designed the buildings and supervised their construction to the minutest details;

he gathered the faculty, planned the curriculum and even selected the reading for some of the courses. He had never been able to persuade his fellow Virginians to support public education for elementary and secondary pupils, but the university was an appropriate conclusion to a political career remarkable for its creativity as well as for its duration and success.

Range of Interests.—Jefferson's political career was undoubtedly impressive. But it alone would not have captured the affection and respect of so many of his contemporaries and of posterity, and it was far from absorbing all of the energy, time and talent of the man himself. Jefferson probably enjoyed politics more than he was willing to admit but it is also true that his often expressed longing to retire to private life and pursue his other interests was very real. These interests were numerous and varied.

He was an extraordinarily learned man, and the range of his knowledge and even more his inquiry, is scarcely credible in the modern age of specialization. He knew Latin, Greek, French, Spanish, Italian and Anglo-Saxon, and concerned himself with such questions as the difference between the ancient and modern pronunciation of Greek. At the age of 71 he tackled Plato's *Republic* in the original and found that philosopher greatly overrated. He attempted an analysis of the New Testament in order to discover what Jesus really said as distinguished from what he was reported to have said. This effort led to charges in the election campaign of 1800 that he had written a new Bible and would, if elected, substitute it for the old one. It was later published in *Jefferson's Bible*. He also enjoyed the study of mathematics and found its precision and certitude a welcome relief from the untidiness of politics and government. He was an ardent student of the natural sciences, carried on an extensive correspondence with men like Joseph Priestley, and sometimes contributed his time and money to progress in these fields. Upon one occasion, during his stay in Paris, he dispatched urgent messages to friends in the United States to kill, stuff and ship to Europe the biggest moose they could find so that he might prove to the count de Buffon the erroneousness of a then popular theory that something in the physical characteristics of the United States caused a deterioration in all animal life. While president of the United States he received and proceeded to examine and classify a collection of fossils unearthed in New York. He sought to make an ethnological study of Negroes and American Indians, but despaired of a truly scientific method in this area. He was much interested in the experiments with balloons that were conducted while he was abroad, and sent back to his friends in the United States various mechanical and scientific gadgets produced in Europe, including a polygraph and phosphorous matches. His travel notes record impressions ranging from nearly ecstatic admiration of architectural monuments to sober economic analysis of the reasons for the difference in prosperity between regions producing white and red wine.

He was an enthusiastic practitioner of scientific farming, conducted numerous experiments at Monticello, was always on the lookout for some new plant or seed that might contribute to the prosperity of the United States (once going so far as to smuggle a particular variety of rice across the Italian border) and kept meticulous meteorological records. His interest in architecture was intense and his influence on the neoclassical style in the United States was great.

The pursuit of these various interests concurrently with his political activities and the management of his estates (which included several thousand acres and at one time about 150 slaves) is impressive. To this record of industry must be added the voluminous correspondence Jefferson maintained with extraordinary conscientiousness until very near his death. He could have accomplished so much only through rigorous self-discipline and an efficient, systematic organization of his time and activities. Yet he was one of the most generous and approachable of men. Friends and strangers alike wrote to him for advice or came to Monticello, when he was in residence, with or without an invitation. Relatives, invited guests and strangers filled Monticello (frequently beds were made for a score and more, sometimes for 50); they stayed for days, weeks, even months, drank his choice French wines, kept their horses in his stables. For solitude he had to retire to a second home, constructed as a refuge.

He was sensitive and perceptive in personal relations, gracious and charming in manner, and almost invariably even-tempered. As a matter both of principle and inclination, he attempted to prevent political differences from inspiring personal ill-will, and though he was subjected to malicious abuse during the political controversies in which he was involved, he endured it with relative magnanimity and felt genuine animosity toward only a very few of his opponents and critics.

Personality and Features.—Because he was so central a figure, so widely known, so articulate and so meticulous in preserving his letters and papers, it is possible to reconstruct a remarkably complete account of his life and work. Yet for all of this, the man himself—the private man—remains somewhat elusive. He kept many records, but not a diary comparable to that of his friend, John Adams, and very few of his letters reveal much of the man other than as he might appear to guests at Monticello. The note of desperate anxiety over the state of his finances as they affected his daughter and grandchildren shortly before his death is unmistakable. But there was a reserve of privacy which Jefferson kept inviolate. For example, no letters exchanged between him and his wife exist, and there are very few references to her in any other papers. Their marriage was, by all contemporary accounts, an extraordinarily happy one, and it would therefore appear that Jefferson destroyed whatever letters once existed in order to keep their relationship forever private. He was a complex and, as his modern editor has suggested, a lonely man, and ultimately an unknowable one.

Jefferson was 6 ft. 2 in. in height, large-boned, slim, erect and sinewy. He had angular features, a ruddy complexion, sandy hair and hazel-flecked gray eyes. His carriage was somewhat loose and undignified. There was grace, nevertheless, in his manners; and his frank and earnest address, his quick sympathy (yet he seemed cold to strangers), his vivacious, varied, informing talk, gave him an engaging charm.

POLITICAL PHILOSOPHY

Jefferson's enduring significance lies not only in his political career as revolutionist, legislator, diplomat, party leader and president, but in the body of political thought that shaped his actions. He was among those 18th-century Americans who were drawn to politics both by duty and interest, and who brought to their work a carefully thought out but rarely systematic set of political principles. They were equipped with a knowledge of history and a sense of destiny, and were quite aware that their effort to establish republican government over a large area and a relatively heterogeneous people was a novel experiment. Jefferson's confidence in this experiment, his skill in translating ideals into practice, and above all, his devotion to liberty, have made him peculiarly symbolic of that part of the American political tradition linked with the Declaration of Independence.

His conception of the ends of government was derived from the doctrines of natural law and natural rights. He believed, as he wrote in the Declaration, that men were endowed with rights to life, liberty and the pursuit of happiness, and with such other rights as were essential to the enjoyment of these primary ones. He regarded property as a natural but secondary right, and interpreted it as the right to a decent material subsistence. Where positive laws operated to deprive individuals or groups of the means to achieve a decent standard of living—as the concentration of land in the hands of a few in France did—he thought they should be changed. Since Jefferson believed the possession of these rights belonged in the category of self-evident truths, his analysis and justification of them is limited, and may be criticized as philosophically weak. Nevertheless, his devotion to them, and especially to liberty, was sustained and intense.

Slavery.—The fact that he was a slaveowner has been pointed out as contradictory to his belief in both liberty and equality. He was opposed to slavery, as his *Notes on Virginia* and letters reveal quite unequivocably, but saw no satisfactory way to abolish it. He believed that the two races could not live together harmoniously

in the same society, and feared that the United States would sometime have to pay a bitter price for what he regarded as its crime against humanity. The Missouri Compromise (1820) he thought to be a grievous error, because its establishment of a geographical line between free and slave states would render difficult a national, peaceful solution, and would intensify the differences which were already apparent between the two sections. It would, he feared, break up the union. In all of this he was prophetic, but whether slavery could ever have been abolished in a way satisfactory to him is extremely doubtful. The sober concern with means that Jefferson exhibited with respect to the problem of slavery was characteristic of his entire political thought, as indeed it was of most of his contemporaries in the United States. His faith in man's capacity to govern himself has always been emphasized, but his analysis of the conditions in which this capacity could be effectively realized is less familiar. He did not believe that all men everywhere were capable of self-government.

Need for a Moral Sense.—The initial and fundamental prerequisite was one which was a universal characteristic of man, a natural moral sense, implanted in him by his Creator. This moral sense was an ability to distinguish right from wrong, and an inclination toward the former. It was part of the basic equipment man needed to live in society, which was his natural destiny. The moral sense did not, however, provide an a priori catalogue of ethical rules. Right and wrong differed in different societies, and the criterion which Jefferson accepted was the general utility for a given society. Thus he blended together, as he had already done in listing the pursuit of happiness as a natural right, concepts associated with philosophical utilitarianism and natural rights doctrine. The political implications of this element of ethical relativism are clear: stable and successful self-government requires some degree of ethical consensus. The loss of this, marked by a definite geographical line, was at the root of his fear of the Missouri Compromise.

Just as the content of the moral sense was shaped by the society in which an individual lived, so was its effective operation influenced by the environmental situation, and particularly by the economic circumstances of the individual. Jefferson's preference for an agrarian economy and his idealization of the independent farmer was tinged with romanticism, but it also reflected his conviction that representative government required a secure and relatively prosperous economic base in order to function successfully. Jefferson saw the farmer as economically independent, and therefore not likely to surrender his judgment as a citizen to aristocratic or demagogic influences. His distrust and dislike of cities, though undoubtedly intensified by his personal love of the kind of life Monticello afforded, stemmed from his conviction that the conditions of urban life, particularly for the poorer classes, were not conducive to the exercise of virtue in either public or private action. Extreme economic poverty plus the sheer crowded life of the city forced men into a bitter fight for existence, making it nearly impossible for them to satisfy their legitimate needs without jeopardizing those of others. Jefferson's view of city life, especially European, was similar to Hobbes's conception of the state of nature as a war of all against all. Man's moral sense, in situations where self-interest habitually tended to assume the form of self-preservation, could not be relied upon either as the bond of social harmony or as the guarantee of responsible citizenship. Thus Jefferson's belief in self-government, and his confidence in the capacity of a people to sustain it successfully, was not abstractly optimistic, but was limited to certain prerequisite social and economic conditions. The United States possessed them, and his faith in the future of republican government for the American people was virtually unlimited—provided they developed and maintained proper political and social institutions.

Education and Freedom of the Press.—Among these were an effective educational system and a free press. The latter was considered necessary for an informed public opinion. This also was one of the purposes of free public education. It was impossible for an ignorant people to make rational and responsible decisions about public affairs; they must be literate, and have access to information about their government. Another purpose of education was to develop a natural aristocracy, which would supply the leadership so essential to representative government. For Jefferson did not believe that men were equal in virtue and intelligence, and he did not believe that government was a simple job easily mastered by the common man. He assumed that men of superior capacities were those naturally suited for public office, and his scheme of education was intended to insure that such men, regardless of their economic circumstances, were given an opportunity to develop themselves.

Government Structure.—Jefferson's ideas on the formal institutional structure of government were much like those of the majority of Americans of his day. He believed in the principle and practice of the separation of powers as a necessary safeguard against abuse of power; he criticized the Virginia constitution of 1776 because, though it expressed the principle, it did not provide for sufficient separation in practice. He approved the general structure provided by the federal constitution of 1787, though at first he criticized the failure to limit the tenure of the president. His severest criticism of this constitution was directed toward its omission of a bill of rights that would place essential liberties of the individual clearly beyond the reach of the federal government. At this time (1787–88) he seemed to regard the courts as proper guardians of these rights against legislative and executive action, and apparently assumed that judicial review of legislation would be an ordinary and legitimate function of the judiciary. After John Marshall's decision in *Marbury* v. *Madison* (1803), however, Jefferson opposed judicial review on the grounds that it constituted a threat to the people's liberties from that department of the government least subject to popular control.

His views on the relationship between the federal and state governments are well known but sometimes misunderstood. His part in bringing about the cession by Virginia to the United States of Virginia's vast western territories, his support of the movement to strengthen the central government during the 1780s, his approval of the great increase in its powers under the constitution of 1787, his purchase of Louisiana, his willingness to use the power of the central government to its fullest in the Embargo act, his dread that the ultimate effect of the Missouri Compromise would be to break the union—all indicate his desire for and belief in a strong nation, and even a strong national government. But this nationalism was balanced by and indeed permeated with the conviction that a very large sphere of the interests of the citizens could be best served either by state or local governments, or by no governmental action at all. The major difference between Jefferson and Hamilton was that the latter was willing to subordinate the interests of the individual to the cause of national greatness, and Jefferson was not. This difference was associated with their respective opinions on the proper interpretation of the constitution: Jefferson believed that a strict or narrow interpretation was essential to the preservation of the people's liberties; Hamilton believed that a broad or flexible interpretation was essential for an effective central government and for the pursuit of national greatness.

Spirit of Tolerance.—In addition to institutional arrangements, one further factor was believed by Jefferson to be necessary for the success of representative government. That was a spirit of tolerance with regard to the political ideas and attitudes upon which men were bound to differ, sometimes passionately. Jefferson attributed these differences to the fallibility of human reason —"slipperiness" was his frequent term—and should be regarded as comparable to differences in physical form and feature. They should not be taken as cause for personal enmity, nor be permitted to destroy the harmony of social intercourse, which Jefferson valued almost as much as he did liberty itself. It can be said that he sensed and feared, in the sharp conflict of the 1790s, the divisive and destructive effects of ideologically oriented policies in party politics. His preference on so fundamental a denial of his principles as slavery was a politics of compromise, moderation, conciliation and patience. Perhaps this preference was sustained by his belief in progress. Although, like most Americans, he remained more skeptical about the perfectibility of human reason and virtue than European men of the Enlightenment, he did not doubt that man's future would be one of progress, not of decline.

One of the most eloquent of his letters expressed this confidence. "Some men look at constitutions with sanctimonious reverence, and deem them like the ark of the covenant, too sacred to be touched. They ascribe to the men of the preceding age a wisdom more than human, and suppose what they did to be beyond amendment. I knew that age well; I belonged to it, and labored with it. It deserved well of its country . . . But I know also, that laws and institutions must go hand in hand with the progress of the human mind. As that becomes more developed, more enlightened, as new discoveries are made, new truths disclosed, and manners and opinions change with the change of circumstances, institutions must advance also, and keep pace with the times."

In 1813 Jefferson and John Adams, estranged for several years because of political differences which put them in competition with each other, became reconciled. They entered upon a rich and warm correspondence, each relieving the loneliness of the other, and both reviewing the years in which they had done so much to shape the nation whose beginning was marked by the Declaration of Independence. On the 50th anniversary of its proclamation, July 4, 1826, both men died. For his tomb, Jefferson had chosen this epitaph: "Here was buried Thomas Jefferson, author of the Declaration of American Independence, of the statute of Virginia for religious freedom, and father of the University of Virginia."

See also references under "Jefferson, Thomas" in the Index.

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JEFFERSON CITY, the capital of Missouri, U.S., and the seat of Cole county, is on the south bank of the Missouri river, near the centre of the state. Missouri was one of the first states created from the Louisiana Purchase and its capital was named in honour of Pres. Thomas Jefferson. An act of congress gave the land and set the location on the Missouri river near the mouth of the Osage. The present site was selected in 1821; Daniel M. Boone, son of the famous frontiersman, laid out the town, providing for a park on each street (not carried out); the city was incorporated in 1825. Early settlers came from the south, principally from Virginia, Tennessee and Kentucky, traveling by river boat down the Ohio and up the Missouri.

The 1830 census showed a population of 3,023, including 300 slaves. After 1848 there arrived waves of German immigrants, who introduced German architecture and a preference for brick houses (the city ordinances once prohibited the construction of frame dwellings). During the American Civil War the southern settlers sympathized with the Confederacy while the German immigrants supported the Union; a specially elected state convention voted almost unanimously to remain in the Union but the governor defied the legislature and began to recruit volunteers for the Confederacy. Union troops occupied the city in June 1861, and Missouri remained in the Union.

Status as the state capital gives the city its major importance; most of the residents work for state agencies. The impressive capitol building, constructed of Carthage marble in Italian Renaissance style between 1911 and 1918, was dedicated in 1923 and cost $4,215,000. In addition to legislative chambers and executive offices, it contains a military museum and educational exhibits. Exterior decorations include James E. Fraser's statue of Jefferson and Karl Bitter's group representing the signing of the Louisiana Purchase treaty. The most famous of the interior decorations are the murals in the house lounge, depicting the history of Missouri, painted by Thomas Hart Benton; the artist's selection of unconventional aspects of Missouri history (such as the "Frankie and Johnnie" story) created spirited controversy in the legislature over his fee (eventually paid in full).

In 1833 the legislature located the state prison in Jefferson City, which later prevented the city from being considered as the site for the state university. The prison for men is a few blocks from the capitol building, and several branch prison farms are located in the nearby countryside. Lincoln university, founded in 1866 by Negro veterans of the Union army, became the state college for Negroes in 1879; it is now fully integrated. Other important state buildings include the supreme court building (which faces the capitol and houses a well-known law library), the state office building and the highway commission building.

Jefferson City is the trading centre for a large agricultural region. Local industries include the printing and binding of books and the manufacturing of shoes, clothing and electric appliances. Local libraries include the Cole County Historical library, the public library and the Missouri state library, which has a loan service for libraries throughout the state.

For comparative population figures *see* table in MISSOURI: *Population.* (J. A. DE.)

JEFFERSONVILLE, a city of southern Indiana, U.S., opposite Louisville, Ky., on the north bank of the Ohio river at the head of the falls and 114 mi. S.E. of Indianapolis; the seat of Clark county. Built on land which old Ft. Finney (Ft. Steuben was a later designation) occupied during 1786–91, Jeffersonville was laid out in 1802 according to a plan suggested by Thomas Jefferson, for whom it was named; it was incorporated as a town in 1815 and chartered as a city in 1830.

It is the site of the southeastern centre of Indiana university and of the Howard Steamboat museum. Shipyards, foundries, chemical and aluminum plants are among the industries of the area. The city's economy, like that of the Ohio valley generally, expanded considerably as a result of increasing industrialization during and after World War II. During the war one of the world's largest powder plants was located there. For comparative population figures *see* table in INDIANA: *Population.* (G. O. H.)

JEFFREY, FRANCIS JEFFREY, LORD (1773–1850), literary critic and Scottish judge, best known as the editor of the *Edinburgh Review,* was born in Edinburgh on Oct. 23, 1773. He was educated at the high school of Edinburgh, at the universities of Glasgow and Edinburgh and, for a brief period, at Queen's college, Oxford. Admitted, in 1794, to the Scottish bar, he discovered that his Whig politics were seriously prejudicial to advancement in his profession. Sydney Smith, then in Edinburgh, suggested that he, Jeffrey and some of their friends might cooperate in establishing a critical periodical. The result was the publication, in Oct. 1802, of the *Edinburgh Review.* The first number was edited by Smith. In 1803 Jeffrey was appointed editor; he continued in this capacity and as a writer for the *Review* until 1829. In these years he also built up a reputation as an advocate. In 1820 he was elected lord rector of Glasgow university, and, in 1829, dean of the faculty of advocates. In 1830 the Whig party, which the *Edinburgh Review* had powerfully supported, came into office, and Jeffrey was appointed lord advocate. As a member of the house of commons he introduced the Scottish Reform bill in 1831. In 1834 he was made a judge and assumed the title of Lord Jeffrey. He died in Edinburgh on Jan. 26, 1850.

The *Edinburgh Review* enjoyed an immediate triumph. "The effect," Jeffrey's biographer, Lord Cockburn, wrote of its first number, "was electrical. . . . It was an entire and instant change of every thing that the public had been accustomed to in that sort of composition. The old periodical opiates were extinguished at once." The *Review* exerted, for a considerable period, a powerful influence throughout the English-speaking world. Macaulay asserted, in 1843, that he had read and reread Jeffrey's old articles until he had them by heart. A writer in the *North American Review,* published in Boston, described Jeffrey, in 1852, as "one who, both in literature and politics, during the first quarter of the present century, did more than any other man to guide the taste, form the opinions, and direct the conduct of the thinking portion of the English people." "It is hardly possible," Lewis Gates of Harvard wrote in 1894, "to glance through the life of any literary man of the early part of the century without chancing on evidence of Jeffrey's popularity and prestige."

Part of this success must be attributed to the adroitness with which Jeffrey managed his at first inexperienced team. Cockburn

asserted that not one of Jeffrey's associates could have held these elements together for a single year. J. H. Millar in his *Literary History of Scotland* (1903) described Jeffrey as "certainly among the greatest of British editors." Before 1802 periodical criticism had been conducted, for the most part, by publishers' hirelings. Jeffrey found among his first contributors a nervousness, which he himself shared, lest their engaging upon writing of this nature should involve a serious loss of prestige. It was at once made clear that there would be no subservience to booksellers and that all work would be adequately remunerated. For this raising of their status every subsequent writer of review articles is indebted to the *Edinburgh's* managers.

At the same time, this determination to be fearless gave rise to a savagery in criticism that later periodicals copied and from which Jeffrey cannot be absolved. It assisted, in the long run, in highlighting the occasional fallibility of his judgments. This was particularly true in connection with his criticisms of Wordsworth. There was a tendency in the later 19th century to dismiss Jeffrey as a mere bludgeoner, hidebound by 18th-century prejudices and entirely incapable of understanding many of the greatest literary works that appeared in his period. Saintsbury, however, asserted in 1887: "As a literary critic, he is important at this very day, and perhaps more important than he was in his own." Gates spoke, in 1894, of causes that were tending to gain for Jeffrey a second hearing. Merritt Hughes declared, in 1921, that Jeffrey's originality was "only beginning to be appraised." Later scholars have suggested that, while it is unlikely that the essays Jeffrey wrote for the *Edinburgh Review* will be widely reread except by specialists, they remain important to students who desire to discover how the great authors of the early 19th century were regarded in their own time, and that there is still room for revaluation of Jeffrey's critical findings.

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JEFFREYS, GEORGE JEFFREYS, 1ST BARON OF WEM (1645–1689), lord chancellor of England, who was deeply involved in the complex and dangerous politics associated with the reigns of Charles II and James II, was born at Acton in Denbighshire, the son of John Jeffreys, whose forebears had been members of the Welsh gentry for many generations. In older accounts of Jeffreys' life his birth date is usually given as 1648; more recently discovered documents, however, appear to establish that he was born on May 15, 1645. He was educated at Shrewsbury, St. Paul's, and Westminster and spent one year, without receiving a degree, at Trinity college, Cambridge. A legend persists that Jeffreys' father advised him against entering the law, fearing that his son might come to a violent end. Nevertheless, Jeffreys was admitted to the Inner Temple in 1663 and was called to the bar in 1668.

It has frequently been asserted that Jeffreys' legal learning was small, but it cannot be doubted that he possessed shrewd intelligence, great powers of interrogation and cross-examination, a forceful, if overbearing, personality and boundless ambition. Within three years of his call to the bar he was elected common serjeant of the city of London and, while holding that office, continued his practice in the courts. As common serjeant he sat at the trial of the religious sectarian Lodowick Muggleton (*q.v.*), a case distinguished by Jeffreys' harsh and wrathful denunciation of the defendant when sentence was imposed on him. Feeling that continued advancement required adherence to the court party, Jeffreys attached himself to various influential persons, particularly to the king's mistress, the duchess of Portsmouth, and the king's chief minister in parliament, the earl of Danby. Preferment followed rapidly. In 1677 he was appointed solicitor-general to the duke of York (later James II) and in the same year was knighted. In 1678, after intervention by Charles II in his behalf, he was elected recorder of London.

In the summer of 1678 Titus Oates (*q.v.*) made his first revelations of the so-called "popish plot" and implicated various individuals, some of considerable prominence, in an alleged conspiracy against English Protestantism and the life of the king. In the public hysteria that followed, numbers of persons were brought to trial and convicted of treason on the testimony of Oates, his associate William Bedlow and others. Jeffreys played a prominent role in many of these trials as prosecuting counsel or judge. Later, in 1685, when Oates was discredited and charged with perjury, Jeffreys sat at his trial and imposed a stringent sentence upon the defendant. Thereafter Jeffreys' prominence in the court party became increasingly conspicuous. He vigorously opposed the Exclusion bill, which would have barred the duke of York from the throne, and in the controversy that preceded the delay in summoning the parliament in 1680 (in order to prevent passage of the Exclusion bill) he was one of those who initiated the movement of the "abhorrers" in opposition to the demands of the "petitioners" for prompt summoning of the national legislature. In 1680 he was appointed chief justice of Chester and was sworn in as one of the king's serjeants. When parliament convened in October of the same year, Jeffreys' enemies in the commons struck out against him, demanding by resolution that the king remove him from all public offices. To avoid impeachment or other retaliation, Jeffreys surrendered the recordership of London. This incident, however, provided no serious check to his career. Shortly thereafter he became chairman of the Middlesex sessions at Hicks' Hall and in 1681 was created a baronet. In 1683 he prosecuted and obtained a conviction of Lord Russell in a case arising out of the Rye House plot. In the same year, at the age of 38, he was elevated to the office of lord chief justice of the king's bench and a few days later was sworn a member of the privy council. As lord chief justice he presided at the trial of Algernon Sidney (*q.v.*) for high treason, which resulted in the conviction and execution of the defendant. In 1685 he was rewarded with a peerage as Baron Jeffreys of Wem, an honour never before conferred on a chief justice during his tenure of office.

Jeffreys' infamy rests primarily on his role in the "bloody assizes" of 1685. Following the abortive insurrection of the duke of Monmouth against the throne of James II, Jeffreys and four other judges were commissioned to try the rebels and to pacify the west, from which Monmouth had recruited his principal support. The trials generally were conducted with a ferocity which has, with reason, made Jeffreys' name notorious. The numbers of persons actually executed cannot be stated with certainty. Macaulay sets the figure at 320; other estimates range as high as 600 to 700. Modern opinion tends to a much lower figure, perhaps between 150 and 200. Many of those convicted escaped the death penalty by being transported in slavery to the colonies. Others were permitted to purchase their pardons. To some degree, Jeffreys profited personally from these transactions. Severe as was Jeffreys' conduct, his performance was strongly approved by the king and shortly thereafter he was made lord chancellor.

In the initial period of James II's reign, Jeffreys was one of the most influential of the king's advisers. As James's measures became more extreme, Jeffreys appears to have felt considerable disquiet; despite his qualms, however, he permitted himself to be closely identified with some of the government's most unpopular policies. To govern and coerce the Church of England, James in 1686 revived the ecclesiastical commission, over which Jeffreys presided. To advance the king's policy of preferment of Roman Catholics, Jeffreys applied coercive pressure on the authorities of Cambridge university, who in 1687 refused to confer degrees on a Benedictine monk, and on the fellows of Magdalen college, Oxford, who declined to elect as their president a disreputable nominee of the king. Despite the peril of his position upon the approach of William of Orange, Jeffreys stood by the king and continued to perform the functions of his office. Not until James fled the country did Jeffreys make his own effort at escape. The attempt failed when, in the disguise of a common sailor, he was recognized and arrested at a tavern in Wapping. He narrowly escaped death at the hands of angry mobs but was ultimately con-

veyed to the Tower. On April 18, 1689, he died there, not having yet been brought to trial.

The generations that followed him have accepted Jeffreys as the prototype of the brutal and subservient English judge. While a completely objective appraisal of his personality and career is difficult, modern scholarship has tended to soften the indictment. The revolution of 1688 which brought about his fall placed his reputation in the hands of his bitterest enemies. The tradition, so established, was accepted with small modification by such historians as Macaulay and Lord Campbell. Many of the examples advanced to demonstrate Jeffreys' peculiar brutality, however, are wholly typical of the harsh criminal procedures of his day. Sir James F. Stephen, the great historian of English criminal law, concluded that the trials conducted by Jeffreys of the conspirators in the Rye House plot and of Alice Lisle (*q.v.*), the most prominent victim of the "bloody assizes," were not tainted by illegality. In his later years Jeffreys suffered from stone, and there is reason to suspect that some of his most flagrant outbursts from the bench, such as those displayed at the trial of the Puritan divine Richard Baxter (*q.v.*), were associated with the agonies of that disorder. In the trial of civil litigation Jeffreys' performance was creditable. Though his services as lord chancellor did not reach the high levels of certain of his predecessors, such as Nottingham, he succeeded in instituting valuable reforms in the chancery practice of his day. Nevertheless, it remains true that much of Jeffreys' conduct is wholly incapable of palliation. Even in an age in which the courts were employed by royal power as an instrument of political repression, Jeffreys' career is remarkable in reflecting the worst tendencies of his time.

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(F. A. A.)

JEFFREYS, SIR HAROLD (1891–), British astronomer and geophysicist noted for his contributions to a wide variety of scientific topics, was born at Fatfield, County Durham, on April 22, 1891. He studied mathematics at St. John's college, Cambridge, and became a fellow of the college in 1914. His astronomical work includes researches into the origin of the solar system and the theory of the variation of latitude. In geophysics he investigated the thermal history of the earth, and calculated comprehensive and accurate travel times of seismic waves. Meteorological studies include work on wind dynamics. Jeffreys also worked on probability theory and related matters of scientific method, on hydrodynamics and elasticity and on methods of general mathematical physics. He was Plumian professor of astronomy at Cambridge, 1946–58, and was knighted in 1953. Other honours include the gold medal of the Royal Astronomical society (1937) and the royal medal of the Royal society (1948).

Among his principal publications are: *The Earth,* 3rd ed. (1952), *Scientific Inference,* 3rd ed. (1957), *Earthquakes and Mountains,* 2nd ed. (1950), *Methods of Mathematical Physics,* with Bertha Swirles Jeffreys, 3rd ed. (1956). (R. A. L.)

JEHOIACHIN (in the Douai version of the Bible, JOACHIN), son of Jehoiakim (*q.v.*), and king of Judah. His history is related in II Kings xxiv and II Chron. xxxvi. Jehoiachin came to the throne at the age of 18 in the midst of the Chaldean invasion of Judah, and is said to have reigned three months. He was compelled to surrender to Nebuchadrezzar II and was carried off to Babylon (597 B.C.). Eight thousand people of the better class (including artisans, etc.) were removed, and the Temple was partially despoiled. Nearly 40 years later, Nebuchadrezzar died, and his successor released Jehoiachin.

JEHOIAKIM (in the Douai version of the Bible, JOAKIM), son of Josiah (*q.v.*) and king of Judah (II Kings xxiii, 34 *et seq.;* Jer. xxii, 13–19). On the death of Josiah at Megiddo his younger son Jehoahaz (or Shallum) was chosen by the Judaeans, but the Egyptian conqueror Necho removed Jehoahaz to Egypt, appointing in his stead Jehoiakim. For a time Jehoiakim remained under the protection of Necho and paid heavy tribute; but with the rise of the new Chaldean empire under Nebuchadrezzar II and the overthrow of Egypt at the battle of Carchemish (605 B.C.) a vital change occurred. After three years of allegiance the king revolted. Invasions followed by Chaldeans, Syrians, Moabites and Ammonites, perhaps the advance troops dispatched by the Babylonian king; the power of Egypt was broken and the whole land came into the hands of Nebuchadrezzar. It was at the close of Jehoiakim's reign, apparently just before his death, that the enemy appeared at the gates of Jerusalem, and although Jehoiakim "slept with his fathers" his young son, Jehoiachin (*q.v.*), was destined to see the first captivity of the land of Judah (597 B.C.).

JEHOL: *see* CH'ENG-TE.

JEHORAM (in the Douai version of the Bible, JORAM), the name of two biblical kings.

1. Jehoram, the son of Ahab and Jezebel, and king of Israel in succession to his brother Ahaziah (*qq.v.*), maintained close relations with Judah, whose king seems to have recognized his suzerainty and came to his help against Moab, who had revolted (II Kings i, 1; iii). The result of the campaign seems to have been a defeat for Israel. Together with Ahaziah, king of Judah, Jehoram endeavoured to recover Ramoth-Gilead from Hazael, king of Syria. He was wounded in the fighting around that town, and during his absence a revolution took place; Jehu (*q.v.*) seized the throne, putting to death all the living members of Ahab's family including Jehoram and Jezebel. These events seem to have occurred in or about the year 841 B.C.

2. Jehoram, son of Jehoshaphat (*q.v.*) and king of Judah, married Athaliah (*q.v.*), daughter of Ahab, and was thus brother-in-law of the Jehoram discussed above, and contemporary with him. In his days Edom and Libnah revolted (II Kings viii, 20–22), perhaps in concert with one another. The Chronicler (II Chron. xxi, 1; xxii, 1) adds many details: on ascending the throne Jehoram massacred his kinsmen, was condemned to death from disease by Elijah and was utterly defeated by a great invasion of Philistines and Arabs. He died a year before his namesake of Israel; *i.e.,* probably in or about 842 B.C.

JEHOSHAPHAT (in the Douai version of the Bible, JOSAPHAT), was the son of Asa and king of Judah in the early part of the 9th century B.C. He seems to have been a subordinate ally of the house of Omri; his son Jehoram (*q.v.*) married Ahab's daughter Athaliah, and he himself took part in Ahab's fatal expedition to Ramoth-Gilead and in the attack on Mesha, king of Moab, by Jehoram, king of Israel. He engaged in distant trading enterprises, but his attempt to establish a fleet at Ezion-Geber (near the modern 'Aqaba) failed. There is also an account of an attack on Jehoshaphat by an army of Moabites, Ammonites and Edomites, in which he was completely victorious (II Chron. xx; I Kings xxii).

JEHOVAH, an erroneous rendering of the name of the God of Israel. The error arose among Christians in the middle ages through combining the consonants *Yhwh* (*Jhvh*) with the vowels of *Adonai,* "Lord," which the Jews in reading the Scriptures substituted for the sacred name, commonly called the tetragrammaton,

as containing four consonants. *See* YAHWEH.

JEHOVAH'S WITNESSES, formerly known as International Bible Students association, officially adopted its present name in 1931. Its members (all of whom are considered ministers) number about 290,000 in more than 4,000 congregations in the United States; they are also active in about 190 other countries and claim a total world membership of more than 1,000,000. The body is governed by the Watch Tower Bible and Tract Society of Pennsylvania, with headquarters in Brooklyn, N.Y. The group was organized in 1872 by Charles Taze Russell (*q.v.*), popularly known as Pastor Russell. His successor in leadership was Joseph Franklin Rutherford (Judge Rutherford; 1869–1942), who in turn was succeeded by Nathan Homer Knorr (1905–). The body was an outgrowth of the late-19th-century adventist movement.

The Witnesses maintain a complete separation from and are critical of all world organizations, especially governments, which they regard as allies of Satan; for this reason (not because of any pacifist convictions) they refuse to salute the flag or perform military service. They regard both Roman Catholic and Protestant churches as misled by Satan, especially the former. The one true God, the Witnesses believe, is Jehovah God, and they rely more heavily on the Old Testament than does any other Christian denomination. The righteous in the Bible, they believe, testify to the setting up of the Kingdom of God, the Theocracy. Jesus Christ is not God but God's agent in establishing the Theocracy; as perfect man, he is man's redeemer, reconciling him to God. The Witnesses do not believe in an eternal hell; the wicked are to be destroyed. They believe in a millennium, the picture of which they draw from apocalyptic writings, especially the Book of Revelation. They baptize by immersion, disapprove of divorce except on grounds of adultery and discourage drunkenness and the use of tobacco.

The Witnesses use tracts, magazines and books as well as recordings, preaching and visitation in the vigorous presentation of their message. Periodicals include the *Watchtower* (study of which constitutes about half the Sunday services) and *Awake* (both biweekly) and the annual *Yearbook of Jehovah's Witnesses* (1933 *et seq.*).

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JEHU, a king of Israel, son of Jehoshaphat (*q.v.*) and grandson of Nimshi. He was at first general of Ahab and Jehoram (*qq.v.*) of Israel and was noted for his furious driving of the chariot. During the joint expedition of Jehoram of Israel and Ahaziah of Judah, the former was wounded and retired to Jezreel, where he was visited by the king of Judah. Instigated by the prophetic party and supported by the Rechabites, Jehu organized a revolution, hastened to Jezreel, where he put to death both Jehoram and Ahaziah, while he had the whole of the family of Ahab assassinated. The movement was the result of patriotic hostility to the foreign political theories and the religious innovations introduced by Jezebel (*q.v.*), Ahab's wife, which offended both the democratic feeling and the enthusiasm for Yahweh, which were characteristic of Israel. Thus not only Jezebel herself but also large numbers of Baal worshipers were put to death. In the course of an expedition against Damascus, undertaken in 842–841 B.C., Shalmaneser III received tribute from Jehu. This was probably paid in order to secure Assyrian protection for the new regime, but it did not prevent the loss of much Israelite territory to the east of Jordan, or continuous war between Jehu and Hazael, king of Damascus, after the withdrawal of the Assyrian armies.

Jehu is also the name of a prophet of the time of Baasha and Jehoshaphat (I Kings xvi; II Chron. xix, *et seq.*). *See* also AHAZIAH; JEHORAM.

JELAČIĆ, JOSIP, COUNT (1801–1859), Croatian political and military leader whose services to the Austrians against Hungarian nationalism failed to secure freedom for his own country, was born on Oct. 16, 1801, at Petrovaradin. As a young Austrian officer he served in Italy and Bosnia. In March 1848, when revolution had broken out in Vienna and when the nationalists were taking control of Hungary, the Austrian imperial government promoted Jelačić lieutenant general and appointed him ban of Croatia and commander of all troops there. Jelačić immediately occupied Rijeka (Fiume) and Medjumurje and reintegrated them with Croatia; and at his instigation the Croatian diet proclaimed the whole country's independence from the Hungarian government. The diet likewise gave official status to the national language, abolished serfdom, decreed freedom of the press, of education and of religion, and set up a national army under Jelačić's command. When Lajos Batthyány, the Hungarian prime minister, ordered Jelačić to appear in Buda on a charge of high treason, the ban took no notice. Then, in June, Batthyány obtained from the Austrian court at Innsbruck a manifesto condemning the separatist movement in Croatia. A week later (June 19) Jelačić himself appeared at Innsbruck and was well received, though he was dismissed from his post. As the Hungarian revolutionary movement grew more extreme, however, the emperor Ferdinand on Sept. 4 reinstated Jelačić. A week later the ban led his troops into Hungary. At the beginning his campaign was not successful; but his victory at Schwechat in Oct. 1848 over Arthur Görgey, who was marching on Vienna, contributed much toward crushing the Hungarian revolution.

The Croats received little reward for Jelačić's services to the Habsburg dynasty: once peace had been restored, the new emperor, Francis Joseph, introduced an absolutist regime. Jelačić remained governor of Croatia and of the Military Frontier (Vojna Krajina) but offered almost no resistance to the Habsburg policy. In 1852 he succeeded in having the Zagreb bishopric elevated to an archbishopric, thereby making the Croat Catholic hierarchy independent of Hungarian church authorities. He was created count in 1855. He died on May 20, 1859, on his estate near Zagreb. A volume of his *Gedichte* (poems) was published in 1851.

See Baron Joseph Neustädter: *Le Ban Jelačič* . . . (1941).

(A. S. PA.)

JELENIA GORA (Ger. HIRSCHBERG), a district capital in southwest Poland situated 60 mi. W.S.W. of Wroclaw city in the Wroclaw *wojewodztwo* (province). It lies in the western Sudetes (Sudety) in the centre of a basin which derives its name from it. Pop. (1960) 50,000. The Bobr river, a tributary of the Oder, flows through Jelenia Gora, providing picturesque scenery below the town, which is a tourist centre. Visitors are attracted by the thermal springs in nearby Cieplice Slaskie Zdroj and the many interesting buildings in the town itself and the surrounding district. There are a museum and two theatres. Jelenia Gora is a road and railway junction. Weaving has been done there since the 16th century and glass manufactured since the 17th. Other industries include the making of machinery, electrical equipment, chemicals (artificial textiles) and paper. Founded in the 13th century, Jelenia Gora obtained town rights *c.* 1288. In 1392, along with the whole Swidnica-Jawor principality, it was made subject to Bohemia, being handed over later to the Habsburgs and in 1742 to the Prussians. It returned to Poland in 1945.

(T. K. W.)

JELGAVA (YELGAVA; Rus. MITÁVA; Ger. MITAU), a town of the Latvian Soviet Socialist Republic, U.S.S.R., on the Lielupe (Ger. Aa) river, lies 41 km. (25 mi.) S.W. of Riga. Pop. (1959) 36,300. In 1926 the first Latvian sugar mill was built in Jelgava. There are also linen, leather, agricultural machinery and other manufactures, and brick kilns in the neighbourhood. The Teutonic Order (*see* TEUTONIC ORDER, KNIGHTS OF THE) erected a fortified castle in 1265 which was burned down in 1345. In 1561 Jelgava became the residence of the dukes of Courland (*q.v.*) but when the dukedom was annexed to Russia in 1795 Jelgava became a district town. The Academia Petrina, founded in 1775, afterward became the Gymnasium Illustre. In 1738–72 a palace was built for Duke Ernst Biron and there Louis XVIII spent his years of exile. In World War I Jelgava was in German hands from 1915 to 1919 and on their retreat the Germans burned the palace, Gymnasium and other buildings. In 1939 the Latvian Agricultural academy started its work in the restored palace. During

World War II the centre of the town was destroyed in 1944 when the town was retaken from the Germans by the Red army.

(J. A. Bo.)

JELLICOE, JOHN RUSHWORTH JELLICOE, 1ST EARL (1859–1935), British naval officer who commanded the British fleet at the battle of Jutland, was born Dec. 5, 1859, at Southampton, the son of J. H. Jellicoe, a captain in the mercantile marine. Educated at Rottingdean, he entered the navy as a naval cadet in 1872. He soon developed an interest in gunnery and joined the Royal Naval college in 1883 for the theoretical part of the course for gunnery lieutenant, where he won a special £80 prize. The following year he spent in H.M.S. "Excellent," and became a fully qualified gunnery officer. From that time on gunnery was his specialty, though his interests were by no means confined to that branch.

Jellicoe's first seagoing ship as a gunnery lieutenant was H.M.S. "Monarch." He received the board of trade silver medal for his action in saving the lives of the crew of a stranded steamer (1886). After two years on the senior staff of the Gunnery school, he was appointed to the admiralty as an assistant to the director of naval ordnance. In 1891 he was promoted to commander, and shortly afterward was appointed to H.M.S. "Victoria," flagship of Adm. Sir George Tryon, commander in chief of the Mediterranean fleet.

After a three-year commission in the battleship "Ramillies" he was promoted captain on Jan. 1, 1897, and served on the ordnance committee. In 1898 he was appointed to the command of H.M.S. "Centurion," where he became flag captain to Adm. Sir Edward Seymour, commander in chief of the China station. As the latter's chief of staff he took part in the expedition to relieve the legations in Peking during the Boxer rising in 1900. During these operations Jellicoe was badly wounded. He was subsequently appointed companion of the Bath.

Service at the Admiralty.—He returned to the admiralty in 1902 to be the naval assistant to the controller (third sea lord). In Aug. 1903 he went to sea again to take command of the armoured cruiser "Drake." The year 1905 saw him director of naval ordnance at the admiralty. During his period of office he did much to further the advance of long-range firing and to assist the development of naval gunnery on lines that more closely approximated the real conditions of war. In 1908 he rejoined the admiralty as third sea lord and controller of the navy, the first sea lord, Sir John Fisher (*q.v.*), having by this date decided that he was the most suitable officer to command the grand fleet in the event of war. In Dec. 1910 he was appointed acting vice-admiral in command of the Atlantic fleet, being confirmed in that rank in the following November. At the end of the year he transferred his flag to H.M.S. "Hercules," on appointment to the command of the 2nd division of the home fleet.

In 1912 important gunnery experiments were carried out by two battleships of this division, the "Thunderer" and "Orion," the former being fitted with the system of director firing that Sir Percy Scott had been perfecting. The trials culminated in competitive firings under Jellicoe's supervision, and the system was adopted as the primary one for laying and firing the guns of practically all classes of H.M. ships. After a year in this command Jellicoe returned to the admiralty to rejoin the board as second sea lord.

World War I.—On the eve of war, Jellicoe was sent to join the home fleet at Scapa as second in command under Adm. Sir George Callaghan and was soon appointed commander in chief with acting rank of admiral. He was confirmed in his rank in March 1915, and for two years organized and trained the grand fleet and kept it ready for action. His command was put to the test at the battle of Jutland (*q.v.*) on May 31, 1916. His tactics were severely criticized at the time, but it is now accepted that he achieved a strategic victory which left the German high seas fleet ineffective during the remainder of the war. Toward the end of 1916 Jellicoe left his last command afloat to become first sea lord. During the next year his efforts to combat the new German submarine campaign were not effective until the convoy system was adopted at the insistence of the prime minister, Lloyd George, who was responsible for Jellicoe's retirement from the admiralty at the end of 1917. After the Armistice Jellicoe was sent on a special mission to visit the dominions and advise on the postwar organization of their navies. On this tour he flew his flag in H.M.S. "New Zealand." Promoted to admiral of the fleet in 1919, he became governor of New Zealand in 1920.

For his services in World War I Admiral Jellicoe received the thanks of parliament and a grant of £50,000, and at the end of 1918 he was raised to the peerage as Viscount Jellicoe of Scapa, subsequently taking the additional title of Viscount Brocas of Southampton. On his return from New Zealand and in recognition of his services as governor he was, in 1925, created an earl. He died on Nov. 20, 1935, and was buried in St. Paul's cathedral.

He published *The Grand Fleet, 1914–16, Its Creation, Development and Work* (1919) and *The Crisis of the Naval War* (1921). *See* also R. H. Bacon, *Life of John Rushworth, Earl Jellicoe* (1936); D. Lloyd George, *War Memoirs* (1933–37). (E. A.; X.)

JELLINEK, ADOLF (1821–1893), rabbi and Judaic scholar, whose gifts as an orator and advocacy of a synthesis between tradition and modern interests gained him a reputation as the most powerful Jewish preacher of the time, was born at Drslawitz, Moravia, on June 26, 1821. From 1845 to 1856 he was a preacher in the Jewish community in Leipzig, Ger., and from 1856 to 1893 in Vienna, Aus. Over 200 of his sermons were published (*Predigten*, 3 vol., 1862–66, and nine smaller collections, 1847–82).

Jellinek's scholarly activity comprised the fields of Cabala and midrashic literature. He published the writings of Abraham Abulafia, the 13th-century cabalist (*e.g., Sefer ha-Oth*, "The Book of the Sign," 1887); recognized the 13th-century mystic Moses de León as the principal author of the *Zohar*, the fundamental text of the Jewish cabalists; and postulated that the *Zohar* was written in an attempt to counteract the rationalist trend among De León's educated contemporaries (*Moses Ben Schem-Tob de Leon*, 1851). He also traced the influence of Christian mystical ideas and terminology on Jewish cabalists (*Beiträge zur Geschichte der Kabbala*, 1852). In the midrashic field Jellinek contributed editions of hitherto unpublished haggadic treatises, ancient and medieval homilies and documents of messianic and apocalyptic thinking (*Beth Ha-Midrash*, "The House of Study," 6 vol., 1853–77). In addition, he wrote ethnological studies and on Hebrew bibliography. Jellinek also ranks among the more prominent contributors to the scientific study of Judaism (*Wissenschaft des Judentums*) in the 19th century. He died at Vienna on Dec. 29, 1893.

See M. Rosenmann, *Adolf Jellinek, sein Leben und Schaffen* (1931); Meyer Waxman, *A History of Jewish Literature*, vol. iii (1945).

(N. N. G.)

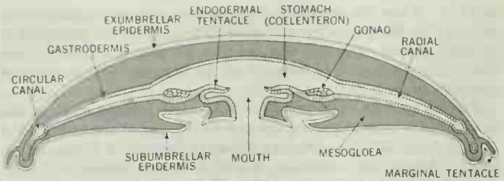
JELLY: *see* FOOD PRESERVATION (IN THE HOME): *Jams and Jellies.*

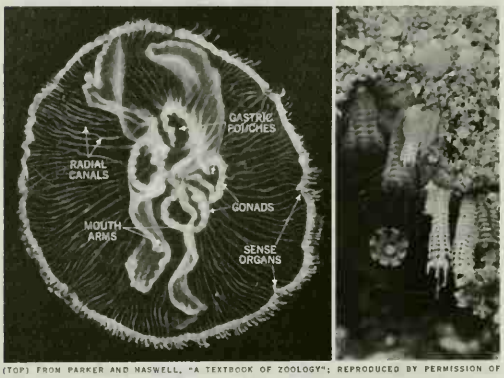
JELLYFISH (MEDUSA), umbrella-shaped, translucent, gelatinous animals, mostly marine, free-swimming forms of the phylum Coelenterata (*q.v.*). These bluish, brownish or purplish hemispheres, occasionally somewhat cubical, may usually be found bobbing on or near the water's surface. More correctly, jellyfish are called medusae and are the sexually mature stages of scyphozoans (class Scyphozoa, *q.v.*) and certain hydrozoans (class Hydrozoa, *q.v.*) of the Coelenterata. Comb jellies and sea walnuts, members of the phylum Ctenophora, because of their superficial resemblance to medusae are often called jellyfish.

The floating portion of the medusa ranges, in different species, from about $\frac{1}{16}$ in. to over 6 ft. across. The largest species, *Cyanea arctica*, a purplish-red medusa found in the North Atlantic, has tentacles hanging from its margin to a length of 120 ft. Many jellyfish are weak swimmers, but all are at the mercy of currents. After violent storms the collapsed and battered "jelly-sacs" may be found strewn across large areas of beach.

Species and individuals are most numerous in warm tropic seas, but jellyfish are not absent from colder waters; in fact, one of the larger medusae, *Chrysaora*, is found in the North sea.

General Structure.—The main body mass consists of a bell or umbrella, from the underside of which hangs a more or less tubular projection, the manubrium or proboscis, having the mouth at its free end. The underside of the bell is referred to as the subumbrellar surface, while the outer side is the exumbrellar side.





(TOP) FROM PARKER AND HASWELL, "A TEXTBOOK OF ZOOLOGY"; REPRODUCED BY PERMISSION OF MACMILLAN CO.; (BOTTOM LEFT AND RIGHT) D. P. WILSON

FIG. 1.—THE SCYPHOZOAN JELLYFISH AURELIA: (TOP) CROSS-SECTION DIAGRAM; (BOTTOM LEFT) VIEW FROM BELOW; (BOTTOM RIGHT) DEVELOPMENTAL STAGES, SHOWING HANGING SCYPHISTOMAE AND ONE FREE MEDUSA RECENTLY RELEASED

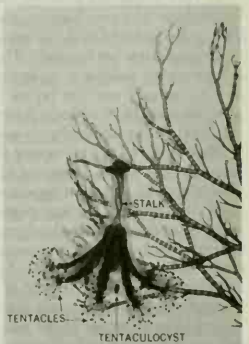
The exumbrella may be ornamented with warts or knobby growths, which are commonly heavily armed with stinging capsules (nematocysts). At the margin of the bell hang few to hundreds of tentacles, which also are heavily armed with nematocysts. Between the tentacles or at their bases, and also at the margin of the bell, there are special sensory structures, such as balance organs (statocysts), pigmented eyespots (light sensory but non-image forming structures) and special sensory bodies, rhopalia or tentaculocysts. The mouth may be a simple opening or, as in many Scyphozoa, it may be very elaborate as a result of complex growth of the lips. Typically there are four lips, and these may be simple, may bear tentacles or may be elaborately extended as long and complexly folded mouth arms. In one group of Scyphozoa, the rhizostomes, the mouth becomes subdivided into hundreds or thousands of minute pores through the fusion of the mouth arms. The mouth opens into a stomach, which is a simple cavity in the Hydrozoa and a four-chambered cavity in the Scyphozoa. In scyphozoans (scyphomedusae) there are clusters of special internal tentacles in the stomach (gastric tentacles) which bear nematocysts. There are no tentacles or nematocyst-bearing structures in the stomach of hydrozoans (hydromedusae). The stomach of some jellyfish is supported from above by a gelatinous prolongation of the subumbrellar surface, the peduncle. From the central stomach there arise centrifugal canals, the radial canals (usually four or multiples thereof), which run out to the bell margin, where they are connected to the ring canal. In the scyphomedusae, by the time adulthood is reached, the canals may be complexly interconnected by lateral branches. The canal system provides a ready device for the distribution of nutritive materials ingested through the mouth.

The chief body tissues are the outer epithelium, or epidermis, covering all the external surfaces; the inner epithelium, or gastrodermis, the digestive layer; and the gelatinous middle tissue, or mesogloea. The musculature of jellyfish, apparently derived from the directly overlying epithelial tissues, is restricted to the subumbrellar surface, to the manubrium and mouth arms and to the tentacles. The subumbrellar muscles are arranged in radial and circular groups and are the primary swimming muscles. The bell itself is made up largely of mesogloea, of a very elastic nature, within which there are also complex proteinaceous fibres. The mesogloea is largely noncellular, but cells that apparently give rise to the jelly and fibres are scattered throughout. A one-layered sheet of tissue, the endodermal or gastrodermal lamella, separates the subumbrellar surface covering from the jelly portions of the bell, and it is along this layer that the radial canals make their way. The tentacles at the bell margin may be solid or hollow, and the cavity of the hollow tentacles is in contact with the cavity of the ring canal. There are many nerve cells, neurons, present in jellyfish as a ramifying subepithelial network. In some jellyfish there are two well-defined nerve rings running near the bell margin. Actually two rather discrete nervous systems can be shown to be present, a fast-acting one, related to swimming movements, and a slower-acting one, probably having to do with the remaining body activities.

Habitat and Distribution.—Jellyfish occur chiefly in marine waters all over the world, although some hydromedusae inhabit fresh and brackish water; *e.g.*, the very widely distributed *Craspedacusta sowerbyi*. In marine waters both hydro- and scyphomedusae are abundant, the greatest numbers being seen in bays and shallow coastal waters (*Cyanea, Haliclystus, Aurelia, Cassiopeia* and *Rhizostoma*). In the open seas or in great depths, jellyfish are far less common. One group of scyphomedusae, the coronate medusae (*Periphylla, Linuche,* etc.), and one group of hydromedusae, the trachymedusae (*Gonionemus, Aglantha,* etc.), are characteristic of the open and deep seas. Most medusae have a tubelike polyp or hydroid state in their life history, immature forms that spend their time attached to the bottom. The greater abundance of jellyfish in shallow water is probably related to the better feeding conditions there for both the polyp and medusa stages.

While it is a valid generalization that jellyfish are free-swimming animals, some exceptions can be cited. A number of hydromedusae, *e.g.*, *Cladonema* and *Gonionema*, possess special suckers on their tentacles and spend most of their lives walking about on marine plants such as eelgrass. Among the scyphomedusae, *Stomolophus*, for example, are found medusae commonly resting upside down on the aboral or exumbrellar bell surface, with the mouth arms bearing the mouths pointed upward. These jellyfish can swim but seem to spend much of their adult lives in this sedentary fashion. This behaviour is assumed to reflect their mode of feeding, since they depend upon the rain of minute organisms from above for their food. One other scyphomedusan group, the stauromedusans (of which *Haliclystus* is a good example), also may be noted as an exception to the general free-swimming life of jellyfish. A member of this group spends all of its life attached by a stalk, a special structure located on the exumbrellar side of the animal, and in its general appearance and behaviour is much more polypoid than medusoid.

Another interesting variation in the life of jellyfish is to be noted in the hydrozoan group called siphonophores, to which belongs *Physalia* (Portuguese man-of-war). Among many siphonophores, which are best described as free-swimming or free-floating hydroid colonies, are found medusae built along the same pattern as other hydromedusae but as a rule lacking gonads and having as their only function the role of providing locomotion for the colony. These medusae are not released from the colony.

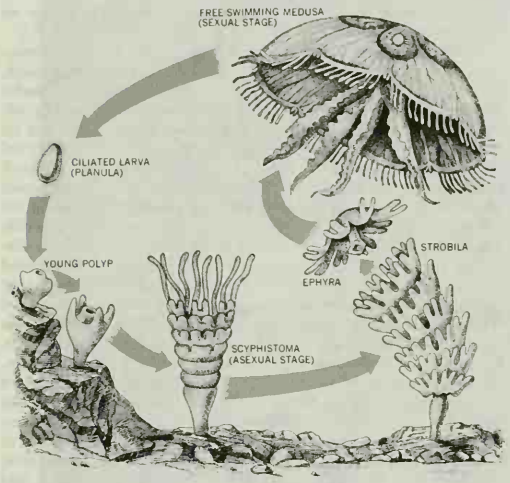


D. P. WILSON

FIG. 2.—NONSWIMMING STALKED JELLYFISH (HALICLYSTUS AURICULA) ATTACHED TO SEAWEED

Life Cycle.—*Alternation of Generations.*—Most jellyfish are produced by asexual reproduction (budding or transverse fission) from polyps, the polyps in turn having resulted from sexual re-

production of the medusae (*see* also POLYP). The process, an alternation of a sexual stage with an asexual one, is termed alternation of generations (*see* COELENTERATA) and is shown in the following life cycle in *Aurelia*. The segments separate from the parent (which in its dividing condition is known as strobila) successively, when sufficiently developed. Each of them is found, on examination, to constitute a small flattened medusa with eight long arms and is termed an ephyra. It is quite unlike the adult *Aurelia* in shape, but assumes the fully developed condition by degrees from this point onward. Occasionally a segment of a strobila becomes a polyp instead of a medusa. In many of the Hydrozoa, however, the medusae that develop on the polyp stage are not released but, instead, reach sexual maturity while still attached to the polyp. In fact there are numerous examples that



FROM R. BUCHSBAUM, "ANIMALS WITHOUT BACKBONES"; REPRODUCED BY PERMISSION OF THE UNIVERSITY OF CHICAGO PRESS

FIG. 3.—AURELIA, LIFE CYCLE

indicate that in a number of evolutionary lines within the Hydrozoa there has been a parallel evolution involving the reduction of the jellyfish or medusoid stage. In these lines one can trace a series ranging from polyps releasing free medusae, to polyps retaining well-formed medusae, to polyps producing almost unrecognizable, minute sexual structures that represent extremely reduced medusae.

Reproduction.—The length of life of medusae is highly variable. No jellyfish are known to live more than one year; however, such may be the case with huge forms, such as the giant *Cyanea arctica* (*see* above). Most free-swimming jellyfish have a normal free life of about one to three months. In that period the gonads mature.

As already noted above, most jellyfish are the sexually mature stage and reproductive form of their kind. The sexes are usually separate; that is, male and female individuals exist for each species. The gonads of the hydromedusae occur either beneath the radial canals or on the sides of the manubrium and are derived from epidermal cells. The gonads of the scyphomedusae are gastrodermal, however, and occur in pits within the stomach. Spawning usually consists of the release of eggs and sperm to the surrounding water, where fertilization occurs. After spawning there is normally produced a minute ciliated larva (planula), which after a short free life settles on its apparent anterior end, attaches to a rock, seaweed, etc., and assumes a polypoid form.

The polyp is commonly asexually reproductive and produces a colony of polyps. With good conditions of feeding and temperature the colony will produce and release numerous small medusae, which assume a free-swimming mode of life. In the life history of some hydro- and scyphomedusae, development may be interrupted after the planula stage by an encysted resting stage. It is in this form that some species overwinter. In most species, once the adult medusoid form has been attained, asexual reproduction does not occur. In some cases the polyp and young of some hydromedusae (certain trachymedusans) are parasitic on other medusae. Although the life history of most jellyfish involves a polyp, this is not always so, for no polyp stage is known for many trachymedusans and certain scyphomedusans. Their life histories seem to involve direct development from the planula to the adult jellyfish stage, although the trachymedusae do have a polyplike larval stage known as an actinula.

Mode of Swimming.—The motion or swimming of jellyfish is the result of the regular contraction of the subumbrellar muscles. The frequency of contraction is controlled by the sensory organs at the bell margin. These organs also determine whether the contractions shall be symmetrical or asymmetrical. In a symmetrical contraction both the radial and circular muscles of the bell contract simultaneously, forcing the water contained in the subumbrellar space to be jetted out of the bell in an oral direction; these pulsations carry the animal in a direction away from the mouth. After contraction the muscles relax and the bell assumes the expanded condition due to the elasticity of the jelly or mesogloea. If a jellyfish is tipped up on one edge, an asymmetrical contraction usually results. The muscles on the lower side of the bell contract, which causes the medusa to right itself. The statocysts, which inhibit muscular contraction as well as initiate it, control such reactions; if they are removed, no righting reactions occur. If all sensory organs are removed from a jellyfish and a ring-shaped preparation is made of the bell, one can initiate a contraction by electrically or mechanically stimulating the preparation. From the point of stimulation a wave of contraction will spread in both directions around the bell. By depressing the tissue with a straight-edged object one can block the wave of contraction in one direction, remove the block and allow the other wave to proceed round and round the bell. Such preparations have been known to continue this circular wave of contraction for days. If only one sensory organ is left on the bell margin, however, such a continuous wave of activity cannot be started.

Feeding and Digestion.—Feeding is usually accomplished with the help of the nematocysts. The tentacles also are usually involved. It has already been noted that certain scyphomedusae feed only on minute organisms and debris. These are the rhizostomes and their feeding does not, as a rule, involve either tentacles or nematocysts. Here, ciliary currents lead by small gutters to the many minute mouths and small objects falling on the complex mouth-arm region are entangled in mucus and carried to the mouths. But for most of the scyphomedusae, feeding is accomplished while actively swimming. These animals trail their long mouth arms out behind the bell, and as organisms run into these arms, they are stung by the nematocysts and then carried to the mouth by the contraction of the mouth arms. Hydromedusae are more dependent, in general, on their tentacles than on their mouth arms. The tentacles, streaming out behind the swimming animal, perform the same fishing function as do the mouth arms of the scyphomedusae. Another common method of fishing used by hydromedusae may be described: The medusa swims upward for awhile, commonly till it hits the surface of the water; it then stops swimming, the bell tips over (exumbrella down) and the tentacles spread far out around the bell. In this position the medusa slowly sinks, capturing small animals as they bump into the widely spread tentacles. A few jellyfish do not feed as adults, their only function being sexual reproduction. Such jellyfish are known among the hydrocorallines (*see* HYDROZOA) and do not possess tentacles or mouths.

One interesting bit of behaviour may be seen in certain jellyfish that have very long manubria. When these jellyfish are touched on the subumbrellar surface, they bend the proboscis in that direction and touch the bell at the point of contact. This behaviour of the proboscis seems clearly to be a specialized type of feeding response, which may be seen when such jellyfish are put into a dish with small crustaceans such as copepods; as a copepod bumps

the underside of the bell, the proboscis of the jellyfish moves to that point and captures the minute animal.

Regardless of how food is taken, once it is captured by the mouth it is ingested and swallowed into the stomach. In the stomach, strong protein digesting enzymes break the food down into minute particles, which move throughout the canal system. Essentially all cells lining the stomach and canals ingest these very fine particles and final digestion takes place inside the cells. The further distribution of nutritive substances takes place either by diffusion or by materials being carried about by wandering cells. Such wandering cells, often referred to as nurse cells, are particularly noticeable around the gonads, where commonly each developing ovum may have one to several such cells gathered around it.

Other Processes.—Jellyfish do not have many special structures related to such bodily processes as respiration, excretion or circulation. The general body surfaces seem to be sufficient for such processes, though the canal systems certainly must be involved. Water moves freely, with the aid of cilia, into the mouth and throughout the canals. Certain medusae also have pores that open from the radial canals to the exumbrellar surface. These may be excretory in function.

The nematocysts of jellyfish, particularly the larger jellyfish, can cause painful stings to man. The toxins present seem to affect the nervous system of organisms that they contact (neurotoxins). One type of scyphomedusae, the cubomedusans, which are restricted to tropical and subtropical waters, have such painful stings that they are called "sea wasps." The Portuguese man-of-war (*q.v.*), whose sting is perhaps the most serious to man of all coelenterates, is not a single medusa but, as mentioned earlier, a colony of hydroids and medusae. Jellyfish are commonly so abundant along seashores that they make swimming for man unpleasant because of their painful and irritating stings. Unfortunately, even when a jellyfish has been broken into small pieces, for instance by being pounded to pieces by waves, the nematocysts remain active, and swimming and wading along a beach where jellyfish are being carried ashore frequently has to be abandoned.

A number of interesting associations are known between jellyfish and other organisms. Jellyfish play host to certain fishes that are immune to the coelenterates' nematocysts, and these fish apparently share the food of their host. Crustaceans such as amphipods (hyperiids) and crab larvae also may be found living on the surfaces of some jellyfish. There also are certain goose barnacles that are known only as commensals of jellyfish. The tissues of some jellyfish contain small, unicellular algae, which probably provide food to the jellyfish in the form of excesses from their own photosynthetic production of organic materials. One interesting association between a jellyfish (*Mnestra*) and a planktonic nudibranch mollusk (*Phyllirhoe*) is known. In this case the jellyfish seems to serve during the early life of the nudibranch as a device for transportation and for food. As the mollusk grows, it gradually eats the jellyfish until apparently it has devoured all of its host. The nudibranch then goes on its free-floating way, feeding on other coelenterates as it finds them. Certain fish, especially the giant sunfish *Mola mola*, seem to live almost entirely on jellyfish and their relatives. Jellyfish, in general, are of little economic importance, though one, *Rhopilema esculenta*, of eastern Asian waters, is the edible jellyfish prized by the Chinese and Japanese. Also of some economic significance are the large masses of jellyfish that have been known to coincide with schools of young fish, in which case the jellyfish may capture and kill great numbers of fish.

See also references under "Jellyfish" in the Index.

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(C. Ha.)

JEMAL PASHA, AHMET (1872–1922), Turkish army officer, a member of the triumvirate that dominated his country during World War I, was born in Istanbul. After graduating from the Cadet school as a staff officer, he held several posts with the army in Macedonia and in Thrace where he joined the secret Union and Progress committee. Returning to Istanbul after the revolution of 1908, he became a member of the military administration. As governor of Adana and then of Baghdad he won a reputation for forcefulness. He was next appointed head of the security forces in Istanbul and then minister of public works. When World War I broke out, Jemal was one of the three most influential men in the government, with Talat and Enver. Sent to the Palestine front in 1914, he attempted unsuccessfully to invade Egypt. Subsequently made governor of Syria, he treated the Armenian minority there with great barbarity. When the Ottoman empire was defeated in Oct. 1918, he escaped to Germany. After the establishment of Mustafa Kemal's regime in Turkey, Jemal went to supervise the reorganization of the Afghan army. In 1922, on transit in Tbilisi (Tiflis), he was assassinated by an Armenian nationalist.

(M. P. P.)

JEMAPPES, BATTLE OF, a battle of the French Revolutionary Wars, fought on Nov. 6, 1792, before Mons in Hainaut, between the French under Dumouriez and the Austrians under Albert, duke of Saxe-Teschen, and C. J. von Clerfayt. The advance of the Austrian army had been halted before Lille, and on Oct. 8 it fell back to Mons. Advancing on the main body of about 25,000 men and 50 guns, Dumouriez' army of the North numbered approximately 55,000 men and 100 guns. Dumouriez hoped at first to force Clerfayt's strong position by turning his left with 10,000 men from Maubeuge under the comte d'Harville (Louis Jouvenel des Ursins). Early on Nov. 6 Dumouriez dislodged Clerfayt's advanced troops at Quaregnon and then halted his advance to allow Harville to come up. Harville failing to arrive, Dumouriez bombarded the Jemappès entrenchments and the batteries on the slopes toward Cuesmes before attacking the Austrian front with his infantry. Except to the south of Jemappes, where Clerfayt was obliged to retreat across the Trouville stream, the assault was unsuccessful. Dumouriez formed and led forward a heavy column which drove in the Austrian centre, where the defenders had begun to feel the pressure of the attack on Jemappes, which threatened their rear. On their left, the batteries at Cuesmes were captured, and with the approach of Harville's force, the Austrians withdrew. Each side lost about 7,000 killed and wounded. Not only had the largely inexperienced French succeeded by virtue of *élan* and weight of numbers in a frontal assault en masse, to the great gain of their morale, but after Jemappes they were able to occupy the whole of Belgium and advance to the Roer.

(J. H. N.)

JENA, a town of Germany and a regional capital in the *Bezirk* (district) of Gera, Thuringia, which following partition of the nation after World War II became part of the German Democratic Republic, lies on both banks of the Saale about 39 km. (25 mi.) W. of Gera and 31 km. (19 mi.) E. of Weimar. Pop. (1961 est.) 81,427. Villas and gardens extend along the partly wooded limestone slopes on either side. On a plateau above the town are the remains of the Saaleburg Fuchsturm ("fox tower"). Besides the old university buildings other interesting buildings are the 14th-century Rathaus (town hall), St. John's church (11th century), the late Gothic St. Michael's church (15th–16th century) and the Schwarzer Bär ("black bear") hotel where Martin Luther spent the night after his flight from the Wartburg. University buildings occupy the site of the former ducal palace (*Schloss*) where Goethe wrote his *Hermann und Dorothea*. There are several other educational institutions; also botanical gardens, town and university museums, an optical school, meteorological institute, observatory, central institute for earthquake research and the Zeiss planetarium.

Jena is on the railways from Gera to Erfurt and from Halle to Nürnberg. It is famous as the home of the old-established Zeiss optical and precision instrument industry and the Schott glassworks. There is also a significant chemical industry.

Mentioned in the late 11th and the 12th centuries, Jena received municipal rights in the 13th century. It belonged to the margraves of Meissen from the mid-13th century and passed in 1423 to the elector of Saxony. In 1547 the elector John Frederick the Magnanimous, while a captive of the emperor, Charles V, conceived

PHOTOGRAPH, F. SCHENSKY IN "TIER UND PFLANZENLEBEN DER NORDSEE" (WERNER KLINKHARDT)

A medusa of the class Scyphozoa, genus *Chrysaora*, a common jellyfish of the North Sea

songs and anthems, and were published in several contemporary collections. The term "rant" (a dance of unknown character) is chiefly found in the titles of Jenkins' works. (A. D. F.)

JENKINS, SIR LEOLINE (1623–1685), British lawyer and diplomatist, who did much to elucidate the legal principles relating to admiralty (particularly prize) jurisdiction and to international law, was the son of a Welsh country gentleman. He was born in 1623 and was educated at Jesus college, Oxford. During the Civil War and the Commonwealth he was an ardent royalist, though no advocate of absolute monarchy; in 1661 he was made registrar of the consistory court of Westminster; in 1664 deputy judge of the court of arches; about a year later judge of the admiralty court; in 1668 judge of the prerogative court of Canterbury. He was selected to draw up the claim of Charles II to succeed to the property of his mother, Henrietta Maria, on her death in 1669, and while in Paris for this purpose he succeeded in defeating the rival claim of the duchess of Orléans, being rewarded by a knighthood on his return. He was one of the English representatives at the congresses of Cologne in 1673 and of Nijmegen in 1676–79. He was made a privy councilor in 1680 and became secretary of state in April of the same year, in which office he was the official leader of the opposition to the Exclusion bill. He resigned office in 1684, and died on Sept. 1, 1685, at his home in Hammersmith.

Jenkins left his impress on the law of England in the Statute of Frauds and the Statute of Distributions, of which the former profoundly affected the mercantile law of the country, while the latter regulated the inheritance of the personal property of intestates.

JENKINS, ROBERT (fl. 1731–1738), English master mariner, gave his name to the so-called War of Jenkins' Ear. In 1731 he reported that his ship "Rebecca" had been boarded and pillaged by a Spanish *guarda-costa* in the West Indies and that his captors had cut or torn off one of his ears before turning the vessel adrift. At the time the story attracted no particular attention, but the matter was raised again in 1738 when Jenkins repeated his tale to a committee of the house of commons. He exhibited what was alleged to be the amputated ear and, asked what were his reactions at the time, replied: "I committed my soul to God and my cause to my country." Public opinion had already been aroused by other Spanish outrages upon British ships and the Jenkins episode was swiftly exploited by the parliamentary opposition; it was undoubtedly a contributory cause, but no more, in forcing the government to declare war on Spain in Oct. 1739. This conflict, the "War of Jenkins' Ear," subsequently merged into the War of the Austrian Succession.

Jenkins was later given command of a ship in the service of the East India company and became supervisor of the company's affairs at St. Helena. Doubts have been cast as to the veracity of Jenkins' allegations and it has been suggested that he lost his ear in some less honourable fashion, but there is reason for believing his story to be substantially correct.

JENNER, EDWARD (1749–1823), English physician and discoverer of vaccination, was born at Berkeley, Gloucestershire, on May 17, 1749, the son of a clergyman. After his early education at Wotton-under-Edge and Cirencester, he began the study of medicine under Daniel Ludlow, a surgeon of Sodbury, near Bristol. In 1770 he went to London as a pupil of John Hunter. During this period he was employed by Sir Joseph Banks to prepare and arrange the zoological specimens which Banks had collected on Captain Cook's first voyage in 1771. In one of his papers contributed to the local medical society, Jenner appears to have anticipated the discoveries of others concerning rheumatic heart disease. He also studied ornithology and geology, and constructed a balloon. He was a favourite in society, a fair musician and poet. In 1788 he married Catharine Kingscote, and in 1792 obtained the M.D. from St. Andrews.

Meanwhile, the idea of vaccination matured slowly in Jenner's mind. While still an apprentice, he had noted a popular belief in Gloucestershire as to the antagonism between cowpox and smallpox (*q.v.*). He first investigated this subject about 1775 and satisfied himself that cowpox really included two different forms of disease, only one of which protected against smallpox, and that many failures to protect could thus be explained. He further ascertained that the true cowpox protected only when it was communicated at a particular stage of the disease, and at the same time concluded that the disease of horses called "the grease" was the analogue of cowpox and smallpox. Cowpox being scarce in his county at that period, Jenner had no opportunity of testing his theory until May 14, 1796, when he was able to inoculate an eight-year-old boy with matter from the cowpox vesicles on the hands of a milkmaid. In the following July, the boy was inoculated for smallpox, but the disease did not follow. Jenner was unable to repeat his successful discovery before 1798, in which year he published his *Inquiry into the Cause and Effects of the Variolae Vaccinae*.

Henry Cline, surgeon of St. Thomas' hospital, London, made a number of successful inoculations against smallpox and thereby brought vaccination before the medical profession, which had been prejudiced against it by the formidable criticism of J. Ingenhousz, a celebrated surgeon. But its adoption was delayed by the rash advocacy of George Pearson, who, without seeing a case of cowpox, lectured on the subject and supplied a defective vaccine that frequently produced not the mild disease described by Jenner but somewhat severe eruptions resembling smallpox. Jenner had first to show (in 1799) that the vaccine supplied by Pearson was accidentally contaminated with variolous matter, and then to secure (in 1800) the abandonment of Pearson's project for establishing in London an institution for free vaccination with the defective vaccine.

In 1803 the Royal Jennerian society for the proper spread of vaccination in London was established. In the first 18 months 12,000 persons were inoculated, and the annual average of deaths from smallpox fell from 2,018 to 622. Dissensions within the society, however, led to its disbanding in 1808, when the national vaccine establishment was founded. In 1802 a parliamentary grant of £10,000 was voted for Jenner, who continued to vaccinate the poor without charge, often as many as 300 a day.

In England his merits were slowly recognized. Lord Henry Petty proposed an address to the crown, praying that the College of Physicians should report on vaccination. The report being favourable, the chancellor of the exchequer proposed a further £10,000 for Jenner. Finally the sum was raised to £20,000, and at about the same time India raised a subscription of £7,383.

In 1813 Oxford conferred on Jenner an honorary M.D. He published his last work, *On the Influence of Artificial Eruptions in Certain Diseases*, in 1822; and in the following year presented to the Royal society his final paper, *On the Migration of Birds*. He died in January 1823.

See also VACCINATION.

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JENNER, SIR WILLIAM, BART. (1815–1898), English physician, was born at Chatham on Jan. 30, 1815, and educated at University college, London. In 1847, at the London Fever hospital he began investigations into cases of "continued" fever, which enabled him finally to make a clinico-pathologic distinction between typhus and typhoid on which his reputation principally rests, although in this he had been preceded by other workers. In 1849 he was appointed professor of pathological anatomy at University college and also served as physician or consulting physician to several hospitals. He was successively Holme professor of clinical medicine and professor of the principles and practice of medicine at University college. He was president of the Royal College of Physicians (1881–88) and was elected in 1864 a fellow of the Royal society. In 1861 he was appointed physician-extraordinary and in 1862 physician-in-ordinary to Queen Victoria, and in 1863 physician-in-ordinary to the prince of Wales. In 1868 he was created a baronet. Jenner died at Bishop's Waltham, Hampshire, on Dec. 11, 1898.

JENNEY, WILLIAM LE BARON (1832–1907), U.S. architect and engineer whose technical innovations were significant in the development of the skyscraper, was born at Fairhaven, Mass.,

on Sept. 25, 1832. He was educated at Phillips academy and Lawrence Scientific school in Massachusetts and the École Centrale des Arts et Manufactures in Paris, graduating with high honours in 1856. In 1859–61 he studied architecture in Paris. After a distinguished American Civil War career, on the staffs of Generals U.S. Grant and William T. Sherman, he resigned from the army in 1866 with the rank of major.

In 1868 Jenney established an architectural and engineering firm in Chicago and quickly rose to prominence. His career reached its culmination with the design of the Home Insurance building in Chicago (1884–85), the first major building to be supported almost entirely by an internal frame, or skeleton, of iron and steel, the first to incorporate steel as a structural material and the first in which the form was determined by the new structural technique. Jenney developed steel framing and its architectural expression further in his later Chicago commissions, chiefly the Leiter building (1889–90) and the Fair store (1890–91). He retired in 1905 and moved to Los Angeles, Calif., where he died on June 15, 1907.

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JENNINGS, (JAMES) HENNEN (1854–1920), U.S. consulting engineer described in 1918 as "an eminent consulting engineer, whose advice is sought in matters of great importance from San Francisco to London and from London to Johannesburg," was born at Hawesville, Ky., on May 6, 1854. After graduating from Lawrence scientific school, Harvard, in 1877, he was engineer at the North Bloomfield and New Almaden mines in California. In 1887 he went to Venezuela as manager of the El Callao mine and in 1889 moved to South Africa, where he became consulting engineer to Wernher, Beit and Co. and did much to develop the gold mining industry on the Rand. Jennings played a major part in the establishment of the School of Mines in Johannesburg and advised on the reorganization of the Royal School of Mines in London. He was awarded the gold medal of the Institution of Mining and Metallurgy in recognition of his services to the mining industry, to the profession and to technical education; and he was president of that institution from 1903 to 1905. He returned to the United States in 1905 to become a consultant in Washington, where his services were in great demand by the U.S. bureau of mines. He died at Washington, D.C., on March 5, 1920. (C. W. D.)

JENOLAN CAVES, probably the most famous tourist resort in Australia, occur in a belt of Silurian limestone, about 500 ft. thick, which runs northwest along the western margin of the Blue mountain plateau in New South Wales. About 70 mi. due west of Sydney, the limestone has been uncovered by the valleys of two converging streams which have burrowed into it, dissolving the lime to create a series of beautiful tunnels and caverns. The caves are on different levels and contain unique limestone formations, particularly stalactites (*q.v.*); about a dozen caves have been opened for tourists, and exploratory work has revealed others. The caves were discovered in 1838 and were made a government reserve in 1866, but the roundabout route to them from Sydney meant that they were not frequented until after 1896, when a more direct road was built from the main western highway. By the 1960s, more than 100,000 persons visited the caves annually.

JENSEN, JOHANNES HANS DANIEL (1907–), German physicist who shared the Nobel prize in physics (1963) with Maria G. Mayer and Eugene P. Wigner. After working independently in the late 1940s, Mrs. Mayer and Jensen collaborated to write *Elementary Theory of Nuclear Shell Structure* (1955). They were awarded the prize for explaining the detailed characteristics of atomic nuclei through their nuclear shell model, according to which nucleons move in definite orbits or shells (*see* NUCLEUS: *Nuclear Structure and Nuclear Forces*).

Born in Hamburg on June 25, 1907, Jensen earned his doctorate in physics from the University of Hamburg in 1932, where he served on the faculty from 1936 to 1941. In 1941 he joined the Institute of Technology in Hanover, leaving in 1949 to become professor at the University of Heidelberg. Jensen frequently visited the U.S., serving as Carl Schurz Memorial professor in 1951 at the University of Wisconsin; he is a fellow of the Institute for Advanced Study in Princeton, N.J.

JENSEN, JOHANNES VILHELM (1873–1950), Danish poet, novelist and essayist who received the Nobel prize for literature in 1944. Born Jan. 20, 1873, in Farsö, Himmerland, the son of a veterinary surgeon of old peasant stock, Jensen went to Copenhagen in 1893 to study medicine but gave it up to live by his pen. A visit to the United States in 1896 began a long period of travel, culminating in an 18-month tour round the world.

His first books, *Danskere* (1896) and its sequel, *Einar Elkjær* (1898), were psychological novels and show that Jensen was influenced by, even while he rebelled against, the pessimism and introspectiveness of the 1890s. In *Den gotiske Renaissance* (1901), intoxicated by the wonders of modern machinery and inspired by Walt Whitman, he proclaimed a matter-of-fact view of life, pointing to England and the United States (the gothic nations) as heralds of a new world.

During these years, Jensen widened the boundaries of literary Copenhagen in many directions. In *Himmerlandsfolk* (1898), a series of tales, he reached back to the soil of his boyhood; and in *Singapore noveller* (1907) he was inspired by his travels, rivaling Kipling as the poet of the east. Reacting against the naturalist novel with its detailed descriptions, in about 1900 he used the word *myter* ("myths") to describe the new attitude and impressionistic technique of his short narrative sketches, a collection of which, *Myter og Jagter*, appeared in 1907. These early myths are accounts of personal experiences, but reality is heightened and given symbolic meaning by the power of imagination. The most daring work of his youth, *Kongens Fald* (1901; Eng. trans., *The Fall of the King*, 1933), is a historical novel, set in the reign of Christian II, but its lyric-symbolic structure makes it a myth expressive of growth and decay, life and death. During this intensely felt early period he was also writing poetry, collected in *Digte* (1906), expressing his own struggle between loneliness and happy acceptance of the goodness of the world. His use of free verse and modern idiom renewed the Danish lyric tradition.

In 1904 Jensen married and settled down in Copenhagen. His attitude to life began to change. Darwinism became the keystone of his outlook, explained in *Den nye Verden* ("The New World," 1907), in *Introduktion til vor Tidsalder* (1912) and in the four concluding books of essays on evolution (1923–28).

Jensen broke completely with the naturalist conception of Darwinism and with Nietzsche's theory of the superman, his conclusions being more akin to those of Julian Huxley in his *Evolution, the Modern Synthesis* (1942). According to Jensen, the object of evolution is the development of the norm of the species, not the individual, and he emphasized the ascent, rather than the descent, of man. He saw in Darwinism a bridge between man and nature, and this gave him a sense of kinship with all creatures, "a sympathy of the whole." Nature taught him intellectual humility and piety: he was even reconciled to death, as the common lot of all creation. His longing for immortality was satisfied by the thought of being a link in the chain of universal evolution.

The subjective myth of his early period now became the myth of evolution, and he sought to understand the essence of things through the history of their origin. As well as writing a stream of volumes containing more than 100 short myths, he produced the epic cycles of myths that form *Den lange Rejse* (6 vol., 1908–22; Eng. trans., *The Long Journey*, 3 vol., 1922–24), with a postscript *Æstetikog Udvikling* ("Aesthetics and Evolution," 1923), explaining his intentions. This tells the story of man from the pre-Ice Ages in the "lost country" of semitropical Scandinavia, ending on the threshold of modern times with Columbus, conceived as the Viking captain. As a painter of nature, Jensen is unsurpassed. His characters, sculptured with monumental outline, embody common human feelings and faculties. All momentary, particular events have a universal aspect: present, past and future blend. *Den lange Rejse* lives for its poetry and its conception of man's story as a longing to become man: loving, not killing. Jensen's idealized Darwinism led him to create a modern classicism, acknowledging Oehlenschläger, Goethe and the Greeks as his masters.

After his period of great prose, Jensen struck a new, rich vein of lyric poetry, classical in its concentrated imagery and weighty verse, the expression of the loving severity which marked his affirmation of life. His poetry was collected in *Digte, 1901–43* (1943).

His strong convictions often involved Jensen in violent controversy, but his supremacy as a poet was recognized even by those who opposed his theories. He died in Copenhagen, Nov. 25, 1950.

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JENSON, NICOLAS (*c.* 1420–1480), French publisher and printer, who completed the development of the roman letter from a reproduction of handwriting into the forms still used for printing types, was born at Sommevoire, Haute-Marne, about 1420. He was apprenticed as a cutter of dies for coining and became master of the royal mint at Tours. In 1458 he was chosen to go to Mainz to learn the art of printing from movable types under Johann Gutenberg. In 1470 he appeared in Venice as a printer and publisher; and in the first work he produced, the printed roman minuscule achieved proportions, shapes and arrangements on which five centuries of printing have inflicted no radical change. He died in Rome in 1480.

As a type designer, Jenson produced Greeks and black letters as well as his famous roman. As a printer, he composed his types in a meticulously even style, but did not always print them with the accuracy they deserved. As a publisher, he produced more than 150 titles, soundly edited by scholars of authority.

In general appearance similar to the roman letter of Jenson, the old-face types most widely used today derive details of finish from those used by Aldus Manutius in 1495 and from similar designs perfected by Claude Garamond in the 16th century. But Jenson's achievement in the design of purely roman letters for printing is agreed to be the first, and is widely believed to be the most beautiful. (H. A. F. W.)

JENYNS, SOAME (1704–1787), English author of poems and essays on religious and political subjects, was born in London on Jan. 1, 1704, the son of Sir Roger Jenyns, of Bottisham hall, Cambridge. He was at St. John's college, Cambridge, from 1722 to 1725 and between 1742 and 1780 was member of parliament successively for Cambridgeshire, Dunwich and Cambridge. He served as a commissioner of the board of trade from 1755 to 1780 and died in London without issue on Dec. 18, 1787. He is remembered for his writings rather than for his public work. In particular, his *Free Enquiry Into the Nature and Origin of Evil* (1757) provoked one of the most famous of Dr. Johnson's critical reviews and his *View of the Internal Evidence of the Christian Religion* (1776) was the subject of keen controversy. (S. C. R.)

JEPHTHAH (in the Douai version of the Bible, JEPHTE), one of the judges of Israel, was a son of Gilead by a secondary wife; being expelled from his father's house by his brethren, he took refuge in the Syrian land of Tob, where he gathered around him a powerful band of homeless men like himself. The Ammonites pressing hard on his countrymen, the elders of Gilead called for his help, which he consented to give on condition that in the event of victory he should be made their head (Judg. xi, 1–xii, 7). His name is best known in history and literature in connection with his vow, which led to the sacrifice of his daughter on his successful return. The annual lamentation of the women for her death suggests a mythical origin (*see* ADONIS). Attached to the narrative is an account of a quarrel between Jephthah and the Ephraimites. The latter were defeated, and their retreat was cut off by the Gileadites, who had seized the fords of the Jordan. As the fugitives attempted to cross they were bidden to say "shibboleth," and those who said "sibboleth" (the Ephraimites apparently being unused to *sh*) were put to death.

JERAHMEEL, in the Bible, the eponymous ancestor of a clan, the Jerahmeelites, which with Caleb, the Kenites and others occupied the southern steppes of Palestine (I Sam. xxx, 29), and was subsequently incorporated into Judah (*q.v.*).

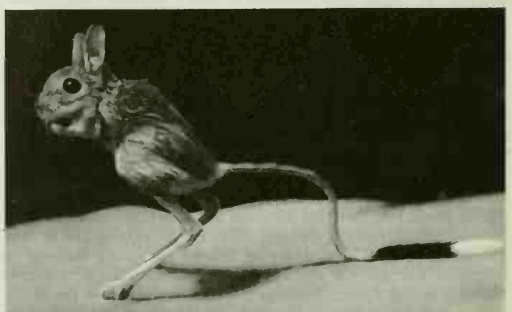
The *Chronicles of Jerahmeel* (M. Gaster, *Oriental Translation Fund*, 1899) is a late production containing a number of apocryphal Jewish legends of no historical value.

JERBA: *see* DJERBA.

JERBOA, the name originally given to several genera of jumping rodents of the family Dipodidae and extended to certain murid rodents of Australia, usually called jerboa rats. Other animals called jerboa, because of their similarity to these rodents, include two Australian pouched mammals known as the jerboa pouched mouse (*Antechinomys*) and the jerboa kangaroo, rat kangaroo or bettong (*Bettongia; see* KANGAROO).

The dipodids include the true or three-toed jerboa (*Dipus*), the five-toed jerboa (*Allactaga*) and the flat-tailed jerboa (*Pygeretmus*), all Eurasian forms; and three genera of African jerboas (*Jaculus, Scirtopoda, Scarturus*). They are dwellers of desert and semidesert tracts; the African genera are not found south of the Sahara. (For characteristics of the family, *see* RODENT.)

In a common African jerboa (*Jaculus jaculus*) the length of the body is eight inches; and that of the tail, which is long, cylindrical and covered with short hair terminated by a tuft, is ten inches.



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EGYPTIAN JERBOA (JACULUS JACULUS)

The front limbs are extremely short, while the hind pair are six times as long. When about to spring, the jerboa raises its body by means of the hinder extremities, and supports itself at the same time upon its tail, while the forefeet are so closely pressed to the breast as to be scarcely visible. It then leaps into the air and alights upon its hind feet, and instantaneously erecting itself, it makes another spring, and so on in rapid succession. It is a gregarious animal, living in burrows, which it excavates with its nails and teeth in the sandy soil of Egypt and Arabia. In these it remains during the day, emerging at night in search of the herbs on which it feeds. It is very shy, and this, together with its agility, renders it difficult to capture. The Persian jerboa (*Allactaga indica*) is also a nocturnal burrowing animal, feeding on grain, which it stores up in underground repositories, closing those when full, and drawing on them only when the supply of food above ground is exhausted.

JEREMIAH, BOOK OF (PROPHECY OF JEREMIAS), a book of the Old Testament, counted as one of the Latter Prophets in the Hebrew canon (along with Isaiah, Ezekiel and the Book of the Twelve "Minor Prophets") and as one of the Major Prophets in the English Bible (along with Isaiah, Ezekiel and Daniel).

Contents.—The Book of Jeremiah is one of the longest in the Old Testament. It is also one of the most difficult to outline, because it has passed through a long process of editing and consists of materials of extremely varied type. It contains both poetry and prose. Some of the chapters contain messages of the prophet, while others are narratives about his life, related in the first or third person. Neither a chronological nor a topical arrangement is consistently followed. The following outline shows the general nature of the contents:

1. Ch. i–xxv consist largely of messages of the prophet, threats and warnings, laments and prayers, visions and a small amount of narrative material concerning events in his life. The call of the prophet and his inaugural visions are recorded in ch. i. Plots against his life are referred to in xi, 18–xii, 6; xviii, 18–23; and xx, 1–6. Messages

concerning the kings of Judah are grouped in xxi, 1–xxiii, 8, and concerning the popular prophets in xxiii, 9–40. The vision of the good and bad figs is recorded in ch. xxiv. For the rest, the materials in this section are very miscellaneous.

2. Ch. xxvi–xlv consist mostly of narratives concerning Jeremiah, especially his latter years. His conflicts with religious leaders are recorded (ch. xxvi–xxix) as are his use of the Rechabites as an object lesson (ch. xxxv), the writing of two scrolls at his dictation by Baruch (ch. xxxvi) and various incidents that took place during the final siege of Jerusalem and its capture by the Babylonians in 586 B.C. (ch. xxxii, xxxiv, xxxvii–xxxix). Incidents during the governorship of Gedaliah are chronicled in ch. xl–xli, and the flight to Egypt and Jeremiah's prophecies in that country in ch. xlii–xliv. Interspersed in the early part of this section are promises of future restoration (ch. xxx–xxxi, xxxiii), and it ends with an oracle to Baruch (ch. xlv).

3. Ch. xlvi–li are oracles against foreign nations—Egypt, Philistines, Moab, Ammonites, Edom, Damascus, Kedar, Hazor, Elam and Babylonia.

4. Ch. lii is a historical appendix, which is almost identical with II Kings xxiv, 18–xxv, 30.

Themes.—Jeremiah the prophet lived during the decline and fall of Judah as an independent kingdom. The book bearing his name tells of his life and message in this critical period. While the book contains some secondary material (*see* below), a great deal of it must be considered as authentic. Indeed, there is no other Old Testament prophet of whom we have so much genuine material as Jeremiah, both his own words and biographical matter.

Jeremiah's call is usually dated in 626 B.C., from Jer. i, 2 and xxv, 3, and the poems in the early chapters referring to a foe "from the north" are connected with the Scythian invasion of Palestine. An increasing number of scholars discount the importance of the Scythian invasion and believe that the prophet's career began about the time of the accession of Jehoiakim in 608. In that case, the foes "from the north" were the Chaldeans.

Early in the reign of Jehoiakim, Jeremiah delivered a message in the Temple court in which he predicted the destruction of the Temple if the people did not show moral amendment (vii, 1–15; xxvi). This led to his arrest by the priests and prophets, but the influence of the common people and princes secured his release. Jeremiah continued to warn the Israelites of impending doom and to call upon them for repentance. He spoke vigorously against the injustices practised by Jehoiakim (xxii, 13–19).

In the reign of Zedekiah (597–586) the prophet continued to protest against the moral and religious degradation of his people. The king was more sympathetic to him than Jehoiakim had been, but he was a weak monarch easily swayed by members of his court. During the final siege of Jerusalem, Jeremiah advocated the unpopular course of surrender to Babylon. He was arrested and put in prison, and eventually even thrown into an old cistern, where he would have died but for the intervention of an Ethiopian, Ebedmelech. He survived the fall of the city and was allowed to remain at Mizpah with Gedaliah. Upon the assassination of the latter, Jeremiah was taken to Egypt by the panic-stricken survivors. The last that is heard of him is his denunciation of his fellow countrymen for worshiping the Queen of Heaven.

The personality of Jeremiah is vividly revealed in the book, especially in the so-called "confessions"—xi, 18–xii, 6; xv, 10–21; xvii, 9–10, 14–18; xviii, 18–23; xx, 7–18. By nature Jeremiah was shy, reticent and introspective, desiring a life of peace and good will. But obedience to the divine compulsion to prophesy led him to denounce his neighbours, champion unpopular causes and predict doom. The result was a conflict in which he could describe the divine impulse to prophesy as a burning fire within his bones which he could not contain (xx, 9). Nevertheless, the outstanding characteristic of his public life was courage, which enabled him to condemn priests, other prophets and ruling kings.

The great contribution of Jeremiah to the history of Hebrew religion was in the realm of personal religion, but it was made more by implication than by express teaching. He believed that true religion did not depend upon the Temple or the Holy Land but upon sincere personal seeking of God. His own life encouraged the ideal of personal religion, and his encounter with God found him wrestling with God as well as expressing faith in the deity. The climax of Jeremiah's message was reached in the prophecy of the new covenant, in which men should have the law written in the heart and know God directly without need of mediator (xxxi, 31–34). Though the new covenant was to be with the house of Israel and the house of Judah, its implications carry one into the realm of personal religion.

Literary History.—The original nucleus of the Book of Jeremiah was probably the scroll prepared by Baruch son of Neriah, as recorded in ch. xxxvi. At the dictation of the prophet, Baruch wrote a scroll containing the messages Jeremiah had delivered from the beginning of his career to 605 B.C. The scroll was read in the Temple, then to a group of officials and finally to King Jehoiakim. That monarch burned the scroll in anger and ordered Jeremiah and Baruch arrested. They escaped by hiding, and Jeremiah redictated the scroll, with additions. It seems likely that this original nucleus of the book consisted of most of ch. i–vi and viii, 4–ix, 1.

Baruch, who was both scribe and disciple of Jeremiah, probably made a second collection near the end of Jeremiah's life, which contained various kinds of materials originating mostly after 605 B.C. This collection contained the "confessions" of the prophet (listed above); various oracles of condemnation and warning in ch. ix–xxiii; laments over national or personal sorrow, such as ix, 10–11, 17–22; x, 17–22; xii, 7–13; xiii, 18–19; xiv, 1–xv, 4 and xv, 5–9; the parables in xiii, 1–10, 12–14 and xviii, 1–6; and possibly some of the messages against foreign nations in ch. xlvi–xlix.

In addition to these materials, largely messages of the prophet, the book contains many prose passages that give information about events in his life. They are not actually a biography but are concerned largely with the conflicts of Jeremiah and his activities toward the latter part of his life. They may rightly be called memoirs and probably were written by Baruch. To these memoirs should be assigned xix, 1–xx, 6; xxvi–xxix; xxxii, 1–15; xxxiii, 4–5; xxxiv–xxxvi; xxxvii, 3–21; xxxviii; xxxix, 3, 14; xlii–xliv. Baruch combined the memoirs with his earlier collections and prefixed i, 1–3 as the heading for the whole.

Many passages in this book are similar in style and thought to Deuteronomy and the historical books prepared by the Deuteronomic school. While these similarities have been explained in various ways, the most probable explanation is that an edition of the Book of Jeremiah was prepared by a Deuteronomic editor or school about 550 B.C., possibly in Egypt. He or they made use of the materials collected and written by Baruch, revising it at some points and making additions at others. Sometimes the editor preserved genuine prophecies of Jeremiah in his own words, as in i, 17; vii, 29; xi, 15–16; xvi, 16–17. Sometimes he gave Jeremiah's message in his own words, as in vii, 1–viii, 3. At other times he composed freely, as in ch. xxiv. Some of the principal passages that show evidence of Deuteronomic editing are: iii, 6–14; vii, 1–viii, 3; xi, 1–17; xvi, 1–13, 16–18; xvii, 19–27, xviii, 7–12; xxi, 1–10; xxiv; xxv, 1–13; xxxii, 16–44; xxxiv, 8–22; and xlv.

Various additions were made even to the Deuteronomic edition of Jeremiah, down through several centuries. Among the more important of these are (1) the passages of hope in xxx–xxxi (in large part) and xxxiii; (2) eschatological predictions such as those in iii, 15–18; iv, 9–10, 23–26; xii, 14–17; xvi, 14–15; xxiii, 3–4; and xxv, 30–38; (3) psalms and psalmlike compositions in x, 25; xvi, 19–21; xvii, 5–8, 12–13; xx, 13; (4) the long passage contrasting the worship of idols and the true worship of Yahweh, x, 1–16; and (5) the discussion of "the burden of the Lord" in xxiii, 34–40. The oracles against Egypt in xlvi are very probably genuine, but the oracles against Babylonia in l–li are certainly later than Jeremiah. The origin of the others is uncertain; they may have originated in part during the time when the Babylonian king Nebuchadrezzar sent armies into Syria-Palestine to subdue the states neighbouring on Judah. Finally, xl, 7–xli, 18 and lii are historical sections taken from a source used by the editor of II Kings xxiv–xxv.

Influence.—Jeremiah was one of the most influential of the Hebrew prophets upon both Judaism and Christianity. By his insistence that true religion might be practised away from the Temple and the Holy Land, he helped his fellow countrymen survive the shock of the Babylonian capture of Jerusalem and the destruction of the Jewish state. His teaching encouraged the be-

lief that religion consists primarily in a personal relationship to deity. The literary style and the piety expressed in the "confessions" seem to have influenced many of the psalms.

The influence of Jeremiah upon early Christianity was profound. There were some in Jesus' lifetime who apparently believed that Jesus was Jeremiah come back to life (Matt. xvi, 14). His teaching about the new covenant exerted great influence: at the last supper, Jesus said over the cup, "This cup is the new covenant in my blood" (I Cor. xi, 25), and the new covenant passage is quoted in Heb. viii, 8–12 and x, 16–17. *See* also BIBLE.

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JEREMY, EPISTLE OF (LETTER OF JEREMIAH), a pseudepigraphal work of the Old Testament, commonly appended to the Book of Baruch (*see* BARUCH, BOOK OF) as a sixth chapter (*e.g.*, in the Vulgate and the King James, Revised and Douai versions of the English Bible), sometimes printed separately (*e.g.*, most Greek manuscripts and the Revised Standard version). The letter purports to have been written by Jeremiah to the exiles who were already in Babylon or on the way there. The author was a Hellenistic Jew and not improbably a Jew of Alexandria. His work, which shows little literary skill, was written with a serious practical purpose. He veiled his fierce attack on the idol gods of Egypt by holding up to derision the idolatry of Babylon. He warned the exiles that they were to remain in captivity for seven generations and that they would there see the worship paid to idols, from all participation in which they were to hold aloof. For idols were nothing save the work of men's hands, without the powers of speech, hearing or self-preservation. They could not bless their worshipers even in the smallest concerns of life. They were indifferent to moral qualities, and were of less value than the commonest household objects; in fact, an idol was like a scarecrow (verse 70), impotent to protect but providing a comforting delusion.

The date of the epistle is uncertain; possibly it belongs to the 2nd or 1st century B.C. It was probably written in Greek; only Greek manuscripts survive.

See C. J. Ball in R. H. Charles (ed.), *The Apocrypha and Pseudepigrapha of the Old Testament in English*, vol. i, pp. 596–611 (1913); R. H. Pfeiffer, *History of New Testament Times With an Introduction to the Apocrypha*, pp. 426–432, with bibliography (1949). (R. H. CH.; X.)

JEREZ DE LA FRONTERA (formerly XERES), a town of Cádiz province, region of Andalusia, southwest Spain, lies near the right bank of the Guadalete, 35 mi. (56 km.) N.E. of Cádiz by road. Pop. (1960) 130,900. Its chief features include the 11th-century Arab alcazar, the city hall, the baroque Colegiata, the Gothic churches of San Miguel and Santiago, and Tempul park with a zoological garden. The town is on the railway and road from Madrid and Seville to Cádiz and has an airport. It lies in a plain which is full of vineyards. The maturing of sherry wine in bodegas forms the chief occupation; the wine is both consumed in Spain and exported all over the world. Jerez horses, of mixed Arab, Spanish and English blood, are highly valued.

The origins of Jerez are obscure, but traces of a settlement, Asta Regia, have been found with vestiges of Iberian, Carthaginian, Roman and Arab cultures. Jerez was taken from the Moors by Ferdinand III of Castile (1217–52), and after recapture was finally occupied by Alfonso X in 1264. Several towns on the Moorish border were called *de la Frontera* ("of the frontier"). The English word sherry comes from the 16th-century pronunciation of the name Jerez. (JE. A. A.)

JERICHO is situated 825 ft. below sea level on the west side of the Jordan valley, 6 mi. N. of the Dead sea in Jordan. It is famous in biblical history as the first town attacked by the Israelites under Joshua after crossing the Jordan (Josh. vi). After its destruction it was, according to the biblical account, abandoned until Hiel the Bethelite established himself there in the 9th century B.C. (I Kings xvi, 34).

Old Testament Jericho has been identified in the mound known as Tall as Sultan, situated at the source of the copious spring 'Ain as Sultan. A number of major archaeological expeditions have worked at the site, including one during 1952–58 under the leadership of Kathleen M. Kenyon, director of the British School of Archaeology in Jerusalem. One of the main objectives of these expeditions was to establish the date of the destruction of the town by the Israelites. It had been thought that evidence of this destruction had been found, but this was an erroneous identification. Almost all the town of the period has been removed by erosion; enough survives to show that there was a town of the period, but that is all. This may have been destroyed in the second half of the 14th century B.C., but the evidence is too scanty for precision. The site was then abandoned until the Iron Age. Little trace has been found of the 9th-century occupation attributed in the Bible to Hiel the Bethelite, but there was a considerable settlement there in the 7th century B.C., ending perhaps at the time of the second exile in 588 B.C. The site was then finally abandoned, and the later Jerichos grew up elsewhere.

Excavations, however, have shown that Jericho had a very long history before the biblical period and that the great importance of the site is that it provides evidence of the first development of permanent settlements and therefore of the first steps toward civilization. Traces have been found of visits of Mesolithic hunters, dated by carbon-14 to *c.* 7800 B.C., and of a long period of settlement by their descendants, in which flimsy huts were the only habitations. From these huts solid houses, still with the curvilinear plan of the huts, were developed, and the settlement spread to cover an area of about ten acres. By *c.* 7000 B.C. this was defended by a massive stone wall, associated with at least one magnificent stone tower. The size of the settlement proves the development of an agricultural economy and probably that the waters of the spring had been used in a system of irrigation. These first Neolithic people were succeeded in the course of the 7th millennium by a second group, characterized by more elaborate domestic architecture, with many-roomed houses, rectilinear in plan. Their advanced culture is demonstrated by some remarkable portrait heads, modeled in plaster over human skulls. These two successive Neolithic towns of Jericho are far older than any other town so far discovered. (*See* also PALESTINE: *Archaeological Exploration.*)

Thereafter the importance of Jericho declined. Newcomers in the 5th millennium brought a much more primitive way of life, and it was not until the Early Bronze Age, *c.* 3000 B.C., that Jericho once more became a town. Excavations have traced its history from this time continuously down to the destruction by the Israelites in the 14th century B.C. The most interesting evidence is that for the successive arrivals and culture of the Amorites and Canaanites.

Excavations in 1950–51 also revealed something of Herodian Jericho. A magnificent façade on the Wadi Qelt, 1 mi. S. of Old Testament Jericho, is probably part of Herod's palace, and its style, completely Italian, illustrates Herod's devotion to Rome. Traces of other fine buildings can be seen in this area, which became the centre of Roman Jericho.

Jericho of the period of the crusades was on yet a third site, 1 mi. E. of the Old Testament site, and on this the modern town grew up. An insignificant village in Turkish times, it became a winter resort in the time of the British mandate. Its major expansion, however, came after its incorporation in Jordan in 1948, with the establishment in the neighbourhood of two enormous camps of Arab refugees from Israel. The town has been largely rebuilt, and the luxuriant oasis is being steadily expanded by irrigation.

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xxix–xxx (1955), and J. B. Pritchard, "The Excavation at Herodian Jericho, 1951," *ibid.*, vol. xxxii–xxxiii (1958). (K. M. K.)

JERITZA, MARIA (real name MARIE JEDLITZKA) (1887–), Austrian, later U.S., dramatic soprano who excelled in roles of a vivid dramatic nature, such as Carmen and Violanta, but was equally successful in the operas of Wagner and Strauss, was born at Brünn (now Brno, Czech.) on Oct. 6, 1887. She made her debut at Olmütz in 1910 and subsequently sang at the Vienna State Opera (1912–35) and the Metropolitan Opera, New York city (1921–32), when she made her debut in E. Korngold's *Die tote Stadt* and became celebrated for her performances of Tosca. She settled in Hollywood, Calif., in 1935.

See her autobiography, *Sunlight and Song*, Eng. trans. by F. H. Martens (1924).

JERKIN, a garment worn over the doublet, known from about A.D. 1450 and in common use soon after 1500. It had a close-fitting body and a full skirt varying in length, reaching to the knees at first but shorter after 1530. The skirt could be made of strips of contrasting material (cloth or leather), and when these were formed into tubular pleats they were known as bases. The jerkin could be made with a deep V or U opening in front. Before 1500 the gap was often laced across; later it was bridged by the placard or stomacher. The neck was at first square or round without a collar, but a low stand-up collar was added about 1540 and gradually increased in height. In spite of its definition by Francis Thynne in his *Animado* (1592) as a "Jackett without sleves," the jerkin was sometimes provided with these. It went out of use about 1630 except for military wear, when it was made of leather. It was revived in World War II as a sleeveless leather coat issued to units in the British army. In modern dress the term is used to describe any somewhat similar tight-fitting, hip-length jacket made without sleeves and collar. (J. LR.)

JEROBOAM is the name, in the Bible, of two kings of northern Israel. The events of their reigns are recorded chiefly in I and II Kings and II Chronicles.

JEROBOAM I (10th century B.C.), son of Nebat, was a *corvée* overseer under Solomon, who incurred the suspicion of the king as an instrument of the popular democratic and prophetic parties. He fled to Egypt, but was recalled by the northern tribes on the refusal of Rehoboam (*q.v.*), son of Solomon, to accept the constitutional terms offered to him at his accession. To counteract the political influence of the sanctuary of the house of David at Jerusalem, he established (or perhaps, rather, especially favoured) the bull cults of Bethel and Dan, a step which the later historian regarded as responsible for all the religious failings and political disasters of the north. The inevitable war between Jeroboam and Rehoboam seems to have gone at first in favour of the south, but the power of Judah was permanently checked by an Egyptian invasion under Sheshonk, who captured a number of cities in Palestine (not including Jerusalem) and exacted an enormous tribute from Rehoboam.

JEROBOAM II (8th century B.C.), son of Joash, was the last of the great kings of Israel, after whose death the country fell into confusion and ultimate servitude. Aided, perhaps, by Assyrian pressure from the east, he brought to an end the long struggle between Syria and Israel, and definitely established the superiority of the latter over Damascus. The record in II Kings xiv, 23–25 states that his kingdom extended from the borders of Hamath on the Orontes to the Dead sea, and it seems clear that he recovered territory in Transjordania which had long been in the hands of Damascus. Two cities in that district are apparently mentioned in Amos vi, 13—Karnaim and Lo-debar—as having been recently captured in 760. The reign of Jeroboam II saw the greatest success and outward prosperity that Israel had known since the days of Solomon, though the social conditions depicted by Amos meant a national corruption that could end only in disaster. (T. H. R.)

JEROME, SAINT (EUSEBIUS HIERONYMUS) (*c.* 347–*c.* 420), one of the four great doctors of the Western Church and the most learned of the Latin Fathers, was born between 340 and 350 of well-to-do parents at Stridon, probably in the environs of Aquileia and Emona (modern Ljubljana, Yugos.). His education, begun at home, was continued in Rome when Jerome was about 12. There he studied grammar, rhetoric and philosophy. A serious scholar, enamoured of Latin literature, he frequented the catacombs, strayed from virtue in ways undefined but surely magnified on later reflection, and near the end of his Roman education was baptized (*c.* 366), probably by Pope Liberius.

The next 20 years were spent in travel and impermanent residences. The first stage was Treves in Gaul; why he went to Treves and how long he stayed are not known, but it is known that while there Jerome was profoundly attracted to monasticism. Possibly as early as 369 he was back in the vicinity of Stridon. In Aquileia he was linked with an ascetical elite grouped around Bishop Valerianus. When the group disbanded for ill-defined reasons (*c.* 373), Jerome decided on a trip through the east, apparently a pilgrimage to Jerusalem. Upon reaching Antioch (374), fatigued by travel and weakened by inner conflict, he rested as guest of the priest Evagrius, and there he may have composed his earliest extant work, *De septies percussa*. There also, in mid-Lent 375, during a near-fatal illness, he had his celebrated dream, in which dragged before a tribunal of the Lord, he was accused of being a Ciceronian rather than a Christian, was severely lashed, and vowed never again to read or possess pagan literature. Long afterward, in controversy with Rufinus, he minimized the dream's importance, but for years it kept him from reading the classics for pleasure, and at the time it was a genuine spiritual crisis. One of its fruits was his first exegetical work, an allegorical commentary on Obadiah, disowned 21 years later as a youthful production of fervent ignorance.

In 375 Jerome began a two-year search for peace as a hermit in the desert of Chalcis. The experience was valuable but not altogether successful. A novice in spiritual life, he had no expert guide; Latin in tongue, he was confronted with Syriac and Greek; lonely, he begged for letters; a gourmet with a weak stomach, he found desert food a penance; desperate for peace, he was racked by passion. Yet he was genuinely happy. His response to temptation was incessant prayer and fasting; he learned Hebrew from a Jewish convert, studied Greek seriously, had manuscripts copied for his library and his friends, and carried on a brisk correspondence. The crisis came when Chalcis echoed with a conflict which in the wake of Arianism rent the orient: the schism at Antioch (episcopal succession disputed among Meletius of Antioch [*q.v.*], Paulinus and Vitalis), with its attendant Trinitarian and Christological dissensions. Suspected of Sabellianism (*see* SABELLIANISM) and dunned for his Credo, insisting that in oneness with the see of Peter lay the answer but unable to evoke a response from Pope Damasus, his peace shattered and his heart bitter, Jerome quit the desert for Antioch.

In Antioch his host, Evagrius, won Jerome for the party of Paulinus. Recognizing his importance, Paulinus decided to ordain him. Jerome accepted (378) on two conditions: his monastic aspirations would not be prejudiced and priestly functions would not be forced on him. He attended the exegetical lectures of Apollinaris of Laodicea, even visited the Nazarenes of Beroea to examine their copy of a Hebrew gospel purporting to be the original of Matthew. Antioch may then have seen his first polemic, *Altercatio Luciferiani et orthodoxi*, whose context is the Luciferian refusal to recognize the pardon which the Council of Alexandria (362) granted to the bishops who had signed the inadequate formula of Rimini.

Still in pursuit of Scripture, Jerome spent almost three years (379–382) in Constantinople. An enthusiastic disciple of Gregory of Nazianzus (*q.v.*), he came to know Gregory of Nyssa (*q.v.*) and Amphilochius of Iconium on the occasion of the Council of Constantinople (381). Under such influences his grasp on Greek improved; he developed an ardent admiration for Origen's exegesis; he turned into Latin 14 homilies of Origen on Jeremiah, 14 on Ezekiel and 9 on Isaiah; he wrote 2 commentaries on the vision of the Seraphim in Isaiah vi. Here too he translated Eusebius' *Chronicon* and continued it to the year 378.

But the most decisive influence on Jerome's later life was his return to Rome (382–385) as secretary to Pope Damasus. Two loves occupied his spare hours: scholarly work on the Bible, and intense propagation of the ascetic life. On Damasus' initiative he

wrote some short exegetical tracts and translated two sermons of Origen on the Song of Songs; more importantly, he revised the Old Latin version of the Gospels on the basis of the best Greek manuscripts at his command, and he made his first, somewhat unsuccessful revision of the Old Latin Psalter on a few Septuagint manuscripts. In the house of Marcella on the Aventine, he held classes for a monastic-minded circle of noble Roman widows and virgins (*e.g.*, Paula and her daughters Blesilla and Eustochium). He taught them the Hebrew text of the Psalms; orally and in letters he answered their biblical problems; and he was their master in spirituality as well. It was in these conditions that he wrote against Helvidius his defense of Mary's perpetual virginity (383) and attacked his foe's subsidiary thesis, the equality of virginity and marriage. But his monastic apostolate and his relationship with the ascetic coterie, his pitiless castigation of Roman clergy, of lax monks and hypocritical virgins, even his correction of the Gospel text provoked such a storm of criticism and calumny, especially after Damasus' death (Dec. 11, 384), that in Aug. 385 Jerome left "Babylon" in bitter indignation and made his way to the Holy Land.

In company with virgins led by Paula, Jerome made a pilgrimage, at once religious and archaeological, through all of Palestine and the monastic centres of Egypt; he spent almost a month with the famed exegete Didymus (*q.v.*) in Alexandria. The summer of 386 found him settled in Bethlehem. There Paula finished, by 389, a monastery for men under Jerome's direction, three cloisters for women under her own supervision, and a hostel for pilgrims. There Jerome lived, with brief exceptions, until his death in 419 or 420.

The literary legacy of those 34 years is the outgrowth of contemporary controversies, Jerome's passion for Scripture and his involvement in monastic life. The controversies were varied. The anti-Origen movement in the east, fanned by St. Epiphanius (*q.v.*), turned Jerome not only against Origen, whose 39 sermons on Luke he had translated in 389, but against his friends Bishop John of Jerusalem (*Contra Ioannem Hier.*, 396) and Rufinus (*Adv. libros Rufini*, 401, 402). His petulance in early correspondence with St. Augustine (394–405), stemming from the African's strictures on Jerome's biblical efforts, imperiled their mutual respect. Even his catalogue of Christian authors, *De viris illustribus* (392), was written to counter pagan pride in pagan culture. Against the monk Jovinian, who asserted the equality of virginity and marriage, Jerome wrote a polemic (*Adv. Iovinianum*, 393) frequently brilliant but needlessly crude, excessively influenced by Tertullian, at times unduly harsh toward marriage. Against the priest Vigilantius, Jerome dictated in one night a warm defense of monasticism, clerical celibacy and especially certain practices connected with the cult of martyrs (*Contra Vigilantium*, 406). The Pelagian problem, transplanted to Palestine with the personal appearance of Pelagius (*q.v.*), called forth Jerome's finest controversial work (*Dial. adv. Pelagianos*, 415); here his use of fictitious interlocutors makes his arguments uncommonly impersonal.

Jerome's biblical production in Bethlehem includes two introductory tools: *Liber locorum*, a useful translation and adaptation of Eusebius' work on Palestinian toponymy; and *Liber interpretationis nominum hebraicorum*, an alphabetical list, with quite fanciful etymologies, of Hebrew proper names in the Bible. Continuing his revision of the Old Latin version of the Septuagint in accordance with Origen's Hexaplar text (an edition with the Hebrew text, in Hebrew and Greek characters, and four different Greek versions arranged in six parallel columns), he took in hand Ecclesiastes, Proverbs, the Song of Songs, Chronicles (Paralipomenon) and Job, and to his Roman revision of the Psalms added Origen's diacritical notes. Between 391 and 405 he produced his Latin translation of the Old Testament on the basis of the original text, a remarkable effort considering the slender instruments at his disposal and the opposition his project provoked. Jerome's Bethlehem commentaries suffer at times from hasty composition, excessive dependence on predecessors and predilection for allegorical interpretation. The *Liber hebraicarum quaestionum in Genesim* gives an important place to geography, etymology and rabbinic tradition. He wrote short glosses on the Psalter and more scientific explanations of Psalms x–xvi. The commentary on Ecclesiastes (*c.* 387) is a milestone in exegesis, because it is the first original Latin commentary that takes advantage of the Hebrew text. Perhaps Jerome's best commentaries are on the minor and major prophets. As for the New Testament, he explained Matthew, accenting the literal sense; he interpreted Paul (Philemon, Galatians, Ephesians, Titus), with the stress on the allegorical; he recast the chiliastic commentary of Victorinus of Pettau on the Apocalypse. Many of his letters are tracts on exegetical problems; and he wrote homilies to his monks on texts of Scripture.

Jerome's ascetical interests at Bethlehem are mirrored not only in his controversies (Jovinian, Vigilantius) but in his charming life of Malchus, the monk captured by Bedouins; his biography of Hilarion, with its miracles and journeyings; his translation of Coptic ascetical works (*e.g.*, the rule of Pachomius); homilies to his monks; and a significant segment of his correspondence.

Jerome's characteristic is his extensive erudition, especially his control of the classics, the Bible and Christian tradition. He is the learned scholar rather than the deep thinker, a sound traditionalist and not a speculative theologian, more competent as editor than as exegete. His career is a turbulent wedding of scholarship and asceticism, his correspondence an exciting source for historian, Scripture student and theologian. His influence has been far-reaching and profound, on the early middle ages in particular: primarily through the Vulgate, but importantly too as exegete and humanist, and because he transmitted much of Greek thought to the west. Despite his excesses in exegesis, it may be that his most lasting lesson to posterity is his insistence, by word and work, that a fruitful intelligence of Scripture must be rooted in the literal sense.

St. Jerome's feast day is Sept. 30.

Collections of Jerome's works include: D. Vallarsi, 11 vol. (1734–42), reprinted in J. P. Migne, *Patrologia latina*, vol. xxii–xxx; J. Haussleiter, I. Hilberg, S. Reiter, in *Corpus scriptorum ecclesiasticorum latinorum*, vol. xlix (revision of Victorinus on Apocalypse), liv–lvi (letters), lix (Jeremiah); G. Morin, in *Corpus christianorum, series latina*, vol. lxxviii (homilies). English translations are: F. A. Wright, *Select Letters of St. Jerome*, Loeb Classical library (1933); W. H. Fremantle, "St. Jerome: Letters and Select Works," in *A Select Library of the Nicene and Post-Nicene Fathers*, vol. vi (1912); C. C. Mierow, *Letters of St. Jerome*, "Ancient Christian Writers Series," vol. xxxi–xxxii (1960).

See also references under "Jerome, Saint" in the Index.

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JEROME OF PRAGUE (*c.* 1380–1416), disciple of John Huss (*q.v.*) and diplomat of his party. On attaining the degree of bachelor of arts in Prague, his birthplace, he journeyed to Oxford, bringing back thence the works of John Wycliffe, of whose philosophy he, like Huss, was a warm admirer. While also bringing copies of the theological works, he himself remained a philosopher only, unlike his colleagues, who mostly sought their living in ecclesiastical posts. He does not seem to have studied further at Prague, but was probably caught up into politics during the civil war between King Wenceslas IV and the great nobles, so that he became the politician among Huss's colleagues. In 1404 Jerome went to Paris, taking the master's degree there within the year, but as a Wycliffite he was compelled to leave and arrived home in 1407, by way of Heidelberg and Cologne, where he had also found adversaries.

He was soon in the forefront of the university dispute between the Czech masters and the foreigners, who were opposed to Wycliffe and who controlled a majority in the university, and he took the lion's share in obtaining from the king, in 1409, the decree of *Kutna Hora*, which abolished the foreigners' privileged position. This brought their enmity upon him and he nearly paid for it with his life in 1410 in Vienna, when he was arrested but saved himself

by flight. He may have visited Oxford again in 1411, but the next year he took a prominent part with Huss in the protest against the sale of indulgences, which cost Huss the royal favour.

Next year Jerome undertook his last mission in the Hussite service, to Cracow and the Lithuanian court. He soon had to leave Cracow, but found sympathetic hearers in Lithuania, and returned home with valuable information, both about the intentions of Poland, which saw in Bohemia an ally in its continual wars with the Teutonic knights, and also about the Orthodox Church and its orders. Arriving home, he heard of the Council of Constance (*q.v.*), and of Huss's invitation thereto. Having promised Huss his support, against all his warnings he arrived at Constance in April 1415 to demand a free hearing. The council refused, and he was arrested near the Bohemian frontier and subjected to cruel imprisonment during which he almost died. The explosion provoked in Bohemia by the burning of Huss caused the council to try to persuade Jerome to recant. After a long struggle he succumbed to temptation when the council offered him a comparatively moderate form of recantation, which was to set him at liberty. But he was not released, and further unconditional recantation was demanded of him; when he refused, further charges were brought against him. He refused to answer these, thus ensuring a public hearing which lasted two days. He disputed bitterly with his judges, concluding with a splendid defense in which he retracted all into which he had previously been tempted, in particular his denial of Huss. On May 30, 1416, he died bravely at the stake on the same spot as his teacher.

Jerome's part in Huss's struggles was not always happy. He was of a disputatious and passionate temperament, ennobled, however, by a Christian humanism which is expressed in the following sentence from one of his letters: "to despise dangers, to go to meet wounds, to receive joyfully and with bared breast the enemy's arrows, this is the finest part of Christian courage." He won the respect and admiration of the scholar Poggio, who described the termination of his trial and his death.

Only fragments of his works exist: some letters, university disputations and lectures and a volume of university public debates, the so-called *Quodlibet* of Jan. 1409. His world was rather that of politics, to which he was drawn by the crisis in Bohemia at the turn of the century. For his part therein, as for his courageous death, he holds a place beside Huss in the memory of later generations.

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JEROME, JEROME KLAPKA (1859–1927), English humorist and playwright whose humour—warm, unsatirical and unintellectual—won him an affectionate public for his books (*Idle Thoughts of an Idle Fellow*, 1889; *Three Men in a Boat*, 1889; *Diary of a Pilgrimage*, 1891; *Three Men on the Bummel*, 1900; etc.). Although the serious passages which intersperse the comedy have worn less well, it was his moral seriousness which contributed to the greatest of his stage successes, *The Passing of the Third Floor Back* (1908), a modern morality in which J. Forbes-Robertson acted. He also wrote an autobiographical novel, *Paul Kelver* (1902). Jerome was born on May 2, 1859, at Walsall, Staffordshire. He was in turn clerk, schoolmaster, actor and journalist, becoming co-editor of the *Idler* (1892–97), for which Mark Twain, W. W. Jacobs and Eden Phillpotts wrote, and editor of *To-Day* (1893–97). He died on June 14, 1927, at Northampton.

See his *My Life and Times* (1926); A. Moss, *Jerome K. Jerome* (1929). (M. KL.)

JEROME EMILIANI, SAINT (GIROLAMO MIANI or EMILIANI) (1486–1537), founder of the Somaschi, one of the Counter-Reformation orders of clerks regular which specialized in the care of orphans, was born of noble parents in Venice. He became an officer in the Venetian army to fight the League of Cambrai (1508) and was taken prisoner at Castelnuovo near Treviso (1511). He turned to prayer in captivity and attributed his escape to divine assistance. Ordained in 1518, he returned to Venice in 1527, and, encouraged by Gian Pietro Carafa (afterward Paul IV), he devoted himself to the relief of the suffering that followed the invasion of northern Italy and the sack of Rome that year. He opened a hospital at Verona (1531) and the house of Somasca (near Bergamo) from which his order took its name (1532). In Bergamo he founded Italy's first home for penitent prostitutes. He died at Somasca on Feb. 8, 1537, having caught typhus while tending sufferers in Bergamo.

He was canonized in 1767 and made patron of orphans and abandoned children in 1928. His feast is kept on July 20.

The Somaschi date their foundation from 1528, and began a community life under the Augustinian rule in 1532. The order was approved by Paul III in 1540 and finally confirmed in 1568. It spread through Italy and in the 20th century to Switzerland and central America.

See G. Landini, *S. Girolamo Miani* (1947). (M. DK.)

JERROLD, DOUGLAS WILLIAM (1803–1857), English dramatist and journalist, who supplied the English theatre with its best-known nautical melodrama, *Black-Eyed Susan*, and captured one brand of Victorian humour in his *Punch* articles—"Mrs. Caudle's Curtain Lectures." He was born in London on Jan. 3, 1803, the son of Samuel Jerrold, sometime manager of the Sheerness theatre. As a boy he served in the navy during the Napoleonic Wars (1813–15) and later put his experience to good use in his plays. After several years' drudgery as resident dramatist at the Coburg theatre, he achieved great success with *Black-Eyed Susan*, based on John Gay's ballad and produced at the Surrey theatre on June 8, 1829. This marked the triumph of a native melodrama over the Gothic drama (of French or German origin) which had previously dominated the English stage. Jerrold wrote other plays in this style (*The Mutiny at the Nore*, 1830; *The Rent Day*, 1832), but aimed increasingly at high comedy. However, in plays such as *Bubbles of the Day* (1842) and *Time Works Wonders* (1845) he was less successful. A prolific journalist, he contributed to *Blackwood's* and many other magazines. He also founded several short-lived journals and edited *Lloyd's Weekly Newspaper* with success. He was at his best in the numerous contributions he made to *Punch* from its second number in 1841 until his death. His series, "Mrs. Caudle's Curtain Lectures," appeared there in 1845 and confirmed the magazine's popularity. The articles appeared in book form in 1846 and were regularly reprinted. Their genial humour distinguishes them from Jerrold's other journalism which was often bitter and sometimes personal in tone. Jerrold died at his home, Kilburn Priory, London, on June 8, 1857. His son William Blanchard Jerrold (1826–84) was also a journalist and dramatist, his play *Cool as a Cucumber* (1851) being one of the most popular vehicles of Charles James Mathews, the actor (*see* MATHEWS, CHARLES).

See William Blanchard Jerrold, *Life and Remains of Douglas Jerrold* (1859); Walter Jerrold, *Douglas Jerrold*, 2 vol. (1914). (GE. R.)

JERSEY, EARLS OF. The English earldom of Jersey was first created in 1697 for SIR EDWARD VILLIERS (*c.* 1656–1711). He was the son of Sir Edward Villiers (1620–1689), of Richmond, Surrey, and had been created Baron Villiers and Viscount Villiers in 1691. His grandfather, Sir Edward Villiers (*c.* 1585–1626), master of the mint and president of Munster, was half brother of George Villiers, 1st duke of Buckingham, and of Christopher Villiers, earl of Anglesey. The 1st earl's sister was Elizabeth Villiers, the mistress of William III and afterward countess of Orkney. Villiers was knight marshal of the royal household in succession to his father; master of the horse to Queen Mary; and lord chamberlain to William III and Queen Anne. He attended the congress of Rijswijk in 1696 and was ambassador at The Hague and in Paris (1698–99). He was made secretary of state for the southern department in 1699. After his dismissal from office by Anne in 1704 he was concerned in Jacobite schemes. He died on Aug. 25, 1711.

The 1st earl's son WILLIAM (*c.* 1682–1721), 2nd earl, was an adherent of the exiled house of Stuart. His son WILLIAM (d. 1769), 3rd earl, succeeded his kinsman John Fitzgerald (d. 1766) as 6th Viscount Grandison. The 3rd earl's son GEORGE BUSSY (1735–1805), 4th earl, was, according to Mrs. Montagu, the "prince of Maccaronies" at the court of George III. His son GEORGE (1773–1859), 5th earl, married Sarah Sophia (1785–1867), daugh-

ter of John Fane, 10th earl of Westmorland, and granddaughter of Robert Child, the banker. She inherited her grandfather's wealth, including his interest in Child's bank, and with her husband took the name of Child-Villiers. Their grandson VICTOR (1845–1915), 7th earl, was governor of New South Wales in 1890–93. His grandson GEORGE (1910–), 9th earl, succeeded to the title in 1923.

JERSEY, largest of the Channel Islands (*q.v.*) and the southernmost of the important ones, lies 12 mi. W. of the Cotentin peninsula, France; its capital, St. Helier, is 100 mi. S. of Weymouth, Eng. The island is about 10 mi. across and 5 mi. from north to south. Pop. (1961) 63,345. Area 44.87 sq.mi. (116.2 sq.km.). The Ecréhous (6 mi. N.W.) and the Minquiers (12 mi. S.), included in the bailiwick of Jersey, are usually unoccupied.

Jersey consists largely of a plateau sloping from north to south. Picturesque cliffs reaching 485 ft. and with remarkable caves line the north coast; elsewhere rocky headlands enclose sandy bays bordered by infilled lagoons which end landward in old cliffs 200 ft. high. These coasts are reef-strewn but protection from southwest gales is afforded to St. Helier harbour on the south coast by a breakwater extending from a rocky island in St. Aubin's bay. The plateau, widely mantled with loess, drains southward through deeply incised and beautiful valleys. Blown sand forms dunes at the northern and southern ends of St. Ouen's bay on the west coast, spreading onto the plateau top. The climate of Jersey is less maritime but more sunny than that of Guernsey. Mean annual temperature is 11° C. (52° F.) and sunshine averages 1,956.7 hours annually. Frost is rare, but cold waves spreading from France in spring occasionally damage the potato crop. Public water supply depends on reservoirs, chiefly in the central Waterworks valley. (G. H. D.)

Remains of Paleolithic man have been found at La Cotte de St. Brelade and there is abundant evidence of the Neolithic and Bronze ages, though it is likely that Jersey did not finally become an island until the Bronze Age. It was probably colonized from Normandy early in the 11th century as part of a general reconstruction in western Normandy after the Viking ravages. The earliest surviving documents date from that century and show the 12 parishes organized as part of the diocese of Coutances. Much of the island in the 12th century was held by landowners in Normandy and by Norman abbeys. Justices from Normandy visited the island, which was divided into three units for the collection of the king-duke's revenue.

The separation from Normandy in King John's reign made reorganization necessary. Jersey kept its Norman law and local customs, but with the other islands was administered on the king's behalf by a warden (*custos, gardien*) and sometimes—regularly in the 15th century—by a "lord of the islands" (dominus, seigneur). From the end of the 15th century Jersey was given its own "captain," a title later changed to that of governor. This office was abolished in 1854, when the duties devolved upon a lieutenant governor who had in fact exercised them for almost 200 years and still exercises them.

Even in the 14th century, however, the warden could not fulfill all his duties regularly in four islands, and delegated his judicial responsibilities in Jersey to a bailiff, often a Jerseyman. In 1617 it was ruled that "the care of justice and civil affairs" belonged wholly to the bailiff. The Royal court, as it came to be called, took the same form as that of Guernsey, except that the executive officer was the *vicomte* appointed by the king, and it still survives in a form that reveals its medieval origin.

The States of Jersey, which evolved similarly to the States of Guernsey, were in 1771 separated from the royal court and assumed residual powers of legislation. Deputies from the parishes were first elected in 1857. Late in the 19th century the States of Jersey contested the right of the privy council to legislate for the island without consultation; no judgment was made against them.

During the middle ages Jersey was much less involved in commerce than Guernsey and its aristocracy was relatively stronger. In the 17th century the De Carterets, seigneurs of St. Ouen, dominated the island, and it was due to them that Jersey was held for the king from 1643 to 1651. In the 18th and 19th centuries

E. W. TATTERSALL

MONT ORGUEIL CASTLE DOMINATING THE VILLAGE OF GOREY ON THE EAST COAST OF JERSEY, LARGEST OF THE CHANNEL ISLANDS

the island was torn by repeated feuds—Magots *versus* Charlots, Laurels *versus* Roses—but it also grew wealthy from the Newfoundland fisheries, privateering and smuggling and later from cattle, potatoes and tourists. There was an influx of English immigrants from about 1830, of political refugees from Europe after 1848 and, after about 1918, of men and capital seeking to avoid taxation. (LE P.)

The population, mainly of Norman descent but with an admixture of Breton, numbered 28,600 in 1821, 57,020 in 1851, 52,576 in 1901 and 49,701 in 1921, no net increase having occurred for a century. Nearly half the people live in St. Helier parish and high densities are also recorded in the adjacent parishes of St. Saviour and St. Clement. Apart from St. Helier (*q.v.*), Gorey on the east coast and St. Aubin in the southwest, settlement in Jersey is dispersed.

The Channel Islands are not part of the United Kingdom and Jersey is governed under the British monarch in council by the States, in which the bailiff (appointed by the crown) presides over 12 senators, 12 constables and 28 deputies, all popularly elected. The lieutenant governor and crown officers have seats in the States and may speak but not vote. The Royal court consists of the bailiff as chief magistrate and 12 jurats chosen by an electoral college. The judicial and legislative functions of jurats were not separated until 1948 when other reforms excluded from the States the rectors of the 12 parishes. The proceedings are conducted in French, which is the official language of the island though English is everywhere understood.

Farming, more prominent than in Guernsey, concentrates on dairying (with ancillary cropping) and on breeding for export of the famous small, cream- or fawn-coloured Jersey cattle, renowned for their rich milk, which have been the only breed allowed on the island since 1789. Market gardening is most developed in the southwest, but many small farms grow early potatoes, harvested in May, followed by outdoor tomatoes picked at the end of summer. The number of greenhouses and the production of flowers, indoor tomatoes and vegetables were increasing in the late 1950s. Soil quality is maintained by dressing with vraic (Fr. *varec*, "wrack" or "seaweed"), compost and artificial fertilizer. Jersey has a well-established and flourishing tourist trade. The principal imports are foodstuffs, solid fuels, petroleum and building materials. The chief exports are potatoes, tomatoes, vegetables (mainly broccoli) and granite. Passenger and cargo ships connect Jersey with Guernsey, Southampton and Weymouth and with St. Malo, France, and there are cargo services to London and Liverpool. St. Helier is the main port and Gorey a secondary port. Air links are extensive; internal transport relies mainly on bus services centred on St. Helier. (G. H. D.)

JERSEY CITY, a city and seat of Hudson county, northeastern New Jersey, U.S., located on a peninsula between the Hudson and Hackensack rivers directly opposite Manhattan Island. It is connected to New York city by ferries and auto tunnels and is a major vehicular route to that city also via the three-mile long Pulaski skyway, carrying vehicles to the entrance of the Holland

tunnel. Railroads have extensive terminal installations and marshaling yards there, constituting one of the greatest railhead concentrations in the world. The Morris canal, a part of the national inland waterways system, has its terminus there also. The population in 1960 was 276,101 (for comparative population figures *see* table in NEW JERSEY: *Population*). Jersey City is within the Jersey City standard metropolitan statistical area (Hudson county), with a population (1960) of 610,734, and is a part of the New York-Northeastern New Jersey standard consolidated area.

The site of Jersey City was first visited by Henry Hudson in 1609 and was settled by the Dutch trappers operating in the area in 1618. About 1630 the site was formally purchased from the Leni-Lenape Indians by Michiel Pauw and by 1650 a permanent settlement had been established. In 1664 the British seized it briefly, returned it to the Dutch, and then took it back permanently in 1674 as part of the spoils in the Dutch War then raging. In 1804 Anthony Dey and a number of his associates founded the Town of Jersey, which name later (in 1820) was reconstituted as Jersey City. Between 1834 and 1873 it grew tremendously and rapidly absorbed several surrounding communities so that in 1874 it was formally chartered as a city. In the middle of the 19th century the foremost ceramics industries located there, as did the P. Lorillard Tobacco company, then a dealer in snuff.

Its major industrial activities include paper products, containers, paints, oil refining, chemicals, locomotives, apparel, tanks, toys and asbestos products. It is also a seaport of some note, being part of the complex known as the Port of New York.

Jersey City, which, after the state legislature had passed enabling legislation at the behest of Gov. Woodrow Wilson in 1913, had become the first large city in the eastern U.S. to adopt the commission form of government, voted in 1960 to replace it with a mayor and council. It is the site of St. Peters college, a Roman Catholic school of liberal arts for men, established in 1872, as well as of Jersey City State college, founded as New Jersey State Normal school in 1921, which specializes in training public school teachers. Also located there is Seton Hall College of Medicine and Dentistry and a municipal medical centre which includes the Margaret Hague Maternity hospital. (D. N. A.; M. P. M.)

JERUSALEM (in Arabic AL QUDS ASH SHERIF, commonly AL QUDS), the holy city par excellence of Judaism and Christianity, and after Mecca and Medina the chief shrine of Islam, has in an unbroken span of 3,000 years been the centre and goal of religious devotion. Since 1948 it has been divided between Jordan and Israel; the Israeli part is the capital of Israel.

Jerusalem is situated on the ridge of the Judaean hills, at an average height of 2,500 ft. above the Mediterranean sea on the west and 3,800 ft. above the Dead sea on the east. It owes its position first to its natural strength, being protected from assault by deep valleys, Kidron on the east and Hinnom on the west, which converge at its southern extremity, leaving only the north exposed; second, to the presence beneath its eastern flank of a perennial spring, a rare asset in Palestine; third, to its command of the pass from east to west immediately north of the Dead sea. Its history has been marked by two phenomena: it has always been the hearth and home of monotheism, but its material fortunes have invariably depended on the rivalries of external powers.

Jerusalem of the Old Testament.—The first documentary evidence for the existence of Jerusalem is supplied *c.* 1370 B.C. by the Tell el-Amarna tablets, wherein the governor of the town appeals to the Pharaoh Ikhnaton for help, as the country is being overrun. The city is called Urusalim, meaning, possibly, city of peace, or abode of a Semitic god called Salem. In 1961 excavations by the British School of Archaeology in Jerusalem showed that a walled town existed on part of the site during the Middle Bronze Age II, probably in 1800 B.C. Clearly, therefore, before the arrival of the Hebrews, Jerusalem was a Canaanite city of importance. The original city stood immediately above and to the west of the spring on the tongue of land known as Ophel (the Old Testament Zion; *q.v.*), south of the temple, and flanked by the Tyropoeon and Kidron valleys. The excavations proved that the town was much larger than was formerly supposed, that it extended far down the eastern slope and that the earliest shaft giving access to the spring was well within the line of its walls.

Jerusalem was captured by David in the seventh year of his reign, *c.* 1000 B.C., his men under Joab entering the city by scaling the well shaft (II Sam. v, 6–9). David's purchase of the threshing floor which occupied the rocky hilltop to the north of his new capital was to determine the future of Jerusalem for all time, because it was there that his successor, Solomon, built the first Temple. The little state knew no peace: first about 926 the northern tribes seceded, then in 922 (estimates of these dates vary) Shishak of Egypt sacked the city, followed by the Philistines and Arabians in 850 and Joash of Israel in 786. Sennacherib's siege in 701 was unsuccessful, largely because the construction of the famous Siloam tunnel had denied his forces access to the waters of the spring. Hezekiah nevertheless was forced to pay heavy tribute. Under Assyrian influence pagan cults made headway but were denounced by Jeremiah and Ezekiel. In 597 Jerusalem was despoiled and its king deported to Babylon (which had overcome Assyria). In *c.* 588 (some authorities give 587, 586) the city and temple were completely destroyed and the captivity began. In 537, after Cyrus the Persian had replaced the Babylonian power, came the postexilic return. Through the initiative and energy of Nehemiah the city walls were restored. The Temple was rebuilt and dedicated under the governorship of Zerubbabel. It was uninspired as compared with the original (Hag. ii, 3), but it survived longer than either its predecessor or its successor.

Greco-Roman Jerusalem.—Little is known of the city's development during the next two centuries, but the advent of Alexander the Great to the Levant and his victory at Issus in 333 profoundly affected Jerusalem. Hitherto it had been an oriental city subject to oriental influences. Now, for almost a thousand years, until the coming of the Arabs and Islam, it was to be within the orbit of western power politics, a situation repeated in the 19th and 20th centuries. Ptolemy I of Egypt entered Jerusalem; but in 198 the northern or Seleucid dynasty acquired it. The growth of Greek—that is, pagan—influence increasingly alarmed the orthodox, whose hostility showed itself in open revolt in 168, when Antiochus IV Epiphanes deliberately desecrated the Temple. The revolt was led by a pious countryman called Mattathias of the family of Hasmon, and was carried on by his son Judas Maccabaeus (*see* MACCABEES). The Hasmonaeans were able to establish a state, ruled by priest-kings, which was almost the size of Solomon's kingdom, and came to include Galilee "of the Gentiles," thus ensuring that all those born to Galilean parents, including Jesus of Nazareth, would be brought up in a Jewish society.

Rome was now in the ascendant, and in 63 B.C. Pompey captured Jerusalem and horrified the Jews by entering the Holy of Holies—a bad augury for Rome's dealings with Judaea. The inevitable clash between Rome and Jewish nationalism was averted for some time by the adroitness of a remarkable family, whose most illustrious member was Herod (*q.v.*) the Great. His father, Antipater, of Idumaean (Arab) stock though of Jewish faith, had married an Arab noblewoman from Petra. He and his son were quick to see that opposition to Rome was useless and that cooperation with the new power might bring golden rewards. In 40 B.C., three years after his father's death, Herod, previously governor of Galilee, was appointed king of Judaea by the Roman senate. With the help of a Roman army he defeated the last of the Hasmonaeans, and, as the friend first of Antony and then of Augustus, ruled Judaea for the next 36 years, during which he largely rebuilt Jerusalem. He first erected the Antonia fortress at the northwest corner of the Temple area and then rebuilt the Temple, enlarging the parvis, now Al Haram-ash-Sharif, to its present extent of 35 ac. Finally he constructed a palace the vestiges of which remain in the present citadel. This was joined to the Antonia fortress by the second wall. Herod was succeeded by an unsatisfactory son, Herod Archelaus (*q.v.*), and in A.D. 6 Judaea became a province of the third class, governed by a procurator. It was under the fifth of these, Pontius Pilate (26–36), that Jesus of Nazareth was put to death.

During the years 41 to 44 the Herodian kingdom was reconstituted in favour of Herod Agrippa I (*q.v.*), a grandson of Herod the Great. Agrippa's contribution to Jerusalem was the building of a

new north wall, known as the third wall, to enclose the new suburb which Roman security had brought into being. The trace of this wall has been the subject of much controversy; but the question may be regarded as settled in the light of the latest archaeological knowledge and expert judgment of the Dominican fathers, who have shown that it occupied in the main the site of the existing north wall of the city. The third wall enclosed Calvary and the tomb of Joseph of Arimathea nearby, which, in accordance with immemorial custom, had been built just outside a gate of the second wall. Excavations made in 1961 suggested that Agrippa also enlarged the walled area on the south.

In A.D. 66 the Jews rebelled against Rome. The revolt was crushed in 70, and it involved the siege and destruction of Jerusalem and the burning of the Temple. Jerusalem was left desolate save for a garrison camp. By 130 the town was partly repopulated; but the emperor Hadrian, who, like Herod, was a passionate builder, decided to erect on the site a new city which was to be a Roman colony. The Jews, under the leadership of Bar-Cochba, again revolted and again were crushed (132–135). Jerusalem ceased to exist even in name and Aelia Capitolina arose in its place. This creation, which is represented in the famous mosaic map at Madeba (Ma'daba) in east Jordan (*see* MAP: *History: Medieval Europe and Orient*), changed the orientation of the main street, which had been between the Temple and the citadel (that is, east and west), to what it has been ever since (north and south), in accordance with Roman practice. The *cardo maximus* or main street of Hadrian's colony is still the main street, leading south from the Damascus gate or the Gate of the Pillar, as it was called, after the memorial column which the Madeba map shows Hadrian to have erected inside the gate. The Temple area was left outside the new town, and statues of Hadrian and of Jove were placed on the hill. The site of the Holy Sepulchre was desecrated by a temple of Venus, patroness of Rome. Jews and Christians of Jewish origin were excluded from Aelia, but a gentile Christian church continued to exist. Its bishops bore Greek names and its liturgy was Greek. In 212 Bishop Alexander founded a library. He had come originally as a visitor from Cappadocia, so that this date may be taken as marking the beginning of the pilgrimages. Origen, the greatest thinker of his age, several times visited Jerusalem to collect manuscripts. In 250 Alexander, bishop of Jerusalem, was a victim of Decius' persecution. The Palestinian church suffered severely also under the persecution of Diocletian.

Christian Jerusalem.—By 315 pilgrims were flocking to Jerusalem, worshiping on the Mount of Olives, which seems to have been the only site then accessible to veneration. In 325 Bishop Makarios of Jerusalem attended the Council of Nicaea and obtained the support of Constantine for his project of rehallowing Calvary and the Sepulchre. In the following year the empress Helena visited Jerusalem, and basilicas were founded on the Mount of Olives and at Bethlehem. In 333 the anonymous Bordeaux pilgrim saw these buildings in the course of erection; and in 335 a synod was held at Jerusalem and the Church of the Resurrection (Anastasis, as the Greeks still call it), or Holy Sepulchre, was consecrated (*see* SEPULCHRE, HOLY). The church is clearly discernible in the Madeba mosaic. It was approached from the east by a triple gateway, portions of which still stand. Over the tomb a rotunda was built, and between the gate and the rotunda a great basilica of five aisles and an apse, in a spacious courtyard. Calvary remained isolated as a separate shrine. The grandeur of the design and the richness of the decoration of this group of buildings now restored to Jerusalem the religious primacy it had enjoyed when the Temple stood. Julian the Apostate is said to have contemplated the restoration of the Temple, but the plan was brought to nothing by an explosion of firedamp in 362. In the middle of the 5th century the empress Eudocia further embellished the holy city, where she died in 460. In 451 the Council of Chalcedon made Jerusalem a patriarchate independent of Caesarea, to which it was previously subordinate. It has ever since been autocephalous (*see* JERUSALEM, GREEK ORTHODOX PATRIARCHATE OF). About 522 the emperor Justinian enriched the city with a great basilica dedicated to the Virgin, on the western hill, of which no trace remains. In 614 this splendid epoch was brought to an end by the invasion of the Persians, who looted the city, massacred the inhabitants and burned the churches. The True Cross was carried off, to be recovered in 629 or 630 by Heraclius. But in 638 the Muslim caliph Omar entered Jerusalem.

Muslim Jerusalem.—Jerusalem is sacred to Islam because the prophet originally enjoined that prayer be directed toward it (Koran ii, 136, 138) and because it was the goal of his nocturnal journey (xvii, 1). Omar was content to build a wooden-roofed mosque on the Temple site, the forerunner of the present Aqsa; but the tenth caliph, Abd-al-Malik, built the Dome of the Rock (completed 691), modeled on the rotunda of the Resurrection. The Church of the Resurrection, which had been rebuilt on a more modest scale after the Persian sack, remained in Christian hands. The Muslims showed themselves tolerant to both Jews and Christians, so much of whose religious tradition they themselves revered. In 750 the Omayyads were succeeded by the Abbasids of Baghdad, who continued the liberal policy of their predecessors. Harun al-Rashid is said to have sent the keys of the Holy Sepulchre to Charlemagne in 800. In 969 Jerusalem passed to the control of the Shi'ah caliphs of Egypt, and about 1009 al-Hakim ordered the destruction of the Christian shrines. In 1077 the Seljuk Turks inflicted on the Byzantines, at Manzikert, a disastrous defeat. They then swept down through the Levant, displacing the Egyptians as the lords of Jerusalem. Their interruption of the pilgrim routes stimulated the resentment of western Christendom; and a movement for the liberation of the Holy Land was started which resulted in the crusades (*q.v.*).

A Latin kingdom was established, which lasted from 1099 to 1187. The Knights Templar made their headquarters in the Temple area, whence their name; and the Dome of the Rock became their church, the model for the round churches built by the Templars in London and elsewhere and for baptisteries such as that at Pisa. Other churches were built, the best surviving example of which is St. Anne's. When the crusaders entered Jerusalem, they founded there many hospitals and hostels for pilgrims. One, created originally by merchants from Amalfi, Italy, was directed by a certain Gerard. In 1113 Pope Paschal II issued to him the bull which may be regarded as the instrument which constituted the Order of the Hospital of St. John of Jerusalem.

In 1187 Saladin united Syria and Egypt under his rule and defeated the Latins at Hattin above Tiberias. Except for two short interludes, 1229–39 and 1243–44, and between 1917 and 1948, Jerusalem has ever since been in Muslim hands. In 1244 the city was sacked by the Khorezmian Tatars. Ruled, from 1187, by the Ayyubid sultans of Damascus, in 1247 the Holy City fell once again to Egypt, and was to remain subject to the Mameluke power for 270 years, during which many of the finest examples of Jerusalem's surviving Islamic architecture were built. In 1517 the Turkish sultan Selim I occupied Jerusalem, thus inaugurating an Ottoman domination which was to last for 400 years. Selim's successor, Suleiman the Magnificent, rebuilt the ramparts in their

G. REITZ—PIX FROM PUBLIX

BUILT IN THE 16TH CENTURY, THE DAMASCUS GATE WAS ONE OF THE LAST OTTOMAN ARCHITECTURAL ACHIEVEMENTS IN JERUSALEM

present form and constructed the Damascus gate, Islam's last architectural gift to Jerusalem.

For nearly 300 years Jerusalem was to have no history. But in the 19th century the eyes of the west were once again turned toward it. From 1832 to 1840 it was governed by Mohammed Ali of Egypt and his son Ibrahim Pasha. In 1838 a British consulate was opened, among its duties being to safeguard the interests of the Jews generally. In 1841 the Anglican bishopric was founded. Shortly afterward the Latin patriarchate was revived, to rank with those of the Orthodox and Armenian churches. The Coptic and Abyssinian churches are also represented in Jerusalem. The Crimean War, when France and England took the field as allies of Turkey, had a profound influence on the status of Europeans in Jerusalem. In 1855 they were admitted for the first time to the Haram. In 1856 the Edict of Toleration for all religions in the Ottoman empire was promulgated by the Porte. Archaeological research was undertaken. In 1841 two officers of the Royal Engineers had made the first survey of Jerusalem. In 1864 a new and more extensive one followed, at the expense of Angela (afterward Baroness) Burdett-Coutts. These activities led to the foundation of the Palestine Exploration society. The work of Warren, Wilson, Conder and Kitchener resulted in the *Recovery of Jerusalem* and the *Survey of Palestine*, both still standard works. The Jewish communities, both the Sephardic and the Ashkenazic, under the patronage of England, expanded throughout the century, their vitality being reinforced by the foundation in the 1880s of the first agricultural colonies and the growth of the Zionist movement. The first international Zionist congress was held at Basel, Switz., in 1897 (*see* ZIONISM).

Modern Jerusalem.—In Nov. 1917 the British government issued the Balfour declaration. In the following month Gen. E. H. H. Allenby entered Jerusalem. A military administration was set up, to be followed in 1920 by a civil administration. On April 25 of that year the supreme council sitting at San Remo, Italy, allocated the mandate to Great Britain (*see* also PALESTINE). Under the mandatory regime Jerusalem enjoyed a period of material prosperity and expansion such as it had not known since Roman days. Justice, health, education, roads, water supply, land settlement, all the amenities of a modern community were introduced and consolidated. At the close of the mandatory period Palestine was probably the best-administered state in Asia. Politically, matters had gone from bad to worse. The Balfour declaration had encouraged Zionist hopes and inflamed Arab suspicions. Throughout the period, therefore, while the material and social progress of both communities was greatest, their distrust of each other and of the mandatory power increased, and was repeatedly marked by violence. Thus in its latter days, as in its earliest, Jerusalem was to illustrate the paradox innate in its destiny: it was never more powerfully the magnet of devotion, never more fatally the source of strife. The armistice line, after the fighting between the Arabs and Jews in 1948, which served as a *de facto* frontier, left the Old City, historic Jerusalem, together with the northern suburbs, the airport and the archaeological museum, within the jurisdiction of the Hashemite Kingdom of Jordan, and the western and southern suburbs under the control of Israel. No intercourse between the inhabitants of the two zones is permitted, except for Christians domiciled in Israel at Christmas and Easter. Visitors may cross from one side of the line to the other at one controlled point, but may not re-enter by it.

On both sides much new construction has taken place, the most remarkable on the Israeli side (where many unsightly old quarters have been redesigned) being the buildings of the Hebrew university, which formerly was sited on Mt. Scopus in a demilitarized enclave in Jordanian territory. On the Arab side, the enforcement of the regulation that all buildings must be faced with stone has ensured that the new quarters are dignified and attractive. New roads have been laid out, and a new municipal garden near the Damascus gate. The Ophthalmic hospital of the Order of St. John was inaugurated in Oct. 1960. Arab Jerusalem is the seat of a *muhafiz*, or governor, who is also charged with the supervision of the holy places of Jerusalem and Bethlehem. Jerusalem is accessible by air from Beirut, Leb., and by road from Damascus, Syria, and Aqaba on the Red sea. Although hindered by the division of the city, pilgrims and visitors throng to Jerusalem from all over the world, many of them coming from lands unheard of in biblical times.

A. L. GOLDMAN FROM RAPHO GUILLUMETTE

A VIEW OF THE HEBREW UNIVERSITY CAMPUS AT GIVAT RAM

See also PALESTINE: *The Holy Places* and references under "Jerusalem" in the Index.

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(S. H. P.)

JERUSALEM, GREEK ORTHODOX PATRIARCHATE OF. This patriarchate of the Orthodox Eastern Church (*q.v.*) includes the territories of Jordan and Israel and all that was Palestine and Transjordan before 1948; the Orthodox Eastern population of the patriarchate numbered about 100,000 in the early 1960s.

According to tradition, the first bishop of Jerusalem was James, "the brother of Jesus" (*see* JAMES, SAINT), and the first church there included Jews who spoke Greek (Acts vi. 1). In the year A.D. 68, because of the war between the Jews and Rome, the Christians of Jerusalem fled to the Greek city of Pella, from which they returned a few years later. Hadrian rebuilt Jerusalem in 138 as a Roman colony; its bishops were still regarded as successors of James. In the 4th century the emperor Constantine and his mother, Helena, built and endowed the shrines in the holy places and Jerusalem became a great centre of Christian religious life and pilgrimage. In 451 the Council of Chalcedon made it a patriarchate. After the Muslim conquest in the 7th century Islam became the religion of the majority of the population, but a Christian minority remained, subject to patriarchs still in communion with Constantinople.

Under the rule of the crusaders Western clergy acquired a predominant position in the holy places, but the Eastern Christians never abandoned the shrines. After the departure of the crusaders, the holy places were used, with the permission of the temporal power, by Greek monks, by Syrians of various confessions and by others who came to Jerusalem on pilgrimage and established mon-

asteries there, including Georgians, Armenians, Copts, Ethiopians and the Franciscan Friars who were in charge of the Western Christian pilgrims. Each community struggled to acquire and preserve the right of worship in the various holy places. In modern times a considerable number of local Orthodox Christians have become Roman Catholics and some have joined other churches.

The Orthodox Eastern patriarchate of Jerusalem is officially known as "Greek Orthodox" (in Arabic *Roum*) because its monks and hierarchy are Greek and also so that it may be distinguished from other churches called "Orthodox." The patriarch and bishops are drawn from the monasteries in and near the holy places, of which the monks form the Brotherhood of the Holy Sepulchre, a Greek body whose members, however, have to be Jordanian subjects. The married clergy are drawn from the local population; the liturgy is in Greek in the monasteries and in Arabic in the parish churches.

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JERUSALEM, SYNOD OF, held in 1672, was the most important modern council of the Orthodox Eastern Church. Convened by Dositheos (*q.v.*), the patriarch of Jerusalem, in order to combat the Calvinizing *Confession of Orthodox Faith* (1629) of Cyril Lucaris (*q.v.*), in its 18 canons it repudiated that confession article by article and accepted the *Orthodox Confession* of Peter Mogila (*q.v.*). Against Calvinism the synod aimed its rejection of unconditional predestination and of justification by faith alone, as well as its advocacy of what are substantially the Roman doctrines of transubstantiation and of purgatory; against the Church of Rome, however, it maintained the rejection of the *filioque*, affirming once more that the Holy Spirit proceeds from the Father only. (*See* CREED: *Nicene Creed: Filioque Clause;* HOLY SPIRIT.) Among other points, the synod decreed also that the church is equally infallible with Scripture, that there are seven sacraments, and that the books of Tobit, Judith, Ecclesiasticus and Wisdom are canonical.

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JERUSALEM ARTICHOKE: *see* ARTICHOKE.

JESPERSEN, (JENS) OTTO (HARRY) (1860–1943), Danish linguist, born at Randers, Den., on July 16, 1860, was once regarded as the greatest authority on English grammar. He helped revolutionize language teaching in Europe and contributed greatly to the advancement of phonetics, linguistic theory, the history of the English language, and the international language movement.

Appointed professor of English in the University of Copenhagen in 1893, he led a movement for basing foreign language teaching on everyday speech. His *Lehrbuch der Phonetik* (1904) was long the best scientific treatment of general phonetics. His *Philosophy of Grammar* (1924) and his encyclopaedic *Modern English Grammar*, seven volumes (1909–49), a reaction against the usual set of rigid rules put into traditional Latin categories, presented grammar as something relative and ever evolving. Early influenced by Darwin's evolutionary theories, he believed in progress in language and efficiency in linguistic change. His works—much quoted by linguists—were clear and stimulating enough to attract a wide public. Jespersen died in Roskilde on April 30, 1943.

There is an account of his life in *English Studies*, vol. xxv, p. 5 (Oct. 1943). For a bibliography of his works to 1930 see *A Grammatical Miscellany Offered to Otto Jespersen* (1930); beyond 1930, see *Det Kongelige Danske Videnskabernes Selskabs Oversigt over Selskabets Virksomhed 1943–44*, pp. 57–63 (1944) and *Selected Writings* (1963). (W. F. Mv.)

JESSE, in the Bible, the father of David (*q.v.*), and as such often regarded as the first in the genealogy of Jesus Christ (*cf.* Isa. xi, 1, 10). Hence the design representing the descent of Jesus from the royal line of David, which was formerly a favourite ecclesiastical ornament, is called a "tree of Jesse." From a recumbent figure of Jesse springs a tree bearing in its branches the chief figures of the line of descent, and terminating in the figure of Jesus, or of the Virgin and Child. The design was chiefly used in windows. The great east window at Wells and the window at the west end of the nave at Chartres are fine examples.

JESSEL, SIR GEORGE (1824–1883), English judge noted for his success in expediting the work of the court of appeal and in helping assure the successful application of the Judicature acts of the late Victorian era, was born in London, Feb. 13, 1824, the son of Zadok Aaron Jessel, a Jewish coral merchant. George Jessel was educated at a school for Jews at Kew, and at University college, London. He entered as a student at Lincoln's Inn in 1842 and was called to the bar in 1847, becoming queen's counsel in 1865. Jessel entered parliament as Liberal member for Dover in 1868, and attracted Gladstone's attention by two learned speeches on the Bankruptcy bill that was before the house in 1869, with the result that in 1871 he was appointed solicitor general. His reputation at this time stood high in the chancery courts; on the common law side he was unknown, and on the first occasion upon which he came into the court of queen's bench to move on behalf of the crown, there was very nearly a collision between him and the bench.

In 1873 Jessel succeeded Lord Romilly as master of the rolls. From 1873 to 1881 Jessel sat as a judge of first instance in the rolls court, being also a member of the court of appeal. In 1881 the Judicature act of that year made the master of the rolls the ordinary president of the first court of appeal, relieving him of his duties as a judge of first instance. In the court of appeal Jessel presided almost to the day of his death. He sat for the last time on March 16, 1883, and died on March 21.

As a judge of first instance Jessel was a revelation to those accustomed to the proverbial slowness of the chancery courts and of the master of the rolls who preceded him. He disposed of the business before him with rapidity combined with correctness of judgment, and he not only had no arrears himself but was frequently able to help other judges to clear their lists. His knowledge of law and equity was wide and accurate, and his memory for cases and command of the principles laid down in them extraordinary. In the rolls court he never reserved a judgment, not even in the Epping forest case, in which the evidence and arguments lasted 22 days (150 witnesses being examined in court, while the documents went back to the days of King John), and in the court of appeal he did so only twice, and then in deference to the wishes of his colleagues. Never during the 19th century was the business of any court performed so rapidly, punctually and satisfactorily as it was when Jessel presided.

Jessel was master of the rolls at a momentous period of legal history. The Judicature acts, completing the fusion of law and equity, were passed while he was judge of first instance, and were still new to the courts when he died. His knowledge and power of assimilating knowledge of all subjects, his mastery of every branch of law with which he had to concern himself, as well as of equity, together with his willingness to give effect to the new system, caused it to be said when he died that the success of the Judicature acts would have been impossible without him. His faults as a judge lay in his disposition to be intolerant of those who endeavoured to persist in argument after he had made up his mind; but though he was peremptory with the most eminent counsel, young men had no cause to complain of his treatment of them.

Jessel's career marked an epoch on the bench, because of the active part taken by him in rendering the Judicature acts effective, and also because he was the last judge capable of sitting in the house of commons, a privilege of which he did not avail himself. He was the first Jew who, as solicitor general, took a share in the executive government of his country, the first Jew who was sworn a regular member of the privy council and the first Jew who took a seat on the judicial bench of Great Britain.

See the *Times* (London) (March 23, 1883); Sir Charles Jessel, "An Eminent Victorian Lawyer," *Blackwood's Magazine* (Jan. 1926); Sir Arthur Lehman Gondhart, *Five Jewish Lawyers of the Common Law* (1949). (S. TT.; X.)

JESSORE, a town and district formerly in the Rajshahi and now in the Khulna division of East Pakistan. The town is the district headquarters and lies on the Bhairab river, 68 mi. N.E. of Calcutta, India. Pop. (1961) 46,366, including 7,062 in the cantonment. The name Jessore was given to the village of Kasba when it was made the headquarters of the district about 1790. According to tradition Jessore is the corruption of Yasohara, which means glory-depriving, as the village is said to have robbed the ancient city of Gaur of its pre-eminence. The ancient buildings include the old Rajbari of Chanchra and the shrines of the pirs Bahram Shah and Gharib Shah. The modern buildings are the municipal hall, the collectors' offices, the town hall and a fine stadium. The Michael Madhusudan college, named after the poet (*see* DUTT, MICHAEL MADHU SUDAN), is affiliated to Rajshahi university. A public library is attached to the Jessore institute. The town is connected by rail with Darsana to the north and Khulna to the south, and is served by the Pakistan International airlines. Uday Shan-Kar, the dancer, was born in Jessore.

JESSORE DISTRICT (area 2,547 sq.mi.; pop. [1961] 2,190,151) lies in the centre of the Ganges delta. It is an alluvial plain, intersected by rivers and watercourses which in the south spread out into large marshes. The rivers of Jessore have ceased to be true deltaic rivers. Some, such as the Madhumati, have active currents, but others have become silted up and except during the rains are chains of long, almost stagnant pools. The staple crop of Jessore is rice and the principal industry is the manufacture of sugar from date palms. At the time of the partition of the Indian subcontinent, the southwest part of the British district of Jessore was incorporated into Twenty-Four Parganas (*q.v.*), India.

(K. S. AD.)

JESTER: *see* FOOL (Jester); CLOWN.

JESUATI (APOSTOLIC CLERKS OF ST. JEROME), a religious congregation of laymen founded about 1360 by Blessed John Colombini of Siena, who gave away his fortune to two convents and a hospital and attracted other laymen to a common life of works of mercy; in 1367 Urban V approved the group. The Jesuati received their name from their frequent use of the phrase "Jesus be praised" as they walked through the streets. In 1499 Alexander VI gave them the title of Jesuati of St. Jerome and they were also known as the Aquavitae Fathers because of the medicines and alcoholic liquor they manufactured. The congregation was dissolved by Clement IX in 1668 by the bull *Romanus Pontifex.*

See "Gesuati," in *Enciclopedia Cattolica*, vol. vi, p. 223 (1951); "John Colombini, Blessed" in *Catholic Encyclopedia*, vol. viii, p. 458 (1910).

(C. J. BO.)

JESUIT DRAMA: *see* DRAMA: *Modern Drama.*

JESUITS, the name commonly given to the members of the Society of Jesus. *See* JESUS, SOCIETY OF.

JESUS, SOCIETY OF (SOCIETAS JESU; S.J.), a Roman Catholic order of clerks regular, founded in 1540 by St. Ignatius of Loyola. Its members rely on alms for their support and have for their aim the spiritual perfection not only of themselves but of others. In the beginning Ignatius used the Spanish term *compañia* to express the soldierly spirit of loyalty to the captain, Jesus; this name was later Latinized by Ignatius into *societas.* The word "Jesuit," originating in the preceding centuries, was fixed on Ignatius' companions as a term of reproach and contempt, but gradually it was accepted by the society and acquired an honourable meaning. The two understandings of the name have persisted, so that the Jesuits have always been regarded by some as a society to be feared and condemned and by others as the most laudable and esteemed religious order in the Catholic Church.

FOUNDATION AND INSTITUTE

The establishment of the Society of Jesus as a religious order evolved in the mind of Ignatius of Loyola (*see* LOYOLA, SAINT IGNATIUS OF) through a term of years and a series of clarifications. Born in 1491 in the ancestral castle of Guipúzcoa, Ignatius was early inducted into the career of the soldier. In 1521, campaigning for the defense of Navarre against the French, he was struck down by a cannon ball at Pamplona. The period of inactivity that necessarily followed turned him from military pursuits to religious aspirations. His definite conversion dated from his pilgrimage to Montserrat and his life as a recluse at Manresa, where he was inspired with the ideas which later were formulated in the *Spiritual Exercises.* His first apostolic impulse was for labour in the Holy Land, where he went in 1523. Visioning more clearly, however, he realized that education and companions were required to execute his plans for God's greater glory. He devoted 11 years to study at Barcelona, Alcalá, Salamanca and finally at Paris.

At Paris he attracted to himself six brilliant young university students: Peter Favre, a Savoyard; Francis Xavier of Navarre; Diego Laínez, Alphonsus Salmerón, Nicholas Bobadilla, Spaniards; and the Portuguese Simon Rodriguez. In 1534 these seven bound themselves by vows to poverty, chastity and a pilgrimage to Jerusalem. Three others had joined the brotherhood by 1536: Claude Le Jay, a Savoyard; and the Frenchmen Jean Codure and Paschase Broët. Being prevented by the war between Venice and the Turks from going to the Holy Land, the companions, who with papal permission had been ordained, went to Rome in order to place themselves at the disposal of the pope. Thus far, they had followed no rule and were subject to no communal authority. But, looking toward their future mode of life, they saw the necessity of obedience to an authority and of seeking means to perpetuate their brotherhood. In 1539 Ignatius drew up a *Formula instituti,* which contained the fundamentals of the order they wished to found and which, after some hesitation, Paul III approved on Sept. 27, 1540, in the bull *Regimini militantis ecclesiae.* The membership was limited to 60, a limitation removed by Julius III, Paul's successor. In April 1541 Ignatius was chosen general of the new order.

The concept of the society is briefly expressed in two documents composed by Ignatius: the *Spiritual Exercises* and the *General Examen.* The latter, intended for persons proposing to join, is a brief statement of the aims and requirements of the society. The former is a concise memorandum for the guidance of a director and an exercitant in the performance of a carefully planned series of reflections, meditations, affective aspirations, self-examinations and resolutions. The aims of the *Spiritual Exercises* are: (1) purification of the soul from disordered affections and worldly standards; (2) discovery of the Divine Will before making a choice of a state of life; (3) consecration of the person's mind and will to the service of the Creator under the leadership of Jesus Christ. The *Spiritual Exercises* are divided into four periods, designated as "weeks." In a sense, they are to the society what the rule is to the older religious orders. From them have been derived the ascetic teaching and practice of the members as well as methods of their apostolate.

Corresponding to the "Foundation," or fundamental considerations with which the *Exercises* begin, that "man is created to praise, reverence, and serve God our Lord, and so doing to save his soul," is the opening declaration of the *General Examen:* "The aim of this Society is not only to seek with the aid of the Divine grace the salvation and perfection of one's own soul but with the aid of the same earnestly to labour for the salvation and perfection of one's neighbour." Distinctive, in comparison with the older orders, is the definiteness with which Ignatius relies upon the exterior and interior sacrifices required by the apostolate itself as a primary means of sanctification.

From the maximal orientation of the Ignatian apostolate to the "greater glory of God" stems the Ignatian universalism, by which the society is traditionally the exponent of the "catholic" or universal idea of the Catholic Church. At the same time the person-to-person following of Christ taught by the *Exercises* encourages the vigorously humanistic trend that characterizes Jesuit asceticism, preaching and educational methods.

Ignatius' realism, based on his experience, prescribed for the society a "common" manner of living (*Examen,* i. 60). The strictness of the rule of poverty is derived more from the rigid requirements of common ownership and dependence upon superiors than from any striking outward observances; while chastity is safeguarded by intensive cultivation of the inner life. Obedience, while practically indispensable for the efficacy of an organized spiritual campaign, is filial, not servile; and it is definitely limited by the boundaries of the Constitutions, the canonical structure of

the church and the requirements of conscience and the moral law. The unique emphasis laid upon this virtue in the Ignatian scheme derives from Ignatius' insistence upon its transcendental aspect, by which obedience to a fellow human being, whose personal limitations are frankly acknowledged, is made the means of interiorly consecrating the noblest part of man's nature, his will and judgment, to the Creator from whom he has received them.

Ignatius made many innovations in the form of the religious life of which the principal were: (1) he dropped many medieval practices, such as penances of rule, a common uniform or "habit" and the recitation of the liturgical office in choir—all in the interest of greater mobility and greater adaptability; (2) he abandoned the capitular or democratic form of government common in previous orders in favour of a monarchical regime in which most members would never have a voice; and (3) he introduced, instead of the customary solemn vows, simple vows from which the members could be more readily dispensed by the Holy See, should such a dispensation be judged advantageous for the individual or the society.

Even before papal approbation was given to the society, the first members were employed in delicate and dangerous missions by the pope. Ignatius remained at Rome, sending frequent instructions to the dispersed brethren and receiving their reports. In 1541 he had been empowered to draw up Constitutions for the new order. He experimented for six years, tentatively reducing the principles of the *Formula instituti* to practice. In 1547 he began to elaborate the text of the Constitutions, ably assisted by his secretary, Juan Polanco. In 1551 the first draft of the Constitutions was finished and was submitted to leading members of the society for examination. Ignatius revised the Constitutions according to their suggestions and in 1552 began to introduce them throughout the order, although as yet they did not have legal force. During the last four years of his life (1552–56), Ignatius further revised and perfected his text. The first general congregation of the order (1558), after some slight changes, approved the Constitutions as the fundamental law of the society.

The Constitutions are a part of the "Institute of the Society of Jesus," which, in addition, contains also various papal documents approving the order and enumerating its privileges, legislation of general congregations, regulations of the generals, etc. The Constitutions recognize three grades in the society: scholastics, coadjutors and professed. Aspirants, besides conforming to canon law requirements, should have constancy of character, virtue, prudence and, if they are to be priests, learning. The aspirant goes through a brief "first probation." This familiarizes him with the spirit of the order and affords a prayerful opportunity to stabilize his vocation. Two years of "noviceship" follow, devoted to his ascetical development under a skilled novice master. To test his vocation the novice devotes himself to the *Spiritual Exercises* for 30 days and is assigned to menial occupations. If approved he takes the simple religious vows of poverty, chastity and obedience. Scholastics are those who have taken such vows and are destined for studies. For about nine years the scholastic studies literature, the sciences, philosophy and theology, two or three years' teaching, under carefully supervised conditions, usually intervening between the last two courses. Following his ordination to the priesthood, he passes through a further year the tertianship, devoted again to asceticism and another 30-day retreat.

If he has evidenced a special fitness for the society's work, he is now admitted to the profession. The professed constitute the society in its fullest sense. They may hold any office. They alone participate in general congregations. They make solemn religious vows and, in addition, a special vow of obedience to the pope. They also promise neither to desire nor to seek any dignity in or out of the order.

Others are admitted among the "formed spiritual coadjutors." Except for their exclusion from the very highest offices, these engage in all the activities of the society. St. Ignatius advises that from among them rectors be usually selected. They bind themselves only by simple vows. Occasionally, because of special talents, some of them are raised to the profession. The society also recognizes "temporal" coadjutors (lay brothers), who have for their duties domestic and kindred occupations and live in community.

The general congregation is the supreme governing and legislative body in the society. It meets on the death of a general to elect his successor; also for extraordinary business. Though the general presides at its sessions, he is subject to it. Its personnel includes the provincials with two delegates from each province elected by the respective provincial congregations. The general is chosen for life and, except for certain constitutional limitations, has complete authority and power in the society. He is aided by a group of "assistants," each representing a definite geographical section of the world. These assistancies are divided into provinces, each presided over by a provincial. The latter is responsible for the province and assigns men to their tasks, but he may not interfere with the autonomy of the several houses or colleges. Provincials and local superiors are appointed by the general. He is kept informed of what goes on by official reports which he gets from them and other officials in each house, college and province.

The work of the society is practically coextensive with the needs and ideals of the apostolic ministry. Secular business and political activity are expressly forbidden. Administration of the sacraments, preaching, missionary, charitable and educational work are the proper province of the Jesuit priest.

EARLY HISTORY

The history of the Society of Jesus is clearly divided into two periods, 1540–1773 and from 1814. These periods are separated by the suppression (1773–1814), when the society was dissolved by Clement XIV; during the suppression a small group maintained corporate existence in Russia.

The first century of the order's history was marked by rapid expansion, by the performance of the duties of the apostolic ministry and also by strong opposition from non-Catholics and even from some Catholics. During the early years of the generalate of St. Ignatius (1541–56) the members engaged in the ministry, traveled from place to place at the request of ecclesiastical and secular rulers, putting energy into the Catholic reform by preaching and catechetical instruction. Two members were dispatched to Ireland by the pope, others to Poland and Germany; the best theologians were sent to the Council of Trent.

As numbers increased and colleges were founded (the first at Gandia in Spain in 1546), a more stable organization was evolved. In Catholic countries the main effort went into colleges and seminaries where religious information was imparted and instruction in literature, philosophy and theology was given. Especially noteworthy were the Roman college, founded at Rome in 1551 as a model seminary; and the German college, founded at Rome in 1552 for the education of German priests to replace those who had gone over to Lutheranism. In addition to teachers, the early Jesuits produced preachers and catechists who devoted themselves especially to the care of the young, the sick, prisoners, fallen women and soldiers. Spiritual retreats based on the *Spiritual Exercises* of Ignatius were used as a means of reform for individuals. In countries where Catholicism was threatened by Protestantism, the early Jesuits took up key positions, usually in colleges, in order to stop the defections from the Roman Church. In the judgment of many, they gave the Catholic resistance a confident spirit which it had lacked until their appearance.

In the meantime the society had entered the foreign mission field with equal vigour. Leaving Lisbon in 1541, Francis Xavier founded in south India what was destined to be the working model of Catholic missions to pagans. By 1546 he had reached the Moluccas and in 1549 he entered Japan. He died in 1552 without having been able to penetrate into China (*see* XAVIER, SAINT FRANCIS). Other Jesuit missionaries went to the Congo in 1547 and to Morocco in 1548. In 1549 Manuel da Nobrega began the more successful mission of Brazil. Missionaries dispatched by Ignatius reached Ethiopia in 1557. At his death (1556) the founder left 1,000 religious in about 100 houses and divided into 12 provinces. The society at the time had taken firmest root in Italy, Spain and Portugal. The India mission was manned by a relatively large number of members.

Under the two following generals, Diego Laínez and Francis Borgia, the order's positions in France and Germany were strengthened (*see* LAÍNEZ, DIEGO; BORGIA, SAINT FRANCIS). Peter Canisius (*q.v.*), a Hollander, became the leader of the Counter-Reformation in German-speaking lands; Edmond Auger and Antonio Possevino distinguished themselves on the Catholic side in France. Borgia, who had at one time been viceroy of Catalonia, pushed the development of the missions, especially in Mexico and Peru. Rome saw the construction of the Gesù, the central church of the society, and the inauguration of the sodalities of the Blessed Virgin Mary. In 1566 Spanish Jesuits began to evangelize the Indian tribes of Florida; Father Peter Martínez, the first Jesuit martyr of North America, was slain in that year when landing on the coast at a point in northern Florida. His fate did not discourage Fathers Segura and Quiros, who attempted to found a mission in Virginia in 1570. There in Feb. 1571 they, together with six other Jesuits, were slain by the Indians. Needs of the apostolate in other parts of New Spain led to the withdrawal of missionaries from Florida. The generalate of the Belgian Everard Mercurian (1573–80) saw the end of Spanish preponderance in the government of the order and the beginning of the English mission (1578).

The long generalate of the Italian Claudio Aquaviva (*q.v.*) marks one of the high points in the history of the order. Although only 37 at the time of his election, Aquaviva with exceptional prudence and resourcefulness overcame grave internal and external difficulties. The energetic Franciscan pope Sixtus V thought of changing the Constitutions of St. Ignatius, but never actually took the step. More dangerous were the machinations of discontented members, who had powerful support, especially in Spain. Two extraordinary general congregations (1595 and 1608) supported Aquaviva and succeeded in bringing most of the disaffected members back into line. In France the society was the object of repeated attacks; it was proscribed in 1594 but regained its rights in 1608. It was banned from the republic of Venice in 1606 because of its observance of a papal interdict and was not readmitted until 1656. The publication in 1588 by Luis de Molina of his *Concordia,* a treatise on the relationship between divine grace and human freedom, led to a serious theological struggle with the Dominican fathers (*see* MOLINA, LUIS DE; MOLINISM). This dispute was taken up by a papal commission *De auxilius divinae gratiae* which decided that each side could hold its own doctrine but must not attack that of its opponents as unorthodox.

Under Aquaviva the membership of the society grew from about 5,000 to over 13,000, the number of provinces from 21 to 32; the number of colleges was increased by more than 200. Matteo Ricci (*q.v.*) introduced the society into China, and beginnings were also made in the Philippines, Indochina, the near east, Canada and Paraguay, where in 1609 the first of the famous reductions (Indian mission territories) was established. In Japan the Christian cause had a setback in 1597 but continued to advance until 1614. In Europe the position of the society as a leader in ecclesiastical and humanistic education was strengthened. Efforts to bring the Protestants back into the Church of Rome were also increased.

While directing this advance, Aquaviva was ever concerned to preserve and strengthen the original spirit of the order. The society counted among its members at the time: Peter Canisius, Robert Bellarmine, Aloysius Gonzaga (*qq.v.*), Peter Claver, Alonso Rodríguez and Bernardino Realini. In addition, Jesuits shed their blood for the faith in India, where one of the martyrs, Rudolph Aquaviva, was a cousin of the general; in Japan, where the government undertook the extermination of the flourishing Christian communities; in England, where the society was falsely accused of involvement in the Gunpowder plot (*q.v.*); and in France during the Wars of Religion. This was also the period of the great Jesuit spiritual writers: Alphonsus Rodríguez, Álvarez de Paz, Luis de la Puente, Antoine le Gaudier and the other exponents of the Jesuit school. More noteworthy was a galaxy of theologians of the first rank: Francisco de Toledo, Francisco Suárez, Gabriel Vásquez, Gregorio de Valencia, Diego Ruiz de Montoya, Molina, Jacob Gretzer, Leonard Lessius and many others.

With the generalate of the Roman Mutius Vitelleschi (1615–45), the rapid expansion of the society came to an end. The order continued to grow during its second century but at a slower rate. This was the period of French predominance in politics and culture: *le grand siècle.* Many French Jesuits stood out: Pierre Coton and François Annat as confessors of the kings; Julian Maunoir, Vincent Huby and Jean François Régis as home missionaries; Dionysius Petavius, Antoine Sirmond and Philippe Labbe as savants and theologians; Louis Lallemant as founder of the French school of Jesuit spirituality. In Canada and New York, eight French Jesuits—Isaac Jogues, Jean de Brébeuf (*qq.v.*) and their companions—were martyred by the Iroquois; they were canonized in 1930. With the rise of Jansenism, the outlook in France darkened. In Belgium the society continued to prosper and in 1643 Belgian Jesuits began the publication of the celebrated *Acta sanctorum* (*see* BOLLANDISTS). It was under Father Vitelleschi that the first English-speaking priests arrived in North America. A group of Jesuits, headed by Father Andrew White, went out with the Maryland colonial expedition of 1634. Gov. Thomas Dongan of New York introduced Jesuits into that colony in the 1680s.

Vitelleschi's immediate successors ruled briefly: Vincent Caraffa (1646–49), Francis Piccolomini (1649–51), Alexander Gottifredi (1652) and Goswin Nickel (1652–64). During this period the colleges continued to prosper, but trials were not lacking. In Poland the Jesuits suffered from the Cossacks, who martyred Andrew Bobola in 1657; and also from the Swedes. In Ireland they had much to suffer under Cromwell. In France Pascal's *Provinciales* opened a long campaign against the alleged laxity of Jesuit moral theology (*see* JANSENISM; PASCAL, BLAISE).

John Paul Oliva, a Genoese, the next general (1644–81), governed the order with energy and success. During this period many Jesuits were much in the public eye: François de la Chaise in France; Johann Eberhard Nidhard in Austria and Spain; Edward Petre in England; Charles Vota in Germany and Poland; Antonio Vieira in Portugal; Paolo Segneri, Daniello Bartoli and Pietro Pallavicino in Italy; Ferdinand Verbiest in China and John de Britto in India. The nationalism and absolutism of the time caused troubles in France and in the foreign missions; in England the imaginary plot concocted by Titus Oates (*q.v.*) led to the execution of a group of Jesuits, eight of whom have been beatified. The charges of laxity in moral theology continued and under Alexander VIII and Innocent XI led to the condemnation of some propositions maintained by Jesuit moralists in 1665, 1666 and 1679. In Italy home missions were conducted, while the work of spiritual retreats prospered in France. Also in France, Claude de la Colombière was the counselor of St. Margaret Mary Alacoque (*q.v.*) in launching the modern devotion to the Sacred Heart of Jesus.

After the brief rule of the Belgian Charles de Noyelle (1682–86), the Spaniard Thyrsus González (1687–1705) succeeded to the generalate. Although he had had no experience in government and was known for some views which were contrary to those generally held in the society, he was elected because of the pressure brought on the electors by the reigning pontiff, Innocent XI. González was an outspoken opponent of the regalistic pretensions of the French king, Louis XIV. This led that monarch to withdraw all French Jesuits in 1688—including the French assistant general—from Rome, while he forbade all correspondence with the general. González considered himself obliged by his election to free the society from certain moral doctrines, which, although not official, were commonly held. His efforts to publish a tract on the matter involved him in disputes with his subjects and with the Roman *curia.* His *Fundamentum theologiae moralis* finally did appear and the action of the general was, on the whole, approved by the 15th general congregation (1696–97). Michelangelo Tamburini (1706–30) was able to re-establish internal harmony but his generalate was troubled by the wars of the period and by the revival of Jansenism in France. Still more trying was the condemnation by papal decree of the Chinese and Malabar rites, certain traditional practices permitted to their converts by the missionaries as non-religious in character. This led to an unfavourable reaction on the part of the Chinese emperor K'ang-hsi (1661–1722) and to charges of disobedience to the Holy See against the Jesuit missionaries. The controversy, publicly conducted, dealt a severe blow to the reputation of the society. *See* RITES CONTROVERSY.

SUPPRESSION AND RESTORATION

During the generalates of the Bohemian Francis Retz (1730–50) and the Italians Ignatius Visconti (1751–55), Aloysius Centurioni (1755–57) and Lorenzo Ricci (1758–73) the adversaries of the society made it clear that they sought its total destruction. The leaders of the opposition were Italian and French Jansenists, Gallican leaders of the French *parlements*, philosophers like Voltaire and the Encyclopaedists and the ministers of state of the "enlightened despots."

The decades preceding the suppression were a time of neither spiritual nor intellectual decadence in the society. The number of members increased and in 1756 the assistancy of Poland was erected. While in the far east recovery from the condemnation of the rites was slow, the missions in Latin America flourished. In the intellectual field the Jesuits hesitated to take up the study of the natural sciences and to adopt modern experimental methods. But by the middle of the 18th century they accepted both and counted among their members men eminent in all the scientific branches cultivated at the time, so much so, indeed, that the years preceding the suppression were actually years of intellectual revival in the society.

Suppression.—The assault on the order reached its critical phase in the lands where for 200 years and more it had been strongest: Spain, France and Portugal. The reasons behind this reversal of policy are to be sought in the anticlerical and anti-Roman attitude of the ministers of the governments. The suppression of the society is probably best seen as a prelude to the French Revolution. The political leaders of the epoch rightly felt that profound changes were inevitable. An attack on the church was thought to offer the best hope for the security of the political *status quo*. The Jesuits, because of their intimate connection with the Holy See, seemed to offer the best immediate target.

In Portugal José de Carvalho, marquês de Pombal and powerful first minister of Joseph I (1750–77), opened the attack. After a defamatory campaign directed particularly against the Jesuits of the Portuguese colony of Brazil, the government arrested and shipped to the Papal States nearly all the Jesuits of Portugal and its possessions (1759–61). In France the occasion for the dissolution of the order was the bankruptcy of the treasurer of the mission of Martinique in the West Indies. The French *parlements* took occasion from this unhappy episode to condemn the Constitutions and doctrine of the society and to close its colleges (1761–63). The crown was forced to approve these measures (1764) and to suppress the order in France and its possessions. In Spain Charles III in 1767 decreed the expulsion of all Jesuits from the homeland and the colonies, and Naples, Sicily and Parma, which were ruled by members of the Spanish royal family, followed this example the following year. The summary expulsion of the Jesuits from Spain and Portugal and their possessions was a catastrophe from which it took those missions decades to recover.

The governments of Portugal, France and Spain were not content with the extinction of the Jesuits in their own territories. They banded together to force the pope to suppress the society throughout the world. Clement XIII resisted their efforts despite the threat to form national churches independent of Rome. Clement XIV finally yielded in 1773 and by the brief *Dominus ac Redemptor* abolished the order. He asserted that he did so because the society could no longer attain the ends for which it had been founded, and for other reasons which he kept secret, as well as to restore true and lasting peace to the church.

The suppressed Jesuits devoted themselves, where it was permitted them, to the sacerdotal ministry or to a life of study. Fifty-five former Jesuits, in the course of time, were raised to the episcopacy, among them Archbishop John Carroll (*q.v.*), the founder of the Catholic Church in the United States. Political circumstances, notably the opposition of Catherine II, prevented the canonical execution of the brief of suppression in Russia. The small group of Jesuits who continued the corporate existence of the society there obtained the secret approbation of Pope Pius VI in 1783 and public recognition under Pope Pius VII in 1801.

Restoration.—The demand that the Jesuits take up their former work, especially in the field of education and in the missions, became so insistent that in 1814 Pius VII re-established the society throughout the church. He said that he would consider himself guilty of a very grave sin if in such difficult times he should fail to make use of the auxiliaries which divine Providence was offering him. In England and the United States, the surviving former Jesuits had already been readmitted by the superiors in Russia. In 1805 Robert Molyneux, Charles Sewall and Charles Neale had reinaugurated the society in America with the consent and encouragement of Archbishop Carroll.

The restored order was governed in its early years by Tadeusz Brzozowski (*q.v.*), who had been general superior in Russia from 1805. The Russian government, however, prevented his going to Rome. Brzozowski was succeeded by the Italian Aloysius Fortis (1820–29), who guided the order through a period of internal and external crisis. But the principal rebuilder of the society was Johannes Philipp Roothaan (1829–53), who in 1803, as a youth of 18, had left his native Holland in order to become a Jesuit in Russia. He became general in 1829 and laboured earnestly to infuse the Ignatian spirit into the educational and missionary activity of the order, which was spreading with a speed which rivaled that of its early years. He was especially insistent on the use of the *Spiritual Exercises* as a source of inspiration.

Both Roothaan and his successor, the Belgian Pierre Jean Beckx (*q.v.*), witnessed repeated persecution of various sections of the order. Indeed the history of the restored society is dotted with such episodes as the following incomplete summary will make clear. In 1818 the Dutch rulers of Belgium expelled the society; in 1820 it was excluded from Russia; in 1829 the colleges in France were closed. The Portuguese and Spanish Jesuits were expelled in 1834 and 1835 respectively. In 1847, after the Sonderbund War, the Swiss Jesuits were exiled. In 1848 the society was proscribed in Austria and parts of Italy. The Jesuits were expelled from Colombia in 1850 and from Ecuador two years later. Spain excluded them again in 1868 and Germany during the *Kulturkampf* in 1872. In 1873 many houses in Italy were confiscated while France again proscribed the order in 1880 and 1901. It was expelled from Portugal in 1910 and from Spain during 1932–35. Jesuits lost their lives during disturbances in Spain in 1822, 1836 and 1932–35; in Paris in 1871, and in Mexico in 1927. There were also martyrdoms in the missions: in China in 1860, 1900–02; in Syria in 1859–60 and in Madagascar in 1883 and 1896.

Later generals of the society were the Swiss Anthony M. Anderledy (1887–92), the German Francis X. Wernz (1906–14), the Pole Vladimir Ledochowski (1915–42), the Belgian John Baptist Janssens (1946–64), and the Spanish Pedro Arrupe (1965–). The order has grown steadily and under Father Ledochowski attained both in numbers and variety of works a development which it had never known before in its history. Noteworthy was the great expansion in all English-speaking countries, especially in the United States. In Germany the society suffered severely under the Nazi regime both before and during World War II.

20th-Century Activities.—In the early 1960s there were about 35,000 Jesuits of whom approximately half were priests; they were divided into 8 assistancies and over 80 provinces and vice-provinces. After World War II the missions in China, for the most part were dissolved by the Communist regime which expelled or imprisoned the missionaries. In other parts of the world the missionary effort continued.

Education is the principal occupation of Jesuits in the missions as well as in Europe and America. In addition to colleges, the society directs many universities, especially in the United States—Georgetown, Fordham, Boston college, Detroit, Loyola (Chicago), Marquette, St. Louis, Loyola (New Orleans), Seattle, Santa Clara, San Francisco and Loyola (Los Angeles). The Jesuits operate colleges in Great Britain at Glasgow, Liverpool, Leeds, London, Preston, Spinkhill, Stonyhurst and Wimbledon, and since 1896 they have maintained Campion hall as a part of Oxford university. The Irish Jesuits have colleges at Clongowes Wood, Dublin, Galway, Limerick and Mungret. Significant too are the seminaries for the formation of the pastoral clergy (Gregorian university, Oriental and Biblical institutes and some national colleges in Rome; Comillas in Spain and Innsbruck in Austria). At Mundelein, the

seminary at Chicago, the Jesuits have charge in large measure of the spiritual and intellectual formation of the seminarians. They have charge also of important seminaries in Mexico and South America. Close spiritual retreats have developed rapidly during the 20th century, as has the social apostolate, especially in the United States, where so-called "labour schools" were established in many industrial centres. The sodalities of the Blessed Virgin Mary have grown in the United States, where they have influenced an important segment of the Catholic young people. The Apostleship of Prayer, founded at Vals in France in 1844, is also a spiritual force of world-wide scope. Jesuits edit more than 1,000 periodicals, ranging from propaganda bulletins to scientific reviews. They also take an increasingly active part in radio and television.

In countries under Communist domination, the activities of the Jesuits have been radically limited. Elsewhere the society continues to grow.

See also references under "Jesus, Society of" in the Index.

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JESUS CHRIST, the Founder of Christianity and, according to the teachings of Christianity, the Son of God and the Lord and Saviour of the world.

The term "Jesus Christ" thus designates a historical person who lived in Palestine during the reigns of the Roman emperors Augustus and Tiberius, but it also designates one who has been the object of Christian faith and worship for almost 20 centuries. These two designations may be distinguished, indeed they must be; but they cannot be separated. For almost everything we know about the historical person comes from the reports of those who addressed faith and worship to Him. The portraits of Jesus in the Gospels are the testimony of "faith to faith." It is therefore impossible to write a biography of Jesus in the conventional sense of the word. Rather we are compelled to draw a picture of a picture, to describe Him on the basis of the way He was remembered by the believing community that took His name. How satisfactory is such a picture of a picture? That depends in part upon the credence one is ready to assign to the sources, and how much credence to which of the sources. Yet the amount of biographical information that the sources provide is very slight, whether or not we take them all as literal accounts of what really happened. We can know more about the life of many ancient Caesars and many modern prize fighters than we can know about the life of Jesus of Nazareth.

The description that follows is necessarily a picture of a picture. Although it seeks to piece together much of what can be pieced together of the story of Jesus' life and teachings, it is concerned even in that attempt to describe His mission and message as the primitive Christian community saw them and bore witness to them in the Gospels. As a result, what Jesus Christ meant to the Christian community in the period surrounding and following the composition of the Gospels must form an integral part of any such description. But the full implications of His life and work did not come upon the church suddenly and in a flash. A long development of devotion and of theology has sought to clarify what He was and what He meant. If the subject of this description is to be the historical person in the full dimension of His historical influence, the controversies attendant upon that development must form part of the description, including the modern controversies which have issued in perspectives and conclusions like those represented here.

THE LIFE AND CAREER OF JESUS IN THE GOSPELS

The principal source of information about the life of Jesus is the record of the four evangelists, Matthew, Mark, Luke and John. There are, in addition, other Christian writings and a few non-Christian writings that should be consulted.

Source Problem

Each of the four Gospels is written from a perspective and for a purpose, even though the perspective and the purpose may not always be easy to discern today.

The Gospel of Matthew appears to have been written with a Jewish audience in mind; that would account for the way it quotes and interprets the Old Testament and for the way it describes the relation between Jesus and the Jews. Mark is usually taken to be the earliest of the four Gospels, interested primarily in the mighty deeds of Jesus and only secondarily in His teachings; a very old and credible tradition traces it to the memoirs of the apostle Peter. Luke is addressed chiefly to gentiles, as the author indicates in his preface. Both Luke and Matthew seem to have used Mark, either in its present form or in an earlier form. In addition, both used other sources—the sayings of Jesus, transmitted and perhaps collected in some form, and some narratives of Jesus' infancy. The Gospel bearing the name of John is an independent production, reporting sayings of Jesus in the form of discourses that differ from the accounts of the other three Gospels, which, because they have so much material in common, are called "synoptic." Most New Testament scholars have regarded John as the last Gospel to be written, but various archaeological discoveries in the 20th century served to confirm the report of the ancient church that it was written during the 1st century. Even after those discoveries, however, the authorship of the Fourth Gospel remained a subject of controversy.

This variety among the Gospels can be taken to mean that in every story recounted by the evangelists we must ask: what circumstances in the early church would help to explain the way this story was being told? Thus the denunciations recorded in Matt. xxiii make sense when viewed against the background of conflicts between the new Christian sect and its parent, Judaism. Some of the statements put into the mouth of John the Baptist by the Gospel of John (i, 20–28) may be an indication of the controversies between early Christians and some who supposed John to have been the Christ. What we have in the Gospels would then be what the church itself was saying and teaching, ascribed to the historical Jesus. But it may also be that this very act of ascribing was simultaneously an act of remembering: as the primitive Christian community passed through experiences analogous to those its Lord had known, it called to remembrance all that He had said and done. So, at least, the early Christians seem to have believed (John xiv, 26). Long before any of the Gospels had been written, these stories and sayings were being told and remembered, often in response to a particular need or problem in the church (*see* Acts xx, 35). Thus the historical event called Jesus Christ and the response of the church to that event are so

intertwined in the Gospels as we have them that only occasionally and only tentatively can scholars claim to be in a position to ascribe a particular saying solely to either source. As Martin Dibelius in his book *Jesus* says, therefore, "discussion as to whether a particular saying is 'genuine' is often idle because on neither side are the arguments decisive. In general the historian will do well to look at the tradition as a whole" (trans. by Charles B. Hedrick and Frederick C. Grant, copyright 1949. W. L. Jenkins, The Westminster Press. Used by permission. German ed., Walter de Gruyter & Co., Berlin).

Chronology.—The setting of the Gospels makes it extremely difficult to deal with chronological problems in the life of Jesus. Even if the Fourth Gospel is accepted as accurate, with its framework of Jewish feasts (John ii, 13; v, 1; vi, 4; x, 22; xii, 1), it remains unclear whether the evangelist intended each of these references to mean a different festival. The arrangement of the material in the other Gospels around these festivals leaves many problems unsolved, since none of the Gospels follows any but the loosest chronological sequence except in the Passion story. An indication of the difficulty in the chronology of the Gospels is the contention of Church Fathers like Clement of Alexandria, Origen and Tertullian, on the basis of Luke iv, 19, that the ministry of Jesus lasted only about a year—this in spite of the fact that these Church Fathers possessed and accepted all four Gospels. Nevertheless, some modern scholars are ready to concede that John's account probably comes closest to describing the actual span of events, and that a period of two or three years, more or less, seems to be right for the public ministry of Jesus. Yet these same scholars point to the conflict between the chronology of John and the narratives of the Synoptic Gospels; *e.g.*, in the story of Jesus cleansing the Temple. The Synoptic Gospels put it into the events of Jesus' last week (Matt. xxi, 12 ff., and parallels), where it fits very well into the narrative. John, on the other hand, seems to say that it occurred near the beginning of Jesus' career (John ii, 13–17). Some harmonists have gone so far as to suggest that Jesus cleansed the Temple twice, even though the story is told only once in any one Gospel. This problem is only one illustration of the fact that the fundamental need in any ordinary biography, the chronological outline, is lacking for a biography of Jesus.

Other Sources.—To the modern reader, accustomed to think of the important role that Jesus has played in the history of the world during the past centuries, it may be surprising to realize that few of His contemporaries even took notice of Him. The Jewish historian Josephus (*q.v.*) seems to refer to Him, although at least one of the passages mentioning Jesus is a later addition, possibly even a Christian forgery. The Roman historian Tacitus and the Roman man of letters Pliny the Younger (*qq.v.*) make mention of Jesus in discussing the treatment of the early Christians. A dubious passage in the Roman historian Suetonius (*q.v.*) may mean "Jesus Christ" by "Chresto," though it is quite clear that he did not understand it that way. The major purpose served by these non-Christian references to Jesus is to stress how provincial and limited a role He actually played in His own lifetime.

They may also help to refute the contention, advanced quite seriously by some critics at the end of the 19th century, that Jesus never actually lived at all and that the story of Jesus was the Christian elaboration of a myth about a god who appeared on earth for a while in human form. A more impressive collection of source material is that gleaned from early Christian sources in addition to the Gospels. Since the Gospels are a compilation of materials used in Christian preaching, teaching and worship, it is understandable that some of these materials should have escaped compilation. A few of them seem very genuine. Thus the "pericope of the adulterous woman," inserted into the 8th chapter of St. John in some manuscripts, has the ring of genuineness about it, even though it may not have formed an original part of any of the Gospels. There are other stories—*e.g.*, the infancy stories of the apocryphal Gospels—that are fantastic and quite alien to what we find in the four Gospels. Yet even they shed light on the sifting out of which the four Gospels emerged.

The Beginnings of Jesus

The most obscure portion of Jesus' life is the part before He became "about thirty years of age" (Luke iii, 23), including as it does the formative stage of His development.

Birth and Boyhood.—Neither Mark nor John supplies any data at all about the birth and childhood of Jesus. Both Matthew and Luke begin their narratives with a brief account of the early years, but except for the Virgin Birth and the reference to Bethlehem there is almost no correspondence between them. Matthew describes an angelic visit to Joseph, Luke angelic visits to Elizabeth and to Mary. Matthew has the Magi, Luke the shepherds. Matthew narrates the flight to Egypt, Luke the story of the boy Jesus in the Temple. Because of stylistic differences between the first two chapters of Luke and the rest of the Gospel, some interpreters maintain that the first two chapters came from an early source, perhaps from the mother of Jesus herself (*cf.* Luke ii, 19, 51). Many modern critics, on the other hand, have placed little credence in these infancy stories. They even contend that Jesus was actually born in Nazareth as the son of Joseph and Mary. Although they find indirect support in some Syriac versions of Matt. i, 16, they are forced to admit that in the main this contention is a historical construction, based upon a particular view of how the picture and story of Jesus developed in the early church. Despite difficulty in squaring the report of Luke ii, 1, with other records of Roman history, interpreters tend to agree that Jesus was born from four to seven years B.C.—*i.e.*, "before Christ." The source of this anomaly is the reform of the calendar by Dionysius Exiguus, who set the date of "the incarnation of the Lord" as the year 753 after the founding of Rome. But Herod, into whose reign the Gospels place the birth of Jesus, died about 749 according to Roman reckoning, or 4 B.C.; and the census mentioned in the Christmas story of Luke seems to have happened in the year 747 by the Roman count, or 6 B.C. Somewhere between 4 and 7 B.C. is as close as modern research has been able to come in attempting to fix the date of Jesus' birth, and 4 B.C. is the year most commonly given. (*See* also Chronology: *Christian.*)

Even if He was born in Bethlehem, it was as "Jesus from Nazareth of Galilee" (Matt. xxi, 11) that He was known, since it was there that He was reared. Beyond that, all we have to go on is the tantalizing statement of Luke ii, 52, "And Jesus increased in wisdom and in stature [or in age], and in favour with God and man."

Relation to Predecessors.—Because we know so little about the early life of Jesus, we are at a loss to give definite answers regarding the possible influence of His predecessors and contemporaries upon Him. Students of Palestinian Judaism frequently classify Jesus among the "people of the land" (*am-ha-arets*), those silent and devout folk who were expecting the deliverance of the Lord to come out of Zion. Others have painstakingly examined parallels between His teachings and the ethical admonitions of Jewish teachers in the period between the Old Testament and the New Testament. For example, every petition of the Our Father has its counterparts in pre-Christian Jewish literature, and so have many other statements in the Gospels. In the absence of any information regarding possible contacts between Jesus and His predecessors, historians are compelled to reason back from the Gospels to possible antecedents. This procedure, hazardous at best, is made even less reliable by the fluid state of the Jewish oral tradition in Jesus' day; for it is no longer possible to determine the precise date of sayings and ideas that were eventually incorporated into the Talmud and the Midrash (*qq.v.*).

From Talmud and Midrash, as well as from other Jewish sources, we can nevertheless derive information regarding the state of Jewish teaching in the times of Jesus. Some of this information supplements the reports of the Gospels. The Gospels speak of three main groups among the Jewish teachers: the Sadducees, the Scribes and the Pharisees; the latter two are often grouped together. The principal difference among them was in their attitude toward the oral tradition that had developed in Judaism since the days of the prophets. The Scribes and Pharisees were those who had elaborated the prescriptions and prohibitions of

REPRESENTATIONS OF JESUS CHRIST FROM THE 2ND TO THE 14TH CENTURY

Photographic negative of the face imprinted on the Holy Shroud of Turin, a relic venerated as the winding sheet in which St. Joseph of Arimathea wrapped the body of Christ for burial. Preserved in the cathedral at Turin since 1578; known from the 14th century

Painting on cloth of the head of Christ; 2nd century. Church of S. Bartolomeo, Genoa, Italy

"Division of the Sheep and Goats," Byzantine mosaic of the 6th century. Church of S. Apollinare Nuovo, Ravenna, Italy

"The Trinity," from a German illuminated manuscript; 12th–13th century. Pierpont Morgan library, New York city

Head of Christ painted on cypress wood; by tradition attributed to St. Luke, but probably 3rd century. Vatican library, Rome

Mosaic of the head of Christ, from the Roman catacombs

Head of Christ, detail from "The Last Judgment," by Giotto di Bondone (1267?–1337), Italian. In the Arena chapel, Padua, Italy

BY COURTEST OF (TOP RIGHT, BOTTOM LEFT, BOTTOM CENTRE) THE SOCIETY FOR PROMOTING CHRISTIAN KNOWLEDGE, (CENTRE RIGHT) THE PIERPONT MORGAN LIBRARY; PHOTOGRAPHS, (TOP LEFT) FRATELLI DUTTO, TORINO, (CENTRE LEFT) ANDERSON, (BOTTOM RIGHT) ALINARI

JESUS CHRIST

"St. Teresa Praying to Christ for the Souls in Purgatory," by Peter Paul Rubens (1577–1640), Flemish. In the Royal museum, Antwerp, Belgium

"Ecce Homo," pastel by Guido Reni (1575–1642), Italian. In the National gallery, London

PAINTINGS OF JESUS CHRIST FROM THE 15TH TO THE 20TH CENTURY

"Christ at Emmaus," by Rembrandt van Rijn (1606–69), Dutch. In the Louvre, Paris

"Head of Christ," by Georges Rouault (1871–1958), French. The collection of Walter P. Chrysler, Jr., New York city

"Christ," by El Greco (Domenikos Theotokopoulos, 1541–1614), of the Spanish school. In the cathedral at Toledo, Spain

BY COURTESY OF (BOTTOM LEFT) THE COLLECTION OF WALTER P. CHRYSLER, JR., PHOTOGRAPHS, (TOP LEFT) FRANZ HANFSTAENGL, (TOP RIGHT) PHOTOGRAPHISCHE GESELLSCHAFT, (CENTRE RIGHT) ARCHIVES PHOTOGRAPHIQUES, (BOTTOM RIGHT) MORENO

the Old Testament into a complex code of behaviour. The conventional Christian picture of them is certainly incomplete, and it has often been called a distortion. Jesus clashed with them over the importance of external conformity with such a code of behaviour as contrasted with the true relation to God demanded by the prophets. The Sadducees were conservative defenders of the Mosaic Law against the innovations of the oral tradition. Jesus is described as having clashed with them over issues like the resurrection of the dead. Another group, only mentioned but not described in the Gospels (Luke vi, 15), were the Zealots, dedicated to the overthrow of the Romans and the restoration of the kingdom of Israel. Jesus' reinterpretation of His messianic mission was set in antithesis to this political cause. A special problem in measuring Jesus' relation to His contemporaries is the question of the ascetic community described in the Dead sea scrolls. Some writers have found parallels between the "Teacher of Righteousness" spoken of there and the picture of Jesus in the Gospels. It has even been suggested from time to time that Jesus was an initiate of the secret Essene community, so that its esoteric practices and doctrines are the source of His teachings. But New Testament scholars representing the greatest possible variety of theological viewpoints have repudiated this suggestion on purely historical as well as on religious grounds.

Somewhat more plausible is the suggestion, made even before the discovery of the Dead sea scrolls, that John the Baptist came under the influence of the Essene community. Here, too, scholars are forced to reason backward; and it is, of course, entirely possible that a common source in the history of Israel influenced both (*see* Judges xiii, 4, 5). But there is considerable affinity between the ascetic life of John as described in the Gospels and the ascetic ideals of the Essenes. That affinity, in turn, raises the ancient question of how much John the Baptist influenced the early teaching of Jesus. Mark's account (Mark i, 14, 15) may even indicate that Jesus regarded Himself as the successor of John in the proclamation of John's message, but all are agreed that almost immediately the teachings of Jesus went far beyond that message. In part, the whole question is related to the matter of John's attitude toward Jesus. The Gospels unanimously seek to minimize any suggestion that John may have thought of himself as the Christ or have encouraged such thoughts in others. It is clear from the Gospels that such thoughts there were (Luke iii, 15); and the story recorded in Matt. xi, 1–6, is, in the opinion of some interpreters, the remnant of a tradition quite different from that suggested in passages like Matt. iii, 11, 12. Whatever may have been John's own attitude toward Jesus, the narrative of Acts xix, 1–7, and the protestations of John i, 8, 20, both suggest what other sources corroborate, that a sect of disciples of John the Baptist continued alongside early Christianity for a considerable time. But it seems from the sources we have that John's message pointed beyond himself to someone else. Early Christians, including some of those who had followed John, found that someone in Jesus.

The Career of Jesus

Inauguration.—It was at the hands of John the Baptist that Jesus received the baptism that launched His public ministry. It seems from the reports of the Synoptic Gospels—John's Gospel says nothing about the baptism of Jesus—that in connection with this event a call came to Jesus to undertake His mission, analogous to the call of the prophets in the Old Testament (*e.g.*, Isa. vi, 1). But thereupon He also experienced a challenge to His vocation, elaborated in most detail in Matt. iv, 1–11, and told so vividly there that the account seems to have come from the recollection of Jesus Himself. The temptation to use His miraculous power for selfish ends, to put the providence of God to the test and to lay claim to temporal power represented a continual threat to His career. Significantly, these were also the ways His vocation was continually being misunderstood by both His supporters and His enemies; they were the ways the church was in danger of misunderstanding its own vocation as well. After being inaugurated through His baptism and temptation, Jesus began His career as a religious teacher in Galilee. The problem of chronology, referred to earlier, complicates the task of determining the locale of Jesus' public ministry. From the narrative of the Synoptic Gospels it would seem that He confined His work chiefly to Galilee until after His decision that He "must go to Jerusalem" (Matt. xvi, 21). But if the feasts mentioned in John represent three or four separate visits to Jerusalem, the work in Galilee must be divided into several units, separated by tours of Judaea. In any case it is fair to say that the major part of His public life was spent in Galilee, even though its denouement took place in Judaea.

From the outset Jesus performed the twofold work of teaching and working miracles. These miracles were of various sorts, the usual classification being: miracles of healing, nature miracles, the raising of the dead and the expulsion of demons. Although the performance of extraordinary deeds was a phenomenon not unknown among the Jews of the day (*see* Luke xi, 19), the manner and the number of Jesus' miracles were sufficiently unusual to call forth the marvel and the hostility reported throughout the Gospel accounts. His own attitude toward these manifestations of divine power was not a simple one. Thus Luke's Gospel can portray Him as pointing to them for the validation of His mission (Luke vii, 22) and as minimizing their importance (Luke x, 20); and John's Gospel can make miracles the immediate cause of faith (John ii, 23) as well as the basis for a complete misunderstanding of Jesus' mission (John vi, 15). This same ambivalence, apparently originating in Jesus Himself and already at work in the early church, has characterized the Christian interpretation of the miracle stories since; for a long time they were used to support the church's claims about Christ, but since the 18th century they have had to depend upon those claims for whatever support they have received. The findings of modern science have caused interpreters of the New Testament to concern themselves at length with the philosophical problem of miracles—what they are and whether they are possible in a universe of order. Such problems were not the business of the writers of the New Testament. The word they used most often for miracles was "sign"; unlike the miracle mongers who compiled the apocryphal Gospels, their main emphasis was not alone upon the supernatural character of these mighty deeds, but upon the fact that they were intended as signs of the coming kingdom of God. And the greatest such "sign" was Jesus Himself (*see* Luke ii, 12).

The miracles of healing and those of exorcism, the expulsion of demons, fall into a special category. Despite evident parallels between the healing miracles of the Gospels and stories of healing in non-Christian literature, it seems that most of the stories of healing had the function of calling attention to the wholeness or "salvation" that the coming kingdom of God was to bring. Similarly, the miracles of exorcism were no mere display of supernatural power. Often they form part of a healing story; at least once, in the enigmatic account of the Gerasenes (Mark v, 1 ff.), exorcism is an element in a "nature miracle." But it appears that the stories of exorcism often served to bring out the church's proclamation that Jesus had come to bind and to destroy the powers of hell. Hence the tormented cry of the Gerasene demoniac (Mark v, 7), acknowledging that Jesus was the "Son of the Most High God." It has become almost a commonplace in much of modern New Testament criticism to regard demoniac possession as a form of insanity or epilepsy. This explanation, like most others of its kind, solves some problems but creates others; and it tends to ignore the aforementioned function of the miracles of exorcism in the theological plot of the Gospels.

Closeness to God.—The obverse side of Jesus' exorcist activity is the emphasis of the Gospels upon His closeness to God. Perhaps the most prominent expression of that closeness was His life of prayer. It was remembered that He had prayed alone (Mark i, 35), and sometimes all night (Luke vi, 12). Several of His prayers were remembered and quoted, notably the Our Father (Matt. vi, 9–13) and the prayer before His Passion (John xvii), which may be an elaboration of the synoptic report regarding prayer in Gethsemane. The story in Luke xi, 1, suggests that there was apparent in His praying an unusual closeness to God, which came to notice in other ways as well. Both His teachings (Matt. vii, 29) and His actions (Mark i, 27) gave the impression

of "authority"; *i.e.*, of an independent commission from God that carried with it the power of its execution. His attitude toward even the most sacred traditions of His people (*e.g.*, Luke vi, 5) rested upon an insight into the will of God not granted to everyone. Many of the titles attributed to Him in the Gospels, whatever their origin, were indications of His divine character. Other men are portrayed as rendering to Him an adoration that belongs properly to God alone. But it is important to remember that all these actions, titles and powers were predicates attached to that Christ who was known and remembered historically, and not vice versa. Not even the Fourth Gospel, with its eloquent prologue, gives a warrant for describing the earthly days of Jesus as merely an episode in the cosmic career of an unearthly being. Rather, His deity was disclosed to those who saw Him or remembered Him in His historical career, and the story of Caesarea Philippi indicates that such a disclosure was incomplete without an awareness of the Cross (Matt. xvi, 16, 21).

The Message of Jesus

As a worker of miracles, Jesus was also a teacher. Although Mark emphasized His deeds and John His teachings (without any reference either to exorcism or to parables), all four Gospels deal with both activities.

The Form of Jesus' Teachings.—Many of Jesus' best-remembered teachings were cast in the familiar Jewish form of parables, brief glimpses into the ways of God and of His kingdom presented as stories. Although some have attempted to question the accounts of Jesus' parables, it is the consensus of most students that, allowing for the way the parable stories were transmitted in the oral tradition, this form of teaching must go back to Jesus Himself. Nor does it appear to be a rationalization of the failures which the church was experiencing in its missionary efforts when Jesus is quoted as saying that the purpose of these parables was simultaneously to reveal and to conceal (Matt. xiii, 10–17). Just this had been the purpose and the experience of the prophets since Isaiah. It would seem that in the preaching and teaching of the early church the same parable was sometimes used to teach two different lessons, and that the same saying was sometimes attached to more than one parable. Something similar also seems to have happened to the sayings that Christian teaching used to interpret the miracle stories.

In addition to the parables, the Gospels contain other kinds of teaching, notably precepts of admonition and instruction and chains of discourses; the best-known of the latter are the Sermon on the Mount (Matt. v–vii) and the discourses in John. Here, too, it is important to keep in mind the role of early Christian teaching in the formation of the Gospels. Thus a comparison of the Sermon on the Mount in Matthew with the Sermon on the Plain in Luke vi, 20–49, creates the impression that the evangelists have strung various sayings together into a single discourse, or that they found them strung together that way in the tradition. The discourses in John, which make use of certain events in the narrative as their basis, are much more unified, being the development of a single theme. It was common in the 19th century to dismiss the discourses in John as the fabrication of an imaginative author, and to point to a supposed analogy in the way Plato embellished the simple picture of Socrates drawn by Xenophon. But as that conception of the Socratic question has proved to be an oversimplification, so this interpretation of John gave way in the 20th century to a growing realization that the Fourth Gospel preserves a tradition of authentic teachings of Jesus in a form and content different from, but not necessarily irreconcilable with, the tradition evident in the Synoptic Gospels. Apparently the primitive church remembered Jesus as having taught both ways.

The Themes of Jesus' Teaching.—The attempt of the 19th century to reduce Jesus' teachings to a single and simple "essence of Christianity" was similarly replaced by an effort to do justice to the full scope of His message. When, for example, the Gospels represent Him as calling God "Father," this is not an assertion of the modern liberal and ancient Greek teaching that God is the universal Father of the human race, but a declaration concerning Jesus' relation to God and the relation of those whom God had chosen through Him. The God whom Jesus proclaimed and revealed was the forgiving Father in the parable of the prodigal son (Luke xv, 11 ff.), but He was also the wrathful King in the parable of the unmerciful servant (Matt. xviii, 23 ff.). Rather than mitigating the holiness of God and the severity of His judgment as described in the Old Testament, Jesus made the requirements of God's will even more stringent (Matt. v–vii). Through His message God was addressing man with a threat, a demand and a promise, all at the same time. Paradoxically, both the rigour and the tenderness of God received greater emphasis in His proclamation than they had before.

Partly this was due to the close connection in Jesus' message between the picture of God and the announcement of the kingdom of God. "The kingdom of God is like . . ."—these words form the introduction to many of the parables in which Jesus described the kingly activity of God. By "kingdom" He seems to have meant not principally the realm of God, but the reign of God: not a country or territory, but a divine activity and a relation. It is therefore foreign to Jesus' teaching when Christians speak of their "building the kingdom." Clearly, He directed His hearers to that which was to come when He spoke to them about the kingdom. They did not and could not take possession of the kingdom now. In this sense it is valid to describe Jesus' view of the kingdom as futuristic. But there are also statements in the Gospels, and not merely in the Fourth Gospel, that have no meaning unless this coming kingdom, not yet here, were already breaking in here. Jesus Himself appears in the Gospels as the herald, but also as the sign and the bringer of the kingdom. Jesus brought the kingdom, and the kingdom was bringing Jesus: this is the only way to summarize the relation between Jesus' coming and the coming of the kingdom according to the Gospels. Therefore He could say to His enemies that the kingdom was "in the midst of you" (Luke xvii, 21, not "within you"): for He himself was the sign of the kingdom in their midst. God's reign was working in hidden ways, but one day soon it would come out of its hiding. Until then only some were privileged to know "the secrets of the kingdom of heaven" (Matt. xiii, 11). Hence it was with the announcement of the kingdom that Jesus began His public preaching (Mark i, 15).

Joined directly to this announcement of the kingdom in that earliest account of Jesus' preaching was the invitation to repent and to believe the Gospel. Repentance meant a change of mind, a break with the past and a new direction. The promises of the kingdom were not for those who boasted of their moral goodness before God, but for those who were genuinely sorry for their sins (Luke xviii, 9–14). Some of the strongest words in the Gospels are those in which Jesus denounced the pride of religious men in His time, with their claims upon God and the inner corruption of their hearts (Matt. xxiii, 25–28). Because such claims and such corruption were not restricted to Jesus' contemporaries, these denunciations and this invitation to repentance and faith formed a continuing part of the Christian witness. One of the purposes of Jesus' stress upon the severity of God's demands was to bring about the kind of awareness out of which true repentance would issue. But the call to repentance was also an invitation to "believe the Gospel." The kingdom was a gift of God's good pleasure (Luke xii, 32), and the God who laid His demands upon men was also the God whose purpose it was to forgive men their sins. Hence the only response proper to His invitation and His generosity was the response of faith, described by Jesus as resembling the trust of children (Mark x, 15).

Thus the primary commandment was to believe in God and to love Him. Next to this commandment, Jesus put the "second commandment" (Mark xii, 31) of love toward the neighbour. In enjoining such love, Jesus insisted that outward performance did not suffice. Not merely murder, but even hate was prohibited; not merely adultery, but evil lust (Matt. v, 21–30). What was revolutionary about Jesus' ethic of the kingdom was this insistence, coupled as it was with His primary emphasis upon the mercy and righteousness of God. Many other themes appear in the Gospels. Jesus spoke of marriage, of religious and cultic duties, of prayer and thanksgiving, of spiritual blindness and the illumination of

God. But if there were such things as themes in His teachings, it is around God, the kingdom of God and the call to repentance, faith and love for the neighbour that His message appears to have been centred.

The Mission of Jesus

His Sense of Vocation.—In the Gospels Jesus is described as having had the sense that God had called Him for a special duty, but the descriptions of that sense of duty are not uniform. This has led New Testament scholars to concern themselves with the problem of development in the messianic consciousness of Jesus. Two questions are uppermost in that problem: Is the identification of Jesus as the Messiah in the Gospels principally a construction by the later church, read back into the career of Jesus? If not, when and under what circumstances did Jesus come to think of Himself as the appointed Messiah? Luke's Gospel even makes this identification a part of its infancy narratives (Luke ii, 11, 26), while John's Gospel credits it to Andrew, the first of the disciples to be called (John i, 41). The title "Messiah" came from the Old Testament, but had undergone further development in the period immediately preceding the time of Jesus; even then, however, it was by no means as prominent among Jews as Christians often tend to suppose. Among many of the common people the title had come to represent their hope for deliverance—deliverance from sin, or at least from the Romans. That hope, coupled as it was with imaginative expectations of radical changes in the order of things, seems to have arisen with new fervour each time a new national or religious leader appeared. The coming of Jesus as a religious teacher and worker of miracles aroused speculation whether He might not be the promised one (Matt. xvi, 14). The story of the entry into Jerusalem told by all four Gospels (*see* Matt. xxi, 1 ff.) and the account of the feeding of the five thousand in John's Gospel (John vi, 14, 15) both disclose the character of the popular hope as Jesus stirred it up once more.

But Jesus not only stimulated this hope, He also reinterpreted it. In the expectations of Israel there were many elements, two of which were: the expectations of the Messiah, the Son of David, who would restore the lost glory of his father's kingdom; and the idea, summarized most fully in Isa. liii, that God's purposes for Israel could not achieve their fulfillment except through the suffering of God's servant. It is not altogether clear how closely or how often these two elements had ever been combined in previous versions of the messianic ideal, but the reactions of Jesus' contemporaries and disciples would suggest that the combination was rarely if ever a part of Israel's hope. From the sources it is evident that such a combination eventually determined Jesus' own conception of His mission. Immediately after the great messianic disclosure at Caesarea Philippi (Matt. xvi, 16) Jesus goes into a discussion of the crucifixion (Matt. xvi, 21 ff.). The combination, significantly, comes out most clearly in one of the post-Resurrection scenes (Luke xxiv, 26, 27), where the disciples learned to identify the Davidic king with the Suffering Servant. It may be the intent of the Gospels to say that fear of the political interpretation of the Messiah led Jesus to disclose His messianic mission to His disciples only gradually, until the course of the terminal events at Jerusalem should make any such political interpretation impossible. But some scholars have taken the Gospels to be saying that the full meaning of His messianic vocation only came upon Jesus over a period of time, and that part of this meaning was His realization that the Messiah had to suffer and die. The difficulty with this notion of development is the difficulty already noted in any attempt to fix chronological sequence in the career and inner life of Jesus.

A special problem in the interpretation of Jesus' vocation is the so-called "messianic secret." Among the first to recognize Jesus as the Christ in the Gospels were the demons (Luke iv, 41), whom He then charges to keep silent. Mark attaches an admonition of silence to both Caesarea Philippi (Mark viii, 30) and the transfiguration (Mark ix, 9). In Matthew and even more in John, on the other hand, Jesus is quite overt about His declarations (*see* John iv, 25, 26). Which of these portrayals more accurately represents the usual attitude of Jesus toward the matter of His messianic character? Some critics maintain on the basis of this and other evidence that Jesus never thought of Himself as the Messiah at all: He suppressed the messianic hopes of others as much as He could; but as part of the process of glorification that took place in the memories of His followers after His death, the disciples ascribed to Him messianic claims which He had never made for Himself. The majority of interpreters, however, trace the identification of Messiah and Suffering Servant to Jesus Himself, even though they differ widely on the extent to which that identification remained Jesus' private secret until near the end. At least in part, the answer to these and related questions will depend upon one's attitude not only toward the Bible, but toward Jesus Himself. For those Christians whose view of Jesus is determined by the decisions on dogma made by the ancient church, the question should read: how did the limited human nature of Jesus Christ in the days of His sojourn on earth share in that full awareness of His mission from the Father which was a continual part of His unlimited divine Nature? According to His divine nature, He was omniscient and always knew Himself to be the Christ, whether or not this awareness was always complete in His human nature. Passages like Mark xiii, 32, would then have to apply only to His human nature, not to the person of Christ as a whole.

His Expectations.—As already mentioned, part of the messianic ideal which Jesus' contemporaries cherished was the expectation that a radical change was in the offing, to affect not only political and national destiny, but the arrangement of the universe itself. Jewish apocalyptic literature gave vivid voice to this expectation in language that often finds echoes in the Gospels. About 1900 these echoes began to be the subject of debate among students of the New Testament. One party maintained that Jesus shared the apocalyptic beliefs of His time and that He confidently expected the end of the world to come in the near future. Accordingly, His death was the way He expected the coming of the end to be set in motion. Other students of the Gospels claimed that the eschatology of Jesus, His view of the last things on earth, was a "realized eschatology." This means that the dramatic language of His apocalyptic utterances was intended to describe the "end" of human history—not the end understood as termination, but the end understood as purpose, the appearance in human history of that which interprets, redeems and judges it. In other words, Jesus was not talking about a finish so much as He was talking about a continuing feature of life seen under the judgment of God. A third way to interpret these utterances has been to say that in Jesus' own message both elements were present. Those in which "end" meant primarily "termination" found their way chiefly into the Synoptic Gospels, while John's Gospel contains those that speak of the "end" as the continuing judgment of God. Again, a decision among these interpretations depends upon one's picture of Jesus. Orthodox Christian doctrine, both Catholic and Protestant, forbids any interpretation that would either ascribe error to Christ's expectations or deny the ultimate termination of human history.

The title "Son of Man" was one of the symbols appearing in Jewish apocalyptic, and the Gospels frequently put it into the sayings of Jesus. Sometimes it merely takes the place of the personal pronoun "I," as is evident from a comparison of Matt. xvi, 13, with Luke ix, 18, and from other sets of parallel passages. At other times it is merely equivalent to "man," which may indeed have been the original term in sayings like Mark ii, 28. In some passages it may even refer, as it perhaps did in Ps. viii, 4, to man in his lowliness. But in some places it clearly carries the connotation it acquired in Jewish apocalyptic, possibly under the influence of Persian thought, of God's representative, anointed to bring in His kingdom. This connotation was most prominent in sayings like Matt. xxiv, 27, 30, and it may be that Jesus used it deliberately to avoid the political overtones that were so difficult to avoid in the title "Messiah." "Son of Man" appears in the Gospels approximately 80 times, carrying one or several of these connotations. The fact that Jesus used the title in the third person certainly does not prove, as some have contended, that He did not regard Himself as the Son of Man; this was merely

general Semitic usage, prevalent in Arabic even today. The implications of terms like "kingdom," "Son of Man" and "end" are therefore more complex than has often been realized, combining meanings that later interpreters have falsely set into antithesis with one another.

The Influence of Jesus

During the course of His public ministry Jesus called forth a variety of reactions among His contemporaries, ranging all the way from worship to hatred; but it seems that the hatred grew more intense toward the end of His career.

Acceptance.—The Gospels make it clear that Jesus, like John the Baptist, attracted considerable attention and support among the Jewish people. The chief grounds for this were His miracles and His teaching. In part He seems to have been voicing a resentment of their religious leaders that was quite widespread; in part His teachings appeared to confirm the hopes of the people for deliverance. But beyond all such factors there was His "authority" (Matt. vii, 28, 29), which He manifested in both His words and His deeds, causing the people to conclude that a special action of God was taking place in their midst as a harbinger of even greater actions to follow. There is no reason to doubt the accuracy of the reports in all four Gospels regarding the ardour and enthusiasm with which He was received. Accepting the division into three years suggested by the narrative of John's Gospel, some students of the Gospels have put the height of Jesus' popularity into the second of the three years. But as has been pointed out, the evidence is inadequate for this or almost any other chronological hypothesis.

In the Gospel accounts, the story of the entry into Jerusalem may well represent the zenith of Jesus' acceptance among the people—all the more ironic because of the events that immediately followed.

Concerning the attitude and relation of Jesus to non-Jews we know very little. His use of a Samaritan in the familiar parable of Luke x, 30–35, and the later reports of his other contacts with this hated semi-Jewish people suggest that He had made an impression upon the memory of His followers by His freedom from the sort of parochialism that had often marked His people. What He said about "the rulers of the Gentiles" (Matt. xx, 25) indicates how geographically limited His career was. The people spoken of in John xii, 20, were not pagan Greeks, but Hellenistic Jews or perhaps Jewish proselytes of Greek descent. In other contacts with non-Jews He is reported to have healed the daughter of the Syrophenician woman (Mark vii, 24 ff.) and the servant of the centurion (Matt. viii, 5 ff.); in both these stories the evangelist quotes Jesus as commenting upon the unusual faith He had found outside the Jewish religious community. Whether in this connection (so Matt. viii, 11) or some other (so Luke xiii, 29), Jesus envisioned what the prophets had also predicted, that the kingdom of God would be universal, not restricted to the Jewish people; but apparently He saw that this would happen only after His death. In the closing scene of Matthew's Gospel (Matt. xxviii, 19) as well as in the opening scene of the Acts (Acts i, 8) the risen Lord is portrayed as commanding that His followers bear witness to Him throughout the Gentile world. But despite these and other indications of Jesus' personal perspective, it was as an adherent of Judaism that He lived and among Jews that He was both accepted and rejected.

The Disciples.—In addition to the general support and acceptance He gained in the Jewish populace, Jesus also won the loyalty of a group of followers. The size of the group seems to have varied; for example, Luke refers in two successive chapters to the twelve (Luke ix, 1) and to the seventy (Luke x, 1). Other places in the Gospels also indicate that the term "disciple" could refer to the broader circle of Jesus' followers, but more usually it meant the chosen twelve. The lists of their names in the Gospels all put Peter's name first and Judas' last, with some variations between these two. The twelve were (Mark iii, 16–19): Simon Peter, James and John, Andrew, Philip, Bartholomew, Matthew, Thomas, James the son of Alphaeus, Thaddaeus, Simon the Cananaean and Judas Iscariot. These same twelve, with the replacement of Judas Iscariot by Matthias (Acts i, 26), also became the "apostles" (*q.v.*).

What role did Jesus envision for them? The answer to that question is dependent upon whether or not Jesus intended to establish a church, as the words of Matt. xvi, 18, 19, say. While some New Testament critics have doubted the authenticity of these words, Protestants generally have taught that Jesus did indeed intend to found the church, but not the specific form of its outward organization. Churches of Catholic persuasion—Roman, Orthodox and Anglican—have seen in this passage their charter as churches, claiming direct descent from the apostles in the line of ordaining bishops. Among them there has been controversy about the position Jesus here accords Peter among the disciples (*see* also John xxi, 15–18) because of the implication of that position for the status of Peter's successors among the bishops. The Gospels represent the twelve as Jesus' constant companions, as the audience for many of His discourses and as the messengers He trained to continue His work of preaching and teaching. Like the acceptance of Jesus by the common people, their loyalty to Him was inconstant; and in the hour of His defeat they forsook Him.

Opposition.—The hostility to Jesus appears to have stemmed from diverse motives. He had repeatedly manifested an independence and "authority" in relation to the law of the Old Testament that was heretical to the religious leaders of His people. Some of them saw their position threatened by the support He had among the people. The vigorous denunciations He had directed against injustice and hypocrisy had undoubtedly earned Him the hatred of others, while the cleansing of the temple was a dramatic indication to them of how far He was willing to go.

From a report preserved in John xi, 47 ff., it appears that Jesus' miracles, His proclamation of the coming kingdom and the attention He was receiving had become politically embarrassing to the Jewish leaders, who enjoyed considerable local autonomy under Roman rule and were fearful of losing it if there were an insurrection. It also seems plausible that the people turned against Him because of His consistent refusal to lead such an insurrection. Jesus Himself believed that the will of His Father for the kingdom could not come to pass except by His death, and He went up to Jerusalem to die in obedience to that will. Hence it is true that the Cross was imposed upon Him by His enemies, but it is also true that He voluntarily took upon Himself the death of the Cross (John x, 18).

The Cross

Compared with the sparse accounts of Jesus' early years and with the occasional glimpses of His public ministry, the reports in the Gospels of His closing days are quite detailed and lengthy, an indication of the importance which the earliest Christian congregations attached to the events of His Passion and death. Although there is more chronological sequence to the narratives of these events than there is anywhere else in the Gospels, there are also major problems of chronology. Probably the chief one is the fact that after centuries of harmonization it still remains unclear from a comparison of John's account with those of the Synoptic Gospels on just what day of the Jewish calendar Jesus died.

His Last Days.—Differ though they may in many details, the Gospels all begin their report of Jesus' last week with the story of His triumphal entry into Jerusalem on the Sunday of that week, celebrated in Christian liturgy as Palm Sunday. The Synoptic Gospels represent Him as spending the week teaching and disputing with the Jews; because of its purpose, Matthew's Gospel contains the fullest account of these disputes. As the time of crisis drew near, Jesus gathered the twelve for the Last Supper. Despite the great difficulties in chronology, many interpreters have come to conclude with Joachim Jeremias that the Last Supper took place within the framework of a Jewish Passover meal, where Jesus sought to prepare the disciples for what was to come. The church remembered this as the occasion when the new covenant was celebrated, a covenant established when Jesus offered up the sacrifice of that body and blood which the church received in this

Supper. John's Gospel has no account of this institution, but has a lengthy series of discourses, unique to it, in which Jesus gave the disciples His last will and testament, together with the promise of the Holy Spirit.

All four Gospels tell us that one of the twelve, Judas Iscariot, put himself at the service of the enemies of Jesus as an informer. Christian piety and preaching have elaborated upon the story of Judas the traitor in an effort to probe his motives—greed, or disappointment over the failure of Jesus to inaugurate the kingdom, or a desire to precipitate the kingdom by violence. In the New Testament the only elaborations of the story are the accounts of his remorse and his violent end. Jesus is portrayed as having known that Judas would betray Him and as predicting that all the other disciples would forsake Him. To their protestations of loyalty He replied with the further prediction that Peter would deny Him three times, a prediction that Peter remembered (Mark xiv, 66–72) and that the church remembered when it was facing the temptation of apostasy and denial. From the room where the Last Supper was held Jesus and the disciples proceeded to the garden of Gethsemane, where He prepared Himself for the coming ordeal by praying and submitting His will to that of His Father. Into the garden then came Judas, leading a band of men to arrest Jesus and arraign Him before the authorities. In spite of their earlier insistence that they would not forsake Him and their initial show of boldness, the disciples fled; and Jesus was led away to be tried.

The trial of Jesus was twofold, religious and civil. First the religious authorities of His own people examined Him on the charge that He had disobeyed the traditions of the Old Testament and made blasphemous claims about Himself. They adjudged Him guilty. Although the punishment prescribed for the sin of blasphemy was death (Lev. xxiv, 16), the Jews did not execute the punishment; historians disagree about whether they had a right to mete out capital punishment. Instead they referred the case of Jesus to the civil authorities, and it became necessary for Him to have a second trial before the Roman procurator, Pontius Pilate. Like Judas, Pilate has been the subject of Christian speculation, some later accounts even telling of his conversion to Christianity. Closer to historical accuracy appears to be the view that against his better judgment he yielded to the pressures of the populace and of their leaders for reasons of political expediency, giving the command that Jesus be crucified. Students of both Jewish and Roman law have raised questions regarding the legality of Jesus' trial on the grounds that prescribed conditions for the trial of a capital offense were not present. Another question that has frequently been raised, usually in the context of Jewish-Christian relations, is whether the Jews or the Romans were primarily responsible for Jesus' death. Christian theology and piety at their most profound have generally replied that the joint action of Jew and gentile in the crucifixion of Jesus is a symbol of the guilt of the entire human race.

His End.—Jesus' death came by crucifixion, a cruel and painful method of execution reserved for slaves and abject criminals. It was preceded by various tortures and indignities, recited in great detail by the evangelists. The fondness and the reverence with which the early Christians dwelt upon the scene of the crucifixion can be seen from the last words of Jesus reported in the Gospels; the usual number of these is seven, but there are many variations in the text. The awe with which they recalled the scene is evident from the portents associated with the death of Jesus—the earthquake, the darkness and the rending of the veil in the Temple. The evangelists also associated the several events of the crucifixion story with prophecies of the Old Testament. They tell us that the body of Jesus was not permitted to hang on the cross overnight on account of Jewish law (Deut. xxi, 23) and that He was buried the same day He died.

The Resurrection

The Cross was not the end of Jesus, but God rescued Him from death: such was the universal conviction and consensus of the early Christians. The witness of the New Testament to that conviction is unified as to the fact, but not as to the details of the fact. Thus our earliest witness, St. Paul, says nothing about the reports of the empty tomb, which we find in all four Gospels. There are many other problems—literary, historical and theological—connected with the reports of the Resurrection. But apologists for Christianity have maintained that none of these problems is as formidable as the problem of explaining the rise of the Christian Church if there were no Resurrection. The transformation of the fleeing disciples into bold confessors was an even greater miracle than the Resurrection of Jesus Christ from the dead. Throughout the Gospel story, and nowhere more than here, it is necessary to keep faith and history together, the event and faith in the event. On the one hand, it is impossible to explain the faith without some event; on the other hand, the event of Christ's Resurrection was not known to anyone but believers in Him. No unbeliever, with the special exception of Paul on the road to Damascus, ever saw the risen Christ. It is therefore, as Karl Adam says in *The Son of God,* "perverse to apply the standards of the modern historian to the evangelists' account of the Resurrection. Their aims are not historical but dogmatic and missionary" (trans. by Philip Hereford, pp. 229–230, Sheed and Ward, Inc., New York, 1934). Thus the question of whether or not Jesus actually rose from the dead is a question beyond the province of the technical historian to answer either way with finality, but he can report that such was the faith of the entire early church.

The appearances of Jesus after the Resurrection form the concluding unit of the Gospels, but the earliest catalogue of them is the one Paul repeats from an earlier tradition in I Cor. xv. Interpreters are not in agreement whether the purpose of this catalogue is to establish the historicity of the Resurrection or to support Paul's claim to apostolic authority as the last one to whom the risen Lord had appeared (I Cor. xv, 8). It is also very difficult to determine the relation between Paul's catalogue and the traditions represented in the various Gospels, just as it is to harmonize the account in St. John with that of the other Gospels. Therefore we cannot say on the basis of the New Testament how many such apparitions there were, the traditional number of 12 being quite arbitrary. Some scholars have even sought to distinguish two traditions, one of appearances in Galilee and the other of appearances in Judaea. But this much is clear, that the apparitions came to all the apostles, because "apostle" came to mean "appointed witness of the Resurrection" (*see* Acts i, 22). The sermons in the early chapters of the Book of Acts make clear how central a part of apostolic preaching the proclamation of the Resurrection was, based upon personal experience of the risen Christ (*see* Acts iv, 33).

Of all the post-Resurrection appearances, perhaps the most representative is that reported in Luke xxiv, 13 ff.; for it provides a link between the events narrated in the Gospels and the rise of the apostolic church. That link is the so-called "Gospel of the forty days" after Easter, during which the eyes of the disciples were opened (Luke xxiv, 31). Apparently this meant new insight into the meaning of the Old Testament Scriptures as a testimony to Christ (Luke xxiv, 27) and a realization of what He had intended in the institution of the Last Supper (Luke xxiv, 35). It also meant a reconception of the scope of Jesus' mission to include "all nations" (Matt. xxviii, 19), despite remnants of the earlier conception (Acts i, 6). These and other insights the early church traced to the 40 days after the Resurrection. Christians are not agreed about whether the "Gospel of the forty days" is preserved only within the New Testament (so most Protestants) or whether part of it has been transmitted to subsequent generations of the church as part of tradition, to be promulgated by the church under the guidance of the Holy Spirit (so Roman Catholics and Orthodox). Finally, according to a tradition reported in authentic New Testament writings only by Luke in his Gospel (Luke xxiv, 50–53) and in Acts i, 9–11—it also occurs in the "long ending" of Mark (Mark xvi, 19)—Jesus "ascended" to heaven and disappeared from their midst. Yet His presence was known and worshiped in the church through the activity of the Holy Spirit, fulfilling the promise that Christ would be with the church until the consummation of this age (Matt. xxviii, 20).

THE PICTURE OF CHRIST IN THE EARLY CHURCH: THE APOSTLES' CREED

Even before our Gospels were written, Christians were reflecting upon the meaning of what Jesus had been and what He had said and done. It is a mistake, therefore, to suppose that such reflection is a later accretion upon the simple message of the Gospels. On the contrary, the early Christian communities were engaged in witness and worship from the very beginning. The forms of that witness and worship were also the forms of the narratives in the Gospel accounts. From this fact it follows that to understand the Gospel accounts regarding Jesus we must consider the faith of the early church regarding Christ. In this sense it is valid to maintain that there is no distinction between "the Jesus of history" and "the Christ of faith," and that the only way to get at the former is by the latter. Christology, the doctrine about Christ, is then as old as Christianity itself.

To comprehend the faith of the early church regarding Christ, we must turn to the writings of the New Testament, where that faith found embodiment. It was also embodied in brief confessions or creeds, but these have not been preserved for us complete in their original form. What we have are fragments of those confessions or creeds in various books of the New Testament, snatches from them in other early Christian documents and later forms of them in Christian theology and liturgy. The so-called Apostles' Creed is one such later form. It did not achieve its present form until quite late; just how late is a matter of controversy. But in its earliest ancestry it is very early indeed, perhaps dating back to the 1st century. And its confession regarding Christ is probably the earliest core, around which later elaborations of it were composed. Allowing for such later elaborations, we may say that in the Apostles' Creed we have a convenient summary of what the early church believed about Christ amid all the variety of its expression and formulation. The creeds were a way for Christians to explain what they meant by their acts of worship. When they put "I believe" or "We believe" at the head of what they confessed about God and Christ, they meant that their declarations rested upon faith, not merely upon observation.

Pre-existence

The statement "I believe" also indicated that Christ was deserving of worship and faith, and that He was therefore on a level with God. At an early date, possibly as early as the words of Paul in Phil. ii, 6–11, Christian theology began to distinguish three stages in the career of Jesus Christ: His pre-existence with the Father before all things; His Incarnation and humiliation in "the days of His flesh" (Heb. v, 7) and His glorification, beginning with the Resurrection and continuing forever.

Probably the most celebrated statement of the pre-existence of Christ is the opening verses of the Gospel of St. John. Here Christ is identified as the incarnation of that Word (Logos) through which God made all things in the beginning, a Word existing in relation to God before the creation. The sources of this doctrine have been sought in Greek philosophy, both early and late, as well as in the Jewish thought of Philo and of the Palestinian rabbis. Whatever its source, the doctrine of the Logos in John is distinctive by virtue of the fact that it identifies the Logos with a specific historical person. Other writings of the New Testament also illustrate the faith of the early Christians regarding the pre-existence of Christ. The opening chapters of both Colossians and Hebrews speak of Christ as the pre-existent one through whom all things were created, therefore as distinct from the created order of things in both time and pre-eminence; the preposition "before" in Col. i, 17, apparently refers both to His temporal priority and to His superior dignity. Yet before any theological reflection about the nature of this pre-existence had been able to find terms and concepts, the early Christians were worshiping Christ as divine. Phil. ii, 6–11, may be a quotation from a hymn used in such worship. Theological reflection told them that if this worship was legitimate, He must have existed with the Father "before all ages."

Jesus Christ.—By the time the text of the creed was established, this was the usual designation for the Saviour. Originally, of course, "Jesus" had been His given name, meaning "Yahweh saves" or "Yahweh will save" (*see* Matt. i, 21), while "Christ" was the Greek translation of the title "Messiah." Some passages of the New Testament still used "Christ" as a title (*e.g.*, Luke xxiv, 26; II John, 7), but it is evident from Paul's usage that the title became simply a proper name very early. Most of the Gentiles took it to be a proper name, and it was as "Christians" that the early believers were labeled (Acts xi, 26). In the most precise language, the term "Jesus" was reserved for the earthly career of the Lord; but it seems from liturgical sources that it may actually have been endowed with greater solemnity than the name "Christ." Within a few years after the beginnings of the Christian movement, Jesus, Christ, Jesus Christ and Christ Jesus could be used almost interchangeably, as the textual variants in the New Testament indicate. Only in modern times has it become customary to distinguish sharply among them for the sake of drawing a line between the Jesus of history and the Christ of faith, and this only in certain circles. The theologians and people of many churches still use phrases like "the life of Christ," because "Christ" is primarily a name. It is difficult to imagine how it could be otherwise when the Old Testament implications of the title have become a secondary consideration in its use—a process already evident within the New Testament.

God's Only Son.—The declaration that Jesus Christ is the Son of God is one of the most universal in the New Testament, most of whose books refer to Him that way. The Gospels do not quote Him as using the title for Himself in so many words, although sayings like Matt. xi, 27, come close to it. There are some instances where the usage of the Gospels appears to echo the more general implications of divine sonship in the Old Testament as a prerogative of Israel or of the true believer. Usually, however, it is evident that the evangelists, like Paul, meant some special honour by the name. The evangelists associated the honour with the story of Jesus' baptism (Matt. iii, 17) and transfiguration (Matt. xvii, 5), Paul with the faith in the Resurrection (Rom. i, 4). From this association some have argued that "Son of God" in the New Testament never referred to the pre-existence of Christ. But it is clear in John and in Paul that this implication was not absent, even though it was not as prominent as it became soon thereafter. What made the implication of pre-existence more prominent in later Christian use of the term "Son of God" was the clarification of the doctrine of the Trinity, where "Son" was the name for the eternal Second Person (Matt. xxviii, 19). As the Gospels show, the application of the name "Son of God" to Jesus was offensive to the Jews, probably because it seemed to smack of gentile polytheism. This also made it all too intelligible to the pagans, as early heresies indicate. Facing both the Jews and the Greeks, the apostolic church confessed that Jesus Christ was "God's only Son": the Son of God, in antithesis to Jewish claims that the Eternal could have no sons; the only Son, in antithesis to Greek myths of divine procreation.

Our Lord.—As passages like Rom. i, 4, show, the phrase "Jesus Christ our Lord" was one of the ways the apostolic church expressed its understanding of what He had been and done. Luke even put the title into the mouth of the Christmas angel (Luke ii, 11). From the way the name "Lord" (*Kyrios*) was employed during the 1st century it is possible to see several implications in the Christian use of it for Christ. The Christians meant that there were not many divine and lordly beings in the universe, but only one *Kyrios* (I Cor. viii, 5, 6). They meant that the Roman Caesar was not the lord of all, as he was styled by his worshipers, but that only Christ was Lord (Rev. xvii, 14). And they meant that Yahweh, the covenant God of the Old Testament, whose name they pronounced as "Lord," had come in Jesus Christ to establish the new covenant (*see* Rom. x, 12, 13). Like "Son of God," therefore, the name *Kyrios* was directed against both parts of the audience to which the primitive church addressed its proclamation. At times it stood particularly for the risen and glorified Christ, as in Acts ii, 36; but in passages that echoed the Old Testament it was sometimes the pre-existence that was being primarily emphasized (Matt. xxii, 44). Gradually "our Lord," like "Christ," became a common way of speaking about Jesus Christ, even when the

speaker did not intend to stress His lordship over the world.

Incarnation and Humiliation

Conceived by the Holy Spirit, Born of the Virgin Mary.—Earlier forms of the creed seem to have read: "Born of the Holy Spirit and of the Virgin Mary." The primary affirmation of this article is that the Son of God, the Word, had become man or, as John's Gospel put it, "flesh" (John i, 14). Pre-existence and Incarnation presuppose each other in the Christian view of Jesus Christ. Hence the New Testament assumed His pre-existence when it talked about His becoming man; and when it spoke of Him as pre-existent, it was ascribing this pre-existence to Him whom it was describing in the flesh. It may be that the reference in the creed to the Virgin Mary was intended to stress primarily her function as the guarantee of Christ's true humanity, but the creed also intended to teach the supernatural origin of that humanity. Although it is true that neither Paul nor John makes reference to it, the teaching about the virginal conception of Jesus, apparently based upon Isa. vii, 14, was sufficiently widespread in the 1st century to warrant inclusion in both Matthew and Luke, as well as in creeds that date back to the 1st century. As it stands, the creedal statement is a paraphrase of Luke i, 35. In the New Testament the Holy Spirit was also involved in the baptism and the Resurrection of Jesus.

Suffered Under Pontius Pilate, Was Crucified, Dead, and Buried.—To a reader of the Gospels, the most striking feature of the creed is probably its omission of that which occupied a major part of the Gospels, the story of Jesus' life and teachings. In this respect there is a direct parallel between the creed and the Epistles of the New Testament, especially those of Paul. Judging by the amount of space they devoted to the Passion story, even the writers of the Gospels were apparently more interested in these few days of Jesus' life than they were in anything else He had said or done. The reason for this was the faith underlying both the New Testament and the creed, that the events of Jesus' Passion, death and Resurrection were the events by which God had accomplished the salvation of men. The Gospels found their climax in those events, and the other material in them led up to those events. The epistles applied those events to concrete situations in the early church. From the way Paul could speak of the Cross (Phil. ii, 6–11) and of "the night when he [Jesus] was betrayed" (I Cor. xi, 23) it seems that before our Gospels came into existence the church commemorated the happenings associated with what came to be called Holy Week. Some of the earliest Christian art was a portrayal of these happenings, another indication of their importance in the cultic and devotional life of early Christianity. How did the Cross effect the salvation of men? The answers of the New Testament and the early church to this question involved a variety of metaphors: Christ offered Himself as a sacrifice to God; His life was a ransom for many; His death made us alive; His suffering was an example to us when we must suffer; He was the Second Adam, creating a new humanity; His death shows us how much God loves us; and others. Every major atonement theory of Christian theological history discussed below was anticipated by one or another of these metaphors. The New Testament employed them all to symbolize something that could be described only symbolically, that "God was in Christ reconciling the world to himself, not counting their trespasses against them" (II Cor. v, 19).

He Descended Into Hell.—This phrase was probably the last to be added to the creed. Its principal source in the New Testament was the description in I Pet. iii, 18–20, of Christ's preaching to the spirits in prison. Originally the descent into hell may have been identified with the death of Christ, when He entered the abode of the dead in the underworld. But in the time before it entered the creed, the descent was frequently taken to mean that Christ had gone to rescue the souls of the Old Testament faithful from the underworld, from what western Catholic theology eventually called the *limbo patrum*. Among some of the Church Fathers the descent into hell had come to mean Christ's declaration of His triumph over the powers of hell. Despite its subsequent growth in importance, however, the doctrine of the descent into hell apparently did not form an integral part of the apostolic preaching about Christ.

Glorification

The Third Day He Rose Again From the Dead.—The writers of the New Testament nowhere made the Resurrection of Christ a matter for argument, but everywhere asserted it and assumed it. With it began that state in the history of Jesus Christ that was still continuing, His elevation to glory. They used it as a basis for three kinds of affirmations. The Resurrection of Christ was the way God bore witness to His Son, "designated Son of God in power according to the Spirit of holiness by his resurrection from the dead" (Rom. i, 4); this theme was prominent also in the Book of Acts. The Resurrection was also the basis for the Christian hope of life after death (I Thess. iv, 14), and without it that hope was said to be baseless (I Cor. xv, 12–20). The Resurrection of Christ was also the ground for admonitions to manifest a "newness of life" (Rom. vi, 4) and to "seek the things that are above" (Col. iii, 1). The writers of the New Testament themselves expressed no doubt that the Resurrection had really happened. But Paul's discussion in I Cor. xv shows that among those who heard the Christian message there was such doubt, as well as efforts to rationalize the Resurrection. The differences among the Gospels, and between the Gospels and Paul, suggest that from the outset a variety of traditions existed regarding the details of the Resurrection (*see* above). But such differences only serve to emphasize how universal the faith in the Resurrection was amid this variety of traditions.

He Ascended Into Heaven, and Sitteth on the Right Hand of God the Father Almighty.—As indicated earlier, the narrative of the Ascension is peculiar to Luke-Acts, but other parts of the New Testament may refer to it. Eph. iv, 8–10, may be such a reference, but many interpreters hold that for Paul Resurrection was identical with Ascension. That, they maintain, is why he could speak of the appearance of the risen Christ to him in continuity with the appearances to others (I Cor. xv, 5–8) despite the fact that, in the chronology of the creed, the Ascension intervened between them. Session at the right hand of the Father was apparently a Christian interpretation of Ps. cx, 1. It implied the elevation—or, as the doctrine of pre-existence became clearer, the restoration—of Christ to a position of honour with God. Taken together, the Ascension and the session were a way of speaking about the presence of Christ with the Father during the interim between the Resurrection and the Second Advent. From Eph. iv, 8–16, it is evident that this way of speaking was by no means inconsistent with another Christian tenet, the belief that Christ was still present in and with His church. It was, in fact, the only way to state that tenet in harmony with the doctrine of the Resurrection.

From Thence He Shall Come to Judge the Quick and the Dead.—The creed concludes its Christological section with the doctrine of the Second Advent: the First Advent was a coming into the flesh, the Second Advent a coming in glory. Much controversy among modern scholars has been occasioned by the role of this doctrine in the early church. Those who maintain that Jesus erroneously expected the early end of the world have often interpreted Paul as the first of those who began the adjustment to a delay in the end, with John's Gospel as a more advanced stage of that adjustment. Those who hold that the imminence of the end was a continuing aspect of human history as Jesus saw it also maintain that this phrase of the creed was a statement of that imminence, without any timetable necessarily implied. From the New Testament it seems that both the hope of the Second Coming and a faith in the continuing presence of Christ belonged to the outlook of the apostolic church, and that seems to be what the creed meant. The phrase "the quick and the dead" is a summary of passages like I Cor. xv, 51–52, and I Thess. iv, 15–17.

In order to complete the confession of the creed regarding the glorification of Christ, the Nicene Creed added the phrase: "Of His kingdom there shall be no end." This was a declaration that Christ's return as Judge would usher in the full exercise of His reign over the world. Such was the expectation of the apostolic

church, based upon what it knew and believed about Jesus Christ.

THE DOGMA OF CHRIST IN THE ANCIENT COUNCILS

The main lines of orthodox Christian teaching about the person of Christ were set by the New Testament and the ancient creeds. But what was present there in a germinal form became a clear statement of Christian doctrine when it was formulated as dogma. In one way or another, the first four ecumenical councils were all concerned with the formulation of the dogma regarding the person of Christ—His relation to the Father, and the relation of the divine and the human in Him. (*See* COUNCIL.)

Such a formulation became necessary because teachings arose within the Christian community that seemed to threaten what the church believed and confessed about Christ. Both the dogma and the heretical teachings against which the dogma was directed are therefore part of the history of Jesus Christ.

THE COUNCILS OF NICAEA AND CONSTANTINOPLE

Early Heresies.—From the outset Christianity has had to contend with those who misinterpreted the person and mission of Jesus. Both the New Testament and the early confessions of the church referred and replied to such misinterpretations. As the Christian movement gained adherents from the non-Jewish world, it had to explain Christ in the face of new challenges.

These misinterpretations touched both the question of His humanity and the matter of His deity. A concern to safeguard the true humanity of Jesus led some early Christians to teach that Jesus of Nazareth, an ordinary man, was adopted as the Son of God in the moment of His baptism or after His Resurrection; this heresy was called adoptionism (*q.v.*). Gnostics and others wanted to protect Him against involvement in the world of matter, which they regarded as essentially evil, and therefore taught that He had only an apparent, not a real body; they were called docetists (*see* DOCETISM). Most of the struggle over the person of Christ, however, dealt with the question of His relation to the Father. Some early views were so intent upon asserting His identity with the Father that the distinction of His person was lost and He became merely a manifestation of the one God. Because of this idea of Christ as a "mode" of divine self-manifestation, proponents of this view were dubbed "modalists"; from an early supporter of the view it was called "Sabellianism" (*see* SABELLIANISM). Other interpretations of the person of Christ in relation to God went to the opposite extreme. They insisted so strenuously upon the distinctness of His person from that of the Father that they subordinated Him to the Father. Many early exponents of the doctrine of the Logos were also subordinationists, so that the Logos idea itself became suspect in some quarters. What was needed was a framework of concepts, with which to articulate the doctrine of Christ's oneness with the Father and yet distinctness from the Father, and thus to answer the question (Adolf von Harnack): "Is the Divinity which has appeared on earth and reunited men with God identical with that supreme Divinity which governs heaven and earth, or is it a demigod?"

Nicaea.—That question forced itself upon the church through the teachings of Arius (*q.v.*). He maintained that the Logos was the first of the creatures, called into being by God as the agent or instrument through which He was to make all things. Christ was thus less than God, but more than man; He was divine, but He was not God. To meet the challenge of Arianism, which threatened to split the church, the newly converted emperor Constantine convoked in 325 the first ecumenical council of the Christian church at Nicaea (*see* COUNCIL: *First Council of Nicaea [325]*). The private opinions of the attending bishops were anything but unanimous, but the opinion that carried the day was that espoused by the young presbyter Athanasius, who later became bishop of Alexandria. The Council of Nicaea determined that Christ was "begotten, not made," that He was therefore not creature but Creator. It also asserted that He was "of the same essence as the Father" (*homoousios to patri*). In this way it made clear its basic opposition to subordinationism, even though there could be, and were, quarrels about details. It was not equally clear how the position of Nicaea and of Athanasius differed from modalism. Athanasius asserted that it was not the Father nor the Holy Spirit, but only the Son that became incarnate as Jesus Christ. But in order to assert this, he needed a more adequate terminology concerning the persons in the Holy Trinity. So the settlement at Nicaea regarding the person of Christ made necessary a fuller clarification of the doctrine of the Trinity, and that clarification in turn made possible a fuller statement of the doctrine of the person of Christ. (*See* also ARIANISM; CREED: *Nicene Creed.*)

Constantinople.—Nicaea did not put an end to the controversies, but only gave the parties a new rallying point. Doctrinal debate was complicated by the rivalry among bishops and theologians as well as by the intrusion of imperial politics that had begun at Nicaea. Out of the post-Nicene controversies came that fuller statement of the doctrine of the Trinity which was needed to protect the Nicene formula against the charge of failing to distinguish adequately between the Father and the Son. Ratified at the Council of Constantinople in 381, but since lost, that statement apparently made official the terminology developed by the supporters of Nicene orthodoxy in the middle of the 4th century: one divine essence, three divine persons (*mia ousia, treis hypostaseis*). The three persons, Father, Son and Holy Spirit, were distinct from one another, but were equal in their eternity and power. Now it was possible to teach, as Nicaea had, that Christ was "of the same essence as the Father" without arousing the suspicion of modalism. Although this doctrine seemed to make problematical the unity of God, it did provide an answer to the first of the two issues confronted by the church in its doctrine of the person of Christ—the issue of Christ's relation to the Father. It now became necessary to clarify the second issue—the relation of the divine and the human within Christ.

THE COUNCILS OF EPHESUS AND CHALCEDON

By excluding several extreme positions from the circle of orthodoxy, the formulation of the doctrine of the Trinity in the 4th century determined the course of subsequent discussion about the person of Christ. It also provided the terminology for that discussion, since 5th-century theologians were able to describe the relation between the divine and the human in Christ by analogy to the relation between the Father and the Son in the Trinity. The term that was found to express this relation in Christ was the term "nature," *physis*. There were three divine persons in one divine essence; such was the outcome of the controversies in the 4th century. But there were also two natures, one of them divine and the other human, in the one person Jesus Christ. Over the relation between these two natures the theologians of the 5th century carried on their controversy.

The abstract questions with which they sometimes dealt in that controversy, some of them almost unintelligible to a modern mind, must not be permitted to obscure the fact that a basic issue of the Christian faith was at stake: how can Jesus Christ be said to possess that identity with God which He must have to be our Saviour, and yet be called our Brother, as He truly must be to make His salvation available to us?

The Parties.—During the half century after the Council of Constantinople several major points of emphasis developed in the doctrine of the person of Christ; characteristically, these are usually defined by the episcopal see that espoused them. There was a way of talking about Christ that was characteristic of the see at Alexandria. It stressed the divine character of all that Jesus Christ had been and done, but its enemies accused it of absorbing the humanity of Christ in His divinity. The mode of thought and language employed at Antioch, on the other hand, emphasized the true humanity of Christ; but its opponents maintained that in so doing it had split Christ into two persons, each of whom maintained his individual selfhood while they acted in concert with each other. Western theology was not as abstract as either of these alternatives. Its central emphasis was a practical concern for human salvation and for as irenic a settlement of the conflict as was possible without sacrificing that concern. Even more than in the 4th century, considerations of imperial politics were always involved in conciliar actions, together with the fear in countries like Egypt that Constantinople might come to

dominate them. Thus a decision regarding the relation between the divine and the human in Christ could be simultaneously a decision regarding the political situation. Nevertheless, the settlements at which the councils of the 5th century arrived may be and are regarded as normative in the church long after their political setting has disappeared.

The conflict between Alexandria and Antioch came to a head when Nestorius (*q.v.*), taking exception to the use of the title "Mother of God" or, more literally, "God-Bearer" (*Theotokos*) for the Virgin Mary, insisted that she was only "Christ-Bearer." In this insistence the Antiochean emphasis upon the distinction between the two natures in Christ made itself heard throughout the church. The Alexandrian theologians responded by charging that Nestorius was dividing the person of Christ, which they represented as so completely united that, in the famous phrase of Cyril, there was "one nature of the Logos which became incarnate." By this he meant that there was only one nature, the divine, before the Incarnation, but that after the Incarnation there were two natures indissolubly joined in one person; Christ's human nature had never had an independent existence. There were times when Cyril appeared to be saying that there was "one nature of the incarnate Logos" even after the Incarnation, but his most precise formulations avoided this language (*see* also CYRIL, SAINT, of Alexandria). The Council of Ephesus in 431 was one in a series of gatherings called to settle this conflict, some by one party and some by the other. (*See* COUNCIL: *Council of Ephesus* [*431*].)

Chalcedon.—But the actual settlement was not accomplished until the calling of the Council of Chalcedon in 451. The basis of that settlement was the western understanding of the two natures in Christ, as formulated in the *Tome* of Pope Leo I of Rome. Chalcedon declared: "We all unanimously teach . . . one and the same Son, our Lord Jesus Christ, perfect in deity and perfect in humanity . . . in two natures, without being mixed, transmuted, divided, or separated. The distinction between the natures is by no means done away with through the union, but rather the identity of each nature is preserved and concurs into one person and being." In this formula the valid emphases of both Alexandria and Antioch came to expression; both the unity of the person and the distinctness of the natures were affirmed. Therefore the decision of the Council of Chalcedon has been the basic statement of the doctrine of the person of Christ for most of the church ever since. The western part of the church went on to give further attention to the doctrine of the work of Christ. In the eastern part of the church the Alexandrians and the Antiochians continued the controversies that had preceded Chalcedon, but they clashed now over the question of how to interpret Chalcedon. The controversy over the Monophysite and the Monothelite (*qq.v.*) heresies was an effort to clarify the interpretation of Chalcedon, with the result that the extremes of the Alexandrian position were condemned just as the Nestorian extreme of the Antiochian had been.

Emerging from all this theological discussion was an interpretation of the person of Christ that affirmed both His oneness with God and His oneness with humanity while still maintaining the oneness of His person. Interestingly, the liturgies of the church had maintained this interpretation at a time when the theologians of the church were still struggling for clarity; and the final solution was a scientifically precise restatement of what had been present germinally in the liturgical piety of the church. In the formula of Chalcedon that solution finally found the framework of concepts and of vocabulary that it needed to become intellectually consistent. In one sense, therefore, what Chalcedon formulated was what Christians had been believing from the beginning; but in another sense it represented a development from the earlier stages of Christian thought. *See* also COUNCIL: *Council of Chalcedon* (*451*).

THE INTERPRETATION OF CHRIST IN WESTERN FAITH AND THOUGHT

With the determination of the orthodox teaching of the church regarding the person of Christ, it still remained necessary to clarify the doctrine of the work of Christ. While it had been principally in the east that the discussion of the former question was carried on—though with important additions from the west, as we have seen—it was the western church that provided the most detailed answers to the question: granted that this is what Jesus Christ was, how are we to describe what it is that He did?

DOCTRINES OF THE PERSON AND WORK OF CHRIST

The Medieval Development.—The most representative spokesman of the Western Church on this question, as on most others, was St. Augustine (*q.v.*). His deep understanding of the meaning of human sin was matched by his detailed attention to the meaning of divine grace. Central to that attention was his emphasis upon the humanity of Jesus Christ as man's assurance of his salvation, an emphasis to which he gave voice in a variety of ways. The humanity of Christ showed us how God elevated the humble; it was the link between our physical nature and the spiritual nature of God; it was the sacrifice which the human race offered to God; it was the foundation of a new humanity, recreated in Christ as the old humanity had been created in Adam—in these and other ways Augustine sought to describe the importance of the Incarnation for the redemption of man. By combining this stress upon the humanity of Christ as our Saviour with a doctrine of the Trinity that was orthodox but nevertheless highly creative and original, St. Augustine put his mark indelibly upon western piety and theology, which, in Anselm and in the reformers, sought further for adequate language in which to describe God's deed of reconciliation in Jesus Christ.

During the formative centuries of Christian dogma, there had been many ways of describing that reconciliation, most of them having some precedent in biblical speech. One of the most prominent pictures of the reconciliation was that connected with the biblical metaphor of ransom: Satan held the human race captive in its sin and corruptibility, and the death of Christ was the ransom paid to the Devil as the price for setting men free. A related metaphor was that of the victory of Christ: Christ entered into mortal combat with Satan for the human race, and the winner was to be lord; although the crucifixion appeared to be Christ's capitulation to the enemy, His Resurrection broke the power of the Devil and gave the victory to Christ, granting to men the gift of immortality. From the Old Testament and the Epistle to the Hebrews came the image of Christ as the sacrificial victim who was offered up to God as a means of stilling the divine anger. From the sacrament of penance came the idea, most fully developed by St. Anselm, that the death of Christ was a vicarious satisfaction rendered for men. Like the New Testament, the Church Fathers could admonish their hearers to learn from the death of Christ how to suffer patiently. They could also point to the suffering and death of Christ as the supreme illustration of how much God loves mankind. As in the New Testament, therefore, so in the tradition of the church there were many figures of speech to represent the miracle of the reunion between man and God effected in the God-man Christ Jesus.

Common to all these figures of speech was the desire to do two things simultaneously: to emphasize that the reunion was an act of God, and to safeguard the participation of man in that act. Some theories were so "objective" in their emphasis upon the divine initiative that man seemed to be almost a pawn in the transaction between God in Christ and the Devil. Other theories so "subjectively" concentrated their attention upon man's involvement and man's response that the full scope of the redemption could vanish from sight. It was in Anselm of Canterbury (*see* ANSELM, SAINT) that western Christendom found a theologian who could bring together elements from many theories into one doctrine of the Atonement, summarized in his book, *Cur Deus homo?* According to this doctrine, sin was a violation of the honour of God. God offered man life if he rendered satisfaction for that violation; but the longer man lived, the worse the situation became. Only a life that was truly human and yet had infinite worth would have been enough to give such a satisfaction to the violated honour of God on behalf of the entire human race. Such a life was that of Jesus Christ, whom the mercy of God sent as a means of satisfying the justice of God. Because He was true

man, His life and death could be valid for men; because He was true God, His life and death could be valid for *all* men. By accepting the fruits of His life and death, men could receive the benefits of His satisfaction. With some relatively minor alterations, Anselm's doctrine of Atonement passed over into the theology of the Latin church, forming the basis of both Roman Catholic and orthodox Protestant ideas of the work of Christ. It owed its acceptance to many factors, not the least of them being the way it squared with the liturgy and art of the west. The crucifix has become the traditional symbol of Christ in the Western Church, reinforcing and being reinforced by the satisfaction theory of the Atonement.

Scholastic theology, therefore, did not modify traditional ways of speaking about either the person or the work of Christ as sharply as it did, for example, some of the ways the Church Fathers had spoken about the presence of the body and blood of Christ in the Eucharist. The major contribution of the scholastic period to the Christian conception of Jesus Christ appears to lie in the way it managed to combine theological and mystical elements. Alongside the growth of Christological dogma and sometimes in apparent competition with it was the development of a view of Christ that sought personal union with Him rather than accurate concepts about Him. Such a view of Christ appeared occasionally in the writings of Augustine, but it was in men like Bernard of Clairvaux (*see* BERNARD, SAINT) that it attained both its fullest expression and its most adequate harmonization with the dogmatic view. The relation between the divine and the human natures in Christ, as formulated in ancient dogma, provided the mystic with the ladder he needed to ascend through the man Jesus to the eternal Son of God, and through Him to a mystical union with the Holy Trinity; this had been anticipated in the mystical theology of some of the Greek fathers. At the same time the dogma saved mysticism from the pantheistic excesses to which it might otherwise have gone; for the doctrine of the two natures meant that the humanity of our Lord was not an expendable element in Christian piety, mystical or not, but its indispensable presupposition and the continuing object of its adoration, in union with His deity. As a matter of fact, another contribution of the medieval development was the increased emphasis of St. Francis of Assisi (*q.v.*) and his followers upon the human life of Jesus. These brotherhoods cultivated a more practical and ethical version of mystical devotion, to be distinguished from speculative and contemplative mysticism. Their theme became the imitation of Christ in a life of humility and obedience. With it came a new appreciation of that true humanity of Christ which the dogma had indeed affirmed, but which theologians had been in danger of reducing to a mere dogmatic concept. As Henry Thode and others have suggested, this new appreciation is reflected in the way painters like Giotto began to portray Jesus, in contrast with their western predecessors and especially with the stylized picture of Christ in Byzantine icon painting.

The Reformation and Classical Protestantism.—The attitude of the reformers toward traditional conceptions of the person and work of Christ was conservative. Insisting for both religious and political reasons that they were orthodox, they altered very little in the Christological dogma. Martin Luther and John Calvin gave the dogma a new meaning when they related it to their doctrine of justification by grace through faith. Because of his interpretation of sin as the captivity of the will, Luther also revived the patristic metaphor of the Atonement as the victory of Christ; it is characteristic of him that he wrote hymns for both Christmas and Easter, but not for Lent. The new attention to the Bible that came with the Reformation created interest in the earthly life of Jesus, while the Reformation idea of "grace alone" and of the sovereignty of God even in His grace made the deity of Christ a matter of continuing importance.

In the ideas about the Lord's Supper set forth by Huldreich Zwingli (*q.v.*), Luther thought he saw a threat to the orthodox doctrine of Christ, and he denounced those doctrines vehemently. As this controversy progressed, Luther interpreted the ancient dogma of the two natures to mean that the omnipresence of the divine nature was communicated to the human nature of Christ, and that therefore Christ as both God and man was present everywhere. Although he repudiated both Luther's and Zwingli's theories, Calvin was persuaded that the ancient Christological dogma was true to the biblical witness and he permitted no deviation from it. All this is evidence for the significance that "Jesus Christ, true God begotten of the Father from eternity, and also true man, born of the Virgin Mary," to use Luther's formula, had in the faith and theology of all the reformers.

At one point the theology of the reformers did serve to bring together several facets of the biblical and the patristic descriptions of Jesus Christ. That was the doctrine of the threefold office of Christ, systematized by Calvin and developed more fully in Protestant orthodoxy: Christ as prophet, priest and king. Each of these symbolized the fulfillment of the Old Testament and represented one aspect of the church's continuing life. Christ as prophet fulfilled and elevated the prophetic tradition of the Old Testament, while continuing to fulfill His prophetic office in the ministry of the Word. Christ as priest brought to an end the sacrificial system of the Old Testament by being both the priest and the victim, while He continues to function as intercessor with and for the church. Christ as king was the royal figure to whom the Old Testament had pointed, while exercising His rule among men now through those whom He has appointed. In each of the three, Protestants differed from one another according to their theological, ethical or liturgical positions. But the threefold office enabled Protestant theology to take into account the complexity of the biblical and patristic pictures of Christ as no oversimplified theory was able to do, and it is probably the chief contribution of the reformers to the theological formulation of the doctrine of the person and work of Christ.

The Debate Over Christology in Modern Christian Thought

Few Protestant theologians in the middle of the 20th century were willing to endorse the ancient dogma of the two natures in Christ as unconditionally as the reformers had done, for between the Reformation and modern theology there intervened a debate over Christology that altered the perspective of most Protestant denominations and theologians. By the 20th century there was a wider gap between the theology of the reformers and that of many modern Protestants than there had been between the theology of the reformers and that of their Roman Catholic opponents.

Origins of the Debate.—The earliest criticism of orthodox dogma came in the age of the Reformation, not from the reformers but from the "left wing of the Reformation," from Michael Servetus (1511?–53) and the Socinians. This criticism was directed against the presence of nonbiblical concepts and terms in the dogma, and it was intent upon safeguarding the true humanity of Jesus as a moral example. There were many inconsistencies in this criticism, such as the willingness of Servetus to call Jesus "Son of God" and the Socinian custom of addressing prayer and worship to Him. But it illustrates the tendency, which became more evident in the Enlightenment, to use the Reformation protest against Catholicism as a basis for a protest against orthodox dogma as well. While that tendency did not gain much support in the 16th century because of the orthodoxy of the reformers, later criticism of orthodox Christology was able to wield the "Protestant principle" against the dogma of the two natures on the grounds that this was a consistent application of what the reformers had done. Among the ranks of the Protestant laity, the hymnody and the catechetical instruction of the Protestant churches assured continuing support for the orthodox dogma. Indeed, the doctrine of Atonement by the vicarious satisfaction of Christ's death has seldom been expressed as amply as it was in the hymns and catechisms of both the Lutheran and the Reformed churches. During the period of Pietism in the Protestant churches, this loyalty to orthodox teaching was combined with a growing emphasis upon the humanity of Jesus, also expressed in the hymnody of the time.

When theologians began to criticize orthodox ideas of the person and work of Christ, therefore, they met with opposition from the common people. Albert Schweitzer dates the development of a critical attitude from the work of H. S. Reimarus (1694–1768),

but Reimarus was representative of the way the Enlightenment treated the traditional view of Jesus. The books of the Bible were to be studied just as other books are, and the life of Jesus was to be drawn from them by critically sifting and weighing the evidence of the Gospels. The Enlightenment thus initiated the modern interest in the life of Jesus, with its detailed attention to the problem of the relative credibility of the Gospel records. It has been suggested by some historians that the principal target of Enlightenment criticism was not the dogma of the two natures but the doctrine of the vicarious Atonement. The leaders of Enlightenment thought did not make a sudden break with traditional ideas, but gave up belief in miracles, the Virgin Birth, the Resurrection and the Second Advent only gradually. Their principal importance for the history of the doctrine of Christ consists in the fact that they made the historical study of the sources for the life of Jesus an indispensable element of any Christology.

The 19th Century.—Although the Enlightenment of the 18th century was the beginning of the break with orthodox teachings about Jesus Christ, it was only in the 19th century that this break attracted wide support among theologians and scholars in many parts of Christendom—even, for a while, among the Modernists of the Roman Catholic Church. Two works of the 19th century were especially influential in their rejection of orthodox Christology. One was the *Life of Jesus* first published in 1835 by David Friedrich Strauss; the other, bearing the same title, was first published by Ernest Renan (*q.v.*) in 1863. Strauss's work paid more attention to the growth of Christian ideas—he called them "myths" —about Jesus as the basis for the picture we have in the Gospels, while Renan attempted to account for Jesus' career by a study of His inner psychological life in relation to His environment. Both works achieved wide circulation and were translated into other languages, including English. They took up the Enlightenment contention that the sources for the life of Jesus were to be studied as other sources are, and what they constructed on the basis of the sources was a type of biography in the modern sense of the word. In addition to Strauss and Renan, the 19th century saw the publication of a plethora of books about the life and teachings of Jesus. Each new hypothesis regarding the problem of the Synoptic Gospels implied a reconstruction of the life and message of Jesus.

The fundamental assumption for most of this work on the life and teachings of Jesus was a distinction between the "Jesus of history" and the "Christ of faith." Another favourite way of putting the distinction was to speak of the religion *of* Jesus in antithesis to the religion *about* Jesus. This implied that Jesus was a man like other men, but with a heightened awareness of the presence and power of God. Then the dogma of the church had mistaken this awareness for a metaphysical statement that Jesus was the Son of God and had thus distorted the original simplicity of His message. Some critics went so far as to question the very historicity of Jesus, but even those who did not go that far questioned the historicity of some of the sayings and deeds attributed to Jesus in the Gospels.

In part this effort grew out of the general concern of 19th-century scholarship with the problem of history, but it also reflected the religious and ethical assumptions of the theologians. Many of them were influenced by the moral theories of Kant in their estimate of what was permanent about the teachings of Jesus, and by the historical theories of Hegel in the way they related the original message of Jesus to the Christian interpretations of that message by later generations of Christians. The ideas of evolution and of natural causality associated with the science of the 19th century also played a part through the naturalistic explanations of the biblical miracles. And the historians of dogma, climaxing in Adolf von Harnack (1851–1930), used their demonstration of the dependence of ancient Christology upon non-Christian sources for its concepts and terminology to reinforce their claim that Christianity had to get back from the Christ of dogma to the "essence of Christianity" in the teachings of Jesus about the fatherhood of God and the brotherhood of man.

The 20th Century.—At the beginning of the 20th century the most influential authorities on the New Testament were engaged in this quest for the essence of Christianity and for the Jesus of history. But that quest led in the early decades of the 20th century to a revolutionary conclusion regarding the teachings of Jesus, namely, that He had expected the end of the age to come shortly after His death and that His teachings as laid down in the Gospels were an "interim ethic," intended for the messianic community in the brief span of time still remaining before the end. The effort to apply those teachings in modern life was criticized as a dangerous modernization. This thesis of the "consistent eschatology" in Jesus' message was espoused by Johannes von Weiss (1863–1914) and gained wide circulation through the writings of Albert Schweitzer.

The years surrounding World War I also saw the development of a new theory regarding the composition of the Gospels. Because of its origin, this theory is usually called form criticism (German *Formgeschichte*). It stressed the forms of the Gospel narratives—parables, sayings, miracle stories, Passion accounts, etc.—as an indication of the oral tradition in the Christian community out of which the narratives came. While the attention of earlier scholars had been concentrated on the authenticity of Jesus' teachings as transmitted in the Gospels, this new theory was less confident of being able to separate the authentic from the later elements in the Gospel records, though various proponents of it did suggest criteria by which such a separation might be guided. The studies of form criticism made a life of Jesus in the old biographical sense impossible, just as consistent eschatology had declared impossible the codification of a universal ethic from the teachings of Jesus. Some adherents of form criticism espoused an extreme skepticism regarding any historical knowledge of Jesus' life at all, but the work of men like Martin Dibelius and even Rudolf Bultmann showed that such skepticism was not warranted by the conclusions of this study.

Influenced by these trends in New Testament study, Protestant theology by the middle of the 20th century was engaged in a reinterpretation of the Christology of the early church. Some Protestant churches continued to repeat the formulas of ancient dogma, but even there the critical study of the New Testament documents was beginning to call those formulas into question. The struggles of the evangelical churches in Germany under Adolf Hitler caused some theologians to realize anew the power of the ancient dogma of the person of Christ to sustain faith, and some of them were inclined to treat the dogma with less severity. But even they acknowledged that the formulation of that dogma in static categories of person, essence and nature was inadequate to the biblical emphasis upon actions and events rather than upon states of being. Karl Barth for the Reformed tradition, Lionel Thornton for the Anglican tradition and Karl Heim for the Lutheran tradition were instances of theologians trying to reinterpret classical Christology. While yielding nothing of their loyalty to the dogma of the church, Roman Catholic theologians like Karl Adam were also endeavouring to state that dogma in a form that was meaningful to modern men. The doctrine of the work of Christ was receiving less attention than the doctrine of Christ's person. In much of Protestantism, the concentration of the 19th century upon the teachings of Jesus had made it difficult to speak of more than the prophetic office. The priestly office received least attention of all; and therefore, despite the support accorded to efforts like that of Gustaf Aulén to reinterpret the metaphor of the Atonement as Christ's victory over His enemies, Protestant theology in the middle of the 20th century was still searching for a doctrine of the Atonement to match its newly won insights into the doctrine of the person of Christ.

In a curious way, therefore, the figure of Jesus Christ has become both a unitive and a divisive element in Christendom. All Christians are united in their loyalty to Him, even though they express their loyalty in a variety of doctrinal and liturgical ways. But doctrine and liturgy also divide Christian communions from one another. It has not been the official statements about Christ that have differed widely among most communions. What has become a sharp point of division is the amount of historical and critical inquiry that is permitted where the person of Christ is involved. Despite their official statements and confessions, most

Protestant denominations had indicated by the second half of the 20th century that they would tolerate such inquiry, differ though they did in prescribing how far it would be permitted to go. On the other hand, the exclusion of Modernism by the Roman Catholic Church in 1907–10 drew definite limits beyond which the theological use of the methods of critical inquiry was heretical. Within those limits, however, Roman Catholic biblical scholars were engaging in considerable critical literary study, at the same time that critical Protestant theologians were becoming more sympathetic to traditional Christological formulas.

See also references under "Jesus Christ" in the Index.

BIBLIOGRAPHY.—From the enormous amount of literature on Jesus Christ the following list selects books that survey the field or combine data that are otherwise accessible only in many other books.

It may seem gratuitous to suggest that the basic books for a study of the life and teachings of Jesus remain the Gospels of Matthew, Mark, Luke and John. But many a modern student has become so preoccupied with conflicting theories about Jesus and the Gospels that he has neglected to study these basic sources by themselves. For the scholar there are critical texts of the original Greek, that of Eberhard Nestle in its various editions being perhaps the most widely used and that of Westcott-Hort being one of the most influential. For the English reader there are modern translations into English by Protestant scholars (James Moffatt; E. J. Goodspeed; the Revised Standard Version) as well as by Roman Catholics (Ronald KNOX; F. A. Spencer; the translation of the New Testament from the Vulgate in 1941; and the New Testament in the Westminster version by Cuthbert Lattey in 1948, from the original Greek).

The literature on the Gospels is a study in itself (*see* GOSPELS); in fact, a separate literature has grown up around each of them. B. H. Streeter, *The Four Gospels: a Study of Origins*, 4th ed. (1930), remains the standard introduction to the problem. Martin Dibelius, *From Tradition to Gospel*, Eng. trans. by Bertram L. Woolf, 2nd ed. (1934), and Frederick C. Grant (ed. and trans.), *Form Criticism* (1934), provide orientation in the modern trends of Gospel analysis. Roman Catholic evaluation of those trends has generally been in the context of studies on the life of Jesus. J. Lebreton, *The Life and Teaching of Jesus Christ*, Eng. trans. by Francis Day, 2 vol. (1935), gives a good orientation to the Roman Catholic view.

Lives of Jesus have continued to appear. Albert Schweitzer, *The Quest of the Historical Jesus*, Eng. trans. by W. Montgomery (1948), is, as its German title indicates, "a history of research on the life of Jesus from Reimarus to Wrede." Chester C. McCown, *The Search for the Real Jesus* (1940), is another useful history of this research. Jean Guitton, *The Problem of Jesus*, Eng. trans. by A. Gordon Smith (1955), presents a Roman Catholic assessment of modern biblical criticism with detailed references. Among the most influential and useful lives of Jesus are: John Knox, *The Man Christ Jesus* (1941); Rudolf Bultmann, *Jesus and the Word*, Eng. trans. by Louise P. Smith and Erminie Huntress (1934); E. J. Goodspeed, *The Life of Jesus* (1950); S. J. Case, *Jesus: a New Biography* (1927); and Martin Dibelius, *Jesus*, Eng. trans. by C. B. Hedrick and F. C. Grant (1949). F. M. William, *The Life of Jesus*, Eng. trans. by Newton Thompson (1944); Karl Adam, *Christ Our Brother*, Eng. trans. by Justin McCann (1931); Ferdinand Prat, *Jesus Christ*, Eng. trans. by J. J. Heenan, 2 vol. (1950); Romano Guardini, *The Lord*, Eng. trans. by Elinor Castendyk Briefs (1954); and the work of Lebreton mentioned above are discussions of the life of Jesus from the Roman Catholic standpoint. Henry Daniel-Rops, *Jesus and His Times*, Eng. trans. by Ruby Millar, 2nd ed. (1956), has received considerable circulation in Roman Catholic circles.

The history of Christology is summarized in works like Sydney Cave, *The Doctrine of the Person of Christ* (1925), and in the standard histories of doctrine. Roman Catholic Christology can be studied in R. Garrigou-Lagrange, *Christ the Savior*, Eng. trans. by Bede Rose (1950); Aloys Grillmeier and Heinrich Bacht (eds.), *Das Konzil von Chalkedon: Geschichte und Gegenwart*, with an immense bibliography, 3 vol. (1951–54); and in the works of Karl Adam mentioned above, in addition to *The Christ of Faith*, Eng. trans. by Joyce Crick (1957). Another important book is R. V. Sellers' *Two Ancient Christologies* (1940), a very good study of the clash between Alexandria and Antioch by an Anglican scholar. H. R. Mackintosh, *The Doctrine of the Person of Christ* (1912), is an excellent introduction to the problem of Christology in modern Protestantism. Lionel S. Thornton, *The Incarnate Lord* (1928); Karl Heim, *Jesus der Herr* (1935), *Jesus der Weltvollender* (1937); and the sections on Christology in the dogmatics of Karl Barth and Emil Brunner are efforts to meet and solve that problem. In his *Christ the Lord* (1945) and *On the Meaning of Christ* (1947), John Knox used insights of his earlier life of Jesus to construct a Christology. Gustaf Aulén, *Christus Victor* (1931), occasioned new discussions of the Atonement. (J. J. PN.)

JET, a dense, fine-grained, compact variety of subbituminous coal, or lignite (*q.v.*). It is coal-black in colour and has a hardness of 2+ and a specific gravity of 1.1 to 1.4. Unlike lignite, it is not laminated and so has little tendency to split, but breaks with a conchoidal fracture. It can be worked readily on a lathe and takes a high glossy polish.

Jet, used for ornaments and buttons, has been found in Bronze Age burial sites in Britain. It occurs near Whitby, Yorkshire, and was originally found as nodular or lenticular masses that had weathered out of the hard shales and were found in streams and along the Yorkshire coast. Later small mines in the shale were opened to enlarge the supply. Similar material has been found in other coal formations.

From prehistoric times until the 20th century, jet was a popular item in English jewelry. It enjoyed considerable vogue as jewelry suitable to wear during mourning. Because of its softness it scratches readily. It was supplanted by the harder chalcedony, which can be dyed a deep black colour. Although this is harder, it is much heavier, and longer necklaces are a burden to the wearer.

With the advent of coloured plastics which are easily cut in any form, jet is now seen only in antique jewelry and in museums. It still has considerable importance to archaeologists but is no longer worn as jewelry. (C. B. SN.)

JETHRO, also called REUEL (Ex. ii, 18) and HOBAB (Judg. iv, 11), was the priest of Midian with whom Moses took refuge after having killed an Egyptian, and whose daughter Moses married (Ex. iii, 1). After the exodus Jethro visited the Hebrews encamped at the "mountain of God," bringing Moses' wife and sons (Ex. xviii); and while there he officiated at a sacrifice to God which was attended by Aaron and the elders of Israel. From this incident some scholars have argued that the Kenites (*q.v.*; the clan to which Jethro belonged) worshiped the same god as the Hebrews and that it was through Jethro that the sacred name Yahweh (*q.v.*) was introduced to the Hebrews. The same chapter attributes the founding of the Hebrew judiciary to the suggestion of Jethro that Moses appoint assistant judges to share his work (Ex. xviii, 17–23). But the narrative also makes clear that it was Moses, and not Jethro, who was the first to realize the true greatness of Yahweh (verses 8–11).

When the Hebrews left the mountain of the Lord, Moses prevailed upon "Hobab, the son of Reuel" (Num. x, 29) to accompany them as a guide through the wilderness. The Kenite descendants of Jethro settled in Judaean territory in the Negev (Judg. i, 16) and continued to be on friendly terms with the Hebrews in the time of Deborah (Judg. v, 24 ff.), Saul (I Sam. xv, 6) and David (I Sam. xxx, 29). (M. F. T.)

JET PROPULSION: *see* AIRCRAFT PROPULSION; ROCKETS AND GUIDED MISSILES; AIRPLANE.

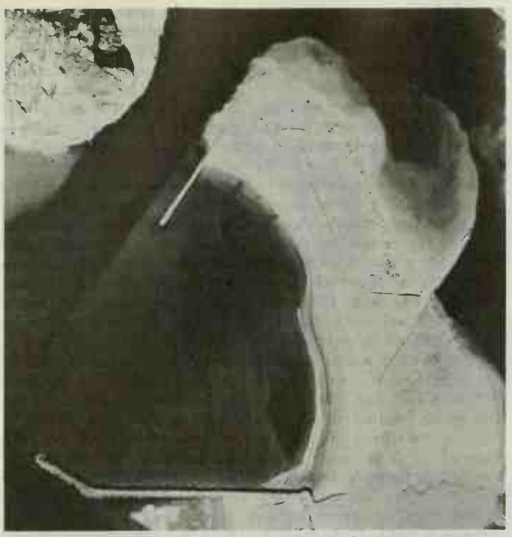
JETSAM: *see* FLOTSAM, JETSAM AND LAGAN.

JET STREAM, a high-speed westerly wind which is notable for being concentrated in a narrow current. It occurs in the middle latitudes, at altitudes ranging from 20,000 to 40,000 ft. Winds at the centre of the stream can exceed 200 m.p.h. *See* WIND.

JETTY. The term jetty, derived from the French *jetée*, thus designating something "thrown out," is applied to a variety of civil engineering structures connected with river, harbour and coastal works.

Although most jetties resemble either small breakwaters or piers, their forms and structural designs are varied and depend primarily on their uses and the availability of materials from which economical structures may be fabricated. The two principal kinds of jetties are those constructed at river mouths and other coastal entrances and those used for the berthing of ships in harbours and offshore where harbour facilities are not available. Jettylike structures may be extended at intervals from the banks of rivers where a wide channel must be contracted so as to effect a concentration of the current and thus help maintain a navigable channel. These structures, variously termed spurs, spur dikes, and groynes, may also be projected from the concave side of a river to retard erosion of the bank.

Jetties of open-pile or impervious-masonry construction may be built on each side of a navigation channel immediately outside the entrances to docks which must be entered through locks. These structures, sometimes called lead-in jetties, are positioned so as to form a funnel-shaped entrance to the lock. They serve to guide vessels' ingress and egress, to protect vessels from river



BY COURTESY OF U.S. ARMY ENGINEER DISTRICT, LOS ANGELES, CALIF.

AERIAL VIEW OF MORRO BAY HARBOUR, CALIFORNIA, SHOWING JETTY CONSTRUCTION

or tidal currents and to provide temporary mooring facilities; if of solid construction, they may serve also as minor breakwaters. (*See* also BREAKWATER.)

Entrance Jetties.—Entrance jetties are built at bay inlets, at entrances to harbours of the lagoon type, and at the mouths of rivers. Since the function of entrance jetties is the training of river and tidal flows to improve navigation, they are also referred to as training jetties. They confine and direct the currents so as to maintain a navigable channel by promoting scour; they extend farther into deep water, the reach of river where currents slacken and deposit transported material; and they protect the flow of water at such entrances from the disturbing effects of littoral currents, sand drift and wave action. Entrance jetties are usually constructed in pairs, either parallel or converging toward the seaward ends, and are of several structural types. They may be of rubble-mound construction, masonry or concrete walls, composite-type structures (concrete or masonry wall placed on an underwater rubble mound), concrete caissons, sheet piling, or timber cribs.

Approximately 24 mi. of primary and secondary parallel training jetties and about 7 mi. of groynes have been constructed at the South and Southwest passes of the Mississippi river. In 1856 work was started on a jetty one mile in length on the east side of Southwest pass. This jetty was a light-weight, sheet-pile structure, and was seriously damaged by a storm shortly after construction began. After considerable controversy as to the best method of securing a satisfactory navigation entrance and channel from the Gulf of Mexico to the Head of Passes, the U.S. congress in 1875 accepted the proposition of James B. Eads, who, by the construction of jetties and auxiliary works, contracted to secure and maintain for 20 years a 26 × 200 ft. channel for the sum of $8,000,000. This jetty system, constructed during the period 1875–79, included a total of 3.6 mi. of primary, parallel jetties constructed of fascine mats topped with rubble stone; a similar set of inner, secondary jetties which reduced the channel width from 1,000 to 650 ft.; an extensive system of groynes averaging about 200 ft. in length, placed perpendicular to the inner jetties, and spaced from 400 to 1,300 ft. apart; submerged sills across the heads of Southwest pass and Pass a Loutre; and a closure of the outlet to Grand Bayou.

Berthing Jetties.—In Great Britain a narrow projecting pier is commonly referred to as a berthing jetty. Other forms of berthing jetties are those with T-shaped berthing heads, and openwork island structures connected to shore by lightweight bridging or open-pile viaducts.

The conditions in some ports make it more economical to extend berthing jetties into deep water, to provide shore facilities to the ships, than to dredge the additional depths necessary to allow ships to berth near shore at conventional piers or quays. This practice became more common shortly after World War II, at which time the advantages of large, deep-draft tankers were proven. A factor which gave impetus to the construction of larger tankers was the increased reliance on the middle east as a source of oil for Europe and the United States. It is significant that even 15 years later no harbour in the United States could satisfactorily accommodate tankers with drafts between 40 and 49 ft., although more than 80 such vessels were in use, under construction or in the design stage and planned for service within a few years. Berthing jetties for the discharging of oil were constructed at a number of ports and harbours, including Mena Al Ahmadi, Kuwait; Heysham in Morecambe bay, Fawley on Southampton water, Thames Haven, and Yonderberry Point, Devonport, in England; Falconara (Ancona), Italy; Port of La Spezia, Italy; and the oil harbour at Loudden, Stockholm, Swed. (R. Y. H.)

JEVONS, WILLIAM STANLEY (1835–1882), leading English economist and logician, was born at Liverpool on Sept. 1, 1835, and educated at University College school and University college, London.

In 1854 he had to break off his studies of the natural sciences to take a post as assayer in the new mint at Sydney, Austr., where he stayed until 1859. It was in these lonely years in Australia that Jevons turned increasingly to political economy and social studies.

When Jevons returned to England he soon completed two of his most original and seminal papers, his "General Mathematical Theory of Political Economy" (read before the British association, 1862) and "A Serious Fall in the Value of Gold" (1863). In the first paper he outlined what subsequently came to be known as the marginal utility theory of value (though the adjective "marginal" was not used by Jevons). In the second (republished in the posthumous collection *Investigations in Currency and Finance*, 1884) he set out to measure the rise in prices in the period following the Californian and Australian gold discoveries and made one of the greatest contributions to the theory of index numbers ever published. But neither of these papers obtained for Jevons any public recognition; this was first achieved with his book *The Coal Question* (1865), a powerful warning on the gradual exhaustion of Britain's coal supplies.

In 1866 Jevons was appointed to a chair at Owens college, Manchester, from which he moved to University college, London, in 1876.

Jevons' *Theory of Political Economy* (1871; new ed., 1924) is his most famous work, and its exposition of the "final" utility theory of value, in the same year as Karl Menger's similar work in Vienna, and almost simultaneously with Léon Walras in Switzerland three years later, can now be seen to have marked the opening of a new period in the history of economic thought. But at the time Jevons' challenging new theory met with an unsympathetic reception from most English economists.

Of Jevons' various works on logic and scientific method, the most important are his *Principles of Science* (1874) and his construction of a logical machine exhibited before the Royal society in 1870.

Among his many other writings mention should be made of *The State in Relation to Labour* (1882), in which he eloquently advocated a cautious empirical approach to the problems of the role of the state in economic affairs, and of his essays on economic crises (see *Investigations in Currency and Finance*, 1884). Jevons was drowned near Hastings on Aug. 13, 1882, at the age of 46, and it is only possible to guess at the magnitude of the loss to the wide range of subjects to which he had made such powerfully original contributions.

See *Letters and Journal of W. Stanley Jevons*, ed. by his wife

(1886), which contains a bibliography of his writings.
(T. W. H.)

JEWEL, JOHN (1522–1571), bishop of Salisbury, was the defender of the religious settlement of Elizabeth I against Roman Catholic antagonists and author of the first apologia for the Anglican *via media*. Born at Buden, Devon, May 24, 1522, and educated at Merton college, Oxford, he was elected fellow of Corpus Christi college in 1542. During the reign of Edward VI he came under the influence of Peter Martyr and hence became a leader of the reforming party. On the accession of Mary I, he signed a set of anti-Protestant articles, but found it prudent nevertheless to flee the country and settle at Frankfurt. There he supported the moderate "Coxians" (*see* COX, RICHARD) against the radical "Knoxians" in the controversy concerning the use of the 1552 Book of Common Prayer; afterward he visited Peter Martyr at Strasbourg and journeyed to Zürich and also to Padua. On the accession of Elizabeth I he returned to England, was one of the disputants against the Romanists at the Westminster conference in 1559 and became one of the royal visitors to carry out a visitation of churches in the southwestern counties. In 1560 he became bishop of Salisbury. He died at Monkton Farleigh in Wiltshire on Sept. 23, 1571.

At first in the vestiarian controversy, concerning the wearing of the surplice and concerning the crucifix and candles in the royal chapel, he took the Puritan side, consulting Martyr as to the compatibility of such ornaments with his acceptance of episcopal office. Shortly however he became the foremost exponent and defender of the Elizabethan settlement. In a sermon at Paul's cross on Nov. 26, 1559, he challenged Roman Catholics to produce evidence from the Scriptures, the Fathers and the councils of the first six Christian centuries on a number of points of controversy between Anglicans and Romanists; and as a result of polemical exchanges arising from this sermon he published in 1562 his *Apologia ecclesiae Anglicanae* (Eng. trans. 1564), described by Mandell Creighton as "the first methodical statement of the position of the Church of England against the Church of Rome." An Oxford contemporary of Jewel and a deprived prebendary of Salisbury, Thomas Harding, engaged in protracted controversy, publishing an *Answer* in 1564, which evoked a *Reply* from Jewel in the following year, a *Confutation* from Harding in 1566 and a *Defence of the Apology* in 1567; and in the course of these years the whole field of Anglican-Roman differences was expounded. With his experience of episcopal administration on the one hand and with the development of a more extreme position on the part of the Puritans on the other hand, Jewel became a stout defender of the Elizabethan settlement in its domestic aspects.
(N. S.)

See Jewel's works, edited under Archbishop Richard Bancroft's direction (1609). *See* also J. A. Booty, *John Jewel as Apologist for the Church of England* (1963).

JEWELRY. The history of wearing jewels is as old as the history of mankind. Apart from their decorative value, ornaments have been worn as charms and amulets from very ancient times. In Arabia, Persia and China, green stones used to be placed in the mouths of the dead because they were supposed to contain life-giving substance. This old conception about green stones still persists, though in a modified form. Jade even today is widely believed, in Persia and India, to have the power to protect the wearer from heart diseases and the turquoise to ward off approaching danger. From time to time various precious stones have been associated with different stars and worn in order to receive special protection from them. Even metals have not escaped such an interpretation. "Those who wear gold ornaments live a long time in the abodes of the gods" was a belief not confined to India. From the very early period, Egyptians and Sumerians also decorated themselves with gold and silver ornaments because they thought that these metals had magical powers. An investigation of the symbolism of ornaments, especially, reveals the belief in their magico-religious value—a belief inherent in a vestigial form in, for example, the wearing of birthstones (*q.v.; see* also AMULET). (R. G. CH.)

The wearing of important jewelry has been associated in the past with solemn occasions in the life of the community. In the mid-20th century there is an increasing avoidance of ceremonial and a desire for informality. At the same time the perfection of manufacturing processes has put within the reach of the majority standardized versions of articles formerly associated only with a luxurious and rather idle life. The relatively low cost of the mass-produced piece means that an imitation jewel is worn in circumstances where wearing of the real jewel would not have been contemplated.

People who are accustomed to machine perfection may seek the same degree of finish in "luxury" articles, and the ring or brooch assembled from mass-produced materials may appeal because of the very "perfection" of detail of the setting. A consequence of the modern changed social, economic and manufacturing pattern is that fashion in jewels is no longer originated by the skilled jeweler, but through chains of retail stores, by the manufacturing jeweler. Apart from amateur or semiamateur hand craftsmen there continues to exist (particularly in western Europe and in North America), a small number of designer-craftsmen of precious jewels. There is much encouragement for the artist-designer-craftsmen from the older craft guilds and newer commercial firms dealing in precious stones, and artists in such other fields as painting and especially sculpture have been attracted to the craft. Some of the great houses of jewelry founded in the 19th century also help to preserve, however tenuously, the tradition of creative skill. Technical advances, such as ever new techniques to produce different colours or textures in metals or of utilizing semiprecious stones hitherto considered unusable, contribute to change in design and may prove beneficial to the jewelers' art in the long run. Nevertheless, the majority of jewelers working even in precious stones are concerned with unimaginative assemblages in machine-made settings.

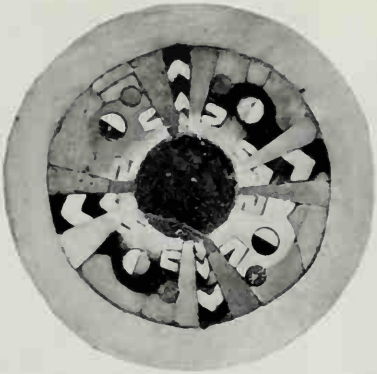
Jewelry has a vital connection with the occasion when it is worn and it loses some of its glamour when studied in isolation in assembled collections. A great deal of the attraction of a jewel comes from the movement of the body of the wearer. A diamond gains life from a constantly changing strength and source of light. No method of display can convey the personality of the wearer or produce the effect of pearls against the human skin, or diamonds against the hair.

Whether worn for personal enjoyment, to display power or wealth, for protection against harm, or as part of ceremonial dress, it is in the association with the individual wearer that the jewel has its primary importance. If the creating jeweler is deprived of contact with his patron, if the decreasing number of great occasions limits the number of important pieces required and if the public, who should be both audience and customer, have diminishing opportunities of seeing great jewels worn in their right context, the creative force in the manufacture of jewelry is in danger of dwindling.

Real jewelry, when not worn for want of occasion, loses much of the awe it was intended to inspire: the talismanic stone from which the aura of belief has been dissipated, the chieftain's great brooch, chain or bracelets whose original intention was to transform the ordinary man into the lawgiver, the ruler or the god, lose something by deprivation of the context in which they originally confronted the community. Jewels become lifeless artifacts when studied apart from it. The historical survey that follows is intended to indicate this context and to throw light on the cultures of the various peoples whose jewelry is preserved in public and private collections throughout the world. (P. M. B.)

The sections are arranged as follows:

I. Egypt
  1. Materials and Techniques
  2. Forms
II. The Near East
  1. Origins in the 4th Millennium B.C.
  2. The 3rd Millennium: Sumer
  3. Anatolia, Phoenicia, Palestine, Late 3rd–2nd Millennium
  4. Babylonia and Assyria, *c.* 1800–*c.* 700 B.C.
  5. Urartu and Centres in Iran
  6. Iran in the Achaemenid Period
  7. Iran in the Parthian and Sasanian Periods
III. Islamic Jewelry



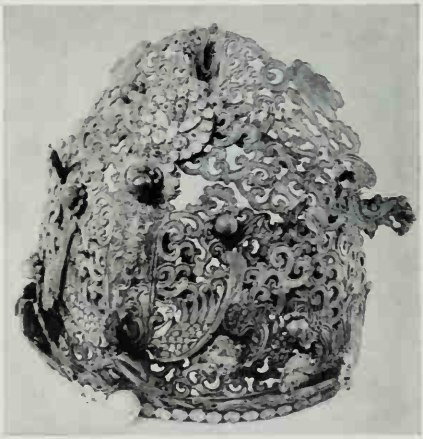
Earplug of mosaic shell inlay; central Tiahuanaco, Bolivia. About A.D. 1000

Chinese jewelry of the T'ang dynasty. *Centre*, gold hairpin in the form of a filigree phoenix; *left and right*, gold earrings

Armlet of gold, with birds, monkeys and a man riding a cloven-hoofed horse; late Incan

JEWELRY OF CHINA AND PRE-COLUMBIAN AMERICA

Gold breast plaque with imperial dragons in *repoussé*; Chinese, 15th century



Headdress of gilded bronze inlaid with kingfisher feathers; Chinese, Ch'ing dynasty

Gold nose ornament from Colombia

BY COURTESY OF (TOP LEFT, CENTRE LEFT) THE ART INSTITUTE OF CHICAGO; (TOP RIGHT, BOTTOM LEFT, BOTTOM RIGHT ABOVE) THE TRUSTEES OF THE BRITISH MUSEUM, PHOTOGRAPHED ESPECIALLY FOR ENCYCLOPAEDIA BRITANNICA INC.; (BOTTOM RIGHT) CAMBRIDGE UNIVERSITY MUSEUM OF ARCHAEOLOGY AND ETHNOLOGY

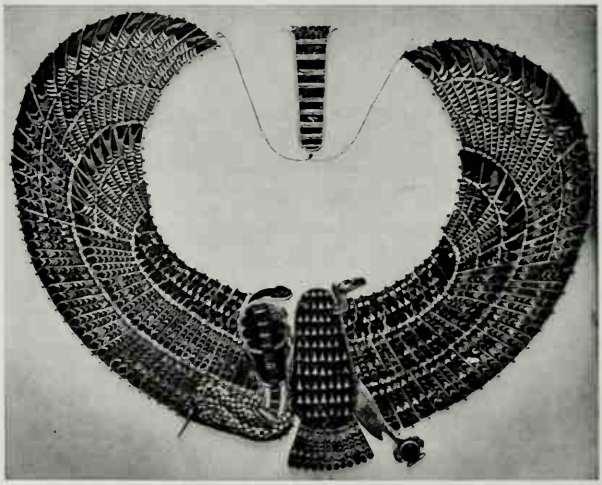
JEWELRY

Diadem of a princess, gold, lapis lazuli, carnelian and amazonite; from Lahun, Egypt. Middle Kingdom

Necklace from Ur

Fibula, gold, with fastening in the form of a human hand and decorated with two lions head to tail; Iranian, 7th century B.C.

Fibula, silver, found at Ziweye, Iran; 8th or 7th century B.C.



Nebti's collar from the treasure of Tutankhamen; Egyptian, 14th century B.C. The collar is gold, with 166 plaques inlaid in cloisonné with coloured opaque glass. Cairo museum

ANCIENT NEAR EAST, INCLUDING EGYPT

Three gold earrings discovered at Marlik, north Iran. *Left*, stylized pomegranates; *centre*, cage design with granular decoration; *right*, double pyramid design built from gold beads of graduated sizes

BY COURTESY OF (TOP LEFT) METROPOLITAN MUSEUM OF ART, (SECOND ROW CENTRE) METROPOLITAN MUSEUM OF ART, ROGERS FUND, 1954, (SECOND ROW RIGHT) METROPOLITAN MUSEUM OF ART, GIFT OF KHALIL RABENOW, 1951, (TOP RIGHT) THE TRUSTEES OF THE BRITISH MUSEUM, (THIRD ROW RIGHT) GRIFFITH INSTITUTE, ASHMOLEAN MUSEUM, OXFORD, (BOTTOM ROW) ILLUSTRATED LONDON NEWS BY EZAT O. NEGAHBAN

Egyptian headdress of a lady of the court; *c.* 1450 B.C. (18th dynasty). Gold, carnelian and turquoise

Griffin armlet from the Oxus treasure, a collection of Persian art of the Achaemenid period. (6th–4th century B.C.)

Girdle of gold leopard heads and a pair of anklets from Lahun, Egypt. Gold with amethyst beads. Middle Kingdom

Part of an armlet, in the form of a goat's head, from the Oxus treasure

Three penannular earrings and a star-shaped pendant from Ajjul, Palestine; 7th century B.C.

Gold bracelet from Ziweye. 7th century B.C.

ANCIENT NEAR EAST, INCLUDING EGYPT

Beach leaf headdress from Ur, Iraq

Armlet from the Oxus treasure

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JEWELRY

Thumb ring, Mughal, 17th century; tooled and enameled gold, set with rubies and emeralds

Turban ornament, Jaipur, Rajputana, 18th century; gold, enameled

Necklace, Mughal, 18th century; gold set with jargons, emeralds and pearls, and enameled

Turban ornament, Jaipur, Rajputana, 17th century; gold, enameled

JEWELRY OF INDIA

Turban ornament, Jaipur, Rajputana, 18th century; gold, enameled

Ear ornament, Delhi, 19th century; gold, enameled, set with pearls, turquoise and jargons

BY COURTESY OF THE VICTORIA AND ALBERT MUSEUM. PHOTOGRAPHED ESPECIALLY FOR ENCYCLOPÆDIA BRITANNICA, INC.

Greek pectoral ornaments, 7th century B.C., from Camirus in Rhodes. Gold

Roman necklace, 1st century A.D., from Rome. Gold with precious stones

Greek necklace, 4th century B.C., from Tarentum. Gold

Minoan nature god, 17th century B.C. Gold pendant

Etruscan ear stud, 6th century B.C. Gold with coloured glass

AEGEAN, GREEK, ROMAN AND ETRUSCAN JEWELRY

BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM. PHOTOGRAPHED ESPECIALLY FOR ENCYCLOPÆDIA BRITANNICA, INC.

JEWELRY

16TH-CENTURY EUROPEAN JEWELRY

Pendant with the figure of Prudence; Italian, 16th century. Wrought gold, chalcedony, enamel and jewels

Pendant with the figure of Justice on scrolled mount set with gems; German, 16th century. Gold, enamel, pearls, diamonds and emerald

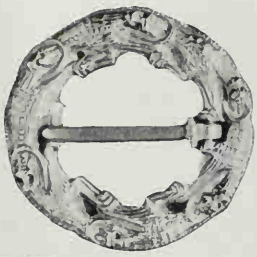
Ship pendant; Italian, 16th century. Crystal, gold, enamel, pearl and rubies

The Canning jewel; Italian, 16th century. A large baroque pearl mounted in enameled gold, set with pearls, rubies and diamonds

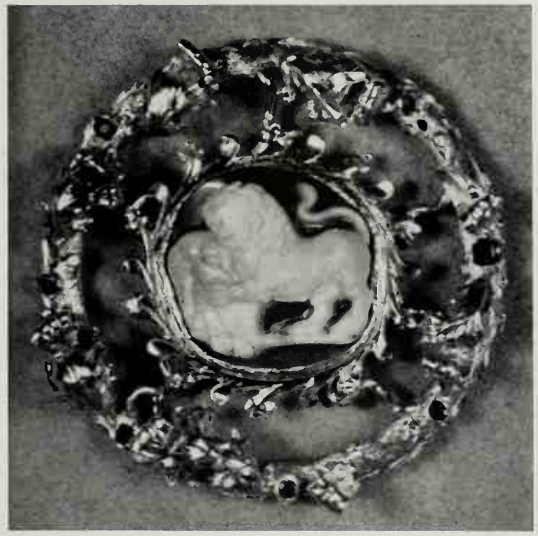
Hat medallion of the entombment of Christ; French or Italian, 16th century. Gold, enamel, jewels

BY COURTESY OF (TOP LEFT, BOTTOM RIGHT) THE METROPOLITAN MUSEUM OF ART, GIFT OF J. PIERPONT MORGAN, 1917, (TOP RIGHT, CENTRE RIGHT) THE METROPOLITAN MUSEUM OF ART, THE MICHAEL FRIEDSAM COLLECTION, 1931, (BOTTOM LEFT) THE VICTORIA AND ALBERT MUSEUM; PHOTOGRAPHED ESPECIALLY FOR ENCYCLOPÆDIA BRITANNICA, INC., BY C. H. CANNINGS

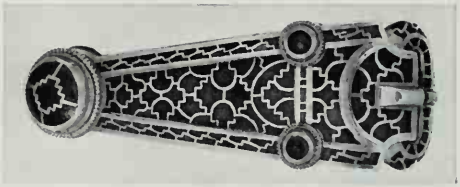
Gold belt buckle with interlacing patterns, from the ship burial at Sutton Hoo, Suffolk, Eng.; 7th century



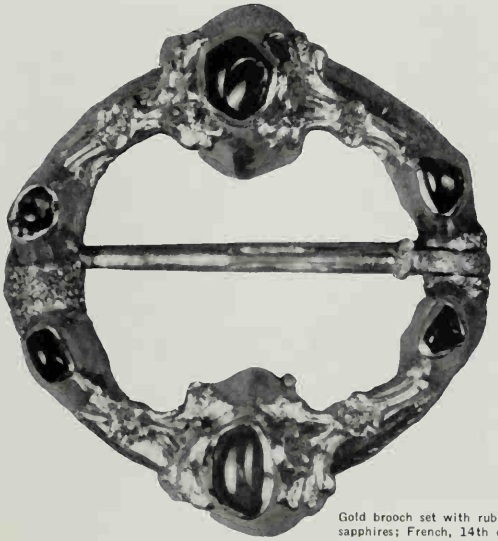
Kames brooch, gold, ring pattern of six dragons; 14th century. Below, back of the brooch with its amuletic inscription in Lombardic letters



Gold brooch set with rubies and a cameo of a lion; French, 14th century



Curved dummy buckle with cutaway tongue, gold with garnets and enamels; from the Sutton Hoo ship burial



Gold brooch set with rubies and sapphires; French, 14th century

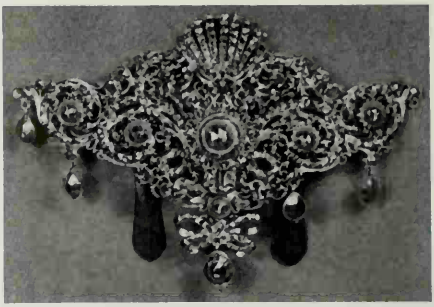
Castellani brooch, gold enamel and pearls; Italian, 6th or 7th century

EUROPEAN JEWELRY, 7TH TO 14TH CENTURY

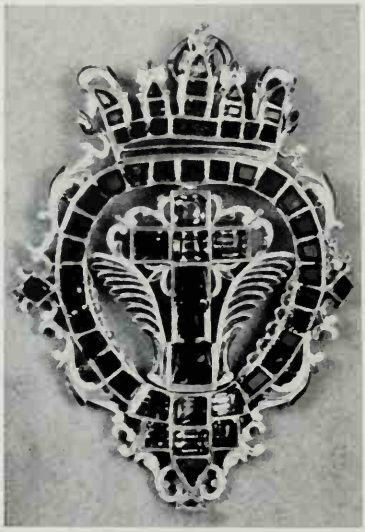
BY COURTESY OF (TOP LEFT, CENTRE RIGHT, BOTTOM RIGHT) THE TRUSTEES OF THE BRITISH MUSEUM, (TOP RIGHT, ABOVE AND BELOW) THE NATIONAL MUSEUM OF ANTIQUITIES OF SCOTLAND, (CENTRE LEFT, BOTTOM LEFT) THE VICTORIA AND ALBERT MUSEUM. PHOTOGRAPHED ESPECIALLY FOR ENCYCLOPÆDIA BRITANNICA, INC.

JEWELRY

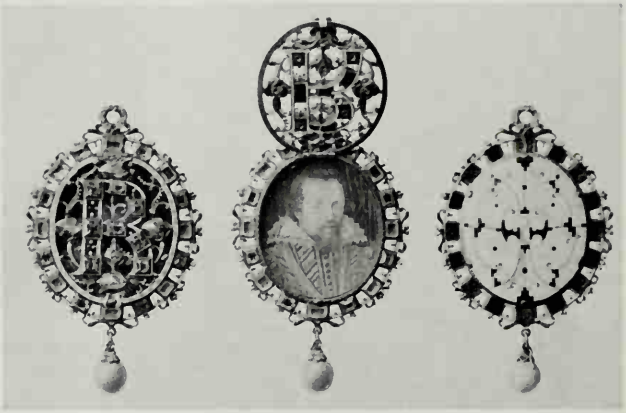
Parure of brooch, earrings and ring; chrysoberyls set in silver. Portuguese, late 18th century



Bodice ornament, gold, set with rose-cut diamonds. Spanish, early 18th century



Devotional jewel with a cross set between two palm leaves. Spanish, 17th century



The Lyte jewel, enameled gold set with diamonds, containing a miniature of James I. Shown, from left to right, front; front, open; and back. English, 17th century

Necklace of gold and semiprecious stones set with miniatures of peasant costumes of Swiss cantons. Swiss, 19th century

EUROPEAN JEWELRY,
17TH TO 19TH CENTURY

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IV. India
1. The Indus Civilization, *c.* 2500–1500 B.C.
2. Later Periods
3. The Muslim Period From *c.* 1200
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VI. Japan
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4. The Hellenistic Period (330–27 B.C.)
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IX. Europe
1. Derivations From Roman Jewelry
2. Medieval Jewelry
3. The Renaissance
4. The 17th and 18th Centuries
5. The 19th and 20th Centuries
X. The United States and Latin America
XI. Collections

I. EGYPT

Jewelry in ancient Egypt was an important part of the dress of both men and women. Even if she wore nothing else, a serving-maid would have a girdle of beads around her hips. Information about jewelry comes from representations in sculpture, painted illustrations and from actual examples which have survived in tombs. A distinction must, however, be made between jewelry worn by the owner during his or her lifetime and the funerary jewelry intended to decorate the mummy of the dead person. This latter jewelry was frequently made of glazed composition, which is very fragile, and was not provided with any means of fastening.

1. Materials and Techniques.—The materials of jewelry for use by the living were gold (occasionally silver) and semiprecious stones: carnelian, red and green jasper, chalcedony, turquoise and lapis lazuli, or imitations of such stones in glass and glazed composition. Amethyst was used in the Middle Kingdom either alone or in conjunction with gold, since it does not harmonize with other colours. The Egyptians liked the effect of massed colours, although in the best periods of their craftsmanship the individual details are most carefully executed.

The techniques known to the ancient craftsmen included cloisonné work, granulation (the attachment of tiny balls of gold in patterns), engraving and chasing. Their equipment was the simplest, consisting of copper and bronze tools and a charcoal fire. Some wall paintings showing goldsmiths' workshops have been preserved which give an idea of the varied output of the smiths: gold vessels and gold decoration for furniture and possibly architecture, as well as articles for personal use.

2. Forms.—*Diadems.*—These, known from the 1st dynasty (3100–*c.* 2890 B.C.), *e.g.*, a gold circlet from Naga ed-Der, were worn only by royalty and people of high social rank. The only two diadems worn by kings which have been preserved are the silver diadem in the museum in Leiden, Neth., of King Intef of the 11th dynasty (*c.* 2133–1991 B.C.) which contrasts in its simplicity with the flamboyant 18th-dynasty gold diadem of Tutankhamen (reigned 1361–1352 B.C.), in the Cairo museum. Some of the most pleasing of the examples worn by ladies of high rank are those which were found at Dahshur and el-Lahun dating from about 2000 B.C. during the Middle Kingdom. Three, very different in design, have survived. One of the diadems of Princess Khnumuit is a fine mesh of gold threads upon which are strung inlaid medallions in the form of lotus flowers. Her other diadem is more solid, being a band of gold inlaid with a floral motif with some of the flowers standing up from the band. The third diadem was found at el-Lahun by Guy Brunton and Sir Flinders Petrie and is now in the Cairo museum. The owner was Princess Sit-Hathor-Yunet, daughter of Sesostris II. On the front of the gold circlet is a gold uraeus which is inlaid with lapis lazuli, carnelian and glazed composition. Fifteen rosettes are soldered to the band. They represent lotus flowers with a lily pad in each quarter. Tubular gold beads found with the diadem were probably strung together in 34 strands to form a moving curtain of gold suspended from the circlet. The gold uraeus indicates that the owner was a member of the royal family and the tall plumes were attributes of the goddess Hathor. Another gold headdress which belonged to a member of the harem of Thutmose III (1504–1450 B.C.) is an example from the New Empire.

Earrings.—Earrings did not come into use until about 1500 B.C. when they appeared as simple hoops made of carnelian, red jasper or gold. They were soon made more elaborate and weighty, as can be seen in those of Tutankhamen and the almost baroque earrings of Ramses II (1304–1237 B.C.).

Necklaces.—At all periods except the very early (prehistoric) and very late (Coptic), necklaces for wealthier people were composed of many rows of beads joined by vertical spacer beads and by a clasp with a counterpoise hanging down the back. Beads were made of glazed composition (blue, yellow, red, green, etc.), steatite, semiprecious stones, gold, silver and coloured glass, both opaque and transparent (at later periods only). The characteristic broad collar can be seen on many representations of men and women at all periods and many examples have been preserved. In the Old Kingdom there is seldom any variation, but in the Middle Kingdom, the best period for Egyptian jewelers, double and treble strings of beads, frequently amethyst, were introduced, and sometimes pendants or specially designed gold beads were added to the string. Stars, bivalve shells and floral designs are to be found in the treasure of Dahshur as well as hieroglyphic signs inlaid with semiprecious stones which may have been worn as part of a collar or threaded individually, as were the examples from el-Lahun. The wide collar with hawk-headed or semicircular terminals, however, was still popular. Many examples have been found in burials and they are frequently illustrated in tomb paintings. The broad collar, greatly elaborated, continues into the New Kingdom. Several have been reconstructed from the tomb of the three princesses at Thebes (Metropolitan museum, New York). Some of the most spectacular collars are those of Tutankhamen. A Nebti collar was found on the mummy of the king and consists of 166 separate gold plaques engraved on the back and inlaid with coloured opaque glass. The design represents the vulture goddess of el-Kab, Nekhbet, side by side with the cobra goddess of Buto. In the claw of the vulture is the hieroglyph *shen,* meaning "circuit of rulership."

Pectorals, which hung below the collar, were rectangular and often bore a religious motif. Frequently they were made of gold and inlaid with semiprecious stones, but they were sometimes also made of glazed composition. Some of the most famous pectorals are those found at Dahshur and el-Lahun and in the tomb of Tutankhamen.

Bracelets.—Bracelets were made of beads threaded together (the 1st-dynasty bracelets found in the tomb of King Djer *c.* 3100 B.C.) or of beaten gold in the form of hoops (those found in the 3rd-dynasty pyramid of Sekhemkhet *c.* 2622 B.C.). In the Middle Kingdom bracelets were composed either of two strings of beads threaded through a couple of gold beads in the form of couchant lions (el-Lahun treasure) or several rows of beads forming a fairly wide flexible band terminating in a decorated gold clasp (also el-Lahun treasure). In the New Kingdom a hinged bracelet, made of two solid gold semicircular bands decorated with cloisonné work of glass and semiprecious stones, was added to the existing patterns (bracelets of the Three Princesses in the Metropolitan museum, New York, and those of Tutankhamen and Ramses II in the Cairo museum, also that of Nemareth, son of Sheshonk, in the British museum).

Anklets, similar to bracelets, were made of several rows of beads joined to a clasp, or of two or three rows threaded through a spacer bead made in a distinctive design. Those belonging to Princess Sit-Hathor-Yunet, matching her other jewelry, have two gold claws—possibly of leopards or lions—on each anklet.

Rings.—Finger rings with scarab bezels were often inscribed with the owner's name and titles or with a lucky spell. The scarab was made of glazed composition, steatite, etc., and the setting of gold. The common glazed composition rings may have been for funerary use only. Solid gold, silver and bronze were used for rings particularly in the late period and in Ptolemaic times.

Girdles.—Girdles are shown in illustrations of both men and women. Kings wore a special belt from which a tail was suspended. The actual belts and tail were found on the mummy of Tutankhamen. They were made of a narrow band of gold and the tail was of beadwork covering a cloth core. An apron made of beadwork was also found with this king, similar to the one found on the mummy of Senebtisi (Metropolitan museum, New York). Such articles were only for ceremonial occasions. A girdle, which belonged to Princess Sit-Hathor-Yunet, instead of being a simple string of beads, was made of gold beads in the form of double leopard heads and spherical amethyst beads. One of the leopard heads formed a sliding clasp and the other heads contained pellets of diorite which rattled as the wearer moved. Another leopard-head girdle belonging to Queen Mereret was found at Dahshur and is now in the Cairo museum. Many wall paintings from tombs show women wearing girdles of beads under their transparent draperies, and small statuettes of women sometimes have a girdle of cowrie beads painted around the hips. Actual girdles of gold cowrie beads were found at Dahshur and el-Lahun dating from the Middle Kingdom and are now in the Cairo and Metropolitan museums. (A. H. MacF.)

II. THE NEAR EAST

1. Origins in the 4th Millennium B.C.—The origin of the working of fine jewelry in the ancient near east must be sought in the prehistoric periods of Iraq and north Syria, and the early appearance of gold and silver in sites such as Tepe Gawra, at the foot of the Kurdistan hills, or Tell Brak in the valley of the Habur river, suggests that the goldsmith's craft had a long history before the appearance of the great school of Sumerian smiths centred on the city-state of Ur on the lower Euphrates river. It is at about 3200 to 3000 B.C., when trade between Mesopotamia and Iran and the gold producing highlands of Anatolia was expanding along the caravan routes which linked the sources of raw material to the religious centres in the Tigris-Euphrates valley, that we can detect the beginnings of organized work by goldsmiths and jewelers.

2. The 3rd Millennium: Sumer.—In the succeeding 3rd millennium the historic period begins and by the third Early Dynastic period in Mesopotamia Sumerian goldsmiths and jewelers were producing an astonishing amount of jewelry which shows expert knowledge of practically every kind of technical method known in later periods. Here the complex temple organization provided the ideal background for the activities of the different classes of craftsmen, and jewelry, while always in demand by queens or priestesses, now played an important part in the religious life of the whole community, not only for its magical properties but also as an essential part of the adornment of the gods and goddesses taking part in the religious festivals and ordinary temple rituals. At Ur the remarkable finds in the royal tombs show how the elaborate ritual which culminated in the immolation of the "king" and "queen" required their adornment in the finest products of the goldsmith's art. Elaborate headdresses, necklaces with quadruple spiral pendants, earrings, hair ornaments and bracelets have survived alongside other magnificent products of the metalsmith's art from the graves at Ur, showing that Ur must have been the main centre of Asiatic craftsmanship whose influence affected other centres all over the near east. The extent of this influence is still difficult to assess, but Syria and Anatolia were certainly affected by the spread of the knowledge of Sumerian techniques which were imitated by native smiths at such sites as Alaca Hüyük and Kültepe, in central Anatolia, and Troy in the west. In Mesopotamia, the continuity of this tradition is well attested by finds of gold and silver jewelry dating from the Sargonid period (Brak and Khafajah) and also at the end of the 3rd millennium B.C., at the period of the 3rd dynasty of Ur, when a priestess was buried at Warka in southern Iraq with a massive necklace made of large onyx beads set in gold mounts decorated with filigree ornament of wire and cloisonné work.

3. Anatolia, Phoenicia, Palestine, Late 3rd–2nd Millennium.—The development of native schools of gold working and jewelry both in Anatolia and at sites such as Tepe Hissar, in northern Iran, can be dated to the centuries just before and after *c.* 2000 B.C., and the widespread distribution of certain distinctive types of spiraliform jewelry, from Troy in the west to Lothal in India, attests not only to the easy trading facilities but also to the importance of certain religious concepts which had spread over a wide area in western Asia. Another flourishing school of gold and jewelry work can be found on the Phoenician coast at Byblos, where native smiths, influenced in many ways by Egypt, managed to design and produce pieces of an extremely high technical standard. The art of granulation, known and used at Ur on a small scale, was here applied to large objects such as the shafts of ceremonial axes, while the use of cloisonné inlay and filigree work on pectorals and pendants also testifies to high technical ability. Granulation was later used on the rich finds of jewelry found at Tell Ajjul in southern Palestine, especially on earrings, which include the hawk and crescent shaped types. The rosette pendants from Ajjul suggest connections both with the Hurrian site of Nuzi, near Kirkuk, in Kurdistan, as well as to the north, where goldsmiths at Ugarit on the Phoenician coast near Latakia, and at Alalakh 60 mi. farther north, were engaged in making jewelry decorated with fine filigree, granulation and cloisonné inlay work and whose activities reflect the internationalism prevalent during the second half of the 2nd millennium B.C.

4. Babylonia and Assyria, *c.* 1800–*c.* 700 B.C.—Examples of jewelry which can be dated to the period of the 1st dynasty of Babylon in Mesopotamia are rare, but it is unlikely that the knowledge of techniques such as granulation or filigree were ever forgotten in Mesopotamia; the fine examples of granulation from the Kassite site of Aqarquf, near Baghdad, imply a continuity with earlier work. Here, connections both with the Syrian coast and Ajjul are evident, while trade connections with Elam to the east provided facilities both for the movement of craftsmen and for the spread of improved technical methods.

Fine examples of early Assyrian jewelry dating to the 13th century B.C. were found at the site of the first Assyrian capital at Ashur, where a rich collection of jewelry illustrates the conservatism of the craftsmen both in matters of design and technique. In the period of the late Assyrian empire, however, the different types of jewelry worn by the king, queen, high court officials and army commanders are better known from the examples portrayed in detail on the reliefs, which also show the jewelry worn by the different gods and goddesses. An important extant example is the quartz seal set in a gold setting, with attached chain, from the grave of an Assyrian lady, of the time of the emperor Sargon II (722–705 B.C.), excavated at Nimrud in Iraq.

5. Urartu and Centres in Iran.—In Iran, there is new evidence of centres of jewelry workers in the northwest, who must have been in close contact both with Assyria and with the kingdom of Urartu situated in eastern Anatolia and Transcaucasia. The wealth of jewelry excavated at Marlik, near the southwestern shore of the Caspian sea, suggests a tradition of gold and jewelry working which must have started much earlier in the latter part of the 2nd millennium B.C., and whose origins may well lie in Transcaucasia and in the valleys of the Talish region along the west coast of the Caspian sea. In the kingdom of Urartu, and especially at the site of Altin Tepe, near Erzincan, rich finds of jewelry with techniques similar to those used at Marlik have been made, and the delicacy of the minute granulation work and the occurrence of similar distinctive types of beads among Urartian and northwest Iranian gold jewelry suggests that the smiths must have learned these techniques, if not in the same workshop, then by traveling from one centre to another. The pendants of double pyramid shape from Marlik are also known in the Talish region and in Urartu; distinctive multiple tubular beads decorated with granulation occur at Altin Tepe and from the site of Ziwiye in Persian Azerbaijan, 74 mi. S.E. of Lake Urmia, while the mass of jewelry from this latter site found with the celebrated treasure, or alleged to have come from this area, suggests that by the 9th–8th centuries B.C. there were probably several centres of jewelry working in Iran, whose products were distributed all over the area which later became part of the Median empire. One of these centres was certainly at Hasanlu, in the Solduz plain near the

southern shore of Lake Urmia, where jewelers' molds have been found. Gold and silver fibulae from Ziwiye again show the skill of the Iranian craftsmen of the 8th and 7th centuries B.C. in copying basic types known in Mesopotamia and Syria in bronze and decorating them with animal motives. A magnificent gold bracelet from Ziwiye can also be dated to the 8th–7th centuries B.C. and shows Urartian influence in the treatment of the stylized lions' heads. It can be regarded as a link between Urartu on the one hand and Ziwiye and other centres in Media. That gold jewelry, as well as other metal objects, was brought as tribute to Assyria by foreigners is known from reliefs dating from as early as the reign of Ashurnasirpal II (884–859 B.C.), and on one of the Nimrud ivories, tributaries, who can almost certainly be identified as Medes, carry flat dishes on which are placed enlarged examples of a distinctive type of lunate-shaped earring which is well known from the Assyrian reliefs, where it is worn by the king, officials and army officers.

The final development of techniques practised by jewelers and metalsmiths in eastern Anatolia and northwestern Iran, including the region south and east of Lake Urmia, can be seen on some of the magnificent bracelets and armlets from the Oxus treasure, a collection of jewelry found in Afghanistan along the Oxus (Amu-Darya) river in 1877 and now in the British museum. Here the technique of champlevé, which had been extensively used on bronze objects by Urartian metalsmiths, is employed with great effect, and the stone inlay was set in depressions carved out of the gold background. The technique of cloisonné inlay, which was much favoured by Achaemenid jewelers, also occurs in the Oxus treasure and the combination of the two methods of inlay on a magnificent griffin armlet can be regarded as one of the most brilliant examples of the Iranian jewelers' art.

6. Iran in the Achaemenid Period.—Among the considerable amount of jewelry which has been dated on stylistic grounds to the Achaemenid period there is a lack of stratified material, but dating evidence for some of the types of earrings, fibulae, armlets, bracelets, pendants and torques is given by the detailed representations on the reliefs at Persepolis, and extant examples of some of these types were found at Persepolis and in the large tomb of Achaemenid date excavated at Susa. This grave group illustrates the fact that the techniques used by the Achaemenid jewelers in the 4th century B.C. were still those used in the pre-Achaemenid period in Iran. Champlevé was used as a basis for inlay, and turquoise and lapis lazuli occurs on a pair of earrings decorated with fine cloisonné work. The Susa group also contains fine examples of turquoise, veined agates, jasper and carnelian and shows that later Achaemenid jewelers used rare precious stones extensively. Another important group of gold work which includes jewelry is said to have come from Hamadan and to have been found in association with inscribed gold plaques of Arsames and Artaxerxes II. Here gold bracteates were found in the form of striding lions and *ajouré* roundels with lions rampant, which were intended to be sewn onto the robes of king or priest and worn for ceremonial or ritual occasions. (K. R. M.-H.)

7. Iran in the Parthian and Sasanian Periods.—During the Parthian period (2nd century B.C.–3rd century A.D.) Iran entered the sphere of Hellenistic art. With rare exceptions ornaments were no longer solid but were composed of gold or silver wire, braided or twisted. Under the Sasanians (Sassanids; *c.* A.D. 224–651), Persia reverted to the tradition of Achaemenid polychrome jewelry. The only sure example of Sasanian jewelry is the so-called "Cup of Khosrau," preserved in the Bibliothèque Nationale, Paris. It has a circular gold base inset with roundels of red and white glass, and with green glass in the interspaces. The central roundel is of crystal carved with the seated figure of Khosrau (Chosroes) I (ruled A.D. 531–579). The figural arts of the period represent men and women wearing necklaces and earrings. No doubt the finest achievements must have been the elaborate crowns made for each of the kings of this dynasty. None has survived, but a later Arab historian describes the crown of Khosrau II as of "Pure gold encrusted with pearls that looked like sparrows' eggs, with grenadine rubies that lit up the shadows and were used as lights on dark nights, and with emeralds the very sight of which melted the sight of vipers. A gold chain 70 cubits long was hung from the ceiling of the palace and the crown was attached to that chain so that it touched the king's head without bothering him or weighing on him."

III. ISLAMIC JEWELRY

After the Arab conquest of Iran brought it into the Islamic community of peoples, rings, pendants, earrings and necklaces of gold continued to be worn and the Iranian tradition of animal art persisted, modified to some extent in order to conform to the canons of Islam. A 12th-century gold pendant in the form of a lion is a highly schematic rendering of this animal; it is decorated with granulation. Other techniques were filigree and encrustation with precious and semiprecious stones and the use of niello (a mat black substance). From the 14th century onward, manuscript illustrations give some idea of the kind of jewelry worn by Persians. In Mongol and Timurid times, jeweled coiffures for women and diademed headdresses for men seem to have been fashionable in court circles. Under the Safawid rulers jewelry became more sumptuous and elaborate. In the 19th century native traditions were corrupted by European influence. Traditional designs, however, have persisted in Zinjan and among the Kurdish mountaineers of northwest Iran. Silver decorated with twisted wire arranged in scrolls is a feature of the former. The Kurdish goldsmiths also work in silver which they decorate with chased or *repoussé* designs, sometimes reminiscent of motives found on Sasanian metalwork.

Jewelry worn by men and women in Turkey during the Ottoman period was probably influenced by the fashions current in Iran. Objects of adornment were jeweled turban aigrettes, rings, earrings, necklaces and armlets. A technique popular in Turkey from the 16th century onward was the encrusting of jade and other hard stones with jewels attached to the surface by delicate floral scrolls in gold. Unfortunately not many surviving pieces are earlier than the 19th century, when native tradition had been stifled by a taste for rococo jewelry.

In north Africa an independent tradition has been maintained by the Berber and Arab tribes. In design the jewelry of southern Morocco shows curious analogies to Byzantine jewelry—heavy silver plaques decorated with niello or cabochons, serving as diadems or headbands. In other parts of Morocco, in Algeria and Tunisia, popular forms are headbands, breast ornaments, brooches, pendants and a characteristic triangular-shaped shawl pin.

Islamic jewelry in India is discussed in the section on India.

IV. INDIA

The Indian love for jewelry is proverbial (Strabo, *Geography* xv, 1, 54). Because of their climate Indians decked themselves with ornaments instead of heavy clothes from the Chalcolithic period (*c.* 3000 B.C.) to the beginning of the 20th century.

1. The Indus Civilization, c. 2500–1500 B.C.—The jewelry unearthed from the Indus valley sites consists of fanlike plumes of faïence for the head; V-shaped fillets of gold with holes for hanging pendants; hollow gold cones; animal-headed and carnelian-studded hairpins and ivory and bone pinheads, one of which shows monkeys clasping one another; gold and bronze earrings; leaf-, fiddle- and cone-shaped blue and yellow faïence eardrops; faïence and steatite ear studs bearing divided circle and lotus designs; necklaces of several strings of variegated coloured beads of carnelian, agate, jasper, steatite, chalcedony, gold, etc., with spacers and dome-shaped terminals of metal; minute steatite beads of necklaces; coloured bangles of pottery, faïence bangles and hollow bangles, gold, silver and bronze; finger rings of bronze, silver and gold, some of which bear designs on their bezel tops; girdles of beads on bronze wire interspersed with decorated disks; and round and elliptical anklets. The Indus jewelers appear to have acquired in those early days the knowledge of melting, refining and mixing of metals; molding, chiseling and doing *repoussé* work; drawing wire; cold setting of stones; designing, casting, colouring and glazing of faïence pieces; of hardening steatite, carving, filling colour in depressions to give an enameled effect, and glazing the stone; of shaping beads, making facets, polishing and drilling them.

2. Later Periods.—*The Aryans.*—The Rigveda (*c.* 1500 B.C.) asserts that the Aryans decorated themselves with gold fillets, round crowns, crowns with horns, gold breast plates, necklaces of gold beads, earrings, armlets, bangles and girdles. The Yajurveda testifies to the magical power of gold and the Rigveda describes brides wearing ornaments symbolic of married bliss.

Piprawa, c. *450 B.C.*—The jewelry found in Piprawa in Nepal along with the relics of Buddha consists of beautifully designed flowers of gold, thin gold pieces bearing various ancient symbols, beads of semiprecious stones, coral and pearls testifying to the belief that these would protect the relics from evil eyes.

The Mauryan Age, c. *321–200 B.C.*—In the Mauryan age men and women wore heavy jewelry but there are not many pieces which can be definitely assigned to this period.

Sunga Period, c. *200 B.C.–A.D. 100.*—During the Sunga period the fashion of covering the body with jewelry appears to have continued, as attested by the terra-cotta figurines of the period.

Indo-Greek, c. *100 B.C.–A.D. 100.*—The Indo-Greek jewelry found at Taxila, which influenced the later Indian designs, includes, among others, ornamented gold fillets, gold and ivory hairpins with decorated heads, one of which is like that of the figure of a ram in low relief, thin gold chain necklaces of long cubical pieces, of round gold beads and of twisted gold wire representing coiled serpents; necklaces of beads of various shapes of crystal, amethyst, banded agate, carnelian, jade, etc.; gold crescent-shaped pendants, an ivory pendant with two philosophers' heads carved on it, gold decorated ear-tops with dome-shaped pendants hung with chains, oval gold earrings with decoration on the thick middle portion, ivory earrings, hollow bangles with decoration near the ends, bracelets with cut-out work, gold and silver finger rings with engraved designs on their bezel tops, gold safety pins, amulets and engraved gems.

Kushan Period, c. *A.D. 100–300.*—The Kushan period jewelry, found from different sites of India, consist of round disks attached to fillets; long eardrops; flat torques; necklaces of variously shaped beads, some of them carved in the form of animals; broad ornamented armlets; bangles of gold, bronze and glass; finger rings of gold and bronze with bezel tops bearing various symbols and designs; beautifully designed girdle pieces; foot bangles and anklets.

The Guptas, c. *300–500.*—In the golden age of the Guptas people had begun to wear light jewelry. The excavations have yielded earrings like wheel tires, ear studs bearing flower designs, bead necklaces, armlets, round bangles, finger rings of gold and of stones such as lapis lazuli.

Medieval Period, c. *500–1200.*—The jewelry of the medieval period includes fillets with round decorated pendants to bind the women's raised coiffures, decorated disks for the buns, elaborate earrings which were probably worn attached to the locks of hair, torques studded with gems and having pendants in the form of rats' teeth, necklaces of beads, a sort of thick chain which used to be hung to the necklaces separating the breasts, elaborate armlets, bangles of gold and silver, finger rings studded with jewels, girdles of several strings of beads in loops with chains which used to hang over the thighs, neatly worked oval anklets and silver foot bangles.

3. The Muslim Period From c. 1200.—The Muslim invaders from the north were averse to wearing jewelry but their contacts with Indians and the hot climate of India made them discard their heavy cloaks for the lighter muslim jama and ornaments. Akbar (reigned 1556–1605) wore a double line of pearls on his Indian turban and sometimes a plume of *simurgh* or roc, two single lines of pearls interspersed with garnets on his neck and finger rings studded with emeralds set *en cabochon;* Jahangir (1605–27) wore earrings of two pearls and a garnet in between and a long necklace of pearls interspersed with garnet and emerald beads. Shah Jahan (1628–66) wore a plume of *Surkhab* (bird of paradise) on his turban adorned with the famous Koh-i-nor diamond. He also added a heart-shaped pendant studded with rose-cut diamonds backed by silver foil to his large pearl necklaces and wore an armlet, the central piece of which had a cut garnet (a novelty). The scabbards and the jade handles of his knives and swords were also embellished with jewels. The famous peacock throne on which he sat was the costliest throne ever made. It was of gold, enameled and studded all over with precious stones. Most of the jewelry pieces of his day were enameled on the Persian pattern and set with precious stones by chiseling out a hollow place, backing the stones with white or coloured foils and covering their edges with gold. Aurangzeb (1658–1707) also wore elaborate jewelry like his father. The later Moguls however began to wear in addition bangles studded with diamonds, and a jeweled *kalgi* (aigrette).

The ladies of the harem, many of whom had come from the great Rajput houses, wore on their foreheads a round or star-shaped pendant set with rose-cut diamonds, emeralds and rubies attached to a string of pearls; round jeweled disks hung to the lock of the hair with a string of pearls on the ears; earrings with pearls on the upper lobes of the ears; a nose ring as a mark of married bliss; a choker of three to four strings of pearls and a garnet in the centre; two to three necklaces of pearls; armlets of small vertical pieces of gold set with emeralds and garnet or with one large horizontal piece set with a big jewel beautifully enameled at the back; bangles with ends in the form of alligators and elephants; finger rings set with precious stones and enameled *en cloisonné* in green, blue, red and white, depicting animals, leaves and trees; and girdles and anklets of chiseled gold. The Persian and the Mogul princesses of the court wore a sort of a cap with a plume, bracelets of pearls, long pearl necklaces, finger rings and strings of pearls on their ankles.

During the days of the later Moguls all the ladies, whether Persian or Rajput, began to wear practically similar ornaments. Their jewelry consisted of a fillet composed of small vertical pieces of gold enameled and set with jewels, and a round or crescent-shaped pendant held by a string of pearls for the forehead, lotus-shaped disks with bell-shaped ear pendants having small drops attached to its base and hung to a lock of hair near the ears by a string of pearls, gold nose rings with pendant jewels, chokers and other ornaments of the type worn during the days of the great Moguls. The commoners also wore jewelry though these were generally made of silver and cheap stones.

The close contact of Indians with the Europeans greatly influenced the Indian ornaments made during the close of the 19th and the beginning of the 20th century. The move was toward lightness, simplicity and perfection of forms. The design of ornaments was also westernized. A trend toward a revival of the ancient designs was noticeable by the mid-20th century, the old enameled pieces being reoriented to form the few pieces of jewelry worn by women. The men have now ceased wearing jewelry except finger rings, buttons and tiepins. (Most of the ancient, medieval and Mogul jewelry can be seen in the national museums of India and Pakistan and in the Indian section of the Victoria and Albert museum, London.) (R. G. Ch.)

V. CHINA

Much of Chinese jewelry, both of recent and early date, displays the familiar manipulative skill of the Chinese craftsmen; yet the work of the goldsmith or lapidary applied to personal ornament does not represent so distinct a branch of craft as it does in the west, and is accorded no special attention by the native connoisseurs and writers on the arts. Most of the jewelry is designed to adorn the costume rather than the person, and much of it has a fulsome and insubstantial quality which is not immediately pleasing to western eyes. Necklaces, bracelets and earrings are comparatively rare, headdresses and elaborate hairpins being the commoner forms attached to the person. In the traditional costume of recent times, ornate hooks and buckles were used to attach girdles, and women wore strings of beads, often multiple and variously spaced, with decorative plaques and other larger ornaments interspersed. The beads might be attached to the neck, head or waist, and their purpose was to dignify the whole figure rather than to display the fine quality of a curiously wrought gem. In any case, the splendour of the stuff of the costume, with richly woven or embroidered ornament, provided the distinctions of rank and wealth, and jewelry was often dispensed

with altogether. The long sleeves and high collar of the garment left little of the person exposed for ornament set against the skin, in the manner favoured in the west.

In the time of the Shang dynasty, in the last centuries of the 2nd millennium B.C., bone and ivory hairpins with ends carved as birds or abstract figures were a popular adornment. The many finely wrought small jade plaques of the period, depicting animals in profile, are in many cases clearly intended for sewing to the costume. The earliest evidence of gold ornaments belongs to the time about 400 B.C., though these are harness mounts, or weapon parts, rather than jewelry in the normal sense. The latter is better represented by the belt hooks which are said to have been adopted from the nomads of inner Asia (and were called by a barbarian name). They were mostly made of bronze, with fine cast ornament in the prevailing style of abstract design, dragon and bird heads, inlaid with gold or silver foil, or polished fragments of turquoise, more rarely with jade or glass, and sometimes gilded. These girdle hooks were probably worn by both men and women.

Toward the end of the Han dynasty, probably not before the later 2nd century A.D., the art of granulation was communicated to China from the Hellenized region of the Black sea coast. Granulation can be traced in China until about the 10th century A.D., its discontinuation in the east curiously coinciding with the loss of the technique in the west. Granulation was combined with filigree, and hairpins, combs, earrings and costume plaques survive in some quantity, particularly from the richly furnished tombs of the T'ang dynasty (A.D. 618–906). There are plaques with birds and flowers delineated by soldered wire, inlaid with turquoise, on a ground of fine granulation which appears like a dust of gold.

The employment of the *repoussé* technique in gold and silver, particularly on the heads of combs, can be attributed to the T'ang period, but became commoner in the Sung dynasty (A.D. 960–1279). Meanwhile hairpins of filigree, with heads shaped as butterflies or flowers, sometimes with pearls or small jade additions, continued the age-old fashion. A scented hairpin takes the place of the scarf or ring of European romance. They were called *pu yao* ("shaking while walking") and were loosely made so as to sway when the wearer moved. Gilded bronze and silver were the principal materials. There are accounts of elaborate headdresses, some no doubt of the kind representing a complete phoenix, such as are to be seen on clay tomb statuettes of the T'ang period, but no surviving examples of these can be attributed with certainty to the Sung period. Jade ornaments were still attached to the costume.

Jewelry survives in greater quantity from the Ming dynasty (A.D. 1368–1644) and gives an impression of greater taste for elaborate figural and floral designs in high *repoussé* relief, and for the effect of semiprecious stones. The latter were prized for their colour rather than their luminosity or rarity. They are never elaborately faceted, being merely ground flat and beveled at the edge for the most part, and are set nearly always *en cabochon*, with barely a preliminary polishing, sometimes even retaining the irregularities of the pebble. The stones are invariably semiprecious or even commonplace: amethyst, agate, chalcedony, pink and other quartzes, and of course jade. Until modern times this last has been the most admired of the stones, especially the white variety, which was used for spacers and linking pieces in the silk and beaded hangings of elaborate costumes. The plaques of silver *repoussé* with flowers and scenes of people were probably used only by men as belt ornaments. Apart from the signet ring, the use of which may not go back beyond Ming times, the male could affect jewelry only in his accoutrement. An unusually splendid piece of personal jewelry is represented by the openwork gold plaque set with rough stones which is said to have come from the tomb of Emperor Hsüan Te (1426–35).

VI. JAPAN

In the later prehistoric and early historical period of Japan (*c.* 2nd century B.C.–6th century A.D.) comma-shaped objects, not usually more than an inch in length, called *magatama*, were made of green jade and eventually even imitated in glass. They were sometimes pierced to be strung in a necklace. The symbolic meaning of the *magatama*, which was often placed in tombs, can only be guessed at. But in historical times Japanese costume, male and female, has never allowed the use of ornaments of precious metal or stone, so that nothing in the history of Japanese craft and taste corresponds to the jeweler's work of the west. Hairpins with elaborate heads were increasingly used in the Yedo (Edo) period (1616–1868) by women of the geisha and courtesan classes but not by women of other classes. In the same period men were permitted the ostentation of the *inro*, a small tiered box, destined for tobacco, medicines, confections and the like, which might be beautifully painted in lacquer and inlaid with mother-of-pearl or precious metal. The ivory girdle toggle called netsuke, always delicately and often intriguingly carved, was the only other personal ornament which usage allowed. *See* IVORY CARVING. (W. WN.)

VII. AMERICA BEFORE COLUMBUS

Rich ornaments of metal, semiprecious stones, shell and other substances were used not only by the high civilizations of Mexico and Peru, but equally among the less advanced peoples of the area between.

Metalworking began in Peru in the Chavín civilization before 500 B.C., some 1,500 years earlier than it was known in Mexico, where jade in the form of carved plaques and beads was always held in greater esteem. Metallurgy began with the hammering and embossing of gold to make pendants, cuffs, ear disks, etc. By the classic period, *c.* A.D. 250–750, in the Mochica and Nazca areas, casting of gold, silver, copper and their alloys was used to make a wide variety of objects, such as beads, pendants, nose ornaments and ear disks. The most pleasing effects were produced by combining metals with other substances, as in some Mochica ear ornaments, in which a wooden rod passed through the lobe and carried a disk of turquoise mosaic framed by a gold ring rimmed with little beads. The more delicate castings were done by the cire-perdue process, which was used to make pins and other things of more than one metal, *e.g.*, gold and silver. In the 15th and 16th centuries the Chimú state employed all the aboriginal metallurgical techniques to produce ornaments which include openwork gold nose pendants and magnificent pectorals and crowns. At all times necklaces of turquoise, quartz, shell and metal beads were commonly used. Little specifically Inca jewelry has survived, but Chimú metalworkers are known to have been taken to Cuzco by the Incas.

Of the countries between Mexico and Peru, Colombia is particularly rich in gold jewelry, including breast and nose ornaments and pins with cire-perdue cast heads. The reddish gold-copper alloy *tumbaga* was appreciated and much used. There are necklaces of quartz, emerald and amber beads. The rich grave finds of Coclé, Panama, include nose ornaments and pendants of agate and serpentine and stone ear rods with gold ends.

Metal jewelry in Mexico is confined to periods after the 10th century and the best surviving examples are from the Mixtecs, shortly before the Spanish conquest. Mixtec graves have yielded beautiful quartz ear spools and outstanding cire-perdue castings, including gold pendants and jewels enriched with turquoise mosaic, from which little bells may dangle. (G. H. S. B.)

VIII. THE AEGEAN, GREECE, ROME AND ETRURIA

The jewelry from Greece and Italy from the earliest times down to the end of the ancient world covers some 3,000 years of development. Throughout this period the basic material was pure, or almost pure, gold; less commonly silver and electrum were used.

1. Bronze Age.—*Early Bronze Age* (*c. 2600 or Earlier to c. 1900 B.C.*).—This period is rich in jewelry from the lands of the Aegean, especially from about 2300 B.C. onward.

The most important pieces come from the so-called "Second City" of Troy, destroyed *c.* 2200 B.C., and from a contemporary site on the island of Lemnos. This jewelry shows the influence of two traditions: a Mesopotamian, exemplified by the art of Ur, and a central Anatolian, as seen in that of Alaca Hüyük. Typical products are elaborate diadems, dress pins and earrings. The basic elements are thin sheet gold and delicately wrought chains; the decorative elements are filigree and granulation. The granulation is

considerably finer than that of Ur, and suggests that this technique had only recently been brought to perfection. Jewelry of this general kind was also made in the Cycladic Islands and on the Greek mainland, but in a less accomplished manner.

In Crete is seen another tradition, represented principally in the rich tombs on the island of Mochlos. Here were found diadems, bracelets, hair ornaments and beads, all modeled on the kind of jewelry found at Ur, but made in a simpler way, with no knowledge of filigree or granulation. The only really accomplished pieces are elaborate chains, like those from Troy.

The Middle and Late Bronze Age (*c.* 1900 to 1100 B.C.).—This is the age of the Cretan palaces and of the Mycenaean civilization. In the Middle Bronze Age (*c.* 1900 to *c.* 1600) surviving jewelry is virtually restricted to Crete, and is surprisingly rare there in view of the quantity and quality of ornaments believed to have been worn by the ladies of Knossos.

It appears, however, that soon after 1900 B.C. the arts of filigree, granulation, and *repoussé* reached Crete, probably by way of Syria, followed somewhat later by the predominantly Egyptian art of inlaying with precious stones. The most famous piece of jewelry of the Middle Minoan period (as the Middle Bronze Age in Crete is named) is a pair of hornets (or possibly bees) facing each other across a honeycomb, from a tomb at Mallia, and dating from the 17th century B.C. Filigree, granulation and *repoussé* are used to great effect. To this period and the early part of the next should be ascribed a treasure in the British museum believed (possibly incorrectly) to come from the island of Aegina. The finest jewel from this treasure shows a Cretan god, Lord of Nature, with birds, vegetation and other unidentified objects.

The Late Bronze Age (*c.* 1600 to 1100 B.C.) is much richer in material, especially on the Greek mainland, where the Mycenaean civilization came to full flower under Cretan influence. Jewelry of the highest quality has been found on many sites, but the whole story can best be traced at Mycenae itself, which Homer, writing many centuries later, calls "rich in gold." For the first part of the period (*c.* 1600–1500) the shaft graves provide the richest source (*see* MYCENAE). The next two centuries, from *c.* 1500 to 1300, are also rich in jewelry. The principal types were *repoussé* beads and pendants, the best of them decorated with filigree, granulation and a crude kind of blue enamel; and finger rings, the bezels often inlaid with coloured stones or glass. After 1300 B.C. no new types evolved and the quality rapidly declined as the Mycenaean world moved to its destruction. (*See* also AEGEAN CIVILIZATION; CRETE.)

During the early Iron Age (*c.* 1100 to 800 B.C.), when Greece was plunged into savagery by the invading Dorians, the arts reached an extremely low level. Jewelry was rare, and what there was consisted of strips or wire of gold bent to make finger rings, hair rings, earrings or bracelets.

2. The Orientalizing Period (c. 800 to c. 600 B.C.).—About 800 B.C. the Greeks began to renew contact with their civilized neighbours. Immigrant Phoenician craftsmen, including goldsmiths, apparently began to settle in Greece in the 8th century B.C., where they took on local apprentices and founded local schools owing much to Phoenician skills (practised without a break since Mycenaean times), but exhibiting also the fruits of native Greek genius. The Mycenaean techniques of filigree, granulation, *repoussé* and inlay (forgotten for some four centuries) reappear in much the same form as when they were last seen. A little really superb work was produced in the 8th century; in the 7th the full flood begins. Some of the finest products are pectoral ornaments from Rhodes. Sheet gold is stamped with a figured scene and further decorated with filigree and granulation. In an example from the British museum the winged Asiatic Artemis is shown grasping a lion in either hand to demonstrate her dominion over the animal world.

3. The Archaic and Classical Period (c. 600 to 330 B.C.).—The 6th century, though an age of unsurpassed artistic activity in Greece, is very poor in surviving jewelry. It is, however, to this century that the reintroduction of the art of enameling, possibly from Assyria, in a new improved form should be ascribed. It is found, for example, in the petals of rosettes, bounded by filigree.

After the Persian Wars gold became more plentiful, but jewelry was still rare. From Eretria in Euboea come some splendid earrings and finger rings. Granulation now takes second place to filigree, frequently used to great effect in association with enamel.

In the 4th century earrings, necklaces and finger rings become common, especially in the fringe areas of the Greek world such as Italy and Sicily, South Russia and Cyprus. A superb necklace from Tarentum, now in the British museum, is composed of linked rosettes and double palmettes in sheet gold. From the rosettes hang alternately human heads and acorns; from the double palmettes smaller heads. The general effect is that of a controlled richness typical of classical art at its best.

4. The Hellenistic Period (330–27 B.C.).—The conquests of Alexander the Great between 333 and 323 B.C. changed the face of the Greek world. New territories to the east became Greek, and Greece learned much from them. In addition, for the first time, gold became really common in Greece as a result of the capture by Alexander of the vast Persian treasures.

The forms remained basically the same, but by about 200 B.C. there were new forms beside the old, and the system of decoration had radically changed. Previously the jewelry had relied for its effect primarily on the sculptural forms of the gold itself, embellished discreetly with granulation, filigree or enamel. Now, under Egyptian and oriental influence, a rich polychromy was introduced by means of inlaid stones and glass. At the same time the goldsmith's repertoire was enriched by the introduction of exotic motives such as the Heracles knot (a reef knot), the crown of Isis and the crescent.

Typical Hellenistic jewelry consists of diadems richly encrusted with garnets, enameled in places, and hung with elaborate pendants; hoop earrings with animal-head finials, drop earrings with statuettes of Eros or gaily coloured glass birds; straplike necklaces with pendants on chains; and finger rings set with enormous garnets, amethysts or carnelians.

5. The Roman Empire (27 B.C. to A.D. 400).—The Hellenistic period merged gradually, so far as jewelry is concerned, into the imperial Roman. In the first half of the period, Hellenistic forms continue, with the use of harder stones but with a slight fallingoff in technique, and are supplemented by newer forms, which embody a return to the enjoyment of unbroken surfaces of gold for its own sake. A necklace now in the British museum is typical of the conservative element in this period; bezel-set stones are used in combination with a chain to form the necklace, and similar stones make a charming butterfly pendant. The stones used with such effect are sapphires, garnets and crystal.

In the second half of this period three technical innovations are noticeable, leading directly to Byzantine jewelry: a kind of metal fretwork, known in antiquity as *opus interrasile;* a new kind of polychromy whereby the stones take precedence over the setting; and the use of niello to make a contrast with the gold. Another practice typical of this period is the use of gold coins for ring bezels and necklace pendants—a discreet compliment to the reigning emperor.

6. Etruscan (c. 700–250 B.C.).—Etruscan jewelry stands somewhat apart from Greek, although at its upper end it shares a Phoenician ancestry and at its lower it merges into the general Hellenistic stream. The earliest jewelry comes principally from the rich tombs at Caere, Praeneste and Vetulonia. Characteristic forms of this era are hair spirals, earrings, beads and pendants of various kinds, including certain purely Phoenician types; bracelets; dress pins and, above all, fibulae (safety pins). Granulation was practised with consummate skill, better than anywhere else at any time.

The 6th century was equally rich, but then Phoenician influence was replaced by Greek. Although the forms remained peculiarly Etruscan, the decoration suggests that Greek workmen may have been employed by Etruscan masters. Typical of this period are elaborate earrings. The so-called *a baule* type takes its name from the wicker valise which it resembles. The other popular type, a large disk, is illustrated by a particularly fine example in the British museum which sparkles with filigree, granulation and inlaid blue glass. Finger rings with bezels shaped like an Egyptian cartouche are also typical of the early 6th century.

The 5th century was a lean period in Etruria, and gold was scarce. In the 4th, however, something of a renaissance is seen. From 400 to about 250 B.C. jewelry of an entirely different type was widely produced in Etruria. In marked contrast to the elaborate decoration of earlier jewelry, large convex surfaces of sheet gold with embossed decoration are found. Filigree and granulation are seldom found, enamel never. The jewelry was almost confined to wreaths, earrings, bracelets, finger rings, and the typical Etruscan ornament, the *bulla*, a circular pendant with amuletic properties.

By about 250 B.C. the Etruscan cities joined the Roman confederation and their minor arts, of which jewelry was one, became absorbed into the general Hellenistic style, discussed above.

(R. A. H.)

IX. EUROPE

1. Derivations From Roman Jewelry.—In regions that had been under the Roman empire the form, technique and decoration of jewels were influenced by Roman usage. The use of gold filigree remained general; and the varied forms of the Roman fibula became the basis of yet more complicated brooches. The most important technical development was in the use of thin slices of garnet set like enamel in metal cells, a technique ultimately derived from Egypt and probably transmitted through the Crimea. It is represented in the great 4th-century treasure found at Petrossa, 60 mi. from Bucharest, and appears to have been in use nearly all over Europe between the 3rd and 8th centuries A.D. At the same time under Byzantine influence cloisonné enamel was used for exceptional pieces, such as the famous Alfred jewel. This common tradition, however, was modified by each of the great European tribes into a style characteristic both in design and technique.

The Goths.—In Italy classical influence was strong, but the Ostrogoths developed the type of the Roman radiated fibula into brooches of great magnificence, and combined the Byzantine interlaced style with the northern style of animal decoration, to produce a type of ornament that was to be yet more fully developed in Scandinavia. The Roman tradition of filigree and still more of niello continued to persist, and the techniques lent themselves well to the new style.

The Visigoths used cloisonné work set with garnets or pastes, combined with pearls and gems *en cabochon* set in fretted gold. The most splendid surviving Visigothic jewels are the crowns dedicated by Kings Swintila (621–631) and Recceswinth (649–672), preserved in the Musée de Cluny, Paris, and the Real Armería, Madrid. They show abundant use of cabochon gems, both set in gold and hung as pendants.

Frankish Jewelry.—The Franks practised a more Germanic style, but with their settlement of Gaul they came under the influence of the Gaulish classical tradition. Their style is represented by the jewels found in the tomb of Childeric I, king of the Franks, who died in 481. When it was opened in 1653, it was found to contain a sword with jeweled gold mounts, and 300 golden bees, inlaid with garnet, that must have been sewn upon his robe. (They later inspired the Napoleonic use of bees as an emblem of empire.) Characteristic Frankish forms are rosette or circular brooches, generally decorated with filigree, brooches shaped as birds, and buckles of heavy rectangular form. They also developed the Roman type of radiated fibula with oval foot and square or semicircular headplate (a type which was also used with a lozenge foot in the Rhineland), and occasionally used the classical fish and horse forms of brooch. Great treasures, probably of the late 4th century, have been found in Teutonic graves in Rumania, Transylvania and Walachia. The goldsmiths of the Belgian provinces practised a "chip carving" style of design that was common over a wide area in the 5th century but was later characteristic of Scandinavia.

Scandinavia.—Scandinavia developed the common types along complex lines and produced fibulae of great size and elaboration. The Swedish bracteates, circular pendants of thin gold, are at first imitated from Roman medallions of the time of Constantine, but in the 5th century the local style of animal ornament supersedes this, and when coins are imitated they are Anglo-Saxon sceattas.

In Norway, too, fibula types of the 4th, 5th and early 6th centuries are derived from Roman or Crimean Gothic originals but after about 550 the types become national. The Scandinavian "tortoise" and trefoil brooches are characteristic; the former date from the 7th to the early 11th century, while the latter are mostly of the 9th and 10th centuries. These and cognate circular brooches are generally decorated with symmetrical designs of considerable beauty. The relations between Scandinavia and Ireland in the 8th and 9th centuries brought in the type of penannular brooch which in its attenuated northern form is characteristic of the Viking age.

England.—In England types from many of these areas were received and modified. The continental type of gold filigree and garnet work was introduced by the Jutish settlements of Kent, the Isle of Wight and part of Hampshire. Splendid examples were recovered in 1938–39 from the ship burial at Sutton Hoo, Suffolk (preserved in the British museum, London), which seems to date from the third quarter of the 7th century. They show immense technical ability both in the working of gold and in the extraordinarily complex and minute cloisonné work in garnets with which clasps, purse-mounts and other lesser objects are adorned. The goldsmith who made them was so skilful that he could adapt the flowing animal-form patterns usually worked out in gold or gilt metal to be interpreted in the far more difficult cloisonné technique. In Sussex, Surrey, Berks and Oxon "saucer" fibulae of a type found in the Hanover district are fairly common, while north of the river Thames complex Scandinavian types are general. With the introduction of Christianity such forms as pendant crosses came in, and Carolingian and Byzantine influence is evident.

Ireland.—Ireland, and in a lesser degree Scotland, had types of their own, of which the most characteristic is the penannular brooch. Generally of great size, and worn on the shoulder with the pin pointing upward, it was richly decorated; and the finest example, the "Tara" brooch, represents the climax of Celtic art, with an infinite variety of the delicate interlaced patterns that are characteristic of Irish work. This probably dates from the 8th century and is preserved in the National museum, Dublin. The type continued in use until the 10th century or later. The jewels of the Celtic period are of importance not only for themselves but also because of their relation with the nascent art of manuscript illumination.

2. Medieval Jewelry.—With the dawn of the middle ages jewelry takes its place as one of the many industrial arts, fostered first in the monastic workshops for the service of the church, and then by the jewelers of the towns. At the same time knowledge of it is drawn from different sources. After Carolingian times the custom of burying jewels with the dead fell into disuse; but with the development of graphic and plastic art, more and more jewels were represented in painting and sculpture, and with the development of a settled society more and more were accurately described in wills and inventories. In the late 15th century the manuscript illuminators of Bruges often painted jewels in the margins of their books.

The brooch continued to be the most characteristic ornament, but the Roman safety-pin type fell into disuse. Classical cameos and intaglios continued to be used all through the middle ages, and by the 14th century were being imitated with considerable skill. The medieval brooch is nearly always a ring brooch, of which the pin is held in position by the pull of the stuff through which it passes. The ring form was modified in endless ways: it might be partly filled in, as on the great Eagle brooch at Mainz, or its rim might be formed as a wreath or a heart or in more fantastic shape. The other characteristic medieval jewel is the reliquary or devotional pendant, chased or enameled with religious subjects, often set in an architectural frame. In the 14th and 15th centuries jewelry became increasingly a part of dress and was fashioned into belts and chaplets, hair nets and necklaces, and sewn upon garments. Some splendid crowns of this time survive, notably that which Blanche of England, daughter of Henry IV, wore on her marriage to Louis, elector palatine of the Rhine, in 1402 (Wittelsbach treasure, Munich). Badges were worn in the hat to indicate the wearer's party, to commemorate a pilgrimage he had undertaken or to portray his patron saint. The personal motto

of the wearer, or an amatory sentiment, was often inscribed upon jewels.

3. The Renaissance.—With the Renaissance the link between jewelry and costume became still closer. On occasions of ceremony the whole dress was sewn with jewels, as many portraits of the 16th century show. A new class of artificers in metal came into being, whose only concern was with such small objects as jewels. No ancient Roman jewels were used as models, but classical subjects were often represented and engraved gems of classical type employed. Many ornaments were designed rather as little pictures in enamel than as jewels in the ordinary sense. However, after 1600 a gradual loss of plastic quality is noticeable, compensated by increasing skill in the cutting and display of gems. At the same time the publication of engravings of designs for jewels helped to standardize their patterns throughout Europe. Both these developments, however, were gradual; and the design of Renaissance jewels show no lack of individual fancy, and is often conditioned by the shape of an oddly formed gem or baroque pearl. The Reformation and the classical revival combined to bring the religious symbolism of medieval jewel design to an end; only in Italy and Spain did the medieval reliquary types survive. A new class of portrait jewels came into being and many jeweled cases of great beauty were made to contain portrait miniatures.

4. The 17th and 18th Centuries.—With the 17th century a certain change is evident. Jewels cease to be works of art with some idea or fancy to express, and become mere personal ornaments beautiful in line and in material but without any deeper significance. Many improvements were made in technique; the art of gem cutting was developed. By the middle of the 17th century rose and brilliant cutting had almost superseded the older table-cut diamond, and the enamelers produced painted flower enamels of great beauty as well as enamels in such delicate technique as *émail en résille sur verre*, of which the ground is not metal but glass; and the jewelers learned to mass their gems and to set them with great lightness and elegance in leafy settings of gold and silver. With the development of this style the forms of jewels tended to become stereotyped. The characteristic jewels of about 1700 are a parure: earrings and brooch, necklace or clasp, and ring and sometimes shoulder brooches or buckles, all to match, set with diamonds alone or in combination with rubies, topazes, sapphires or emeralds.

The courtly splendours of the 18th century were reflected in diamond jewelry of the utmost magnificence that looked its best at candlelit fetes. Louis XIV and Louis XV both had parures of great splendour, including their orders and sword hilts, shoe buckles and sets of immense "Brandenburgs" to fasten their coats. Women had no less splendid parures of necklace, earrings, bracelets and a stomacher, or a series of brooches to adorn the front of the dress. Some fine examples were made for the Empress Catherine II, many surviving in the Russian museums.

5. The 19th and 20th Centuries.—The French Revolution impoverished Europe, and the abolition of the French guilds of goldsmiths struck a blow at the continuity of craft tradition. For state occasions the Napoleonic court imitated the parures of the *ancien régime*, with the addition of a jeweled coronet of classic form, while for everyday wear they, and poorer people, contented themselves with parures set with semiprecious stones or shell cameos in mounts of delicate filigree of gold enameled with patterns in black or blue. Many bracelets were worn; and long earrings were matched by extremely long chains and *sautoirs* reaching below the waist. With the Restoration in France such semiprecious jewelry became increasingly important, and quantities of topaz, amethysts and aquamarines were imported from Brazil and Mexico. A considerable amount of jewelry was made in imitation gold such as pinchbeck and its French equivalents, and some in finely cast iron. Diamonds and precious stones were set in light flower, leaf and wheat-ear patterns that could be executed in stones of lesser size. With the reign of Louis Philippe the influence of medieval and Renaissance decoration was shown in the use of Gothic arcadings and baroque scrolls on jewels, but at the same time jewelry became steadily more stereotyped in its form and more industrial and mechanical in its production.

With the creation of the second empire many jewels were designed on simple lines—frets, crescents, stars and so on—simply to display the diamonds with which they were set, while others attempted to imitate flowers with inartistic verisimilitude. A prevailing fashion of the mid-century was a cascade of diamond barley ears. A few jewelers, such as Lucien Falize in Paris and Giuliano in London, revived the Renaissance style alike in design and technique, and produced beautiful work in enameled and jeweled gold. At the same time others—notably Castellani of Rome and Fontenay of Paris—drew inspiration from such classical jewelry as that of the Campana collection, and produced delicate "Etruscan" work in gold adorned with filigree. In England Queen Victoria's widowhood did much to encourage the wearing of mourning jewels in black enamel set with diamonds and pearls.

The redistribution of wealth provided a market for a vast quantity of middle-class jewelry: stars, crescents, lockets, small brooches, chain bracelets and the like, and for the first time the production of jewelry reached a purely commercial level. The tendency was greatly accelerated when South African diamonds began to come on the market after 1868. By the end of the 19th century machine-made millegrain settings were being used for diamonds, and after 1920 an increasing number of settings of all kinds were machine produced. As a reaction against this tendency, jewelers such as R. Lalique produced *art nouveau* jewelry of elegant and fantastic design with relatively few precious stones. It was, however, ill adapted to changing fashion.

Queen Alexandra introduced high pearl and diamond dog collars, the wearing of which encouraged the use of stud rather than pendant earrings. The courts of England, Germany and Italy were at this time splendidly jeweled, but World War I greatly reduced their splendour. Some fine emeralds and pearls came on the market from Russian and Turkish sources and were used by the great French jewelers, one of the chief of whom was P. C. Fabergé. Many brooches and necklaces were sold to India and the U.S. After World War I wrist watches were universally worn and were included in the repertory of the designers of diamond jewelry.

The years between the wars saw a great fashion for diamond bracelets, many of which were worn at once, and for clips, which to a great extent took the place of brooches. They were often designed in pairs, and so made that they could be joined together to form a single brooch. At the same time the market was flooded with strings of Japanese cultured pearls. The introduction in England of a heavy purchase tax on jewelry in 1940 did much to create a fashion for antique jewels, which was encouraged by the vogue of wearing a single large lapel brooch. The years after 1940 will, however, go down in the history of jewelry for their development of "costume" jewelry, designed for effect in materials of little or no intrinsic value. (J. Ev.)

X. THE UNITED STATES AND LATIN AMERICA

All modern United States jewelry has in common an efficient, smooth, streamlined quality. Platinum and, in later years, palladium have taken the place of gold in gem-set work. Palladium, because of its extreme lightness, has been particularly in evidence in large clips and brooches. These two metals have also been widely used for such mass-produced articles as wedding rings, a contrast with the traditional conservatism of Europe which in this respect still prefers gold. A particularly revealing departure from European taste has been the widespread adoption of jewelry by men. Gem-set signet rings, tie- and scarfpins, *minuterie* or small-work in the shape of cigarette cases, lighters and holders have all been produced in the United States with a lavishness of decoration which almost recalls masculine jewelry of the Renaissance.

In the United States, engagement rings and wedding rings are made as matching pairs, often set with diamonds. A certain ostentation in gem-set jewelry—evidenced in very large "cocktail" rings—lends an opulence and a flamboyance to this modern work which would not have seemed out of place in 16th-century Europe.

The most outstanding phenomenon in the United States proved to be the mass production of "costume" or "fashion" jewelry, much of which is tastefully designed and finely executed. The range of techniques and materials used is considerable. Anodized aluminum, silver, often oxydized to give an antique effect, and plastics

have all been employed. In the better-quality articles fine hand-set marcasites or pastes are common. Artificial pearls, the manufacture of which originated in Czechoslovakia, also play a large part in American jewelry. A mixture of nitrocellulose and guanine (a fish silver obtained from the scales of certain fish) is coated over a bead of glass or plastic. These are then used in decorative necklaces and earrings. (The modern cultured pearl which evolved from experiments by K. Mikimoto in Japan must not be confused with this purely artificial and inexpensive article.)

In South America modern jewelry remained more traditional in styling, and there was a wide preference for gold. The richness of this metal has always appealed more to Latin taste, and it is used with that extravagant display of coloured stones which has always been a feature of Spanish work. Enameling continued to be popular, and fan-shaped brooches set with rubies, emeralds and diamonds follow the style familiar to the first conquistadors. Emeralds, mined in Brazil, play a large part. Jewelry is commonly worn by men in the shape of elaborate signet rings, gold and platinum watch straps and gem-set cigarette cases.

Gem-set cocktail rings, mainly executed in gold, are made to go in company with colourful bracelets and matching earrings. Pendant earrings, usually diamond set, are larger and more lavish than their North American or European counterparts. An exchange of influence between North and South America is apparent and, whereas the south tended to streamline its conventional idiom, the north adopted a wider colour range in its gem-set pieces. The combination of precious stones such as the diamond and ruby with semiprecious ones like the tourmaline or peridot in brooches became common to both. The influence of the international fashion houses became noticeable not only in costume jewelry, but even in precious gem-set pieces. Thus, the delicate feminine stylings which were termed the "new look" in the years immediately following World War II gave rise to pendant earrings, light and elegant chain bracelets, and necklaces that were often Victorian in detail. By the 1950s it became difficult to designate whether a piece had been made in New York or in Buenos Aires. This would not have been the case 50 years earlier. But, in any case, it appeared that the dating of a piece of precious jewelry would, in the future, depend largely upon recourse to contemporary fashion plates. (E. D. S. B.)

XI. COLLECTIONS

Many large collections of jewels, often many times reset, remain in private possession. Chief among these are the royal collections of hereditary rulers or members of the aristocracy of blood or wealth. Of public collections the chief are usually in the national museums, though in vast country-continents such as the U.S. or the U.S.S.R. there may be several important collections almost on a national scale.

In addition, many modern private collections of historic pieces have been formed. Catalogues of recent exhibitions provide a lead to these. Important exhibitions were: "Gemstones and Jewelry" (City Museum and Art gallery, Birmingham, Eng., 1960); "Exhibition Kunstindustrimuseet" (Copenhagen, Den., 1960); "Gold and Silver of Ancient Italy" (Turin, Italy, 1961); "International Exhibition of Modern Jewellery" (Goldsmiths' hall, London, 1961).

All the national museums of applied arts of European countries have collections of jewelry.

Jewelry collections in Great Britain are of special importance, notably, in London, those of the British museum, Victoria and Albert museum, Wallace collection, Jewel house, Tower of London (British coronation regalia and crown jewels) and Goldsmiths' hall; National Museum of Antiquities of Scotland, Edinburgh; Ashmolean museum, Oxford; Fitzwilliam museum, Cambridge; City museum, Manchester; City Museum and Art gallery, Birmingham; and the Public museums, Liverpool. The National Museum of Ireland, Dublin, also has an important collection.

In France, museums with important collections include, in Paris, the Louvre, Musée des Arts Décoratifs, Musée de Cluny, Bibliothèque Nationale, Musée Carnavalet, Musée Jacquemart André; outside Paris, Musée Condé, Chantilly, and the Musée de Tous-les-Saints, Schaffhausen. Private collections include the de Clercq collection, now the property of the Comte and Comtesse Henri de Boisgelin.

In Western Germany, apart from the jewels formerly in the royal collections, the public collections are of recent date and include the Schatzkammer der Residenz (Bavarian royal collections), Munich; the treasury of the cathedral, Aachen; Hessisches Landesmuseum, Darmstadt; Hessisches Landesmuseum, Bonn; Germanisches Nationalmuseum, Nürnberg; and the Clemens collection, Cologne. Before World War II Berlin housed jewels from Schliemann's excavations in Asia Minor, and also the important Von Gans collection. Part of this collection has been exhibited in the U.S. The disposal of the collections in East Germany (which includes what survives of Schliemann's finds and also the Dresden collections) is not entirely clear.

Greek collections include those of the National museum and Benaki museum, Athens, and the private collection of Mme H. Stathatos (Hellenistic material).

In the Netherlands, major collections are in the Rijksmuseum, Amsterdam; and the Gemeentemuseum, The Hague.

In Italy, the National and Civic museums throughout the country contain collections. Chief are of course those at Rome: the Vatican, Museo della Villa Giulia, Museo Pigorini, Museo dell'Alto Medioevo; others are in the Museo degli Argenti of the Pitti galleries and the Museo Archaeologico, Florence; Tesoro di San Marco, Venice (for goldsmiths' work); Museo Poldi-Pezzoli, Ancona; Palazzo Madama, Turin; Museo Nazionale, Naples; Museo Archaeologico, Salerno; and the Museo Nazionale, Taranto.

In Denmark there are important collections in the Rosenberg palace (Danish royal collections) and the National museum, Copenhagen. Swedish collections include those of the Treasury of the Cathedral, Uppsala, and the National Historical museum, Stockholm.

In the United States, the Metropolitan Museum of Art in New York has important and expanding collections from Greek and Etruscan times onward (including the Altman collection), while the National gallery at Washington also includes jewelry. The Boston Museum of Fine Arts and the Cleveland (Ohio) Museum of Art have good examples. Of private collections, those of Judge Irwin Untermyer and Mr. Melvin Gutman (on public loan at Chicago) have been widely published.

In the U.S.S.R. the collections of jewelry in the Hermitage museum at Leningrad are of extreme importance, and in particular the Crimean finds of gold Greco-Scythian jewelry. (P. M. B.)

Articles of related interest include GEM (which has a detailed discussion of engraved gem stones); CROWN AND REGALIA; METALWORK, DECORATIVE; SILVER AND GOLD WORK; and articles referred to in these two articles, including separate entries on most of the gem stones. For the various specific techniques used in making jewelry, *see* the Index. Articles that discuss ancient civilizations—for example, EGYPT and BABYLONIA AND ASSYRIA—include material on jewelry, which may be found by consulting the tables of contents of these articles. The article DRESS is also of related interest. *See* also references under "Jewelry" in the Index.

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JEWELWEED: *see* IMPATIENS.

JEWETT, SARAH ORNE (1849–1909), U.S. writer of regional fiction whose finest prose, modeled on Flaubert's style, is distinguished by naturalness, clarity and compactness, was born in South Berwick, Me., Sept. 3, 1849. She attended Berwick academy but obtained her most effective education from long rides with her father, Theodore H. Jewett, a doctor, on his rounds of farms and fishing villages. She absorbed his comments on classic and

modern authors and observed acutely the indigenous characters, customs and details of background. Early in her teens she determined to perpetuate in writing the rapidly disappearing traditions of provincial life about her. In 1869 the *Atlantic Monthly* published one of her first stories. Her attitude is sympathetic without being sentimental. The most worthy of her 20 volumes are collections of realistic sketches and short stories about aging natives of Maine, whose manners, idioms and pithiness she recorded with pungency and humour. She provided narrative framework for *Deephaven* (1877) and *The Country of the Pointed Firs* (1896), considered her greatest single achievement, but exciting incident was not among her strong points. Her three extended novels—*A Country Doctor* (1884), which portrayed her father, *A Marsh Island* (1885) and *The Tory Lover* (1901), a historical romance—are notably lacking in dramatic invention. An edition of collected *Verses* (1916) was published posthumously. In 1901 she became the first woman to receive an honorary degree from Bowdoin college, Brunswick, Me. In 1902 a disabling accident virtually ended her writing career. She died at South Berwick on June 24, 1909.

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JEWFISH, the name given to several large fishes of the sea bass family (Serranidae), especially to *Epinephelus itajara*, found on the Atlantic coast of tropical America, which sometimes attains a length of 8 ft. and a weight of about 700 lb. The adult is dull olive-brown with faint spots and bands; the young are yellowish-green with dark crossbars and spots on the head. Adult jewfish are usually solitary and typically remain in the same area for extended periods. The related south Pacific jewfish (*E. lanceolatus*) may reach 12 ft. in length.

The Warsaw grouper (*E. nigritus*) living in the Atlantic between South Carolina and Brazil and the giant sea bass (*Stereolepis gigas*) from the Pacific off California and Baja California are both occasionally called jewfish and grow to about 7 ft. and 500 lb.

(C. HU.)

JEWISH ART. Certain aspects of Jewish history have had a marked effect on Jewish art. Only before the Diaspora and after the founding of the state of Israel have the Jewish people had a status comparable to that of other nations. For a long period the Jews lived without a country, without political concentration, dispersed among other nations, kept alive as a unit only by their great spiritual tradition. This implies that the word was always more important than the work. Moreover, the Second Commandment, "You shall not make yourself a graven image, or any likeness of anything," meant as protection against idol worship, had a restricting effect on art production, although this effect varies in strength in the different periods and is strongest on sculpture.

It is certainly wrong, on the other hand, to deny interest in artistic production to the Jewish people. The Book of Exodus has a detailed description of the furnishings of the Tabernacle, including the golden seven-branched candelabrum. During biblical times there continued to be a national Jewish art production in Palestine, subject to strong Egyptian and Babylonian influences. After the destruction of the Temple the Jews in the Diaspora were excluded from doing much art work because they could not join the craftsmen's guilds; gentile artists built their synagogues and did the metalwork for ritual objects. On the other hand, skilful Jewish embroiderers, very often women, did Torah curtains and Torah mantles. After the emancipation of the Jews in the 19th century Jewish artists began working in every realm.

All this results in a complicated definition: Jewish art is that art done for Jews or for a Jewish purpose. It is, of course, intrinsically Jewish art if the artist is Jewish, but it has to be called so also if the artist is gentile as long as the work is done for a Jewish purpose. On the other hand, work done by Jewish artists for a non-Jewish purpose is not essentially Jewish art but belongs to the general art production of the country in which it was done.

Jewish art begins in the biblical period of Judaism, characterized by extensive building activity from the time of Solomon. Unfortunately the most important structure, the Temple, cannot be investigated because the site is occupied by the Dome of the Rock (Mosque of Omar); but lengthy descriptions in the books of Kings and Chronicles show a longitudinal building with forecourt, entrance hall, assembly hall and holy of holies which was accessible only to the high priest. The very rich ornaments and furnishings, of which the most important was the ark, containing the tablets of the Law, are also described.

In the first centuries after Christ there was a noteworthy development of synagogue architecture. An especially important group of synagogues in northern Palestine, one-aisled or quite frequently three-aisled, have on one side (often toward the south, the direction of Jerusalem) a niche for the Torah scrolls, the reading of which was the main part of the service. Some of these synagogues were adorned with mosaics or wall paintings. An important example is the floor mosaic of Beth Alpha in northern Israel, made about A.D. 520 by two Jewish artists whose names are recorded on an inscription in the building. The mosaic, discovered in 1928, is divided into three sections: at the south end (facing Jerusalem) is a panel with religious emblems; the large centre section shows the signs of the zodiac, arranged around a symbolic portrayal of the sunrise; the bottom panel is a representation of the sacrifice of Isaac. (*See* SYNAGOGUE; RELIGIOUS ARCHITECTURE.)

A still more important monument is the extensive cycle of wall paintings formerly in the synagogue of Dura Europos in eastern Syria on the Euphrates river, destroyed about A.D. 260. The wall paintings, now reconstructed in the museum of Damascus, represent scenes from different books of the Bible and may go back to some lost Pentateuch illustrated in Alexandria. The style is different from Roman or Hellenistic paintings and shows in its reduction and simplification the hand of Jewish artists.

Very little Jewish art is preserved from the medieval period because of repeated persecutions. There are, however, illustrated manuscripts and also Torah scrolls, not illustrated but relying for their beauty only on the Hebrew script, which has great ornamental qualities. A notable Romanesque synagogue at Worms, Ger., was destroyed during World War II. A 13th-century Gothic synagogue remains in Prague, Czech.

From the Renaissance and Baroque periods are preserved a great number of very beautiful Torah curtains with elaborate embroideries and many Torah ornaments in silver—crowns, headpieces, breastplates and pointers. These silverworks, often richly gilded, were made in western Europe by the best gentile silversmiths and in eastern Europe and the near east by Jewish workmen also. There are many pieces made in silver filigree.

A great number of beautiful ceremonial objects were used in Jewish homes, including Sabbath candlesticks; Sabbath lamps in the form of a star, which has messianic significance; and spice boxes, in the form of flowers in the east and in the form of towers in the west, used for the blessing of spices at the end of Sabbath. These works were often made by the best available craftsmen. For other festivals, such as for Purim or Passover, richly engraved pewter plates were used. The plates themselves were made mostly by gentile pewterers but the engravings of Purim or Passover scenes were often done by Jews, working in the manner of outspoken folk art, which plays a decisive role in many aspects of Jewish art. This characteristic dual workmanship, gentile masters on the one hand, Jewish on the other, is found also in the production of Hanukkah lamps. The form, eight small oil lamps in a row with a backwall, for the eight days of the festival commemorating the rededication of the Temple by Judas Maccabaeus in 165 B.C., is again a very skilful invention of Jewish art. The creation of forms for the specific ritual purposes is in general one of the great achievements of Jewish art; the stylistic details are often an adaptation of the gentile surroundings.

The most important ornaments appearing on works of Jewish art are the tablets of the Law and especially the seven-branched candlestick, used as a sign of Judaism on Jewish objects since antiquity and now, rightly, on the coat of arms of the state of Israel. The Magen David (*q.v.*), the six-pointed star, is found frequently only after the middle ages, and it did not become a universally recognized Jewish symbol till modern times.

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JEWISH AUTONOMOUS OBLAST (YEVREYSKAYA AVTONOMNAYA OBLAST, commonly called BIROBIDZHAN), forms part of Khabarovsk *krai* in the far east of the Russian Soviet Federated Socialist Republic, U.S.S.R. It covers an area of 13,900 sq.mi. in the basin of the middle Amur, which forms the boundary of the *oblast* to the west, south and southeast, and also the frontier between the U.S.S.R. and China. Most of the *oblast* consists of the level plain of the Amur, on which there are extensive swamps and swamp forest of poplar, lime and Manchurian nut trees, with the giant, wild Manchurian vine. The drier parts are under grass, on fertile soils, so that plowing has left little of the natural vegetation. The higher parts are covered in mixed oak-conifer forests. To the north and northwest the land rises gradually to the hills of the Bureya range and the Little Khingan, which reach a maximum height of 4,652 ft. The hills are in dense taiga forest of spruce, pine, fir and larch. The *oblast* is drained by tributaries of the Amur, flowing from the Bureya range across the plain, the largest being the Bidzhan, Bira and Urmi. The *oblast* shares the monsoon climatic regime of the far east, with severely cold and dry winters (January average temperatures are about −25° C. (−13° F.). Summers are hot, with July averages about 20° C. (68° F.), and moist. Rainfall is about 23 in. a year.

The population by the 1959 census was 162,856. Although the *oblast* was established in 1934 as a home for the Jews in the U.S.S.R., no mass Jewish migration developed and Russian and Ukrainian settlers outnumber the Jews. A high proportion, 72% (117,257), of the population is urban, living in the two towns of Birobidzhan, the capital (40,667), and Obluchye and 12 urban districts, notably Bira, Birakan and Nikolayevka. Minerals are important, especially in the Bureya and Khingan mountains, iron ore being mined south of Izvestkovy, tin at Khingansk (formerly Mikoyanovsk), north of Obluchye, and graphite near Bira. At Obluchye the tin ores are processed. Marble and limestones are quarried in various places, the Birakan marble having been used in the Moscow metro. The forests of the *oblast* form the basis of a well-developed timber industry, especially at Birobidzhan, producing saw timber, pit props, sleepers, veneer, furniture and, at Birakan, paper. Other industries include textiles, clothing and shoes, glassmaking and the processing of agricultural products. Agriculture is largely concentrated on the Amur plain and is dominated by wheat growing, with rye, oats, soybeans, sunflowers, potatoes and vegetables. Sheep, dairy and beef cattle, and pigs are kept. Fishing is important along the Amur and Bidzhan, especially for salmon. The main axis of communication is the Trans-Siberian railway, which traverses the northern part of the *oblast*, and on it are located all the larger centres. The Amur is navigable, but is frozen from the beginning of November to the end of April. From Birobidzhan a feeder railway runs to the river port of Nizhne-Leninskoye. Birobidzhan is also joined by motor road to Blagoveshchensk and to Khabarovsk and Vladivostok. (R. A. F.)

JEWISH HOLIDAYS. The leading holidays of Judaism, distinguished by rejoicing and festivity, are Pesach (Passover), Shabuoth (Feast of Weeks, or Pentecost) and Sukkoth (Feast of Tabernacles, or Booths). The other major holidays are Rosh Hashana (New Year) and Yom Kippur (Day of Atonement), the holiest day in the calendar. The semiholidays are Rosh Hodesh (the first day of the month), Hanukkah (Feast of Dedication) and Purim (Feast of Lots).

One trait all the Jewish holidays have in common is cessation of work. In fact, in the Bible (Lev. xxiii, 24, 39) the festivals bear in addition to their particular names also the title Shabaton (*i.e.*, a day of rest), and the prohibition of work on these days is explicitly stated. There is, however, a difference between the holidays and the Sabbath (*q.v.*). While all types of work are prohibited on the Sabbath, on the holidays, with the exception of the Day of Atonement (Yom Kippur), activities related to the preparation of food, provided they could not be performed earlier, are permitted. Similarly, carrying burdens in the street, which is prohibited on the Sabbath, is permitted on the holidays, even when not necessary for the preparation of food.

Passover, Shabuoth and Sukkoth are celebrated over periods of several days, the number of which differs as between the Jews of Palestine and those of the Diaspora, the latter giving each holiday an additional day. The difference arises because of certain peculiarities of the Jewish calendar. Passover, Shabuoth and Sukkoth were and still are celebrated in Palestine for the number of days prescribed in the Bible, namely seven for Passover, one for Shabuoth and eight for Sukkoth. The Jews in the Diaspora (except for the Reform wing, which follows the biblical dating) for at least two millennia have celebrated Passover for eight days, Shabuoth for two and Sukkoth for nine.

The Jewish calendar year consists of 12 lunar months determined by the time of the revolution of the moon around the earth. That revolution is accomplished in 29 days, 12 hours and 793 parts of an hour divided by 1,080. Up to the year 363 C.E., as long as the patriarch (Nasi) and his court functioned in Palestine, the first day of a new month was determined by that body according to the birth of the new moon. Witnesses who noted its first appearance in the sky testified to the court on the same day, and that day was declared to be Rosh Hodesh, *i.e.*, the first day of the month. But if the witnesses could not report on that day, they did so on the next, and the day following the appearance of the moon was declared Rosh Hodesh. Accordingly there were months of 29 days and months of 30 days. The declaration of Rosh Hodesh was broadcast by lighting bonfires on high places and mountaintops so that the people in Palestine might know when the month began, in order to prepare for the holidays or for general reckoning. Nearby Jewish communities were informed by messengers on the same day. Distant communities in the Diaspora added an extra day to the holidays because of the doubt as to whether Rosh Hodesh was declared to be on the 30th day of the preceding month or on the following day.

The celebration of the extra day in the Diaspora continued even after the year 363, when the calendar was firmly established by Hillel II, according to reckoning and calculation, making the testimony of witnesses unnecessary. The talmudic sages of Babylonia urged all Diaspora communities to continue the old way of celebrating the holidays, and thus it remained. In Palestine, however, where there was no such tradition, the celebration according to the biblical dating remained, with one exception. Rosh Hashana (New Year), occurring on the first day of the month, was celebrated for two days even in the days of the Temple, if the witnesses arrived after noon. Hence, it is celebrated in Palestine even now for two days. The Reform wing, however, celebrates all these holidays according to the biblical prescription. (*See* also CALENDAR.)

Pesach.—Pesach (Passover) celebrates the most momentous event in Jewish history, the Exodus. It extends, according to the Bible, for seven days, beginning with the 15th and ending with the 21st (or, in the Diaspora, the 22nd) of the month of Nisan (March or April). On these seven (or eight) days, all leaven, whether in bread or other mixture, is prohibited; only unleavened bread, specially prepared, called matzoth, is eaten.

In early times, a special sacrifice was brought to the Temple; this was the Paschal lamb, the flesh of which was eaten by the family. Even after the destruction of the Temple, Passover was and continues to be celebrated with great pomp and ceremony, especially on the first night, when the festal meal, the Seder (an ordered banquet), is held. At this meal four cups of wine are drunk at certain intervals. The first is the cup of sanctification, Kiddush (*see* KIDDUSH AND HABDALAH), on which a lengthy benediction is pronounced, stressing the holiness of the holiday. This is followed by a special ceremony consisting of washing the hands and eating as an appetizer vegetables dipped in vinegar and salt water. Both the washing of the hands and the eating of the ap-

petizer were customary in early times at festal meals and have been retained in later times, in order to maintain the full formality of the feast.

After this ceremony, the Haggadah ("Tale") containing the history of the Exodus and interpretations of the ceremonies is recited by the whole family. In order that the observance of the Seder should leave an indelible impression even on very young children, the sages ordained that the recitation of the Haggadah be preceded by four questions asked by the youngest child for explanation of the laws and ceremonies. Specifically, the child inquires why only matzoth is eaten and leavened bread is prohibited; why bitter herbs are eaten before the meal; why food is dipped twice (*see* below); and why the father and other leading members of the family sit in special comfort, leaning on cushions (a relic of oriental custom). The Haggadah, which purports to be a detailed answer to these questions, is then recited, and at the end of the recitation the second cup of wine is blessed and tasted.

After the breaking of the matzoth and the pronouncement of a benediction, another ceremony is performed before beginning the meal proper. This consists in dipping bitter herbs, called *maror* in Hebrew, in a mixture of crushed fruits and wine. The bitter and the sweet are mingled together in order to indicate that freedom and spiritual progress are achieved only by means of suffering and sacrifice. The third cup of wine celebrates thanksgiving and is associated with the chanting of grace after meals. Another part of the Haggadah and several religious poems are then chanted, stressing the theme that God is the Lord of history; the fourth cup of wine is a grateful acknowledgment of His beneficent Providence.

In the course of time, the observance of the Seder came to reflect the pathos of Jewish history. The "cup of Elijah" was added as a toast to the messianic future, when all exploitation of man by man will be ended, for, according to the Talmud, the future redemption of which Elijah is supposed to be the harbinger will take place during the week of Passover, which commemorates the redemption from Egypt. Saluted as a vision of the future, not a reality, this cup remains untouched by the celebrants (*see* also *Hol ha-Moed,* below).

Shabuoth.—Shabuoth, celebrated on the 6th (or 6th and 7th) of the month of Sivan (corresponding to parts of the months of May and June), is called in the Bible by three names: Hag ha-Kazir (Feast of Harvest; Ex. xxiii, 16), Yom ha-Bikkurim (Day of the First Fruits; Num. xxviii, 26) and Hag ha-Shabuoth (Feast of Weeks; Ex. xxxiv, 22). The last name refers to the end of the seven-week period, between the beginning of the harvest in the fields (primarily barley) and its close (with the harvest of wheat). These seven weeks begin on the first day of Passover, when as a sign of thankfulness to God the *omer*, a measure of barley, was taken to the Temple as an offering. From that day on, the days were counted for seven weeks, or 49 days, and the 50th day was the festival of weeks, Shabuoth. The custom of counting the days between the two festivals was continued, even after the destruction of the Temple, up to the present day, though no *omer* is offered. The counting is done at the evening service, and the six weeks between Pesach and Shabuoth are called *Sefirah* days. In Jewish custom, this period is observed as a time of mourning, when, except for certain days, no weddings or celebrations are to be held.

In Temple times, Shabuoth was marked by the ceremony of *bikkurim; i.e.,* bringing of the first fruits to the Temple. Throughout the larger part of Jewish history, however, this festival has been observed as the anniversary of the giving of the Law (*Matan Torah*) on Mt. Sinai, and it is this event that dominates the holiday both in prayer and in custom.

Sukkoth.—According to the Bible, Sukkoth extends for eight days, beginning with the 15th and ending with the 22nd (or, in the Diaspora, the 23rd) of the month of Tishri (corresponding to dates in September and October). It is called in the Bible by two names, Hag ha-Asif (Feast of Ingathering; Ex. xxiii, 16), marking the ingathering of all grains and fruits at the end of the year, and Hag ha-Sukkoth (Feast of Tabernacles, or of Booths; Lev. xxiii, 34), as a reminder of the dwelling in huts by the Jews during their march through the desert. Essentially a festival of thanksgiving, it is marked by two commandments, to dwell in the *sukkah* ("hut") in memory of the historical event, and to take four plants—the *ethrog* (a species of citrus fruit), the *lulab* (a branch of the palm tree), the myrtle and the willow branch—and recite thanks to God for the fruitfulness of the land. Both ceremonies are performed for seven days only.

Shemini Azereth and Simhath Torah.—The eighth day of Sukkoth is theoretically a separate holiday, dedicated to the love of God, and is called in the Bible Shemini Azereth (the Eighth Day of the Solemn Assembly, Num. xxix, 35). In the Diaspora, however, the eighth and ninth days are celebrated under two different titles, the eighth bearing its biblical name, Shemini Azereth, and the ninth being called Simhath Torah (joy of the Torah), for on that day the annual cycle of the reading of the Law is completed. It is celebrated with great rejoicing, manifested by a special ceremony called *ha-Kofot* ("encircling"). During the evening and morning services, a number of worshipers with scrolls of the Law in their arms encircle the Ark of the Law and, led by the cantor, sing religious songs.

Hol ha-Moed.—Though Passover and Sukkoth consist of eight (seven) and nine (eight) days respectively, only the first two and the last two days (or in Palestine the first and the last) are really Yom Tob, or complete holy days. The intervening four for Passover and five for Sukkoth partake of the character of semiholidays and are known as Hol ha-Moed (*i.e.,* both holiday and weekdays). The principal ceremonies (as the eating of matzoth, dwelling in the *sukkah* and the benediction over the four plants) are observed, but no cessation of work is enjoined. The fifth intervening day of Hol ha-Moed of Sukkoth, however, bears a special name, Hoshanah Rabba, because of a special ceremony connected with it in which the worshipers carry willow branches and chant *hosha-na* ("please help"). Through the influence of cabala this semiholiday came to be regarded as a Day of Judgment.

Rosh Hashana.—It is not definitely known when Rosh Hashana, which falls on the first day of the month of Tishri, became the first day of the New Year. The Bible (Lev. xxiii, 24; Num. xxix, 1) merely refers to it as a festival which is to take place on the first day of the seventh month, taking Nisan, in the spring, as the first month, as stated in Ex. xii, 1. Nor is it indicated in the eighth chapter of Nehemiah, where a description of the celebration of the holiday is given, that it marks the beginning of the year.

Without entering into the complicated discussion as to whether the ancient Jewish calendar followed the solar or lunar year, it can be asserted that even in early times Tishri practically began the year. Several references in the Pentateuch itself confirm the notion that the month of Tishri initiated the practical year. Ex. xxxiv, 22 speaks of the Feast of Ingathering, or Sukkoth, as the turn of the year. Deut. xxxi, 10–11 speaks of Sukkoth as taking place at the end of the year. Since Sukkoth falls on the 15th of the month of Tishri, it could not begin the year, for such beginning must take place on the first of a month and not in the middle. Both passages are therefore to be understood as meaning that the holiday occurs in the month which begins the year. In fact, the very commandment that the shophar (ram's horn; trumpet) shall be sounded on the first of Tishri points to its special solemnity, for in biblical times the shophar was sounded on important public occasions. However, be that as it may, an old mishnaic statement hailing from early Soferic times (*c.* 350–330 B.C.E.) speaks of the 1st of Tishri, in a very matter-of-fact manner, as the beginning of the civil year. It is evident that it had acquired that status at least several centuries earlier.

Rosh Hashana is the first of the ten days of penitence. In the Agada (Haggadah), it marks the anniversary of the creation of the first human couple, their sin and their repentance. The same idea is expressed in the Rosh Hashana *Musaf* prayers, where it is stated, "This day marks the beginning of Thy work, a memorial of the first day of creation." The principal ceremony is the blowing of the shophar, which is a call for spiritual awakening. The ram's horn recalls Abraham's willingness to sacrifice Isaac, and

God's acceptance of a ram in place of a human being. Many and complex penitential ideas are associated with the various notes of the shophar.

Yom Kippur.—The Day of Atonement, or Yom Kippur (Yom ha-Kippurim), on the 10th of Tishri, is the holiest day in the Jewish calendar and is entirely devoted to fasting, prayer and meditation. The Bible calls it by a double title, Shabbat Shabaton (*i.e.*, a Sabbath of solemn resting), for on this day solemnity and rest from work are most complete. Yom Kippur celebrates the theme of repentance—man's weakness, man's capacity to envision the ideal, God's help to the penitent and God's forgiveness. According to the Haggadah, the Day of Atonement marks the day when the Israelites received the second Tablets of the Law; they then knew that they were forgiven for the sin of the golden calf. The forgiveness of God is conditioned upon man's obtaining the forgiveness of his fellow men; thus the day before Yom Kippur is usually devoted to the mutual asking of forgiveness.

The evening service with which Yom Kippur opens is preceded by the recitation of Kol Nidre, a declaration annulling all vows and oaths of the coming year that are in contradiction to the Jewish faith or that were made under improper conditions (*e.g.*, duress). The practice of annulling vows by confessing them to a court was developed in the mishnaic period. Symbolically, Kol Nidre dramatizes the ideal of holding every spoken word as a hallowed pledge. In addition, the words and the melody of Kol Nidre are associated with the suffering and martyrdom of the Spanish marranos (*q.v.*). Yom Kippur also is distinguished by the number of services held, an additional service, Neila, being chanted just before sunset. In Orthodox and Conservative congregations, the entire day is devoted to prayer and meditation; in Reform temples, two services usually are held, in the morning and in the late afternoon.

Semiholidays.—*Rosh Hodesh.*—The first of the semiholidays is Rosh Hodesh, the first day of the month. The Bible commands no cessation of work on that day, only special sacrifices. However, during the First Commonwealth it was given special distinction and was observed by family feasts. Saul held a family feast on that day and invited David to participate in it (I Sam. xx). The prophets couple it frequently with the holidays (Isa. i, 14). From a passage in Amos viii, 5 it may be inferred that people even abstained from work and from carrying on business on that day. Later, however, Rosh Hodesh declined in importance. It is observed today only by special prayers, recited on the Sabbath before Rosh Hodesh and by certain prayers on Rosh Hodesh.

Hanukkah.—Hanukkah (Feast of Dedication) commemorates the victory of the Hasmonaeans (Maccabees) over the Greco-Syrian king Antiochus IV Epiphanes, who at one time attempted to extirpate the Jewish faith. The Maccabean victory (165 B.C.) was a triumphant vindication of the principle of freedom of religion. Hanukkah extends for eight days, from the 25th of Kislev to the 2nd or 3rd of the month of Tebet (depending on whether Kislev has 29 or 30 days), corresponding to the latter part of December. Its distinguishing ceremony is the lighting of candles each evening, commemorating the rededication of the Temple to the worship of the One God by Judas Maccabeus. One candle is lighted on the first evening, two on the second, and so on for each evening of the festival. Symbolically, it asserts that the light of faith is certain to grow, even if only a small remnant of the faithful remains. The Talmud dramatizes this interpretation with a tale concerning the desecration of the oil in the Temple, leaving only "a small cruse of oil bearing the seal of the high priest." It appeared that the oil would last only one evening, but it lasted miraculously for eight full days. The lighted Menorah, or seven-branched candelabrum, became a Jewish symbol of God's words to Zechariah, "Not by might, nor by power, but by my Spirit, says the Lord of hosts" (Zech. iv, 6).

Hanukkah is observed as a joyous family semiholiday, with the giving of gifts to children and the playing of games. In the state of Israel, national overtones prevail in the evocation of the Maccabean triumph.

Purim.—The origin of Purim (Feast of Lots) is told in the Book of Esther (*q.v.*). Its name is said to be derived from the Persian word *pur*, which means casting of lots (Esth. iii, 7). Purim is celebrated on the 14th of Adar, corresponding to the latter part of February and early March, commemorating the occasion when the Jews of the Persian empire were saved from destruction, planned by their enemy, Haman, through the influence of Queen Esther and her uncle Mordecai. Its principal ceremony consists in the reading of the scroll of Esther in the evening service of the 13th and in the morning service of the 14th of Adar. Another ceremony prescribed in the scroll itself is the exchange of gifts and distribution of charity. Since the scroll calls it a day of joy, it subsequently became a day of public festivity.

See also LITURGY, JEWISH. (M. WA.)

JEWISH LITERATURE: *see* HEBREW LITERATURE.

JEWISH PHILOSOPHY. The term "Jewish philosophy" denotes the attempts made by Jews, at various periods in their history, to harmonize the tenets of their religious faith with prevailing trends in the philosophy of their environment. Attempts of this kind arose, in the first place, from apologetical motives. Soon, however, the philosophical quest as such became predominant, and the reconciliation of religion and reason was sought on a high level of methodical and disciplined thinking. Inevitably, as a result, the interpretation of Judaism underwent certain developments. This explains the sometimes violent opposition to philosophy offered by the more traditionally minded. Philosophy too changed through its liaison with religious faith: the thought of the ancient world developed its Jewish as well as its Christian and Islamic versions. In the modern period, the philosophy of German idealism exercised a profound influence on Jewish religious thinkers.

Jewish mysticism and the Cabala (*q.v.*) are historically linked with the philosophical trend in Jewry. On the whole, however, theosophical speculation falls outside the scope of Jewish philosophy proper: it does not follow the rational standards applied in philosophy and belongs to a tradition of its own.

ORIGINS

Jewish philosophy takes its rise among the Greek-speaking Jews of the Diaspora in the Egypt of the Ptolemies. The four fragments of Aristobulus (fl. *c.* 160 B.C.), dealing with the interpretation of the Mosaic law, show some Pythagorean influence and use allegory to explain the anthropomorphic descriptions of God in the Bible; and allegory is also used to interpret Jewish ritual and dietary laws in the *Letter of Aristeas* (*c.* 100 B.C.), an obviously missionary work that purports to be an eyewitness account of the events leading up to the translation of the Bible into Greek (*Septuagint*). This use of allegory follows the example of Greek philosophers who employed it in order to "save" the Homeric descriptions of the gods; and the excessive application of it by certain Jewish extremists is condemned by Philo.

The *Wisdom of Solomon* (written at some time between 200 B.C. and A.D. 100) follows in the tradition of the Palestinian Hebrew "Wisdom literature," but reflects a decidedly Hellenistic outlook and seems to have some affinities with the thoughts of the Essenes, who themselves were influenced by Hellenistic syncretism, notably by Pythagoreanism (the author's knowledge of Greek philosophy may have been drawn from Poseidonius' *Protrepticus*). Its aim is both apologetic and missionary: the wisdom of the Greeks is already contained in Solomon's. The enumeration of the attributes of the cosmic Wisdom as "a clear effulgence of the glory of the Almighty" suggests a cosmological theory of emanation and foreshadows Philo's Logos doctrine; it combines Platonic and Stoic elements. The cosmopolitan ethics of Stoicism also pervades the *Fourth Book of Maccabees*, which discourses on the rule of reason over the passions and is notable for its use of the expression "pious reason" to denote "reasoning which follows the rules of piety" and also "reasoning for the sake of piety."

Hellenistic-Jewish philosophy culminates in Philo (*q.v.*) of Alexandria (Philo Judaeus). Philo is strongly influenced by Poseidonius (1st century B.C.), who revived Platonism in the later Stoa: God is both transcendent and immanent, "fills all things; contains but is not contained," "is everywhere and nowhere," "is at the same time close to us and far from us." God is "better than the

Good, purer than the One and more primordial than the monad." His essence is unknowable, and the only valid statement about Him is "*that* He is, not *what* He is." Philo's negative theology probably goes back to a passage in Plato's *Parmenides* (142 A) which the Neopythagoreans and Neoplatonists understood to refer to the supreme God. The most celebrated of Philo's notions is that of the Logos, which combines the features of the Stoic all-pervading reason and of the Platonic ideas. "The intelligible world [*i.e.*, the ideas] is the divine mind in the act of creation." The concept of the Logos also re-echoes such biblical notions as those of "angel," "wisdom" and the "Word of God" by which the world was made. In Philo, the Platonic *eros*, the "winged and heavenly yearning" for the "form of the good," is blended with the biblical "love of God": we have to learn to live in the soul alone, to migrate from body, sense and even speech in order to find God in the peace of our mind.

Philonic influence is clearly attested in Christian patristic literature, and the preservation of his writings is due to the Fathers of the Church. Yet it would be wrong to assume that no traces of Philo are left in the Jewish tradition. A number of Philonic motifs occur in Talmudic and Midrashic sources. The Karaites (Qaraites) of the 9th century in Jerusalem had access to the books of the Maghariya ("People of the Cave"), among which were the writings of "the Alexandrian" (namely Philo); and Benjamin Nahawandi's doctrine that the world was created through the intermediacy of an angel may be said to re-echo Philo's concept of the Logos. It may have been through the Karaites that Philonic teachings reached the medieval Jewish Neoplatonists, but it is safer to suppose that it was by way of patristic influence on the Islamic *kalam* (*see* below): thus the writings of St. John of Damascus embody a great deal of Philonic teaching.

THE MEDIEVAL PERIOD

For nine centuries, from Philo to Saadia, Jewish philosophic activity ceased. Alexandrian Jewry had lost its creative impulse, and the rabbinic academies of Palestine and Babylonia, absorbed as they were in the study and expansion of Jewish sacred literature, felt little or no inclination toward philosophy. What there existed of speculative endeavour in the religious field was attracted to Gnostic thought, the influence of which is noticeable in the apocalyptic writings, in scattered Talmudic and Midrashic references and in the ecstatic hymnology of *Hekhaloth* mysticism and kindred tracts. The only systematic treatise of a quasi-philosophical character is the *Sefer Yesirah* ("Book of Creation"), written probably between the 3rd and 6th centuries A.D., which may represent a Jewish version of Proclus' *Elements of Theology*.

The Kalam Tradition.—The rise of medieval Jewish philosophy followed the revival of Greek philosophy under the Abbasid caliphs in the 9th century A.D., when the principal philosophical works of Greek antiquity were translated into Arabic. This "hellenization of Islam," however, had been prepared by Syriac versions of Greek texts made by Nestorian and Jacobite theologians in the 6th–8th centuries; and meanwhile the influence of Christian theologians, notably John of Damascus, on the formation of the Islamic *kalam* (speculative theology) had also been considerable. We find the Islamic *mutakallimun* ("dialecticians"; in Hebrew, *medabberim;* in Latin, *loquentes*) discussing the divine attributes, the eternity of the Koran (corresponding to that of the Logos), free will, etc. Jewish theologians in Egypt and in Iraq were attracted by the writings of the rational Mu'tazilite theologians who, from *c.* A.D. 723, were emphasizing the unity and justice of God. The Mu'tazilites adopted a great deal of Stoic teaching and were familiar with Aristotle's *Categories;* but their metaphysical notions were chiefly based on Democritean or Epicurean atomism and were expressed in a theology of continuous creation. This latter view is not shared by the Jewish theologians.

The Jewish variant of *kalam* represents the earliest phase in medieval Jewish philosophy (preceded only by the solitary figure of Isaac Israeli, the 10th-century Neoplatonist). David ben Marwan al-Mokammes (10th century), the author of the *Ishrun Makalat* ("Twenty Chapters"), discusses the attributes of God in the manner of the Arabic *kalam* but reaches in the end a Neoplatonic outlook. His younger contemporary, Saadia (882–942), a native of the Egyptian Fayyum who became gaon (head) of the rabbinic academy of Sura in Iraq, was brilliant in many fields of scholarship. As a grammarian and lexicographer, as a translator of the Bible into Arabic and as a commentator, he helped to break fresh ground and has been hailed as "the first spokesman in all matters" (*i.e.*, of the faith). His most important work, *Kitab al-'Amanat w'al-I'tikadat* ("Book of Doctrines and Beliefs"), is modeled on the Mu'tazilite *kalam* but far surpasses it in the sovereign manner in which the author replaces its atomism by Aristotelian notions and in the originality with which he deals with the problem of faith and reason. In contrast to patristic teaching, for which philosophy is the mere "handmaid of theology," Saadia assigns to divine revelation a merely pedagogical, preparatory function and regards it as a religious duty to verify its truths by way of rational inquiry. In discussing the rational basis of Jewish law and ritual he draws both on the *kalam* concept of natural religion (*fitra*), which derives from the Stoics, and on Plato's ethics. In his *Commentary on Sefer Yesirah* (ed. and trans. by M. Lambert, Paris, 1891) he introduces the notion of the creative Word of God, which he describes as a vital breath or "second air," serving also as the medium of revelation.

The influence of *kalam* also pervades the theology of Samuel ben Hofni (d. 1034), another gaon of Sura, who offers a rationalistic interpretation of the Bible and combats the belief in magic and astrology. Other followers of *kalam* among rabbinic circles were Nissim ben Jacob of Kairwan (10th–11th century) and Hai Gaon (d. 1038), head of the academy of Pumbeditha (Iraq). Among the Karaite (scripturalist, anti-rabbinic) theologians, *kalam* doctrines are even more pronounced: Joseph ben Abraham al-Basir and his disciple Joshua ben Judah (11th century), for their doctrine of the divine attributes, use the concept of *hal* ("mode"; *i.e.*, an attribute not distinguishable from the essence), which goes back to Abu Hashim, the Mu'tazilite teacher at Basra. The doctrines of *kalam*, moreover, remained in vogue among the Karaites long after they had been replaced in rabbinic Judaism by Neoplatonic and Aristotelian trends: according to Aaron ben Elijah of Nicomedia, whose *'Es Hayyim* ("Tree of Life") was written in Hebrew in 1346, the teachings of *kalam* are essentially of Jewish origin, while Aristotelianism represents a pagan philosophy.

The Jewish Neoplatonists.—In marked contrast to the dry rationalism of *kalam*, the Neoplatonic phase of medieval Jewish philosophy is characterized by the strong mystical bent and by the ascetic frame of mind prevalent in earlier Neoplatonism. Compilations from Plotinus' *Enneads* were current in 10th-century Baghdad, and excerpts from the last three books of that work were known from the so-called *Theology of Aristotle* (extant in two Arabic recensions). Other classical works of Neoplatonism known to the Arabs were Proclus' *Elements of Theology*, of which there was a translation by Abu 'Uthman Sa'id al-Dimashki and from which excerpts had been taken to form the famous *Liber de causis* (extant also in Arabic); Porphyry's *Sententiae;* and above all, the Alexandrian commentaries on Aristotle or compilations of them. Furthermore the works of al-Kindi and the "writings" of the Brethren of Purity (*q.v.*) contain a great deal of Neoplatonic philosophy; and variants of Neoplatonic doctrine are also found in pseudo-Empedoclean writings such as the *Book of the Five Substances*. The influence of Neoplatonic pseudepigrapha on medieval Jewish Neoplatonism is pronounced.

Isaac ben Solomon Israeli (*q.v.; c.* 850–950), court physician at Kairwan and famous chiefly as a medical writer, initiates the era of Jewish Neoplatonism. His philosophical works are based on al-Kindi and on a pseudo-Aristotelian work describing the series of emanations from the supernal Wisdom down to the composite beings of the sublunary world. Israeli was the first to link the tenets of Neoplatonism, especially its notion of the ascent of the soul to the upper world, with biblical theology. His concepts of purification, illumination and union with the supernal Wisdom derive in the main from Proclus. Some of his notions, especially those concerning the nature of prophecy, reappear in the *Commentary on Sefer Yesirah* by his pupil Dunash ibn Tamim; and his influence is also noticeable in other Jewish Neoplatonists, for ex-

ample Joseph ibn Saddik (d. 1149), whose *'Olam Katan* ("Microcosm") blends *kalam* with Neoplatonism, and Moses ibn Ezra (*c.* 1060–1139).

The greatest figure among the Jewish Neoplatonists of Spain is Solomon ibn Gabirol (*q.v.*), the 11th-century poet and philosopher known to the Latin schoolmen as Avencebrol. His chief work, *Fons vitae* ("The Fountain of Life"), is designed to teach man how to achieve freedom from death and the attainment of union with God. Its metaphysical scheme is in many ways similar to Isaac Israeli's but differs in its emphasis on the role of the will of God as the source of all form (a concept which seems to derive from pseudo-Empedoclean sources). Ibn Gabirol's philosophy is cast in poetical form in his magnificent hymn, *Keter Malkhut* ("The Royal Crown").

Another 11th-century philosopher, Bahya ibn Pakuda, wrote his *Kitab al-Hidaya ila Fara'id al-Qulub* ("Book of the Introduction to the Duties of the Heart"; in Hebrew *Sefer Hobot ha-Lebabot*) as a manual of the inner life. The "duties of the heart," in the terminology of the Mu'tazilites, are moral and spiritual commandments as distinct from mere outward observance. Bahya's doctrine is steeped in the ethos of Neoplatonic and Sufi asceticism but also reflects the more homely type of traditional Jewish piety, and his book has become a classic of Jewish moralist literature. The treatise *Kitab ma'ani al-Nafs* ("On the Soul"), falsely attributed to Bahya, is a popular version of Neoplatonic metaphysics and psychology, presented as identical with the Jewish doctrine.

Abraham bar Hiyya of Barcelona (fl. *c.* 1130), a mathematician and an astronomer, is the first medieval Jewish philosopher to write in Hebrew. His *Hegyon ha-Nefesh* ("Meditation of the Soul"), though adopting the Neoplatonic doctrine of the soul's ascent, introduces a more Aristotelian metaphysic by stressing the dualism of matter and form. In his *Megillat ha-Megalleh* ("The Scroll of the Revealer") he outlines a metaphysical doctrine in which the Neoplatonic triad of intellect, soul and nature is enlarged by the superimposition of two more stages, namely the worlds of "light" and of "dominion." The principal aim of this treatise is, however, the "revelation" of the date and the events of the messianic future. His interest in history, something alien to the spirit of Neoplatonism, is inspired by Christian eschatological speculation and in particular by the work of Isidore of Seville. His philosophy of history proceeds from the idea that the periods of the world correspond to the six days of creation—a concept which was later to be developed, again under Christian influence (Joachim of Floris), in the 13th-century cabalistic *Sefer ha-Temunah* ("Book of the Image").

Abraham ibn Ezra (*q.v.*; Abenezra; *c.* 1092–1167) introduces a pantheistic Neoplatonism into his commentaries on the Bible: "God is the One; He is the Former of All, and He is All."

Medieval Jewish Neoplatonism had a considerable share in the rise of the Cabala. 'Azriel of Gerona, a prominent member of the circle of Jewish mystics in Spain, quotes the pseudo-Aristotelian treatise which furnished Isaac Israeli with his metaphysical scheme and finds only a difference in terminology between it and the doctrines of Cabala. Abraham bar Hiyya's teachings were also largely employed by the Cabalists. Though closely akin to Neoplatonism, the doctrine of Judah ben Samuel Halevi (*q.v.*; *c.* 1085–*c.* 1140), poet and philosopher of Toledo, must be regarded as *sui generis*. His *Book of Argument and Proof in Defense of the Maligned Religion* (in Hebrew commonly known as *Sefer ha-Kuzari*), written as a dialogue between a Jewish theologian and the king of the Khazars, offers an incisive criticism of current Aristotelian doctrines and was no doubt inspired by the work of the great Islamic theologian and mystic al-Ghazali.

The Aristotelian Revival: Maimonides.—From about the middle of the 12th century, Jewish philosophy took a turn toward a stricter form of Aristotelianism, following the lead given by the Islamic philosophers al-Farabi, Avicenna and Averroes. The new trend found its first literary expression in the treatise *Ha-Emunah he-Ramah* ("The Sublime Faith"), written by Abraham ibn Daud (Rabed I) in 1161. It contains a spirited attack on Ibn Gabirol's Neoplatonic doctrine of universal matter and form. Ibn Daud's treatise, however, was soon eclipsed by the famous *Guide for the Perplexed* (*Dalalat al-Ha'irin*; in Hebrew, *Moreh Nebukhim*) of Moses Maimonides (*q.v.*; 1135–1204). This, the most important work of medieval Jewish philosophy, exercised a profound influence on all subsequent Jewish thought and, through Latin translations, on Christian scholasticism as well. It shares neither the arid rationalism of *kalam*, whose principles it closely analyzes and refutes, nor the mystical faith of the earlier Neoplatonists, although it retains, in a modified way, some of their metaphysical notions (emanation and the doctrine of negative theology) and their contemplative ethos. Instead it defines the separate provinces of demonstrable and revelational truths. It breaks new ground in theology by its treatment of the divine attributes; in cosmology by joining issue with Aristotle's theory of the eternity of the world; and in the interpretation of Jewish law and ritual by evolving the viewpoint of comparative religion.

The Averroists.—Maimonides was a younger contemporary of Averroes but was unacquainted with the works of this most radical of the Islamic Aristotelians at the time when he wrote the *Guide*. During the subsequent phase of medieval Jewish philosophy, however, Averroes comes increasingly to the fore. His numerous writings were almost all translated into Hebrew, and many commentaries were written on them by Jews. Samuel ibn Tibbon, whose Hebrew rendering of the *Guide* had been approved by Maimonides, translated also some of Averroes' works and made use of them in his biblical exegesis. His son-in-law Jacob Anatoli, author of the homiletical *Malmad ha-Talmidim* ("Instruction of the Disciples"), translated Averroes' "middle commentary" on several of Aristotle's logical works. Shemtob ibn Falaquera (d. *c.* 1295), a prolific writer with strong Neoplatonic tendencies, follows Averroes in an encyclopaedic work and quotes his views constantly in his *Moreh ha-Moreh* ("The Guide of the Guide"), a commentary on Maimonides' work. Joseph ben Jacob Kaspi (1279–*c.* 1340), another commentator of Maimonides, also betrays the influence of Averroes. In Italy, Hillel ben Samuel (d. *c.* 1291) seeks to refute Averroes' denial of the survival of the individual soul in his *Tagmule ha-Nefesh* ("Reward of the Soul").

The most extreme form of Averroism in medieval Jewish philosophy is represented by Isaac Albalag's notes appended to his translation of al-Ghazali's *Aims of the Philosophers*, where the doctrine of "double truth" is propounded: the truth of the Scriptures may contradict the truth of philosophy, and it is futile to attempt to reconcile the two. In spite of his radical rationalism, Albalag believes in an intuitive knowledge superior to discursive thinking and contained in prophecy yet impenetrable to exegetical speculation; hence the revealed law (*Torah*) cannot serve as a guide to solving the problems of metaphysics. An interesting parallel to Albalag's attitude is presented by the philosophizing Cabalists of the 14th century, who were faced with the more complicated problem of reconciling not only philosophy and the Scriptures but also philosophy and Cabala (and astrology as well). This task was attempted by Joseph ben Abraham ibn Wakar of Toledo and by Judah ben Nissim ibn Malka of Fès. Ibn Wakar assigns to each domain a validity of its own but, while he insists on the superiority of Cabala, he does so at the price of adjusting it to the truths of philosophy. A similar position is taken up by Ibn Malka. Moses ha-Kohen ibn Crispin provides an extreme example to the tendency to distinguish revealed truth from metaphysics and astrology.

The outstanding Jewish Averroist of the period is Gersonides (*q.v.*; 1288–*c.* 1344), philosopher, astronomer, mathematician and commentator on the Bible. In his *Milhamot Adonai* ("The Wars of the Lord") he discusses the immortality of the soul, dreams, magic and prophecy, the attributes of God, divine providence, the celestial bodies and the prime mover, creation and miracles. In contrast to Maimonides, he affirms the positive attributes of God and the existence of prime matter as the substratum of creation. God, he teaches, has no knowledge of the individual as such but only knowledge of the universal order of things. Gersonides evolves his position in scholastic fashion by subjecting all opinions held on the matters under discussion to a searching scrutiny. Himself a commentator of several of Averroes' writings, he adopts in most cases the latter's strict Aristotelianism and thus arrives

at a philosophy which does little justice to the intrinsic character of Judaism.

Crescas.—The work of Gersonides was made the target of attack by Hasdai Crescas (*q.v.*; 1340–1410), whose *Or Adonai* ("The Light of the Lord"), one of the profoundest books in medieval Jewish philosophy, contends that Gersonides had only increased the problems that he had set out to solve. Crescas' critique of Gersonides resembles, in a way, Judah Halevi's and al-Ghazali's refutations of Aristotelianism but is less radical in its attitude to philosophy as such. It opposes the Aristotelian notion of God as pure self-thinking and stresses the love of God as the supreme divine attribute: the highest aim of man is communion with God through love, not through the exercise of the intellect; and this can be achieved only by following the way of the revealed law. Crescas combines his theology with a concept of providence that implies a strict determinism: God has a foreknowledge of events by knowing the possible not only as possible but as the inevitable result of human choice, which is itself determined by the law of causality. Crescas' devastating criticism of the "26 Propositions" (*Guide*, ii, introduction) in which Maimonides had expressed the traditional system of Aristotelian physics anticipates the new cosmology of the Renaissance.

The End of the Middle Ages.—In Crescas, medieval Jewish philosophy reaches its climax and turning point. His successors in the field more or less continue the Aristotelian tradition. Simon ben Zemah Duran (1361–1444), in his *Magen Aboth* ("The Shield of the Fathers"), reverts essentially to the position of Maimonides. His importance lies in the fact that, continuing Maimonides' discussion of the principles of the Jewish faith, he lays down three essential dogmas: God's existence, revelation and retribution. Joseph Albo (d. 1444), a pupil of Crescas, tried to harmonize Crescas with Maimonides; his *Ikkarim* ("Principles") is a classic of Jewish dogmatics. Abraham ben Shemtob Bibago (15th century) wrote not only commentaries on Aristotle but also the *Derekh Emunah* ("Path of Faith"), which deals with theology, psychology and dogmatics from the viewpoint of Maimonides without showing any trace of Crescas' influence. Isaac Abrabanel (1437–1508), statesman, philosopher and biblical commentator, the last Jewish thinker on Spanish soil (whence he was expelled with his co-religionists in 1492), likewise clings to the teachings of Maimonides, on whose *Guide* he wrote an elaborate commentary.

In Italy, where some of the Spanish exiles had found refuge and where interest in philosophy had been alive among the Jews since the 13th century, Jewish philosophy was temporarily renovated. Judah Messer Leon, though still within the Aristotelian orbit and largely dependent on Christian scholasticism (notably on Walter Burleigh), is already drawn toward the new humanism, in the spirit of which he wrote on rhetoric. Elijah Delmedigo (1460–97) taught Pico della Mirandola and lectured at the university of Padua, the centre of Christian Averroism. His *Behinat ha-Dat* ("Examination of Religion") reflects the influence of the doctrine of the "double truth" but is careful not to deny the possibility of the philosophical interpretation of religion. In Isaac Abrabanel's son Judah, called León Hebreo (*c.* 1460–1521), contact with the Florentine academy produced the only Jewish Renaissance philosophy worthy of the name: his *Dialoghi di amore* was the most successful work of the period. Its grandiose conception of the universe as an organism animated by love and exhibiting both truth and beauty provides the epilogue to more than 600 years of medieval Jewish philosophy.

ARISTOTELIANISM IN MEDIEVAL JEWISH PHILOSOPHY

All medieval Jewish philosophy reflects the influence of Aristotle; and the study of Aristotle's works eventually dominated the philosophical pursuits of medieval Jewry in Spain, in northern France and in Italy. Aristotle is as a rule referred to as "the philosopher" par excellence. Maimonides calls him "the chief philosopher" and states that "he reached the highest degree of intellectual perfection open to man, being short only of the still higher degree of the divine gift of prophecy." Gersonides speaks in similar terms. The works of Aristotle were included in the school curriculum; and in certain families it became a tradition to specialize in his works and in those of his commentator Averroes. Some knew as much of Aristotle as of the Bible or of the Talmud.

Logic.—Aristotle's logical writings, collectively known as the *Organon*, were studied in the Arabic version as early as the 10th century. Saadia was familiar with the *Categories* and used them for his treatment of the divine attributes. Isaac Israeli's *Book of Definitions* shows that he knew Aristotle's four types of inquiry (whether, what, how and why) through al-Kindi. Ibn Gabirol applies these four questions severally to the various levels of being and asserts that, in the case of God, only the question "whether" He exists is admissible. Maimonides' *Treatise on Logic* represents the first attempt in Jewish philosophy to abridge the entire *Organon* within a unified conspectus (together with the *Rhetoric* and the *Poetics*). Maimonides here adopts Porphyry's notion of the five predicables, which, moreover, in his *Guide* (i, 51–52) he combines with the ten categories in order to present a comprehensive list of possible "attributes": he makes the point that in the case of God only attributes denoting "action" are admissible. Another attempt to present the *Organon* in a concise form was made by Elijah ben Eliezer of Crete (15th century) in his *Book of Logic in Questions and Answers*. Gersonides, in his *Book of Correct Syllogisms*, sought to improve Aristotle's and Averroes' methods in certain respects.

Theory of Knowledge.—The *Organon* introduced into Judaism the concept of scientific knowledge (*episteme*): to "know" was to know scientifically. The biblical "knowledge of God" (*da'at Elohim*) thus came to be interpreted as rational theology capable of furnishing demonstrative proofs for the tenets of faith; and faith itself tended to become identified with scientific knowledge. Aristotle had spoken of faith accompanying, in varying degree, the act of knowledge (scientific knowledge being faith in its strongest sense), so that knowledge was "a particular kind of faith." Hence the Islamic schools of *kalam* could feel in accord with Aristotle when they defined knowledge as faith (*i'tiqad*). Saadia's definition of faith reflects the same outlook, which is found next in Neoplatonists such as Bahya ibn Pakudah and eventually in philosophers of the Aristotelian revival. When Bahya and Maimonides speak disparagingly of faith in the sense of mere reliance on tradition, they imply an interpretation of faith at variance with the biblical concept of faith as trust and surrender to God. Only with the onset of radical Averroism did the identification of faith and scientific knowledge lose its hold on the Jewish philosophical mind.

Natural Philosophy.—Aristotle's natural philosophy exercised considerable influence already on the Islamic *kalam*, especially through the *Commentary on the Physics* by John Philoponus. Saadia's four proofs for creation are borrowed from *kalam* and follow the Aristotelian line as interpreted by Philoponus. Maimonides' emphatic rejection of the *kalam* propositions (*Guide*, i, 73) cleared the way for a more thorough adoption of Aristotelian principles; and the propositions on which Maimonides bases his arguments for the existence of God (*Guide*, ii, introduction) follow Aristotle's example. Averroes' treatment of Aristotle's *Physics* was made the subject of commentaries by a number of Jewish writers. This applies in particular to his "middle commentary" on the *Physics*, on which in turn Gersonides, Moses of Narbonne, Isaac ben Shemtob and Shemtob ben Joseph wrote commentaries and which was twice translated into Hebrew. Moses of Narbonne and Abraham Bibago also wrote commentaries of their own on the *Physics*.

Aristotle had defined nature as "the principle and cause by which a thing rests and moves essentially, not accidentally" (*Physics*, ii, 1); in other words, nature is the formative principle of organic growth. As an immanent principle, inherent in living beings, it seems to render superfluous any transcendent divine principle; Aristotle, indeed, actually identified God and nature (*De Caelo*, i, 4). The operations of nature could thus be equated with divine providence. As this view appeared to run counter to the religious faith in a personal God exercising individual providence and capable of producing miracles, it is not surprising that both orthodox Islamic *kalam* and Jewish traditionalists opposed

the notion of a "wise nature" seemingly independent of God.

The Jewish Aristotelians, however, following in the footsteps of the later Arabic philosophers, accepted the Aristotelian concept of nature. They saw in the regularity of natural happenings evidence of the unchanging nature of things and regarded the universals as subsisting in the mind of God. Nature meant to them the expression of the will and/or wisdom of God. Maimonides speaks of nature as the totality of generic forces which govern the universe and provide for the protection of life and adds: "It may be that by nature the divine will is meant" (*Guide*, ii, 10). There is, obviously, an unresolved tension in Maimonides' view of nature, which he conceives as denoting both the force of the universe and God's will; and this dual aspect is characteristic of the whole of medieval Jewish philosophy.

Maimonides identifies the biblical concept of "angels" with the "natural forces" by means of which God rules the world (*Guide*, ii, 6). Nature is held to be obedient to God, and miracles are therefore considered possible, though the tendency is to explain them in a natural way. Individual providence, which Aristotle was understood to deny (*cf.* the pseudo-Aristotelian *De Mundo*), was affirmed by Maimonides and interpreted on an astrological basis by Gersonides.

Psychology.—Aristotle's psychology, again, was widely studied in medieval Jewish philosophy. The *De Anima* was extant in an Arabic translation from which, *c.* 1284, Zerahyah ben Isaac made a Hebrew rendering. The famous Aristotelian definition of the soul as "the entelechy of a natural organic body" (*De Anima*, ii, 1) is quoted already by Saadia and by Isaac Israeli. Temporarily eclipsed by Plotinian influences in Neoplatonic writers such as Ibn Gabirol, Aristotle's psychology makes its full impact for the first time in Abraham ibn Daud's discussion of the soul. Following Avicenna's *Kitab al-Najat*, Ibn Daud adopts the distinction between the vegetative, animal and rational soul and also distinguishes between the internal and external senses. He moreover assigns to the rational soul a practical and a theoretical faculty and explains the processes by which it acquires knowledge, thus merging psychology into epistemology. The division of the soul according to its functions remains the standard doctrine in both Islamic and Jewish medieval philosophy. It also furnishes the basis for the elaboration of theories on the nature of prophecy.

A more controversial aspect of psychology concerns the relationship between body and soul and the allied question of the soul's immortality. The medieval controversy on this topic reflects an earlier difference between Greek commentators of Aristotle. Alexander of Aphrodisias (*q.v.*) had described the soul as being a mere form of the organic body and as perishing with the body. He meant this to apply to all parts of the soul, including the rational soul, to which substantiality was denied; the "active intellect," which Aristotle had described as immortal, represented in Alexander's view the divine intellect. Themistius, on the other hand, had radically separated the rational soul from the vegetative and animal souls and held it to be an immortal, pre-existent and immaterial substance. The Jewish medieval discussion was focused on this difference between Alexander and Themistius, but was also largely concerned with the novel interpretation of Aristotle's doctrine that Averroes had advanced in a number of writings (all of which came to be translated into Hebrew). Averroes adopts Alexander's concept of the active intellect as a cosmic, divine intellect but regards the passive intellect not as belonging to the individual soul but as being an aspect of the active intellect; viz., as the active intellect "in conjunction with" the human soul. Even so, the corollary of this doctrine is the denial of individual immortality. Maimonides, as has been said, was unacquainted with Averroes' theory. As Avicenna had done, he adopted Alexander of Aphrodisias' distinction between the active and the passive intellect together with al-Farabi's concept of "acquired intellect" as the final stage of intellectual development at which the rational soul becomes substantial and immortal. Shemtob ibn Falaquera ignores Averroes' doctrine in his treatise *On the Soul*, but bases himself on Averroes in another work. Hillel ben Samuel of Verona's *Tagmule ha-Nefesh* combats Averroes' view, following the lead of Thomas Aquinas. Moses of Narbonne reviews the problem in connection with his discussion of Maimonides' doctrine of the unity of the knower, the knowing and the known (*Guide*, i, 68). Gersonides offers the most incisive analysis of the conflicting views and finally reverts to the theory of Alexander of Aphrodisias with the modifications introduced by al-Farabi and by Avicenna.

Metaphysics.—Of all Aristotelian writings the *Metaphysics* claimed pride of place in the estimation of medieval Jewish philosophers. It was commonly held to represent the "ripe fruit" of Aristotle's philosophy; and book xii in particular was regarded as embodying the essence of his thought. Yet no Hebrew version of the *Metaphysics* existed until *c.* 1485, when Barukh ibn Ya'ish produced one from a Latin translation. The work was, however, accessible in Arabic, as also were Alexander of Aphrodisias' *Commentary* (covering the first two chapters of book xii) and Themistius' *Paraphrase* (covering the whole work). Maimonides knew Alexander's *Commentary* and seems also to have read Themistius' *Paraphrase*. Other Hebrew translations from the Arabic include one of al-Farabi's *Treatise on the Tendencies of Aristotle's Metaphysics;* one of Averroes' *Epitome of the Metaphysics* (by Moses Tibbon); and two of Averroes' "middle commentary" on the *Metaphysics* (the first by Isaac She'altiel Hen of Barcelona in 1284, the second by Kalonymus ben Kalonymus of Arles in 1313–17). Both Gersonides and Abraham Bibago based their own commentaries on Aristotle's *Metaphysics* on Averroes' "middle commentary."

Aristotle's concept of matter and form plays a dominant part both in the Neoplatonic and in the more strictly Aristotelian phase of Jewish philosophy. Following Plotinus, the Jewish Neoplatonists consider matter and form to be the constitutive elements not only of corporeal but also of noncorporeal beings: Ibn Gabirol assumes that a universal matter and universal form underlie all beings (including the intelligences or angels) except God; and this view is shared by Bahya ibn Paquda, by Abraham ibn Ezra and also by Judah Halevi. The Jewish Aristotelians, however, oppose this view. For a survey of the controversy *see* Isaac Abrabanel's commentary on I Kings, 2. Maimonides employs the concept of matter and form in a strictly Aristotelian fashion.

In Aristotle, the concept of matter and form served the purpose of explaining the fact of becoming: all change presupposes a substratum that remains identical. This ontological view entails the assumption of an eternal matter (*prima materia*) that becomes endowed with form. God, for Aristotle, is not the creator of prime matter, since pure actuality and form (God) cannot be regarded as the origin of pure potentiality (matter). The medieval Jewish Aristotelians were faced here with a serious difficulty: the ontological framework of matter and form seemed to imply a cosmology incompatible with the notion of God as the creator of the world "out of nothing." Maimonides, like Abraham ibn Daud before him, did not pursue the Aristotelian ontology to its cosmological conclusions but assumed God to be the creator of matter as well; he drew a line between the act of creation and the ontological character of the created world. Gersonides, however, reverted to the strictly Aristotelian position: he argues that God could have created the world only from a material substratum capable of receiving form; that, since God is the form of forms, creation cannot be "out of nothing"; that the world is created out of a matter devoid of all form; but that this prime matter is no rival to God, since its eternity constitutes no pre-eminence, whereas God is God not because He is eternal but because He is the highest principle, the giver of all form. The problem of creation continued to attract a great deal of discussion in medieval Jewish philosophy until its very end. Abraham Bibago mentions a treatise of his own called *Es Hayyim* in which he sought to uphold the concept of creation "out of nothing" against Aristotle and Averroes. Isaac Abrabanel's *Mif'alot Elohim* ("Works of God") is devoted to the same purpose.

The Jewish concept of creation was likewise opposed to the doctrine of the eternity of the world. Aristotle saw in the order of things something existing of necessity and from eternity, and this view clashed with the biblical idea of the world's having been created by the free will of God "in time." Maimonides therefore made a strenuous effort to uphold the concept of creation

against Aristotle, al-Farabi and Avicenna: the world, he argues, exhibits not only rational necessity but also traces of a free, creative will, particularly in the motions of the stars, which present phenomena inexplicable by reference to causal necessity. The postulation of a divine will responsible for creation in time raised, however, a perplexing problem. What moved God to create after an eternity of inactivity? Does creation in time not imply a transition in God from potentiality to actuality, which is inadmissible in the case of God who is pure actuality? Whereas the Islamic philosophers yielded to the force of this argument (discussed first in John Philoponus' *De Aeternitate mundi*), Jewish thinkers, with the exception of Hasdai Crescas, maintain the concept of creation in time and advance three counterarguments: (1) no change is implied in God's will to create, as it has its determinant cause in itself and is not motivated by anything external to it, so that to act at one time and not to act at another does not affect God's unchanging actuality (only beings composed of matter and form can pass from potentiality to actuality); (2) the problem is devoid of meaning, as there is no "before" or "after" in the eternity of God's existence, to which time does not apply; and (3) God willed eternally to create but not to create eternally. The question, however, continued to trouble medieval Jewish philosophers (*cf.* Gersonides, *Milhamot*, vi, 1, 18) and was pondered also in Jewish mystical writings.

Of great importance for medieval Jewish philosophy was the interpretation which al-Farabi and Avicenna had given to the Aristotelian concepts of essence and existence. According to Aristotle essence as such "is" and is "one." Al-Farabi and Avicenna affirmed that existence was an accident of essence. Avicenna's view was understood to be that essences, being universals, "are" in the mind of God and come to exist by having existence conferred upon them, so that essence and existence must be distinguished in all beings except God ("the necessary existent," in whom essence and existence are one). Averroes severely criticized this non-Aristotelian separation of essence and existence. Avicenna's doctrine gained some currency amongst Jewish Neoplatonists and was also echoed by Maimonides, but later philosophers mostly shared Averroes' view.

The question whether Aristotle's prime mover is identical with God (the first cause) had been raised by the Greek commentators of Aristotle and was widely debated in Islamic philosophy: al-Farabi and Avicenna followed Alexander of Aphrodisias in holding God to be above the mover of the first sphere; Averroes followed Themistius in identifying the prime mover with the first cause. Maimonides (*Guide*, ii, 4) rejected the identification of the necessary existent with the prime mover, but his view was attacked by Moses of Narbonne and by Shemtob ben Joseph. Gersonides, however, reverted to Avicenna's and Maimonides' position (*Milhamot*, v, 3, 11). Moses ben Joseph ha-Lawi devoted a whole treatise to the problem and re-affirmed Avicenna's view. Hasdai Crescas (*Or Adonai*, iv, 12) added a note of his own to the discussion, which was reproduced by Albo (*Ikkarim*, iii, 3). The whole matter is finally reviewed by Isaac Abrabanel in *'Ateret Zekenim* and in *Shamayim Hadashim*.

The Opposition to Aristotelianism.—Judah Halevi had already rejected Aristotelianism in the 12th century, stressing the difference between "the God of Abraham" and "the God of Aristotle." After the death of Maimonides, however, opposition became more articulate, and the conflict between philosophers and traditionalists fills the history of the Jews in Spain and in France during the 13th century. Within the Christian Church of the period, moreover, anti-Aristotelian sentiment was also very strong. Among the Jews, one of the fiercest antagonists of Aristotelianism was Solomon Petit, a Cabalist of northern France, toward the end of the 13th century. Other Jewish thinkers, such as Abba Mari ben Moses of Montpellier, readily acknowledged Aristotle's merit as "the father of philosophy" who had demonstrated the existence, unity and incorporeality of God and who could not be expected to believe in creation or in miracles as he had received no divine revelation; but they maintained that a Jewish philosopher who made him his guide in matters of religion deserved to be proscribed: Aristotle's teachings were "like a jar of honey about which a dragon is wrapped." Abba Mari was instrumental in drafting the ban pronounced in 1305 in Barcelona by Solomon ben Abraham Adret, prohibiting the study of Greek natural science and metaphysics before the age of 25.

In the course of the ensuing battle of ban and counterban, opposition to philosophy on the part of the traditionalists stiffened. Attacks on philosophy and on Aristotle in particular became more frequent as the Cabala gained in influence; and Aristotelianism did not achieve within Judaism the status that Roman Catholicism eventually accorded to it. Yet in many ways some of the key notions of Aristotelianism, such as matter and form, active and passive intellect, potentiality and actuality, retained their currency in Jewish thought. Above all, Aristotle remained an object of study among Jews by virtue of the fact that the classical works of medieval Jewish philosophy, notably Maimonides' *Guide*, never ceased to attract students interested in a rational approach to Judaism.

MODERN JEWISH PHILOSOPHY

Modern Jewish philosophy reflects the fundamental changes in outlook characteristic of the period from Descartes onward. It no longer seeks to harmonize revelation and reason as two distinct bodies of truth, but tries to delineate the significance of religion within the general framework of human reason or, later, as a basic attitude toward the situation in which man finds himself.

Moses Mendelssohn.—In Moses Mendelssohn (1729–86), the new philosophical approach is inspired by the intellectual climate of the German *Aufklärung*, of which he was a distinguished representative: he bases his Jewish philosophy on Leibniz's distinction between truths of fact and truths of reason. For him the source of religious truth is not historical revelation, but the "natural light" of human reason: the basic affirmations of religion—the existence of a personal God and the immortality of the human soul—are universal truths on account of their "reasonableness"; manifest at all times, they do not depend on historical revelation. Following a suggestion made by Spinoza, he restricts the significance of historical revelation to the realms of practical morality and of religious law: Judaism is not a revealed religion but a revealed law. Judaism thus shrinks to a body of divinely ordained legislation but at the same time expands into a universal religion of reason.

Kantianism and the 19th-Century Idealists.—The rise of Kantianism accentuated the division between the theoretical and practical spheres which Mendelssohn had accepted. The destruction of rational theology, cosmology and psychology which Kant accomplished made religion wholly dependent on moral philosophy and turned it into an expression of practical reason. Kant's moral and religious philosophy proved exceedingly attractive to Jewish thinkers of the period. Moritz Lazarus (1824–1903), the founder of comparative psychology in its anthropological aspect, interpreted Judaism as a system of autonomous ethics in the light of Kant's categorical imperative. Hermann Cohen (1842–1918), the originator of the Marburg school of neo-Kantianism, evolved a Jewish religious philosophy from the premisses of his own system. Against Hegel, who had made ethics a part of his panlogistic metaphysics, Cohen emphasizes the essential difference between the moral and the ontological. He hailed Kant's division of the two spheres of nature and morality and upheld it with particular emphasis against Spinoza's assertion that the will and the understanding were the same. Cohen's spirited rejection of the monistic principle reflects the biblical consciousness of a holy God who transcends nature: God and nature must not be identified; and the Jewish concept of God's unity expresses the uniqueness and incomparability of God. The idea of God, however, is related to nature as well insofar as it both invests the moral sphere with the aspect of eternal value and guarantees the maintenance of the physical world as a realm for moral realization. Cohen thus gives the Messianic ideal of Judaism a philosophic expression: the idea of God creates the concept of human history as a field for the working-out of God's purpose which is the unification of all mankind under the law of morality. In *Die Religion der Vernunft aus den Quellen des Judentums* (Leipzig, 1919), recognizing that the

concepts of humanity and universal history are insufficient to give meaning to the individual existence of man, Cohen breaks the magic circle of his idealistic philosophy in founding the meaning of religion, not on the universal idea of morality, but on the personal "correlation" between God and the individual soul.

The idealist movements of the 19th century inspired Solomon Formstecher (1808–89) and Samuel Hirsch (1815–89) to recast the systems of Schelling and of Hegel respectively, in order to assess the true significance of Judaism within the dialectical process of history. Schelling, claiming that spirit and nature were expressive of each other and represented two equal aspects of the absolute, had arrived at a philosophy of pantheism; and Hegel, recognizing in nature a lower form of the self-realization of mind, had concluded all that is real is essentially reasonable and good. Formstecher and Hirsch reject these total or partial identifications and subordinate nature to mind. The spirit, they maintain, is, first and foremost, the self-consciousness of nature and is therefore capable of understanding nature and of artistic creation. But mind is also consciousness of itself, of free will and of the ethical ideal. Freedom is the essence of the spirit. Whereas pagan religion, embracing the aesthetic ideal, deifies nature and sees the destiny of man as apotheosis, Judaism, being the religion of the spirit, places God above nature and considers it the duty of man to become free like God but does not deify man. Judaism is superior to paganism inasmuch as the spirit is superior to nature. Revelation becomes, in terms of Hegelian dialectic, the awakening of the consciousness of the ideal: at the first stage—that of historical revelation—the ideal appears to be given from without, as something external (this is prophetic revelation and, as such, is an illusion); at the next stage prophetic teaching is embodied in Scripture and becomes part of a religious tradition; at the third and final stage the mind recognizes itself as the source of the ideal and embraces it as its own child. The old conflict between reason and revelation is thus dissolved not by logical harmonization but by the concept of historical development.

In radical opposition to this view, Solomon Steinheim (1789–1866) affirms that religious truth belongs to revelation only: the teachings of revelation are incompatible with and irreducible to reason; and the latter must sacrifice itself to give way to the former. His position recalls the impassioned stand made by Sören Kierkegaard against Hegel.

Existentialism.—Jewish philosophy from Mendelssohn to Cohen can be seen, on the whole, as a sustained effort to interpret Judaism as the religion of reason par excellence. In the 20th century Jewish philosophers abandon this position and turn toward an existentialist interpretation of religion, in protest no less against the idealistic identification of revelation and reason than against the medieval harmonization of religious and philosophic truths.

Franz Rosenzweig (1886–1929) in *Der Stern der Erlösung* (1921) and Martin Buber (1878–1965) in *I and Thou* (Eng. trans. by R. G. Smith, 1937) evolve a philosophy that seems to revert to the fundamental attitude implied in the prophetic consciousness. Not the formal truths of logic in their timeless, abstract essence, but the truths brought out in the relationships of human beings with God and with one another are the really vital and relevant ones. They are truths which spring from the presentness of time. Traditional philosophy with its stress on contemplation had made God into an object, an "it" to be known. The "new thinking" which Rosenzweig and Buber advocate is centred in the I-thou relationship, with its emphasis on response and action rather than contemplation. This existentialism is not an attempt to make man's existence the measure of all things (which might be a renewal of idealism in disguise): instead, it assumes the task of interpreting the relations between God, man and the world. These relations are brought out in full by the terms creation, revelation and redemption. God is as much alive as the gods of mythology; the world is complete in itself, as are the works of plastic art; and man, thrown back upon himself, is as stubbornly and willfully closed against God as the hero of the Greek tragedy. The importance of classical antiquity lies in the fact that it faithfully portrays the elementary situation of God, world and man. Here Rosenzweig sees the relative truth of paganism: it is truth in an elementary, unrevealing form, but it must not pretend to be the whole and complete truth. Only when God, the world and man enter into relationship with one another do they fully reveal themselves; as this revelation happens in time, it is inaccessible to the pure reason. Truth itself depends on time; and only the future will show whether it is verified by the three factors of history.

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JEWISH SECTS DURING THE SECOND COMMONWEALTH.

A series of different sects, indicating considerable controversy and divergency, emerged in Judaism during the period of the Second Temple (516 B.C.–A.D. 70) and especially during the second commonwealth in Palestine. Modern Judaism and, to a lesser extent, Christianity are the outcomes of this series of internal religious controversies. The sects represented philosophies ranging from conservatism to extremism, from asceticism to activism and from rigid orthodoxy to religious liberalism, and their differences reflected not only religious but also social, political and economic issues.

The second commonwealth may be considered to have lasted from the successful Maccabaean revolt for independence in the 2nd century B.C., through the Roman period, to the fall of Jerusalem and the destruction of the Temple in A.D. 70. For the history of the period, *see* JEWS: *Greek and Roman Conquests;* PALESTINE: *Prehistory and History*. Another sect, not comparable with those discussed below, is described in the article SAMARITANS.

PHARISEES

The Pharisees (Heb. *Perushim*) emerged as a distinct group shortly after the Maccabaean revolt, about 165–160 B.C., probably deriving from the Assideans (or Hasideans; Greek form of Heb. *Hasidim*, "pious ones").

Assideans.—The Assideans were probably organized as a sect during the 4th or 3rd century B.C. to revive and promote the observance of Jewish rites, to study the Law and to uproot paganism from the land. The group is first mentioned by this name during the persecutions of Antiochus IV Epiphanes in the 2nd century B.C., when its members joined and became the nucleus of the Maccabaean revolt against the Syrians. They refused to compromise in any way with the Hellenizing policy of the Syrians and willingly suffered torture and martyrdom rather than desecrate the sabbath or violate other Jewish observances. Explicit references to the Assideans are found in the Apocrypha (Books of Maccabees) and in the Talmud. In I Macc. ii, 42 it is recorded that they were "mighty warriors of Israel, every one who offered himself willingly for the Law." In I Macc. vii they are described as welcoming peace with the Syrians when the latter offered them assurance of religious liberty. They ceased to co-operate with the Hasmonaean dynasty in the fight for political independence. References to *Hasidim* (rendered in the English Bible as "saints" or "the godly") are found in Psalms (xii, 1; xxx, 4; xxxvii, 28), where their efforts to observe the Law, their persecutions by their adversaries and their struggles against their enemies are referred to; it is doubtful whether these accounts refer to the Assideans as such. The *Hasi-*

dim mentioned in the Mishnah and the Talmud (*Berachot* vi; *Hagigah* ii, 7; *Sotah* iii, 4; *Aboth* v, 10; and *Niddah* 17a) may be the Assideans or merely pious persons of a later period. The Talmud refers to the strict observance of the commandments by the *Hasidim*, to their ardent prayers (which they would not renounce even at the risk of their lives) and to their observance of the sabbath. Because of this meticulous legal observance, the Assideans have been linked with the Essenes, but the consensus is that they were the spiritual forerunners of the Pharisees.

Origins of the Pharisees.—For two centuries following the Babylonian Exile (586–537 B.C.) the high priesthood provided the sole leadership of the Jewish people. Gradually, however, learned men and scribes (*q.v.*) of nonpriestly descent began to play a role in the conduct of the religious and, to a lesser extent, the secular affairs of the people, and by the beginning of the 2nd century B.C. the Sanhedrin (*q.v.*; the supreme Jewish council and tribunal of the Second Temple period) was composed of both priests and lay leaders. One of the chief problems of the Sanhedrin was to find in the ancient Torah of Moses answers to questions and bases for decisions about contemporary matters arising under circumstances far different from those of the time of Moses. A conflict developed between priests and laymen over the approach to this problem. Two parties emerged, and in the course of time their theological differences became entangled with politics. Under John Hyrcanus (135–104) the nonpriestly teachers were excluded from membership in the assembly of the Sanhedrin and branded by the priestly party as Dissenters or Separatists (Heb. *Perushim*, "Pharisees"). The name was meant as a taunt, but the group accepted it and took it up, interpreting it as a title of honour (*Perushim* can also mean the interpreters or the exponents of the Torah). A long-drawn-out struggle ensued as the Pharisees tried to democratize the Jewish religion and remove it from the rigid control of the Temple priests.

The Pharisees, though they exercised great political power, were not primarily a political party but a society of scholars and pietists. They enjoyed a large popular following—in Josephus and in the New Testament they appear as spokesmen for the majority of the population. Religious values towered so high above all their other concerns that the Pharisees would rather submit to foreign domination, so long as it did not interfere with their inner way of life, than to an impious Jewish government. On one occasion, three successive Pharisaic delegations appeared, at great personal peril, before Mark Antony, pleading for the removal of Herod. Again, during the great war with the Romans, two Pharisaic leaders, Johanan ben Zakkai and Josephus, made peace with Vespasian.

Attitude to Torah.—The basic difference that led to the split between the Pharisees and Sadducees, the priestly party, lay in their respective attitudes toward the Torah and its interpretation in the solution of contemporary problems. The Sadducees, on the one hand, refused to accept any precept as binding unless it was based directly on the Torah (the Pentateuch), the Written Law. The Pharisees, on the other hand, believed that the Law God gave to Moses was twofold, consisting of the Written Law and the Oral Law. For the Pharisees, the Torah was divine revelation to man, contained in the five books of Moses, but it had been supplemented and explained by the teaching of the prophets and by unwritten traditions of the fathers. They admitted the principle of evolution in the Law. Men must use God-given reason in interpreting the Torah; the Law could never mean anything else than what the teachers understood it to mean. Since they did not follow blindly the letter of the Law, if it conflicted with reason or conscience, the Pharisees found no great difficulty in harmonizing the teachings of the Torah with their ideas or in finding such ideas suggested or implied in it. To discover such scriptural support they developed a ramified system of hermeneutics.

The Pharisees, in contrast to the Sadducees, interpreted the Law according to its spirit. When in the course of time a law had been outgrown, they gave it a new and more acceptable meaning. For example, they interpreted the Mosaic law of an eye for an eye (Ex. xxi, 24) as referring to monetary compensation and not retaliation. It was due to this progressive tendency of the Pharisees that their interpretation of the Torah continued to develop and has remained an everliving force in Judaism. (For a discussion of the evolution of the Oral Law and its relation to the Torah, *see* TALMUD.)

Theological Doctrines.—*Conception of God.*—From the prophets the Pharisees learned to think of God as a spiritual being, omnipotent, omnipresent and just, all-wise and all-knowing, all-merciful and like a father loving all his creatures. He must not be represented in any image and cannot be likened to any other being. None of the expressions in the Torah that speak of him in anthropomorphic terms is to be taken literally. God was conceived of as the One whom no human being could fully comprehend, for he is transcendent. Even the use of his name is to be avoided, except in prayer and in reading of the Scriptures, since no name can describe his essence or the totality of his being. The Pharisees spoke of him in such terms as the "Creator of the World," the "Merciful One," the "Divine Presence" and the "Spirit of Holiness."

Divine Providence and Free Will.—Another point of difference between Pharisees and Sadducees lay in their respective positions regarding free will. The Sadducees believed that God does not concern himself with human affairs. The individual is left to his own resources. To the people as a group God gives his protection if they fulfill his commands, just as he punishes them for violating laws stipulated in his Covenant. The Pharisees believed that God takes cognizance of all human doings, but with the belief in divine providence and prescience they combined belief in the freedom of will; there is no virtue in doing good if man does not have the power to choose between good and evil. In talmudic reports the followers of the Pharisees declare, "Everything is in the hands of God but the fear of God" (*Berachot* 33b), and although "everything is foreseen, yet freedom of choice is given" (*Aboth* iii, 15). As the Talmud puts it, "If a man chooses to do good the heavenly powers help him. If he chooses to do evil, they leave the way open to him" (*Shabbath* 104a).

Divine Retribution.—Belief in man's responsibility for his conduct leads to belief in divine retribution. According to Josephus, the Pharisees believed that souls have an immortal vigour and "that under the earth there will be reward and punishment according as they have lived virtuously or viciously in this life."

Immortality and Resurrection.—According to the Talmud and the New Testament, the Pharisees believed in the resurrection of the dead. This belief in another world makes possible the belief in divine justice in the face of apparent injustices on earth: a practical solution to a nagging problem that threatened to tempt man from virtue and cause him to abandon the pursuit of righteousness. Ideas of immortality and resurrection are generally attributed to Greek or Persian origins, yet to the Pharisees it was a genuine Jewish belief based on passages in the Torah.

Humanity.—The Pharisees were also concerned with the salvation of their people and of humanity, and with the future of this world when all mankind will accept the Law and believe in One God. According to the Pharisees, all men are born equal. Israel's position among the other nations is that of an older brother, since it was the first to recognize God as the Father, and it is Israel's duty and function to help other peoples to do so. Probably with this in mind, the Pharisees engaged in active proselytism. In the words of the New Testament, they did "traverse sea and land to make a single proselyte" (Matt. xxiii, 15).

Divine Worship.—The Pharisees believed that from the rising of the sun until its setting the Lord's name must be praised (Ps. cxiii, 3) and that there was no place where God could not be found and reached in prayer. He could and should be worshiped even away from the Temple and outside Jerusalem. Worship consisted not in bloody sacrifices—the practice of the Temple priests—but in prayer and study of God's Law. Hence the Pharisees fostered the synagogue as an institution of religious worship, outside and separate from the Temple. The synagogue may be considered a Pharisaic institution, since, though it was not they who founded it, the Pharisees developed it, raised it to high eminence and gave it a central place in religious life.

New Testament References.—While the Pharisees, as a body, set for themselves a high ethical standard, not all Pharisees lived

up to it. The Talmud itself lists seven hypocritical types of Pharisees. The derogatory references in the New Testament (Matt. xxiii, 2 ff.; Luke xviii, 10 ff.; etc.) to the Pharisees as "hypocrites" and "offspring of vipers" were probably directed not at the entire Pharisaic group but at the minority who were condemned by leaders of the Pharisees themselves as "sore spots" or "plagues of the Pharisaic party" (*Sotah* iii, 4 and 22b). Many Pharisaic doctrines indeed have a great deal in common with those of Christianity. Paul boasted of being a Pharisee and the son of Pharisees (Acts xxiii, 6); he was educated "according to the strict manner of the law of our fathers" by Gamaliel (Acts xxii, 3), a "teacher of the law" (Acts v, 34), probably grandson of the great Pharisee Hillel.

Evaluation.—The active period of Pharisaism, the most influential movement in the development of orthodox Judaism, extended well into the 2nd and 3rd centuries A.D. The Pharisees preserved and transmitted Judaism. The deepest and most stable elements among the forces that built Judaism and the Jewish people were contained in Pharisaism. Unlike the Zealots, the Pharisees rejected the appeal to force and violence, believing that God was in control of history, that Israel and the nations would be redeemed in God's good time and that in the meanwhile every true Jew should live in accordance with the Torah. It is not surprising, therefore, that the Pharisees devoted much effort to education. After the destruction of the Temple and the fall of Jerusalem, it was the synagogue and the schools of the Pharisees that continued to function and promote Judaism.

SADDUCEES

The Sadducees (Heb. *Tsedukim*) were formed about 200 B.C. as the party of high priests, aristocratic families and merchants—the wealthier elements of the population. While the Pharisees claimed the authority of piety and learning, the Sadducees claimed that of blood and position. During the long period of the two parties' struggle—which lasted until the destruction of Jerusalem and from which the perspective of history shows the Pharisees to have emerged triumphant—the Sadducees dominated the Temple and Sanhedrin.

Origins.—The name Sadducees may be derived from that of Zadok, the high priest in the days of David (II Sam. viii, 17 and xv, 24) and Solomon (*cf.* I Kings i, 34 ff.). Ezekiel (xl, 46; xliii, 19; and xliv, 10–15) selected this family as worthy of being entrusted with the control of the Temple, and in fact Zadokites formed the Temple hierarchy down to the 2nd century B.C. Not all priests were Sadducees, however; the name may best be taken to mean anyone who is a sympathizer with the priestly descendants of Zadok. In the talmudic literature the designations Boethusians and Sadducees are used interchangeably, though some scholars believe that the Boethusians were merely a branch of the Sadducees, deriving their name from their leader, Boethus. The Sadducees came under the influence of Hellenism and later were in good standing with the Roman rulers, though unpopular with the common people.

The rivalry between the priestly and nonpriestly parties was, in a sense, the renewal of a conflict between the prophets and priests of pre-exilic times. Following the restoration of the Temple (516 B.C.) and its sacrificial cult, the priests were also restored to their former position as religious leaders. The rise of learned laymen and scribes who possessed a knowledge of the Law caused the authority of the priests to be questioned. Greek rule also probably helped to weaken priestly authority, for among the Greeks priests were the servants, not the leaders, of the community.

Sadducean Beliefs.—Throughout the second commonwealth period the Sadducees represented the conservative view. Their main difference with the Pharisees was concerned with their attitude toward the Torah (*see* above, *Pharisees: Attitude to Torah*). The theological struggle, as J. Z. Lauterbach puts it, was actually a struggle between two concepts of God. The Sadducees sought to bring God down to man. Their God was anthropomorphic and the worship they offered him was like the homage paid a human king or ruler. The Pharisees, on the other hand, sought to raise man to divine heights and to bring him nearer to a spiritual and transcendent God. The Sadducees denied the doctrine of the resurrection of the body (Mark xii, 18; Matt. xxii, 23; Luke xx, 27; Acts xxiii, 8), they denied (according to Josephus) the immortality of the soul and they rejected the Pharisaic doctrine regarding the existence of angels (Acts xxiii, 8). The Sadducees, because of their strict adherence to the letter of the Law, acted severely in cases involving the death penalty; the Mosaic principle of *lex talionis*, for instance, they interpreted literally. Further, the Sadducees, holding to the older doctrines and cherishing the highest regard for the sacrificial cult, were strongly opposed to any reform in the Temple. The two parties also differed over numerous legal and ritualistic details.

The Sadducean hierarchy had its stronghold in the Temple, and it was not until the last two decades of the Temple's existence that the Pharisees finally gained control. Since the whole power and *raison d'être* of the Sadducees were bound up with the Temple cult, the group ceased to exist after its destruction.

New Testament References.—In the New Testament, John the Baptist condemned both the Pharisees and the Sadducees, calling them a "brood of vipers" and challenging them to "bear fruit that befits repentance" (Matt. iii, 7 ff.). In his denunciation of their doctrines, Jesus, too, grouped Sadducees and Pharisees together (Matt. xvi, 6 ff.), and both parties were said to have posed captious questions designed to perplex Jesus. According to Acts (iv, 1 ff.; v, 17), Peter and John were imprisoned by the Sadducees.

ASCETIC SECTS

Essenes

The Essenes were a religious communalistic sect or brotherhood found in Palestine from about the 2nd century B.C. to the end of the 1st century A.D. The name is of uncertain origin but probably derives ultimately from Heb. *'syym*, "healers." Chief sources of information about them are the Jewish philosopher Philo of Alexandria (in *Hypothetica* and *Every Good Man Is Free*), the Jewish historian Josephus (*The Jewish War*) and the Roman Pliny the elder (*Natural History*), all of whom were writing in the 1st century A.D.

The brotherhood's members clustered in monastic communities from which, with few exceptions, women were excluded. In the course of time the communities developed into more closely linked units, and by the end of the 1st century B.C. the main group was located in the northwestern Dead sea region, organized as a monastic order. The Essenes, according to Philo, were never numerous; there were 4,000 in his day. Historically they have a great deal in common with the Pharisees, both sects stressing the need for meticulous observance of the Law and for avoidance of the impurities of daily life. But the Pharisees took an active part in public life and continued to participate in Temple worship even when that worship was controlled by the Sadducees, while the Essenes, except for a few individuals, withdrew from the larger community. It appears that they deemed themselves the only true Israel and regarded the religious observances in the cities and the Temple as corrupt. They may be regarded as the extremist wing of the Pharisees, probably deriving also from the Assideans.

Practices and Rites.—It is probable that the Essenes first lived as small communities or brotherhoods of men intent on strict observance of the Torah. This led naturally to a strong emphasis on ritual precision, the sabbath and the levitical laws of purity being observed with particular strictness. The brothers met at dawn for prayers, worked till about 11 A.M., then gathered and, clad in white linen garments, bathed in cold water. They had their midday meal together, in silence, with a priest reciting grace before and after the meal. Then they worked until evening and again ate together, again in silence. They spent the entire sabbath in prayer, meditation and study of Torah.

The younger brothers ministered to the elder; seniority and learning were the basis of position in the Essenic society. All activities were regulated by designated officials; only in deeds of mercy and charity toward the aged or the sick was individual initiative exerted.

In principle, the Essenes objected to oaths, but an oath once

taken could not be rescinded. Since they observed strict purity in their food and refrained from eating anything prepared by outsiders, excommunicated persons could soon be starved into obedience. However, expulsion seems to have been almost unknown and disobedience rare. The Essenes supported themselves by manual labour, avoiding commercial and military pursuits and dispensing with the labour of slaves. They opposed private ownership of property and were celibate. Despising luxury and pleasure, they did not anoint their bodies with oil. They studied the books of their ancestors and had some knowledge of medicine. Blasphemy against God was punishable by death.

Doctrines.—According to Josephus, the Essenes attributed all things to fate. They believed in the immortality of the soul but not of the body, from which, in their view, the soul will be gladly delivered. They also believed in reward and punishment and in resurrection after death. Josephus stresses the belief of the Essenes in the resurrection and states that their doctrines were borrowed by the Pythagoreans and Stoics. He observes that the Essenes are the oldest of ascetics and that it was from Egypt that their doctrines spread abroad. Certain scholars believe that they were under foreign influence, pointing to the fact that they worshiped facing the sun, not the Temple, and suggesting that Essenic belief in immortality is derived from Greek or Iranian influences. Such beliefs, however, are thoroughly Jewish and are found among the Pharisees and the Qumran sect.

Initiation.—The Essenes recruited members by adopting proselytes, who had to undergo an arduous probationary period. A candidate had to wait a year before he was given the emblems—hatchet, belt and white garment. Then he was allowed to follow the routine and receive purifying washings, but he was not yet permitted to take part in the common meals. If he proved himself worthy for two more years he was then admitted to the society, but not until he had taken an oath to observe the rules. Josephus, who states that he himself underwent the probationary period but then resigned, says that the oath exacted from the initiate, before he was allowed to share the common meal, was as follows: To be pious to God, to practise justice toward men; never to injure anyone, either of his own accord or under compulsion; always to hate the wicked and side with the just; ever to show faithfulness to all mankind and to be true to those in authority, for all power comes from God; never when in offices to force his personal views or authority or to assume a special dress or luxury; to love truth and hate falsehood; to keep his hands pure of theft and his soul from unrighteous gain; not to have any secret from his brethren and never to betray one of theirs, even at the cost of his life; to pass on the traditions he himself had received; never to be a brigand; to safeguard the sacred books and to preserve, with care, the names of the angels that had been taught him.

The Essenes and the New Testament.—There is no reference to the Essenes in the New Testament. It is possible that John the Baptist, who lived, preached and baptized in the Jordan river only a few miles from a community of Essenes, was influenced by them. Some New Testament scholars also believe that the apostolic church incorporated Essenic elements in its structure.

Varieties of Essenism.—A study of the Essenes is complicated by the term "Essene" itself, which was used to describe individuals and brotherhoods differing widely in significant tenets. Josephus, for instance, speaks of an Essenic order whose members approved of restricted conjugal intercourse until children had been born; Pliny, on the other hand, asserts that the Essenes abstained from marriage altogether. Other bodies of pre-Christian Jews who lived a monastic life were the Therapeutae and the Qumran (Dead sea scrolls) sect. The Hemerobaptists, or *Tobele-Shaharith*, comprised another monastic group whose daily ablutions were a matter of ritual; Epiphanius, 4th-century bishop of Salamis, refers to them as the fourth heresy among the Jew and classes them doctrinally with the Pharisees, noting, however, that, like the Sadducees, they denied the resurrection of the dead.

Common to all the varieties of Essenes were the circumstances that each lived a monastic life and formed a homogeneous body, ruled by officers acting in accordance with traditional laws, and possessing initiatory oaths and ceremonies incumbent on the neophyte. Greek sources make it clear that they are speaking of sects. Rabbinic writings, on the other hand, speak of individuals or informal groups, lacking the cohesion and permanence implied by the Greek sources. Probably both are correct; allowance must be made for the fact that the Greek accounts are connected descriptions, possibly even coloured by the desire to heighten parallels to other bodies, while rabbinic sources contain only incidental references.

Qumran Community.—Shortly after the discovery of the Dead sea scrolls, scholars began to note resemblances between the community described in the scrolls and the Essenes as described by Josephus, Philo and Pliny. Both the Qumran sect and the Essenes had separated themselves from the normative Judaism of their day, including Temple services. The Qumran community, too, had rules of discipline; a superintendent or overseer was responsible for the lives of members; possessions were held in common; newcomers had to undergo a period of probation, and the uninitiated were excluded from the community meal; ritual lustration was practised.

Though there are differences between Essenic and Qumran practices, the majority of scholars classify the Qumran community as Essene. Others, with not much success, have pointed to parallels with Pharisees, Zealots, Ebionites and other groups (*see* also DEAD SEA SCROLLS).

THERAPEUTAE

The Therapeutae (Gr. "healers" or "attendants"), a sect of ascetics closely resembling the Essenes, are believed to have settled on the shores of Lake Mareotis in the vicinity of Alexandria, Egy., during the 1st century of the Christian era. The only original account of this community is given in *De Vita Contemplativa* ("Concerning the Contemplative Life"), attributed to Philo. Their origin and fate alike are unknown. The sect was characterized as being unusually severe in discipline and mode of life. According to Philo, the members, both men and women, devoted their time to prayer and study. They prayed twice every day, at dawn and at eventide, the interval between being spent entirely on spiritual exercise. They read the Holy Scriptures, from which they sought wisdom by treating them as allegorical, believing that the words of the literal text were symbols of something hidden. Attendance to bodily needs, such as food, was entirely relegated to the hours of darkness. Some ate every other day, while others ate on only one single weekday; all abstained from wine and meat. Upon joining the sect a man no longer belonged to the world and voluntarily assigned his property to his heirs.

Members of the community lived in separate and scattered houses, close enough together to afford mutual protection yet not too close to deprive members of solitude. Each house contained a chamber or sanctuary, consecrated to study and prayer (*cf.* Matt. vi, 6). The Therapeutae had, in addition to the Old Testament, books composed by the founders of their sect on the allegorical method of interpreting Scripture. Philo's account refers to the composition of "new psalms" to God in various metres and melodies.

For six days a week members lived apart, seeking wisdom in solitude. On the sabbath they met in the common sanctuary, where they listened to a discourse by the member most skilled in their doctrines and then ate a common meal: coarse bread, flavoured with salt and sometimes hyssop, and a drink of spring water. The sect, according to Philo, revered the number seven and its square, but the most sacred of numbers was 50. Thus on the eve of the 50th day they observed an all-night festival, with a discourse, hymn singing and a meal, followed by a sacred vigil.

The main distinction between Therapeutae and Essenes, as S. W. Baron observes, is that the latter were anti-intellectual, while "wisdom," Philo says, was the main objective of the Therapeutae. Further, the Alexandrian group is described as upper-class, while most Essenes apparently were of the lower classes. The Therapeutae shared with the Essenes a dualistic view of body and soul and an affection for the secret doctrine that underlies the literal word of the Scriptures.

Ascetic Sects and Christian Monasticism

None of the Jewish ascetics left a permanent trace on Jewish life; on the other hand, their semimonastic communities were probably the prototype of a great development in the Christian church. To the modern reader, the importance of all the pre-Christian Jewish ascetic sects lies in the evidence they afford of the existence of a monastic system in the near east long before the Christian era. The Greeks who followed Alexander to India make reference to the Indian ascetic philosophers (gymnosophists), but the first-known form of organized monasticism in the Mediterranean world was Essenism. Eusebius (A.D. 260–339) was so struck by the similarities between the Therapeutae and the Christian monks of his own day as to claim that the Therapeutae were Christians converted by the preaching of St. Mark. N. Bentwich observed in this connection that the emphasis on individual salvation and the breaking away from the national life and the national Law cut these sects off from the Jewish people and led to their absorption into the Christian body.

ZEALOTS AND SICARII

The Zealots (Heb. *Qanna'eem;* Gr. *Zelotes*), a sect of activists —indeed, sometimes terrorists—whose members relentlessly opposed the attempt to bring Judaea under the dominion of idolatrous Rome, regarded themselves as defenders of the Law and the national life of the Jewish people. They were first influential in Galilee and later in Jerusalem, especially from the time of Herod (37–4 B.C.) until the fall of the city. They were members of one of the parties that loosely formed what Josephus called the "Fourth Philosophy," and by this definition were distinguished from Pharisees, Sadducees and Essenes. The main characteristic of the Fourth Philosophy was strong opposition to foreign rule. Sicarii, or Assassins, is a term applied in the two decades immediately preceding the destruction of Jerusalem to the extreme Jewish Zealots. Members of this group concealed under their cloaks small daggers or *sicae* (Gr. *sikarioi*, "daggermen," "assassins"), with which, at public places and assemblies, they stabbed their opponents who were friendly to the Romans.

Under the leadership of Hezekiah (a Zealot martyr who was beheaded by Herod without trial) and his sons, the Zealots became an aggressive political party that would accept no compromise and make no peace with Rome. Josephus says it was the introduction of Roman institutions antagonistic to the spirit of Judaism (such as the gymnasium and the arena) that provoked the indignation of the people. The Zealots were active in Galilee in A.D. 6 at the time of the revolt of Judas of Gamala against the taking of the census (assessing property for taxation) on the grounds that compliance with the Roman demand would constitute an act of enslavement. Some scholars, therefore, believe that the Zealot party was formed during this revolt, though there is little evidence to support the view.

The Zealots are mentioned but not described in the Gospels, the term being applied as a designation of Simon, a disciple of Jesus, in Luke vi, 15 and Acts i, 13; the same disciple is called the Cananaean (from a Hebrew and Aramaic stem *qanna'*, "to be zealous") in Matt. x, 4 and Mark iii, 18.

The Zealots considered it an act of disloyalty to God to acknowledge Roman domination over Judaea and considered it their right to assassinate any Roman who dared enter the consecrated area of the Temple. In addition to refusing to pay taxes, they harassed the Roman administration with every means at their disposal. During the period immediately preceding the great rebellion against Rome in A.D. 66 they won followers from all social classes. The Roman successes in Galilee in that year weakened the Jewish government in Jerusalem and strengthened the position of the Zealots, who fled to Jerusalem and played an important role in the defense of the city. They terrorized their political opponents who accepted foreign rule, deposed the high priest and elected a successor by lot. However, because of their excesses, the population rose against them and drove them, under Eleazar ben Simon, into the inner court of the Temple. With the support of the Idumeans, the Zealots regained control of Jerusalem, under the leadership of John of Gischala, and resumed their acts of terror.

One of the chief leaders of the revolt in A.D. 66, Menahem ben Jair, a Sicarius, appears to have claimed messianic status; surrounded with royal pomp, he went up to the Temple to be crowned but was slain by rivals within his own party. His supporters, including his relative Eleazar ben Jair, fled to Masada, on the shores of the Dead sea, and eventually committed suicide when the fortress was taken by the Romans in A.D. 73.

The Zealots were not, as Josephus pictured them, purely selfish and secularly motivated, but rather, like the early Maccabees, deeply patriotic and motivated by zeal for the Torah. Traditional Jewish history has declared itself in favour of the quietistic Pharisees, who regarded the house of study as more important to the Jews than the state and the Temple. Some modern historians, however, believe that the Zealots deserve recognition for their example of steadfastness.

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(Me. M.)

JEWISH WELFARE BOARD, NATIONAL, was founded by U.S. Jews in 1917, at the request of the war and navy departments, to meet religious, cultural, recreational and welfare needs of Jews in the armed forces. It provides these services through local volunteer committees assisted by a trained field staff. Its chaplaincy division procures and supervises full- and part-time chaplains for military establishments and the Veterans administration. The Jewish Welfare board is the only governmentally recognized Jewish organization to carry out this type of work, and it represents the Jewish community in the nonsectarian United Service organizations. In 1921 the board became also the service agency of the Jewish Community centres

throughout the country. Representing Orthodox, Conservative and Reform agencies, the organization serves about 350 centres, with a membership of about 600,000, providing cultural and recreational opportunities for persons of all ages. (I. M. F.)

JEWS. The word Jew is derived through the Latin *Judaeus* and the Greek *Ioudaios* from the Hebrew *Yehūdhī*, a gentilic adjective, occurring only in the later parts of the Old Testament and signifying a descendant of Yehudhah (Judah, Judas), the fourth son of Jacob, whose tribe, together with that of his half brother Benjamin, constituted the kingdom of Judah, as opposed to that of the remaining tribes (Israel). The name came to mean the followers of Judaism, the racial signification diminishing as the religious increased. The following article, as the outline below indicates, is concerned with the history of the Jewish people. For their religion, *see* the article JUDAISM. (H. M. J. L.)

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I. THE JEWS AS A RACE

The findings of physical anthropology show that, contrary to the popular view, there is no Jewish race. Anthropometric measurements of Jewish groups in many parts of the world indicate that they differ greatly from one another with respect to all the important physical characteristics—stature, weight, skin colour, hair colour and texture, eye colour, cephalic index, facial index, blood groups, etc. The Hebrews of the Old Testament period were already a racially mixed population, as is shown both by occasional references in the Bible (*e.g.*, Deut. xxvi, 5; S. of Sol. i, 5, 6; I Sam. xvi, 12; Ezek. xvi, 3) and by contemporary representation of Hebrews on Egyptian, Assyrian and other monuments. Following the Babylonian exile (586 B.C.), mixture between Jews and gentiles was facilitated by the spatial proximity of scattered Jewish groups to an increasing variety of host peoples (Babylonians, Egyptians, later Greeks, Syrians, Romans, etc.). The traditional Jewish method of reckoning descent patrilineally led to an unquestioning acceptance as full Jews of children issuing from marriages between Jewish men and converted non-Jewish women. Conversion reached considerable proportions beginning with the 1st century B.C., and in certain periods and localities took the form of mass movements (the Khazars in the 8th century, and in Russia and Hungary in the 15th and 19th centuries). In addition, the mere fact of migration into new geographical environments also contributed to the racial diversification of the Jews. A study by Franz Boas (1911) indicated that the descendants of immigrants (such as east European Jews, southern Italians, etc.) to the U.S. show definite, measurable and often considerable changes in bodily form as compared with their European-born parents.

The combined result of all these factors is that the Jews have come to resemble greatly in physical type the local populations, especially in countries in which they have lived for many generations. To mention a few extreme examples, the Chinese Jews of K'ai-feng (who survived up to the 20th century) looked like Chinese; the Ethiopian Jews—the so-called Falashas—like the non-Jewish Ethiopians have black skin and exhibit a mixture of Caucasian and Negroid features; both Yemenite Jews and Yemenite Muslims have dark olive complexions, small stature, longish head, etc., and belong racially to the same dark subvariety of the Mediterranean race. The only race to which the Jews have not achieved a high degree of assimilation is the Nordic; a smaller percentage of Jews living among Nordic peoples exhibits the Nordic physical features than is the case among the gentiles of the locality. In other words, there are relatively more light-skinned, blond, blue-eyed, long-headed, tall individuals among, say, German gentiles than among German Jews.

Also with regard to blood type Jewish groups show considerable differences among themselves and marked similarities to the gentile environment. The Hirszfeld "biochemical index" $\left(\frac{A + AB}{B + AB}\right)$ can be used most conveniently to express this. A few typical examples are: German Jews 2.74, German gentiles 2.63; Rumanian Jews 1.54, Rumanian gentiles 1.55; Polish Jews 1.94, Polish gentiles 1.55; Moroccan Jews 1.63, Moroccan gentiles 1.63; Iraqi Jews 1.22, Iraqi gentiles 1.37; Turkistan Jews 0.97, Turkistan gentiles 0.99.

In the early 1960s there were about 12,000,000 Jews in the world. Racially, most of these (the bulk of the Ashkenazi division of the Jewish people; *see* SEPHARDIM, ASHKENAZIM AND ORIENTAL JEWS) exhibit Mediterranean and Alpine features in varying admixtures. About 1,000,000 Jews (mainly the Sephardic Jews and the Jews of north Africa and Arabia) are predominantly Mediterranean. The Iranian, Kurdish and Iraqi Jews and the Jews of the Caucasian region (about 250,000) are Alpines with a strong admixture of Iranian plateau types and with hyperbrachicephalism, especially in the Caucasus. The Falashas (*q.v.*), the Chinese Jews, the Jews of India (*see* BENE-ISRAEL) and other still smaller non-Caucasian Jewish groups are evidently the result of race mixture to a larger degree than has been the case with the bulk of the Jewish people.

In no country is the great racial variety of the Jews so clearly evident as in modern Israel, with its over 2,000,000 Jews from

more than 70 countries. Among them are represented, by groups of various sizes, all the Caucasian races, as well as good samplings of the other human races. There, more clearly than in any other place on earth, it is demonstrated that the factor that has kept the Jews alive as Jews is not a racial or genetic identity but a set of values comprising historical, traditional, religious and national elements. A discussion that took place in 1959 between opposing political groups in Israel as to who is to be regarded as a Jew indicated that, in the view of most Israelis, any child whose parents declare him to be Jewish is a Jew, and, consequently, any person who declares himself to be Jewish must also be regarded as a Jew. (RA. P.)

II. EARLIEST TIMES TO A.D. 135

A. EARLY HISTORY TO THE EXILE

For the first two periods the history of the Jews is mainly that of Palestine. It begins among those peoples occupying the area between the Nile on the one side and the Tigris and the Euphrates on the other. Surrounded by ancient seats of culture in Egypt and Babylonia, by the deserts of Arabia and by the highlands of Asia Minor, Palestine, with Syria on the north, was the high road of civilization, trade and warlike enterprise, and the meeting place of religions. Its small principalities were frequently dominated by the great powers, whose weakness or acquiescence alone enabled those principalities to rise above dependence or vassalage. The land was traversed by old-established trade routes and possessed important harbours on the Gulf of Aqaba and on the Mediterranean coast, the latter exposing it to the influence of the Levant. It was "the physical centre of those movements of history from which the world has grown." The portion of this district abutting upon the Mediterranean may be divided into two main parts: Syria (from the Taurus to Mt. Hermon) and Palestine (southward to the desert bordering upon Egypt). The latter is about 150 mi. from north to south (the proverbial "Dan to Beersheba"), with a breadth varying from 25 to 80 mi.; *i.e.*, about 6,040 sq.mi. This excludes the land east of the Jordan. (*See* also PALESTINE.)

By the 15th century B.C. Palestine was inhabited by a settled people. Petty princes ruled as vassals of Egypt, which, after expelling the Hyksos from its borders, had entered upon a series of conquests as far as the Euphrates. Some centuries previously, however, Babylonian influence had held sway to the west, and the Akkadian script and language were now used not merely in the diplomatic correspondence between Egypt and Asia but also among the Palestinian princes themselves. Canaan (Palestine and the south Phoenician coast land) and Amor (Lebanon district and beyond) were under the constant supervision of Egypt, and Egyptian officials journeyed round to collect tribute, to attend to complaints and to assure themselves of the allegiance of the vassals. The Amarna tablets and those found at Taannek (biblical Taanach) and at Bogazkoy combine with other archaeological evidence (Lachish, Gezer, Megiddo, Beth-shan, etc.) to reflect advanced conditions of life and culture. This, the "Amarna age," with regular maritime intercourse among the Aegean settlements, Phoenicia and the Egyptian Delta, and with lines of caravans connecting Babylonia, north Syria, Arabia and Egypt, presents a vivid picture of life and activity, in the centre of which lies Palestine, with here and there Egyptian colonies and traces of Egyptian cults.

The Amarna age affords a tangible starting point for any estimate of Palestine and the history of Israel. The records reveal a state of anarchy in Palestine for which the weakness of Egypt and the downward pressure of north Syrian peoples were responsible. Subdivided into a number of small local principalities, Palestine was suffering both from internal intrigues and from the designs of the northern powers. A restless group, called the Habiru, now makes its appearance on the arena of Palestinian history. Many scholars identify the name Habiru with that of the Hebrews, but this statement requires qualification. The name Habiru is found in very early Mesopotamian tablets, where the application is not gentilic but seems to refer to intruding foreigners. It is probably in this sense that it was used in the Amarna tablets (which were written by the vassal princes or governors of Palestine to the Egyptian king Ikhnaton) and is descriptive of the hordes who came into the country over the eastern frontier. If the philological identification of Habiru with Hebrew is correct, then it may be concluded that the term was and remained the designation (in the modified Hebrew form *'ibrim*) of that group of tribes that invaded, conquered and dominated Canaan; *i.e.*, the Hebrews. In this Amarna age, the time had come when the fate of Palestine was no longer controlled by the great powers, and the curtain rises upon the historical traditions of the Old Testament.

1. Traditions of Origin.—The traditions about the Israelites' origins and of the formative years of their early history are found in the records of the Pentateuch. Though scholarly research has established the general conclusion that these narratives, in the literary form in which they have been preserved, are composite and bear the stamp of late (*i.e.*, monarchal and exilic) editing, it is nevertheless recognized that the basic materials in them are ancient (*see* PENTATEUCH). The strands in these composite accounts are regarded by many scholars not as independent late traditions but as recensions of original parent traditions. Confirmation of the detailed biographical accounts in the patriarchal sagas cannot, by their very nature, be expected from external sources. Yet the background in which these sagas are set conforms to the general pattern of social practice and historical situations in the contemporary near east.

The migration of Abraham (*q.v.*) from Ur may be associated with the unsettled conditions in that area during the 18th century B.C., while movement between Mesopotamia and the Mediterranean coast is attested by cuneiform tablets. The mural painting of Beni Hasan in Egypt, dated in the early 19th century B.C. and depicting the arrival in Egypt of a Semitic group, brings to mind Abraham's arrival in that country. The "descent" into Egypt by the Jacob clan is endowed with historical reality in the light of the Hyksos (Asian) domination of Egypt, while the later enslavement of the numerically increased Jacob group fits in with the overthrow of the Hyksos by Ahmose I about 1550 B.C. In the biographical accounts of the patriarchs, the expectation of the childless Abraham that his chief slave, Eliezer, would become his heir, and his taking of Sarah's handmaid, Hagar, as a secondary wife, are examples of current near-eastern social custom. Likewise are the incidents in the Jacob-Laban disputes as, for example, Rachel's theft of Laban's teraphim (or household gods) to make Jacob heir to Laban.

The traditions that prevailed among the Israelites concerning their origin seem to have matured at a time not when Judah and Israel were "brother" or rival kingdoms but when they formed one body and Judah was among the "sons" of Israel (or Jacob), the son of Isaac and grandson of Abraham. The names of the "sons," or rather tribes, vary in origin and probably also in age; and where they represent fixed territorial limits, the districts so described were in some cases certainly peopled by groups of non-Israelite ancestry. But as tribal names they invited explanation, and of the many characteristic traditions that were doubtless current, a number have been preserved, though not in any very early dress. Close relationship was recognized with the Aramaeans, with Edom, Moab and Ammon. Esau (Edom) is the "brother" of Jacob, Moab and Ammon are sons of Lot, Abraham's nephew. Abraham himself, it was traditionally narrated, came from Harran (Carrhae), primarily from Ur, of the Chaldees, and Jacob re-enters from Gilead in the northeast, with his Aramaean wives and concubines and their families (Benjamin excepted). It is on this occasion that Jacob's name is changed to Israel. (*See* also ISRAEL; TWELVE TRIBES OF ISRAEL.)

The story of the settlement of the tribal ancestors in Palestine is interrupted by an account of the southward movement of Jacob (or Israel) and his sons into a district under the immediate influence of the kings of Egypt. After an interval of uncertain duration there appears in the book of Exodus a numerous people subjected to rigorous oppression. No longer "sons" of Jacob or Israel, whole tribes were led out by Moses and Aaron; and, after a series of incidents extending over 40 years, the "children of Israel" invaded the land in which their ancestors had lived. (*See* EXODUS.) The story of the Exodus is that of the religious birth of "Israel," joined by covenant with the national god, Yahweh (*q.v.*),

whose aid in times of peril and need proved his supremacy. In Moses (*q.v.*) was seen the founder of Israel's religion and laws, in Aaron (*q.v.*) the prototype of the Israelite priesthood. Modern scholarship gives due recognition to the personality of Moses and to his molding influence during the formative years following the Exodus: he is no longer regarded as a shadowy and unreal figure, whose historicity was doubted. Yahweh had admittedly been the God of Israel's ancestors, but his name was only now made known (Ex. iii, 13 *et seq.*; vi, 2 *et seq.*), and this conception of a new era in Yahweh's relations with the people is associated with the family of Moses and with small groups from the south of Palestine who reappear in religious movements in later history.

Amid a great variety of motives the prominence of Kadesh in south Palestine is to be recognized; but it is uncertain what clans or tribes were at Kadesh, and it is possible that traditions, originally confined to those with whom the new conception of Yahweh is connected, were subsequently adopted by others who came to regard themselves as the worshipers of the only true Yahweh. Two quite distinct views can be distinguished. The one associates itself with the settlement of the ancestors of the Hebrews and has an ethnic character. The other, part of the religious history of "Israel," is essentially bound up with the religious genius of the people and is partly connected with clans from the south of Palestine whose influence reappears later.

2. The Conquest of Canaan.—The Book of Joshua continues the fortunes of the "children of Israel" and describes a successful occupation of Palestine by the united tribes, in striking contrast to other records of the partial successes of individual groups, whose association appears to have been rather loose (Judg. i). The Book of Joshua, however, is based upon the account of victories by the Ephraimite Joshua over confederations of petty kings to the south and north of central Palestine, apparently the traditions of Ephraim describing from its own standpoint the conquest of Palestine. The Book of Judges represents a period of unrest after the settlement of the people. External oppressions (Moab, Ammon, Philistines, etc.) and internal rivalries rent the Israelites; and the religious philosophy of a later (Deuteronomic) age represents the period as one of alternate apostasy from and of penitent return to the Yahweh of the Exodus, and the Israelites' deliverance by "judges." The best narratives relate to Israel and Gilead; Judah scarcely appears, and in an old poetical account of a great fight of the united tribes against a northern adversary the tribe of Judah lies outside the writer's horizon of interest and is not mentioned (Judg. v; *see* DEBORAH).

Stories of successful warfare and of temporary leaders (*see* ABIMELECH; EHUD; GIDEON; JEPHTHAH) form an introduction to the institution of the Israelite monarchy. The background picture of the period of the judges, as depicted in the book of that name, fits into the general pattern of contemporary political conditions in the near east. The country and the adjacent petty states were free from the domination of the great powers, and the whole area became the scene of local contending interests in the absence of external imperial pressures. The report of the Egyptian Wenamun (in the 11th century B.C.) suggests a background of low Egyptian prestige and the re-emergence of petty local princes. The consolidation of the territorial gains made by the Hebrew tribes and the prospects of further expansion were menaced by the emergence of a new local power, the Philistines (*q.v.*). Expelled from Egypt after their attempt to obtain a foothold there, they settled in the coastal plain of Palestine. They were a highly civilized people and far in advance of the Hebrews in the arts of warfare and in effective weapons, and the contest between them and the Hebrews for supremacy was inevitable. To meet this challenge a united front by the Hebrew tribes was essential, and the loosely associated tribes federated into a national unit. This federation was cemented by the establishment of a monarchy and a new epoch was ushered in, the importance of which was supreme for the future history of Israel.

3. The Monarchy of Israel.—The heroic figure who stands at the head is Saul ("asked"), and there are conflicting accounts of his rise. (*See* SAMUEL, BOOKS OF.) The Philistines, newly settled in the land, held the people in subjection, and their defeat is ascribed by the later account to the godly prophet-judge, Samuel, and by the earlier to Saul. The first of a series of annals of the kings of Israel ascribes to Saul conquests over the surrounding peoples to an extent implying that the district of Judah formed part of his kingdom (I Sam. xiv, 47 *et seq.*). His might is also attested by the fine elegy (II Sam. i, 17 *et seq.*) over the death of two great Israelite heroes, Saul and Jonathan, knit together by mutual love, inseparable in life and death, whose overthrow by the Philistines on the plain of Jezreel was a national misfortune. The court was removed across the Jordan to Mahanaim, where Saul's son, Ishbosheth, through his general, Abner, recovered some of the lost prestige and reigned two years over Israel and Gilead (II Sam. ii, 8–10; contrast the figure in v, 11). But at this point the scanty annals are suspended and the history of the age is given in more popular sources. Israelite national history has come down through Judaean hands, with the result that much of it has been coloured by late Judaean feeling, and the Judaean account of the beginning of the monarchy.

4. David and Solomon.—Certain traditions of Judah and Jerusalem appear to have looked back upon a movement from the south, traces of which underlie the present account of the Exodus. The land was full of "sons of Anak," giants who had terrified the scouts sent from Kadesh. Caleb alone had distinguished himself by his fearlessness, and the (semi-Edomite) clan Caleb drove the Anakites out from Hebron in south Judah (Josh. xv, *et seq.*; *cf.* also xi, 21 *et seq.*). David and his followers are found in the south of Hebron, and as they advanced northward into a hostile district they encountered wondrous heroes between Gath and Jerusalem (II Sam. xxi, 15 *et seq.*; xxiii, 8 *et seq.*). After strenuous fighting the district was cleared, and Jerusalem, taken by the sword, became the capital. Tradition saw in David the head of a lengthy line of kings, the founder of the Judaean monarchy, the psalmist and the priest-king who inaugurated religious institutions. The rise of Jerusalem, the centre of postexilic Judaism, demanded explanation. Israelite tradition had ascribed the conquest of Jerusalem, Hebron and other cities of Judah to the Ephraimite Joshua; Judaean tradition, on the other hand, relates the capture of the sacred city from a hostile people (II Sam. v).

The famous city, within easy reach of the southern desert and central Palestine (to Hebron and to Samaria the distances are about 18 and 35 mi. respectively), had entered into Palestinian history in the Amarna age and had an old religious history. But Judaean tradition dated the sanctity of Jerusalem from the installation of the ark (*q.v.*), a sacred movable object, the symbol of the presence of Yahweh. It is associated with the half-nomad clans in the south of Palestine, or with the wanderings of David and his own priest, Abiathar (I Kings ii, 26). It is ultimately placed within the newly captured city. But canonical tradition associates it with the invasion of all the tribes of Israel from beyond the Jordan.

Other narratives describe the life of the young David at the court of the first king of the northern kingdom. The scenes cover the district which he took with the sword, and the brave Saul is represented in an unfavourable light. It is necessary to allow for the popular tendency to idealize great figures, and for the Judaean colouring of the compilation. To David is ascribed the sovereignty over a united people. After being the popular favourite of Israel in the little district of Benjamin, he was driven away by the jealousy and animosity of Saul. Gradually strengthening his position by alliance with Judaean clans, he became king at Hebron at the time when Israel suffered defeat in the north. His subsequent advance to the kingship over Judah and Israel at Jerusalem is represented as due to the weak condition of Israel and to the compliance of Saul's general, Abner; partly, also, to the long-expressed wish of the Israelites that their old hero should reign over them. Saul had been chosen by Yahweh to free his people from the Philistines; he had been rejected for his sins, and had suffered continuously from this enemy. Israel at his death was left in the unhappy state in which he had found it. It was the Judaean David, the faithful servant of Yahweh, who was now chosen to deliver Israel, and to the last the people gratefully remembered their debt.

The rift between Samuel and Saul marks the initial phase in the

struggle between ecclesiastical and temporal power, a phenomenon prominent in later monarchal times. The rugged warrior-king Saul would not submit to the authority of Samuel and thus brought upon himself the implacable hostility of the prophet. David, on the other hand, recognized the important role which the contemporary prophet could play in the consolidation of his regime and appears to have given him a constitutional status in his court. David accomplished the conquests of Saul, but on a grander scale; "Saul hath slain his thousands and David his tens of thousands" is the popular couplet comparing the relative merits of the rival dynasts. A series of campaigns against Edom, Moab, Ammon and the Aramaean states, friendly relations with Hiram of Tyre, and the recognition of his sovereignty by the king of Hamath on the Orontes, combine to portray a monarchy that was the ideal. (*See* also DAVID; SAMUEL; SAUL.)

David, the warrior, was followed by his son Solomon (*q.v.*), as "peaceful" as his name signifies, famous for his wealth, wisdom and piety and above all for the magnificent Temple he built at Jerusalem. Phoenician artificers were enlisted for the purpose, and with Phoenician sailors successful trading journeys were regularly undertaken. Commercial intercourse with Asia Minor, Arabia, Tarshish (in Spain) and Ophir filled Solomon's coffers, and his realm extended from the Euphrates to the border of Egypt. Solomon's enterprises included a foundry for the smelting of copper ore at Ezion-geber, at the northern tip of the Gulf of Aqaba. Tradition depicts him as a worthy successor to his father, and represents a state of luxury and riches impressive to all who were familiar with the great oriental courts. Another side of the picture, however, shows the domestic intrigues that darkened the last days of David. The accession of Solomon had not been without bloodshed, and David's old general, Joab, and his faithful priest, Abiathar, were opposed to the son of a woman who had been the wife of a Hittite warrior. The era of the Temple of Jerusalem starts with a new regime, another captain of the army and another priest —Zadok of Jerusalem. Moreover, the employment of Judaeans and Israelites for Solomon's palatial buildings, and the heavy taxation for the upkeep of a court that was the wonder of the world, caused grave discontent. External relations, too, were unsatisfactory. The Edomites, who had been almost extirpated by David in the valley of Salt, south of the Dead sea, were now strong enough to seek revenge; and the powerful kingdom of Damascus, whose foundation is dated to this period, began to threaten Israel on the north and northeast. These troubles affected all Solomon's reign, and even Hiram the Phoenician appears to have acquired a portion of Galilee. In the approaching disruption writers saw the punishment for the king's apostasy, and they condemn the sanctuaries in Jerusalem which he erected to the gods of his heathen wives. Nevertheless, these places of cult remained about 300 years until almost the close of the monarchy, when their destruction is attributed to Josiah.

At Solomon's death the opportunity was seized to request from his son, Rehoboam, a more generous treatment. The reply is memorable: "My little finger is thicker than my father's loins; my father chastised you with whips, but I will chastise you with scorpions." These words were calculated to inflame a people whom history proves to have been haughty and high-spirited, and the great Israel renounced its union with the small district of Judah.

The secession of northern Israel from the united monarchy seems to have been the inevitable result of the rivalry that persisted between the north and the south, in spite of their political union. Though the pressure of the Philistine menace had forced them into a united monarchy in an earlier age, the two groups did not merge into one homogeneous national unit and lose their separate identity. Once the Philistine threat was removed, the trend in Israel toward secession was heightened by Solomon's impositions and brought to a head by Rehoboam's autocratic attitude. His haughty rejection of the popular demand for a more liberal regime reflects the despotism of an oriental king who, unlike his grandfather David, was cradled in the arrogant splendour of the court and was far removed from the subjects he was to rule. Jeroboam (*q.v.*), once one of Solomon's officers, became king over the north, and the history of the divided monarchy begins (about 937 B.C.; some scholars, however, date the schism as late as 922) with the Israelite power on both sides of the Jordan and with Judah extending southward from a point a few miles north of Jerusalem.

5. The Rival Kingdoms.—The history of the two kingdoms is contained in the Books of Kings and the later and relatively less trustworthy Chronicles, which are mainly concerned with the fortunes of Judah. In the former a separate history of the northern kingdom has been curiously combined with Judaean history by means of synchronisms (*see* KINGS, BOOKS OF THE). Moreover, the Judaean compiler finds in Israel's troubles the punishment for its schismatic idolatry, nor does he spare Judah. He looks back upon the time when each kingdom laid the foundation of its subsequent fortunes. Judah enjoys an unbroken dynasty, which survived the most serious crises; a Temple that grew in splendour and wealth under royal patronage; and a legitimate priesthood that owed its origin to Zadok, the successful rival of David's priest, Abiathar. Israel, on the other hand, signed its death warrant by the institution of the bull cult, which, however, was scarcely recognized as contrary to the worship of Yahweh before the denunciations of Hosea (*see* GOLDEN CALF). Judah had natural connections with Edom and southern Palestine; Israel was more closely associated with Gilead and the Aramaeans of the north. That Israel was the stronger may be suggested by the acquiescence of Judah in the new situation. Shishak's invasion caused a diversion (*c.* 930 B.C.; or, according to those who accept the later chronology, a few years after 922), but of this reappearance of Egypt after nearly three centuries of inactivity little is preserved in biblical history. Only the Temple records recall the spoliation of the sanctuary of Jerusalem. However, Shishak left an inscription with a long list of cities which he claims to have conquered in Israel, as well as in Judah. Archaeological evidence supports the view that the invasion was of a much wider extent than that suggested by the biblical account. Although both kingdoms suffered, common misfortune did not throw them together. On the contrary, the statement that there was continual warfare is supplemented in Chronicles by the story of a victory over Israel by Abijah, the son of Rehoboam.

Jeroboam's son, Nadab, perished in a conspiracy while besieging the Philistine city of Gibbethon, and Baasha of (north) Israel seized the throne. Incessant warfare prevailed between him and Abijah's successor, Asa. The newly arisen state of Baasha was in league with Damascus, which had once been hostile to Solomon (1 Kings xi, 24 *et seq.*). Upon whom Asa could rely is not stated. Baasha seized Ramah, about 5 mi. N. of Jerusalem, and the existence of Judah was threatened. Asa utilized the treasure of the Temple and palace to induce the Syrians to break off their relations with Baasha. These sent troops to harry north Israel, and Baasha was compelled to retire. Asa, it would seem, was too weak to achieve the remarkable victory ascribed to him in II Chron. xiv. Baasha's short-lived dynasty resembles that of his predecessors. His son, Elah, after a reign of two years (like Ishbosheth and Nadab), was slain in a drunken carousal by his captain, Zimri. Meanwhile, the Israelite army was again besieging the Philistines at Gibbethon, and the recurrence of these conflicts points to a critical situation in a district in which Judah itself (although ignored by the writers) must have been vitally concerned. The army preferred its general, Omri, and, marching upon Zimri at Tirzah, burned the palace over his head. A fresh rival immediately appeared, the otherwise unknown Tibni. Israel was divided into two camps, until, on the death of Tibni, Omri became sole king (*c.* 884/876 B.C.). The scanty details of these important events stand in contrast to the full accounts of earlier Philistine wars and internal conflicts.

6. The Dynasty of Omri.—Omri (*q.v.*), the founder of one of the greatest dynasties of Israel, was contemporary with the revival of Tyre under the priest-king Ethbaal, whose daughter was married to Omri's son Ahab. Omri's most notable recorded achievement was the subjugation of Moab (*q.v.*). Moreover, Judah (now under Jehoshaphat) was bound intimately to Israel; and traditions of intermarriage and of co-operation in commerce and war imply what was practically a united Palestine. Alliance with Phoenicia gave the impulse to extended intercourse; trading expeditions were

undertaken from the Gulf of Aqaba, and Ahab built himself a palace decorated with ivory. Government administration at Samaria is attested by *ostraca* (*i.e.*, potsherds bearing inscriptions) discovered at that site, which, from their contents, are identified as office dockets relating to the collection of taxes in kind. The cult of the Baal of Tyre followed Jezebel to the royal city, Samaria, and even found its way into Jerusalem. This, the natural result of matrimonial and political alliance, already met with under Solomon, receives the usual denunciation. The conflict between Yahweh and Baal and the defeat of the latter are the characteristic notes of the religious history of the period, the records of which are now more abundant.

Although little is preserved of Omri's history, the fact that the northern kingdom long continued to be called by the Assyrians after his name is a significant indication of his reputation. Assyria was now making itself strongly felt in the west. Ashurnasirpal II had exacted tribute from north Syria (*c.* 876 B.C.), and his successor, Shalmaneser III, in the course of a series of expeditions, succeeded in gaining the greater part of that land. Irhuleni of Hamath and Bar-Hadad (the biblical Ben-Hadad) of Damascus formed a coalition with the kings of Cilicia, Phoenicia, Ammon, the Arabs of the Syrian desert and "Ahabbu Sirlai." In the last may be recognized the Israelite Ahab, whose contribution of 10,000 men and 2,000 chariots perhaps included levies from Judah and Moab (*cf.* for the number I Kings x, 26). In 853 the allies at least maintained themselves at the battle of Karkar. Other indecisive battles were fought later, but the precise constitution of the coalition is not recorded.

In 842–841 Shalmaneser records a campaign against Hazael, the new king of Damascus; no coalition is mentioned, although a battle was fought at Sanir (Hermon; Deut. iii, 9), and the cities of Hauran south of Damascus were despoiled. Tribute was received from Tyre and Sidon; and Jehu, the new king of Israel, sent gifts of gold, silver, etc. The "Black Obelisk" (now in the British museum), which records the submission of the petty kings, gives an interesting representation of the humble Israelite emissaries, with their long, fringed robes and strongly marked physiognomy. Yet another expedition in 837 would seem to show that Damascus was neither crushed nor helpless, but thenceforth, for a number of years, Assyria was fully occupied elsewhere and the west was left to itself.

Biblical tradition associates the changes in the thrones of Israel and Damascus with the work of the prophets Elijah and Elisha, but without a reference to Assyria. Ahab, it seems, had aroused popular resentment by encroaching upon the rights of the people to their landed possessions; had it not been for Jezebel, the tragedy of Naboth would not have occurred. The worship of the Tyrian Baal roused a small circle of zealots, and again the Phoenician marriage was the cause of the evil. Elijah of Gilead inspired the revolt which culminated in the accession of Jehu, the son of one Jehoshaphat (or, otherwise, of Nimshi). The work begun by Elijah was completed by Elisha, who supported Jehu and the new dynasty. The royal families of Israel and Judah perished in a massacre. While the extirpation of the cult of Baal was furthered in Israel by Jonadab the Rechabite, it was the "people of the land" who undertook a similar reform in Judah. Jehu (*q.v.*) became king, as the champion of the purer worship of Yahweh. The descendants of the detested Phoenician marriage were rooted out, and unless the close intercourse between Israel and Judah had been suddenly broken, it would be supposed that the new king at least laid claim to the south. Here, however, Athaliah, daughter of Jezebel, destroyed the Judaean court. Only the child Joash was preserved, and six years later the priests slew the queen, overthrew the cult of Baal and crowned the young child.

7. Damascus, Israel and Judah.—Hazael of Damascus, Jehu of Israel and Elisha the prophet are the three men of the new age linked together, as though commissioned for like ends (*see* I Kings xix, 15–17). Elisha had sent to anoint Jehu as king, and, while on intimate terms with Bar-Hadad (Ben-Hadad) of Damascus, recognized Hazael as its future ruler. But after the accession of Jehu the situation changed. "In those days Yahweh began to cut short [or, amending the text, "to be angry with"] Israel." This brief notice heralds Hazael's attack upon Israelite territory east of the Jordan (II Kings x, 32). The cause of the attack is obscure. Certain traditions, it is true, indicate that Israel had been at war with the Aramaeans from before 853 to 841, and that Hazael was attacking Gilead at the time when Jehu revolted; but in the midst of these are other traditions of the close and friendly relations between Israel and Damascus.

The southern kingdom suffered little in the disastrous wars between Damascus and Israel. Hazael indeed advanced upon Gath, and Jerusalem was saved only by a timely bribe. There were internal troubles, and Jehoash perished in a conspiracy. His son, Amaziah, had some difficulty in gaining the kingdom, and showed conspicuous leniency in sparing the children of his father's murderers. Israel, on the other hand, was almost annihilated by the Syrians. These seized Gilead, crossed over into Palestine and occupied the land. Jehu's son, Jehoahaz, saw his army made "like the dust in threshing," and the desperate condition of the country recalls the straits in the time of Saul (I Sam. xiii, 6, 7, 19–22), and the days before the great overthrow of the northern enemy as described in the Song of Deborah (Judg. v, 6–8). The atrocities committed by Damascus and its Ammonite allies upon Gilead were not forgotten (Amos i, 3, 13), and they illuminate a remarkable interview between Elisha and Hazael (II Kings viii, 12). Several of the situations can be more vividly realized from the stories of Syrian wars ascribed to the time of Omri's dynasty but more probably relating to the dynasty of Jehu.

Under Joash (Jehoash), son of Jehoahaz, the tide turned. Elisha was apparently the champion, and posterity told of his exploits when Samaria was visited with the sword. Thrice Joash smote the Syrians—in accordance with the last words of the dying prophet—and Aphek in the Sharon plain, famous in history for Israel's disasters, now witnessed three victories. The enemy under Hazael's son, Ben-Hadad, was driven out and Joash regained the territory which his father had lost (II Kings xiii, 25); it may reasonably be supposed that a treaty was concluded (*cf.* the anonymous I Kings xx, 34). But the peace does not seem to have been popular. The story of the last scene in Elisha's life ascribes to Joash an easily contented disposition that hindered him from completing his successes. Syria had not been crushed and the failure to utilize the opportunity was an act of impolitic leniency for which Israel was bound to suffer (II Kings xiii, 19). Elisha's indignation can be illustrated by the denunciation passed upon an anonymous king by the prophetic party on a similar occasion (I Kings xx, 35–43).

At this stage it is necessary to notice the fresh invasion of Syria by Hadad (Adad)-nirari III, who besieged Mari, king of Damascus, and exacted a heavy tribute (*c.* 802 B.C.). A diversion of this kind would explain the Israelite victories; the subsequent withdrawal of Assyria would afford the occasion for Damascus to retaliate. Men in Israel who remembered the wars between Assyria and Damascus, and the recuperative power of the Aramaeans, would perceive the danger of the lenient policy of Joash. Adad-nirari claims tribute from Tyre, Sidon and Beth-Omri (Israel), also from Edom and Palastu (Philistia). There are no signs of an extensive coalition as in the days of Shalmaneser; Ammon is probably included under Damascus; the position of Moab—which had freed itself from Jehoram of Israel—can hardly be calculated. But the absence of Judah is surprising. Both Jehoash (of Judah) and his son, Amaziah, left a great name; and the latter was comparable only to David (II Kings xiv, 3). He defeated Edom in the valley of Salt, and it is conceivable that Amaziah's kingdom extended over both Edom and Philistia. A vaunting challenge to Joash (of Israel) gave rise to one of the two fables that are preserved in the Old Testament. It was followed by a battle at Beth-shemesh; the scene would suggest that Philistia also was involved. The result was the rout of Judah, the capture of Amaziah, the destruction of the northern wall of Jerusalem, the sacking of the Temple and palace and the removal of hostages to Samaria (II Kings xiv, 12 *et seq.*). This disaster was scarcely the outcome of a challenge to a trial of strength; it was rather the sequel to a period of smoldering jealousy and hostility, and, according to one chronological scheme, 27 years passed before Judah had another king (Uzziah).

8. Jeroboam and Uzziah.—The defeat of Syria by Joash (of

Israel) was not final. The decisive victories were gained by Jeroboam II. He saved Israel from being blotted out, and "the people of Israel dwelt in their homes as formerly" (II Kings xiii, 5; xiv, 26 *et seq.*). Syria must have resumed warfare with redoubled energy, and a state of affairs is presupposed that can be pictured with the help of narratives dealing with similar historical situations. In particular, the overthrow of Israel as foreshadowed in I Kings xxii implies an Aramaean invasion after a treaty, although this can scarcely be justified by the events that followed the death of Ahab, in whose time they are now placed. Under Jeroboam II the borders of Israel were restored and the disastrous Aramaean wars avenged.

For a time the kingdom of Urartu (biblical Ararat) was the most important factor in the north, and the Hebrews may well have come into close touch with peoples who were the descendants of the Hittite, Mitannian and other non-Semitic stock of old. Moab was probably tributary; the position of Judah and Edom is involved with the chronological problems. According to the Judaean annals the "people of Judah" set Azariah (Uzziah) upon his father's throne; and to his long reign of 52 years are ascribed conquests over Philistia and Edom, the fortification of Jerusalem and the reorganization of the army. The two great kings Uzziah and Jeroboam were contemporary, but upon the relations between them there is no information; yet had Amaziah suffered at the hands of Israel, and when, at the death of Jeroboam, Israel hastened to its end amid anarchy and dissension, it is unlikely that the southern kingdom was unmoved. All that can be recognized from the biblical records, however, is the period of internal prosperity enjoyed by Israel and Judah under Jeroboam and Uzziah (*qq.v.*) respectively.

The events inaugurating the dynasty of Jehu, the terrible Aramaean wars, Yahweh's "arrow of victory," and at length the rise of Jeroboam, make the century (*c.* 850–750 B.C.) one of the most conspicuous epochs in Hebrew history. This dynasty culminates in the rise of the great Hebrew prophets (Amos, Hosea, Isaiah, Micah, etc.). That these had predecessors in the stirring days before them is to be expected—for there is much in prophecy that makes it far from unique or necessarily elevated. But they strike so distinctive a note, their teaching is so fundamental, and its effects so evident, that the question arises whether the religious conditions they condemn are those as set forth in the literature referring to earlier periods. In fact, the modern historical and religious study of the Old Testament turns upon the interpretation of the great prophets and the relation between them, on the one hand, and the Pentateuch and historical recensions on the other. (*See* also PROPHET and the articles on the several prophets.)

9. The Fall of the Israelite Monarchy.—Israel's prosperity under Jeroboam II proved its undoing. The disorders that hastened the end find analogy in the events of the more obscure period after the death of the earlier Jeroboam. Only the briefest details are given. Zechariah was slain after six months by Shallum ben Jabesh in Ibleam; but the usurper fell a month later to Menahem (*q.v.*), who only after much bloodshed established his position. Assyria again appeared upon the scene, under Tiglath-pileser III; on his approach a coalition was formed that was soon overthrown. Among those who paid tribute were Rasun (the biblical Rezin) of Damascus, Menahem of Samaria, the kings of Tyre, Byblos and Hamath and the queen of Aribi (the Syrian desert).

Israel was once more in league with Damascus and Phoenicia, and the biblical records must be read in the light of political history. Judah was probably holding aloof. Its king, Uzziah, was a leper in his latter days, and his son and regent, Jotham, claims notice for a circumstantial reference to his subjugation of Ammon—the natural allies of Damascus—for three years (II Chron. xxvii, *cf.* xxvi, 8). Scarcely had Assyria withdrawn before Menahem lost his life in a conspiracy, and Pekah, with the help of Gilead, made himself king. The new movement was evidently anti-Assyrian, and strenuous endeavours were made to present a united front. Judah was the centre of attack. Rasun and Pekah directed their blows from the north, Philistia threatened the west flank, and the Edomites, who drove out the Judaeans from Elath (on the Gulf of Aqaba), were no doubt only taking their part in the concerted action. A more critical situation could scarcely be imagined. The throne of David was then occupied by a youth—Ahaz, the son of Jotham. In this crisis arose Isaiah (*see* ISAIAH, BOOK OF), perhaps the grandest of Hebrew prophets. The disorganized state of Egypt and the uncertain allegiance of the desert tribes left Judah without direct aid; on the other hand, opposition to Assyria among the conflicting interests of Palestine and Syria was rarely unanimous. Either in the natural course of events—to preserve the unity of his empire—or influenced by the rich presents of gold and silver with which Ahaz accompanied his appeal for help, Tiglath-pileser intervened with campaigns against Philistia (734–732 B.C.) and Damascus (733–732). Israel was punished by the ravaging of the northern districts, and the king claims to have carried away the people of "the house of Omri." Pekah was slain, and one Hoshea (*q.v.*) was recognized as his successor. Assyrian officers were placed in the land and Judah thus gained its deliverance at the expense of Israel. But the proud Israelites did not remain submissive for long; Damascus had indeed fallen, but neither Philistia nor Edom had yet been crushed.

When Israel began to regain confidence, its policy halted between obedience to Assyria and reliance upon Egypt—though whether Mizraim (*q.v.*) refers to Egypt proper or includes some more easterly area is open to dispute. The situation is illustrated in the writings of Hosea (*q.v.*). Tiglath-pileser died in 727 and the slumbering revolt became general. Israel refused the usual tribute to its overlord, and definitely threw in its lot with "Egypt." In due course Samaria was besieged for three years by Shalmaneser V. This statement seems perfectly credible when one views the architectural remains of the Israelite city of Samaria. The thick walls of heavy masonry, laid in rock-cut foundations, must have been impregnable, while the storage pits and channels for collecting rain water suggest arrangements for holding out in a protracted siege.

The alliance with So (Seveh, Sibi) of "Egypt," upon whom hopes had been placed, proved futile, and the forebodings of keen-sighted prophets were justified. Although no evidence is at hand, it is probable that Ahaz of Judah rendered service to Assyria by keeping the allies in check; it is possible, also, that the former enemies of Jerusalem had now been induced to turn against Samaria. The actual capture of the Israelite capital is claimed by Sargon II (722/721), who removed 27,200 of its inhabitants and 50 chariots. Other peoples were introduced, officers were placed in charge, and tribute was reimposed. Another revolt was planned in 720 in which the province of Samaria joined with Hamath and Damascus, with the Phoenician Arpad and Simura, and with Gaza and "Egypt." Two battles, one at Karkar in the north, another at Rapih (Raphia) on the border of Egypt, sufficed to quell the disturbance. The desert peoples who paid tribute on this occasion still continued restless, and in 715 Sargon removed men of Tamud, Ibadid, Marsiman, Hayapa (*cf.* the Midianite Ephah, Gen. xxv, 4), "the remote Arabs of the desert," and placed them in the land of Beth-Omri. Sargon's statement is significant for the later history of Samaria; but the biblical historians take no further interest in the fortunes of the northern kingdom and see in Judah the sole survivor of the Israelite tribes (*see* II Kings xvii, 7–23). Yet the situation in this neglected district must continue to provoke inquiry.

10. Judah and Assyria.—Amid these changes the history of Judah was intimately connected with the south Palestinian peoples. Ahaz had recognized the sovereignty of Assyria and visited Tiglath-pileser at Damascus. The Temple records describe the innovations he introduced on his return. Under his son, Hezekiah, there were fresh disturbances in the southern states, and anti-Assyrian intrigues began to take a more definite shape among the Philistine cities. Ashdod openly revolted and found support in Moab, Edom, Judah and "Egypt." This step may possibly be connected with the attempt of Merodach-baladan in south Babylonia to form a league against Assyria (*cf.* II Kings xx, 12); at all events Ashdod fell after a three years' siege (710) and for a time there was peace. But with the death of Sargon in 705 there was another outburst; practically all of Palestine and Syria was in arms, and Sennacherib's empire in the west was threatened.

In both Judah and Philistia the anti-Assyrian party was not without opposition, and those who adhered or favoured adherence to the great power were justified by the result. At Sennacherib's approach, Ashdod, Ammon, Moab and Edom submitted; Ekron (which sent its king in fetters to Hezekiah), Ascalon, Lachish and Jerusalem held out strenuously. The southern allies (with "Egypt") were defeated at Eltekeh. Hezekiah was besieged and compelled to submit (701). The small kings who had remained faithful were rewarded by an extension of their territories, and Ashdod, Ekron (whose king was now restored) and Gaza were enriched at Judah's expense. These events are related in Sennacherib's inscription; the biblical records preserve their own traditions (*see* also HEZEKIAH; SENNACHERIB).

In the long reign of Hezekiah's son, Manasseh (*c.* 686–642; *q.v.*), later writers saw the deathblow to the Judaean kingdom. Much is said of his wickedness, but few details have come down. The land was practically under the control of Assyria. Both Esarhaddon (681–669) and Ashurbanipal (669–630) number among their tributaries Tyre, Ammon, Moab, Edom, Ascalon, Gaza and Manasseh himself, and cuneiform dockets unearthed at Gezer suggest the presence of Assyrian garrisons there, and no doubt also elsewhere. The situation favoured the spread of foreign customs, and the condemnation passed upon Manasseh thus, perhaps, becomes more significant. It is possible that Manasseh merely assimilated the older Yahweh worship to Assyrian form; politics and religion were inseparable, and the supremacy of Assyria weakened that of Yahweh.

If Judah was compelled to take part in the Assyrian campaigns against Egypt, Arabia (the Syrian desert) and Tyre, this would only be in accordance with a vassal's duty. But since tradition preserves some recollection of an offense for which Manasseh was taken to Babylon to explain his conduct (II Chron. xxxiii), also of the settling of foreign colonists in Samaria by Esarhaddon (Ezra iv. 2), it is possible that Judah attempted to regain its liberty. According to Ashurbanipal all the western lands were inflamed by the revolt of his brother, Shamash-shum-ukin. What part Judah took in the Transjordanian disturbances, in which Moab fought invading Arabian tribes on behalf of Assyria, is unknown.

Manasseh's son, Amon, fell in a court intrigue, and "the people of the land," after avenging the murder, set up in his place the infant Josiah (641/640). The circumstances imply a regency, but upon this the records are silent. The decay of Assyria doubtless awoke the national feeling of independence, and an account is given of Josiah's religious reforms. In an age when the oppression and corruption of the ruling classes had been such that those who cherished the old worship of Yahweh dared not confide in their most intimate companions (*cf.* Mic. vii, 5), no reforms were possible; but now the young Josiah, the popular choice, was upon the throne.

A roll, it was said, had been found in the Temple; its contents terrified the priests and king, and it led to a solemn covenant before Yahweh to observe the provisions of the lawbook that had been so opportunely recovered. The writer, as has been recognized since the days of Jerome, is describing the discovery of Deuteronomy (*q.v.*). It is, however, very doubtful whether it was the book in its present form, although the biblical writer believed that Josiah successfully put down the "high places" and centralized the religion. In any case Josiah's reforms were of no lasting effect, to judge from Jeremiah (xxv, 3–7, xxxvi, *et seq.*) and Ezekiel (xvi, xxiii). On the other hand Deuteronomy has a characteristic social-religious side; its humanity, philanthropy and charity are the distinctive features of its laws, and Josiah's reputation (Jer. xxii, 15 *et seq.*) and the circumstances in which he was chosen king may suggest that he, like Joash (II Kings xi, 17; *cf.* xxiii, 3), had entered into a reciprocal covenant with a people who, as Micah's writings would indicate, had suffered grievously.

11. The Fall of the Judaean Monarchy.—A new era was beginning in the history of the world (*see* PALESTINE: *Prehistory and History*). Assyria was rapidly decaying and Egypt, under Psamtik I, had recovered from the blows of Ashurbanipal, to which the Hebrew prophet Nahum refers (iii, 8–10). A Chaldean prince, Nabopolassar, set himself up in Babylonia. Nineveh fell in 612, and Harran, where the court had been removed, was taken in 610. Thus fell an empire that had dominated Palestine for two centuries, whose history in the west went back for a millennium.

Necho, son of Psamtik, marched through Palestine to aid Assyria. Josiah interposed; possibly he had hopes of extending his kingdom (II Chron. xxxv, 20 *et seq.* is more reliable than II Kings xxiii, 29 *et seq.*). That he had authority over a much larger area than Judah alone is suggested by II Kings xxiii, 19, and by the references to the border at Riblah, 45 mi. S. of Hamath (Ezek. vi, 14, xi, 10 *et seq.*). Josiah was slain at Megiddo, and Egypt, as in the long distant past, again held Palestine and Syria. The Judaeans made Jehoahaz (or Shallum) their king, but the Pharaoh banished him to Egypt three months later and appointed his brother, Jehoiakim.

Meanwhile, Nabopolassar recognized in Necho a dangerous rival, and sent his son Nebuchadrezzar, who overthrew the Egyptian forces at Carchemish (605). The battle was the turning point of the age. The succession of the new Chaldean or Babylonian kingdom was assured, though the relations between Egypt and Judah were not broken off. Jehoiakim was inclined to rely upon Egypt. He died just as Nebuchadrezzar, after seeing his warnings disregarded, was preparing to lay siege to Jerusalem. His young son, Jehoiachin, surrendered after a three months' reign, with his mother and the court; they were taken away to Babylonia, together with a number of artisans (597). Jehoiakim's brother, Mattaniah, or Zedekiah, was set in his place under an oath of allegiance, which he broke, preferring Hophra (Apries), the new king of Egypt. A few years later the second siege took place. It began on the tenth day of the tenth month, Jan. 587. The looked-for intervention of Egypt was unavailing, although a temporary raising of the siege inspired wild hopes. The confusion and panic in the last phases of the Babylonian campaign is reflected in the Lachish *ostraca*. These are military dispatches sent by an officer in charge of a scouting party outside Lachish to his commander inside the city. His reports not only deal with the Babylonian advance but also reflect the atmosphere of suspicion and of low morale that beset the people in this shattering catastrophe. Desertion, pestilence and famine added to the usual horrors of a siege, and at length on the ninth day of the fourth month, 586, a breach was made in the walls. (Other authorities put the fall of Jerusalem in 588 or 587.)

Zedekiah fled toward the Jordan valley but was seized and taken to Nebuchadrezzar at Riblah. His sons were slain before his eyes, and he himself was blinded and carried off to Babylon after a reign of 11 years. The Babylonian Nebu-zaradan was sent to take vengeance upon the rebellious city, and on the seventh day of the fifth month 586 B.C. Jerusalem was destroyed. The Temple, palace and city buildings were burned, the walls broken down, the chief priest, Seraiah, and other leaders were put to death, and many people were again carried off. The disaster became the great epoch-making event in Jewish history and literature.

Throughout these stormy years the prophet Jeremiah had realized that Judah's only hope lay in submission to Babylonia. Stigmatized as a traitor, scorned and imprisoned, he had not ceased to warn deaf ears, although Zedekiah himself was, perhaps, open to persuasion. Now the penalty had been paid, and the Babylonians, whose policy was less destructive than that of Assyria, contented themselves with appointing as governor a certain Gedaliah. The new centre was Mizpah, a commanding eminence and sanctuary, about 5 mi. N.W. of Jerusalem; there Gedaliah issued an appeal to the people to be loyal to Babylonia and to resume their former peaceful occupations. The land had not been devastated, and many gladly returned from their hiding places in Moab, Edom and Ammon. But discontented survivors of the royal family under Ishmael intrigued with Baalis, king of Ammon. The plot resulted in the murder of Gedaliah and an unsuccessful attempt to carry off various princesses and officials who had been left in the governor's care. This new confusion and a natural fear of Babylonia's vengeance led many to feel that their own safety lay in flight to Egypt, and, although warned by Jeremiah that even there the sword would find them, they fled south and took refuge in Tahpanhes (Daphnae; *q.v.*), afterward forming small settlements in other

parts of Egypt. But the thread of the history is broken, and apart from an allusion to the favour shown to the captive Jehoiachin (with which the books of Jeremiah and Kings conclude), there is a gap in the records, and subsequent events are viewed from a new standpoint. (*See* JEREMIAH, BOOK OF.)

B. EXILE AND RESTORATION

1. Internal Conditions of the Exile.—Many of the exiles accepted their lot and settled down in Babylonia (*cf.* Jer. xxix, 4–7); Jewish colonies, too, were being founded in Egypt. The agriculturists and herdsmen who had been left in Palestine formed, as always, the stable population, and it is impossible to imagine either Judah or Israel as emptied of its inhabitants. The peasants were left in peace to divide the land among them, and new conditions arose as they took over the ownerless estates. There, as already in Israel, the fall of the monarchy involved a reversion to a premonarchal state, and it is impossible to sever too rigorously two sections of Hebrews who had so much in common. Indeed, kings of Judah might well have been tempted to restore the kingdom of their traditional founder, or Assyria might have been complaisant toward a faithful Judaean vassal. But Israel, after the fall of Samaria, is ignored by the Judaean writers, and lies as a foreign land; although Judah itself had suffered from the intrusion of foreigners in the preceding centuries of war and turmoil, and strangers had settled in its midst, had formed part of the royal guard or had served as janissaries.

Samaria had experienced several changes in its original population. Settlement upon new soil involved dependence upon its god, and a priest was sent to instruct the colonists in the fear of Yahweh. Thenceforth they continued the worship of the Israelite Yahweh along with their own native cults (II Kings xvii, 24–28, 33). Their descendants claimed participation in the privileges of the Judaeans (*cf.* Jer. xli, 5), and must have identified themselves with the old stock (Ezra iv, 2). Whatever recollection they preserved of their origin and of the circumstances of their entry would be retold from a new standpoint.

To the prophets the religious position was lower in Judah than in the "sister" Samaria (Jer. iii, 11 *et seq.*, xxiii, 11 *et seq.*; Ezek. xvi, 51). The prevalence of heathen elements in Jerusalem, as detailed in the reforms of Josiah or in the writings of the prophets (*cf.* Ezek. viii), would at least suggest that the destruction of the state was not entirely a disaster. The political disasters not only meant a shifting of population, they also brought into prominence the old popular and nonofficial religion. When there were sects like the Rechabites (Jer. xxxv), when the Judaean fields could produce a Micah, and when Israel had men who inherited the spirit of a Hosea, the nature of the underlying conditions can be more justly appreciated.

The writings of the prophets were cherished, not only in the unfavourable atmosphere of courts but also in the circles of their followers. In the smaller sanctuaries the old-time beliefs were maintained, and the priests, often perhaps of the older native stock, were the recognized guardians of the religious cults. The stories of earlier days encircle places that, though denounced for their corruption, are not regarded as illegitimate, and the dim traditions of the past, in the form in which they are preserved, reveal an attempt to purify popular belief and thought.

2. Restoration of Judah.—The course of events from the middle of the 6th century B.C. to the close of the Persian period is extremely obscure, although much indirect evidence indicates that this age holds the key to the growth of written biblical history. It was an age of literary activity, which manifested itself not in contemporary historical records—only a few of which have survived—but rather in the special treatment of previously existing sources (*see* EZRA AND NEHEMIAH, BOOKS OF). In 561 B.C. the captive Judaean king, Jehoiachin, received special marks of favour from Nebuchadrezzar's son, Amel-Marduk (Evil-Merodach) (II Kings xxv, 27 *et seq.*; Jer. lii, 31–34). A little later Tyre received as its king Merbaal (555–552), who had been brought from Babylonia. If Babylon was assured of the allegiance of its vassals further acts of clemency may well have followed. But the later recension of Judaean history—the only source—entirely ignores the elevation of Jehoiachin, and, passing over the exile, proceeds at once to the first years of Cyrus II the Great, who proclaims as his divine mission the rebuilding of the Temple (538) (II Chron. xxxvi). The Judaean Sheshbazzar (a corruption of some Babylonian name) brought back the Temple vessels that Nebuchadrezzar had carried away and prepared to undertake the work at the expense of the royal purse. A large body of exiles is said to have returned to Jerusalem under Zerubbabel, who was of Davidic descent, and the priest Jeshua or Joshua, the grandson of the murdered Seraiah (Ezra i–iii; v, 13–vi, 5). When these refused the proffered help of the people of Samaria, men who claimed to be of the same faith as themselves, their troubles began, and the Samaritans retaliated by preventing the rebuilding.

The next historical notice is dated in the second year of Darius I (520), when two prophets, Haggai and Zechariah (*qq.v.*), kindled the Judaeans to new efforts. Despite opposition, the work went steadily onward, because of the favour of Darius, and the Temple was completed four years later, 516 B.C. (Ezra v, 2, vi, 13 *et seq.*). On the other hand, from the independent writings ascribed to these prophets, it appears that no considerable body of exiles could have returned—it is still an event of the future (Zech. ii, 7, vi, 15); little, if anything, had been done to the Temple (Hag. ii, 15); and Zerubbabel is the one to take in hand and complete the great undertaking (Zech. iv, 9). The prophets address themselves to men living in comfortable abodes with olive fields and vineyards, suffering from bad seasons and agricultural depression, and, though the country is unsettled, there is no reference to any active opposition on the part of Samaritans. So far from drawing any lesson from the brilliant event in the reign of Cyrus, the prophets imply that Yahweh's wrath was still upon the unfortunate city and that Persia was still the oppressor. Consequently, although small bodies of individuals no doubt came back to Judah from time to time, and some special mark of favour may have been shown by Cyrus, the opinion has gained ground since the early arguments of E. Schrader (1867) that the compiler's representation of the history is less trustworthy than the independent evidence of the prophetic writings. His main object is to make the new Israel, the postexilic community at Jerusalem, continuous, as a society, with the old Israel.

Unfortunately, the internal conditions in the 6th century B.C. can be estimated only indirectly, and the political position is uncertain. In Zerubbabel the people beheld once more a ruler of the Davidic race. The new Temple heralded a new future; the mournful fasts commemorative of Jerusalem's disasters would become feasts; Yahweh had left the Temple at the fall of Jerusalem, but had now returned to sanctify it with his presence; the city had purged its iniquity and was fit once more to become the central sanctuary. So Haggai sees in Zerubbabel the representative of the ideal kingdom, the trusted and highly favoured minister who was the signet ring upon Yahweh's hand. Zechariah, in his turn, proclaims the overthrow of all difficulties in the path of the new king, who shall rule in glory supported by the priest (Zech. vi). What political aspirations were revived, what other writers were inspired by these momentous events are questions of inference. Again there is a gap in the history.

3. Nehemiah.—The history passes abruptly from the time of Zerubbabel to the reign of Artaxerxes I (but Artaxerxes II according to C. C. Torrey). The enthusiastic hopes have melted away, the Davidic scion has disappeared and Jerusalem has been—as it would seem—the victim of another disaster. The country is under Persian officials, the nobles and priests form the local government, and the ground is being prepared for the erection of a hierocracy. It is the work of rebuilding and reorganization, of social and of religious reforms, that is encountered in the last pages of biblical history, and in the records of Ezra and Nehemiah Jerusalem is in the very centre of epoch-making events.

Nehemiah, the cupbearer of Artaxerxes at Susa, distressed at the news of the desolation of Jerusalem, obtained permission from the king to rebuild the ruins. Provided with an escort and with the right to obtain supplies of wood for the buildings, he returned to the city and aroused the people to the necessity of fortifying and repopulating it. Sanballat of Horon, Tobiah the Ammonite

and Gashmu the Arabian (? Edomite) unceasingly opposed him. Tobiah and his son, Johanan, were related by marriage to Judaean secular and priestly families, and active intrigues resulted, in which nobles and prophets took their part. It was insinuated that Nehemiah had his prophets to proclaim that Judah had again its own king, and that he was intending to rebel against Persia! Nehemiah naturally gives his version; the earlier enthusiasm of Haggai and Zechariah for Zerubbabel would illustrate the feelings of Nehemiah's partisans. But Tobiah and Johanan themselves were worshipers of Yahweh, and consequently, with prophets taking different sides and with the Samaritan claims summarily repudiated (Neh. ii, 20; *cf.* Ezra iv, 3), it is difficult to gather all the facts.

Nevertheless the undaunted Judaean pressed on unmoved by the threatening letters that were sent around, and succeeded in completing the walls within 52 days. Nehemiah also appears as governor of the small district of Judah and Benjamin. Famine, the avarice of the rich and the necessity of providing tribute had brought the humbler classes to the lowest straits. Faced with old social abuses, Nehemiah vehemently contrasted the harshness of the nobles with the generosity of the exiles, who would redeem their poor countrymen from slavery. He himself had always refrained from exacting the usual provision that other governors had claimed; indeed, he had readily entertained over 150 officials and dependents at his table, apart from casual refugees (Neh. v). A 12 years' governorship and a second visit to Jerusalem are mentioned, but the evidence does not make it possible to determine the sequence. Chapter v of the Book of Nehemiah is placed in the middle of the building of the walls in 52 days; the other reforms during the second visit are closely connected with the dedication of the walls and with the events that immediately follow his first arrival, when he had come to rebuild the city. Nehemiah also remedies religious abuses. He found the busy agriculturists and traders (some from Tyre) pursuing their usual labours on the Sabbath, now more strictly observed, and he pointed to the disasters that had resulted in the past from such profanation (Neh. xiii, 18; *cf.* Jer. xvii, 20 *et seq.;* Ezek. xx, 13–24; Isa. lvi, 2, 6, lviii, 13). Moreover, the maintenance of the Temple servants called for supervision; the customary allowances had not been paid to the Levites, who had come to Jerusalem after the smaller shrines had been put down, and they had forsaken the city.

Nehemiah's last acts were the most significant. Jews had married women of Ashdod, Ammon and Moab, and the impetuous governor indignantly adjured them to desist from the historic cause of national sin. Even members of the priestly families had intermarried with Tobiah and Sanballat; the former had a chamber in the Temple, the daughter of the latter was the wife of a son of Joiada, the son of the high priest, Eliashib. Tobiah was cast out, the offending priest was expelled and a general purging followed, in which the foreign elements were removed. With this Nehemiah brings the account of his reforms to a conclusion, and the words "Remember me, O my God, for good" (xiii, 31) have a meaning. According to Josephus (*Antiquities*, xi, 7, 2), a certain Manasseh, the brother of Jaddua and grandson of Joiada, refused to divorce his wife, the daughter of Sanballat. For this he was driven out, and, taking refuge with the Samaritans, founded a rival temple and priesthood upon Mt. Gerizim, to which repaired other priests and Levites who had been guilty of mixed marriages. There is little doubt that the events described by Josephus are those referred to also in Neh. xiii, but Josephus places the schism and the foundation of the new Temple in the time of Alexander III the Great. At all events, there is now a complete rupture with Samaria, and thus, in the concluding chapter of the last of the historical books of the Old Testament, Judah maintains its claim to the heritage of Israel and rejects the right of the Samaritans to the title.

4. Ezra.—In this separation of the Judaeans from religious and social intercourse with their neighbours, the work of Ezra requires notice. The story of this scribe crystallizes the new movement inaugurated after a return of exiles from Babylonia. The age can also be illustrated from Isa. lvi–lxvi and Malachi. There was a poor and weak Jerusalem, its Temple stood in need of renovation, its temple service was mean, its priests unworthy of their office. On the one side was the poverty of the poor, on the other the pride of the governors. There were two religious parties, one exclusive, the other more cosmopolitan and syncretizing, extending a freer welcome to strangers and tolerating the popular and superstitious cults of the day (Isa. lxv *et seq.*). But the former won and, realizing that the only hope of maintaining a pure worship of Yahweh lay in a forcible isolation from foreign influence, it took measures to ensure the religious independence of their assembly.

It is related that Ezra, the scribe and priest, returned to Jerusalem with priests and Levites, lay exiles and a store of vessels for the Temple. He was commissioned to inquire into the religious condition of the land and to disseminate the teaching of the Law to which he had devoted himself (Ezra vii). On his arrival the people were gathered together, and he read "the book of the Law of Moses" daily for seven days (Neh. viii). They entered into an agreement to obey its teaching, undertaking in particular to avoid marriages with foreigners. An account is given of this reform (Ezra ix *et seq.*), and Ezra's horror at the intermarriages, which threatened to destroy the distinctive character of the community, sufficiently indicates the attitude of the stricter party. The true seed of Israel separated themselves from all foreigners (not, however, without some opposition) and formed an exclusively religious body or "congregation." Dreams of political freedom gave place to hopes of religious independence, and "Israel" became a church, seeking its foundation in the desert of Sinai a thousand years before. (*See* EZRA; EZRA AND NEHEMIAH, BOOKS OF; NEHEMIAH.)

5. Postexilic Judaism.—With Nehemiah and Ezra arrives the era of normative Judaism. Judah was a religious community whose representative was the high priest of Jerusalem. Instead of sacerdotal kings, there were royal priests, anointed with oil, arrayed with kingly insignia, claiming the usual royal dues in addition to the customary rights of the priests. With his priests and Levites, and with the chiefs and nobles of the Jewish families, the high priest directs this small state, and his death marks an epoch as truly as did that of the monarchs in the past. This hierarchical government, which can find no foundation in the Hebrew monarchy, is the forerunner of the Sanhedrin (*q.v.*). Laws were recast in accordance with the requirements of the time, with the result that, alongside usages evidently of great antiquity, details now appear that were previously unknown or wholly unsuitable.

The postexilic priestly spirit represents a tendency that is not to be found in the "Deuteronomic" Books of Kings but is conspicuous in the later, and to some extent parallel, Books of Chronicles. There is also an unmistakable development in the laws; and the priestly legislation, though ahead of both Ezekiel and Deuteronomy, not to mention still earlier usage, not only continues to undergo continual internal modification, but finds a further distinct development in the way of definition and interpretation, outside the Old Testament—in the Talmud (*q.v.*). Though postexilic priestly literature is marked by lack of spontaneity and ritualism, it must be recognized that monotheism was thereby placed upon a firm basis. In the words of J. Wellhausen,

> It was a necessity that Judaism should incrust itself in this manner; without those hard and ossified forms the preservation of its essential elements would have proved impossible. At a time when all nationalities, and at the same time all bonds of religion and national customs, were beginning to be broken up in the seeming cosmos and real chaos of the Graeco-Roman empire, the Jews stood out like a rock in the midst of the ocean. When the natural conditions of independent nationality all failed them, they nevertheless artificially maintained it with an energy truly marvellous, and thereby preserved for themselves, and at the same time for the whole world, an eternal good.

Yet the whole experience of subsequent history, through the heroic age of the Maccabees and onward, proves that the minuteness of ritual procedure could not cramp the heart. The work represented in Nehemiah and Ezra, and effected by the supporters of an exclusive Judaism, certainly won the day, and it left its impress upon the historical traditions. But Yahwism, like Islam, had its sects and tendencies, and the opponents to the stricter ritualism always had followers. Whatever the predominant party might think of foreign marriages, the tradition of the half-Moabite

origin of David serves, in the beautiful idyll of Ruth, to emphasize the debt which Judah and Jerusalem owed to one of their neighbours. Again, although some desired a self-contained community opposed to the heathen neighbours of Jerusalem, the story of Jonah implicitly contends against the attempt of Judaism to close its doors. The conflicting tendencies were incompatible, but Judaism retained the incompatibilities within its limits, and the two tendencies, prophetical and priestly, continue, to find their further development in postbiblical Judaism as reflected in the later records of the Mishnah. (S. A. C.; JB. W.)

6. The Consolidation of Judaism.—From the time of Nehemiah, for a period of several generations, information regarding the history of the Jewish people is sparse in the extreme. No more than one or two isolated episodes are recorded. Josephus tells (*Antiquities*, xi, 297–301) of a dispute for the high priesthood that resulted in a murder in the Temple and the intervention of the Persian authorities. The story of the deliverance of the Jews throughout the Persian empire recounted in the Book of Esther, if it has a historical basis, presumably relates to this period. The 5th-century Elephantine papyri, from which it is possible to reconstruct the details of life in a Jewish military colony in Upper Egypt, and the government's paternal solicitude for even its religious observances, illustrate factually the organization and status of Jewish groups outside Palestine. Incidental evidence in these suggests that at this time the province of Judaea was subordinated to that of Samaria, having lost the relative autonomy it had enjoyed under Nehemiah. The revolt of the Phoenician cities against Persia in 362–333 must necessarily have affected Palestine, but no details are known. Persian coins struck presumably for the use of the military garrisons in Palestine and bearing the name of the province Yehud have been identified as belonging approximately to this period.

This is virtually all the information available regarding the lot of the Jewish people between the time of Nehemiah and the invasion of Alexander the Great. On the other hand, it is certain that this was a period of intense religious consolidation and, as it seems, of remarkable intellectual activity. It was then that the forms of postbiblical Judaism evolved and acquired their profound hold on Jewish life in its every aspect. It was in that period that what was to be rabbinic Judaism struck its roots, that the synagogue emerged as an established institution, that the liturgy began to assume its definitive shape and that the works comprising the Old Testament assumed, as it seems, their present form and were assembled in an authoritative fashion. It was thus one of the great formative ages in Judaism, and therefore in the history of the Jewish people, which emerges from this period equipped with the literature, the outlook and the institutions thereafter to be so characteristic of it and the main secret of its endurance.

Later semilegendary rabbinic accounts associate almost all the epochal developments in Jewish religious life at this period—including for example the formulation of the essential parts of the liturgy—with the *Anshe Kennesseth ha-Gedolah*, or "Men of the Great Assembly" (usually translated "of the Great Synagogue"), who were considered as the link between the biblical and talmudic ages, between the prophets and the rabbis. It is probable that the reference is to the assembly recorded in Nehemiah (ch. x), which solemnly confirmed the allegiance of the Jewish people to the Law of Moses, the Torah.

The Dead sea scrolls (*q.v.*) and other documents found in the same area from 1947 onward may show this obscure period in a new perspective, when their investigation is completed. Although there is some dispute as to the scrolls' date, it is believed with considerable certainty that this literature was produced by a group of Jews whose separate existence ended in the 1st century, at the time of the destruction of Jerusalem by the Romans; the documents are therefore all anterior and in some cases considerably anterior to that event. The documents demonstrate a great religious ferment in the last centuries of the pre-Christian era, which expressed itself in vast eschatological speculation; in an intense study of the biblical books and endeavour to apply the prophecies in the organization of semimonastic bodies remote from human habitation; and in the composition of psalms of praise in which the biblical tradition was directly continued. The documents suggest that in this period there was a far greater, but at the same time far less homogeneous, intellectual and spiritual activity than had formerly been imagined, and that the insistence on the Law that was to be characteristic of the later rabbis was paralleled by a no less intense study and even further development of the spirit of the prophets.

C. Greek and Roman Conquests

1. The Greek Conquest.—In 332, after the overthrow of the Persian empire at the battle of Issus (333), Alexander the Great occupied Palestine. Jewish legend, preserved both by Josephus and in rabbinic sources, tells how while preparing to march on Jerusalem he was met by and showed especial favour to the high priest of the Jews. The kernel of truth in this legend is presumably that the high priest hastened to perform homage to the conqueror and was accordingly recognized as the head of the Jewish nucleus in south Palestine (the north of the country had even now not been fully colonized by the returned exiles) and the representative there of the new ruler, to whom he was directly responsible—no longer to an intermediate official or satrap as previously. Judaea was granted limited autonomy under its high priest, whose office was not strictly hereditary but confined by tradition to the members of a single family. This was more or less to remain the constitutional position of the country under different rulers for the next century and a half, reasserting itself at intervals as long as the Temple stood and the high priesthood existed. Jewish legend seems to have personified the ideal priest-ruler of this period under the name of Simon the Just—a title that may however apply to more than one high priest of the name—who administered the country in the pre-Maccabaean period.

The peace imposed by Alexander did not last for very long. In the succeeding period, after his empire broke up, Palestine—the land-bridge between Africa and Asia—reverted to the role it has played repeatedly throughout history, both before and after, as the passive object of dispute between those in control of the countries to the north and south, between the rulers of Egypt and the rulers of Syria. In 320 B.C. Ptolemy I, who had made himself master of the former country, took possession of Jerusalem, without resistance, on the Sabbath day, when the Jews would not defend themselves. During the next few years there was more than one change of master, until the battle of the kings in 301 established the Ptolemies definitely in Palestine for a considerable period. Their rule seems to have been mild and benevolent, their main interest being the maintenance of order and the punctual payment of taxation. The close political and economic connection with Egypt in this period resulted in the rapid development of the Jewish settlement there, particularly in Alexandria. This was to result in due course in the evolution of Hellenistic Judaism, culminating in the work and life of Philo (*q.v.*) and having later a profound influence on the development of Christianity. It was under Ptolemy II Philadelphus that the beginnings at least were made, apparently under the royal auspices, of what was to be termed the Septuagint (*q.v.*) version of the Bible. The first positive archaeological evidences for the existence of the synagogue are from Egypt at this period (3rd century B.C.).

The recurrent conflict between Seleucids and Ptolemies for the control of Palestine inevitably strengthened the authority of the high priesthood and other local Jewish representatives. On the other hand, the prevailing practice of farming out the revenues of the province resulted in the emergence of a class of wealthy tax farmers whose influence rapidly extended. Outstanding among them was the family of a certain Tobias, prominent in Ammon since the period of Nehemiah, who enjoyed great favour in Egyptian court circles and disputed with the high priest for the predominant position in Palestinian affairs. From time to time there were even outbreaks of violence between the two factions. A late member of the house, Joseph, who was chief tax collector in Palestine under Ptolemy III Euergetes, was also nephew of the high priest Onias II, and at one time seemed likely to establish his personal rule in the country.

2. The Hasmonaean Revolt.—The contest for control of

Palestine meanwhile continued between the Ptolemies of Egypt and their former allies the Seleucids of Antioch, who were now masters of Syria. (*See* PTOLEMIES; SELEUCID DYNASTY.) The latter temporarily occupied the country in 295, 219–217, and finally after their great victory at Paneas (Caesarea Philippi, near the sources of the Jordan) *c.* 198 B.C. The constitutional position of Palestine remained unaffected except in one respect. Whereas the heterogeneous nature of the empire of the Ptolemies had reconciled them to a cultural pluralism, that of the Seleucids was somewhat more thoroughly Hellenized, in a crude sort of way, and any ostentatious deviation from superficial Greek standards appeared to them an intolerable relic of barbarism. Moreover, it seemed to them that because of the special position of Palestine as a border province it was supremely necessary for it to become a homogeneous portion of their dominions. This was especially the case under Antiochus (*q.v.*) IV Epiphanes, whose devotion to Greek culture and life (for he had been born in Athens) verged on a mania. Hence the superficial Hellenization of Judaea, already well advanced among the upper classes, began to make very considerable progress under Seleucid rule. There was inevitably much opposition from the conservative elements—it was perhaps indeed at this period that the sect that produced the Dead sea scrolls withdrew into isolation, so as not to be contaminated by or forced to conform to the new currents. It is however necessary to emphasize the fact that the Hellenic culture in question supplied the superficialities rather than the essentials. It was a question not of Athenian philosophy and literary achievement so much as the costume, a smattering of the language, shoddy provincial architecture, the games of the gymnasium and the licentious theatrical productions.

Two factions then emerged in the state, of those who supported and those who opposed the new tendencies. The high priest, Onias III, who was opposed to change, found himself superseded by his brother Jason, who not only was more amenable but also promised a higher tribute. (The Greek or Grecized names that now become so common themselves demonstrate how far Hellenic influences had already permeated the country.) The former's son, another Onias, fled to Egypt, where he was permitted by the Ptolemies to set up at Leontopolis a second temple, lasting for nearly 250 years, in which the old forms were scrupulously observed. The example set by Jason however proved fatal ultimately, for in due course he was in turn ejected from office in favour of one Menelaus, who did not in fact belong to the family of high priests but was prepared to go even further in the direction of Hellenization and to raise an even larger tribute. To bolster up his authority, a Greek garrison, practising its obnoxious heathen ceremonial and ostentatiously contemptuous of Jewish life and values, was installed in the citadel at Jerusalem. On his return from his first Egyptian campaign in 169 Antiochus made a detour to pass through Jerusalem and demanded admittance into the Temple, which he despoiled of its treasures. During his second campaign in the following year the former high priest Jason profited by the general feeling of discontent and raided Jerusalem, where he was greeted with enthusiasm.

Antiochus, on his ignominious retreat from Egypt after the Roman intervention, decided to apply a drastic solution to the problem. He occupied Jerusalem, butchered or sold into slavery those who opposed the regime of his nominee, razed the city walls, installed a large garrison in a new fortress (known as the *Akra*) which he had constructed on the site of the citadel of David, placed a Phrygian governor named Philip in control and systematically set about destroying the last relics of Jewish separatism. For this purpose, an Athenian philosopher was set in authority to supervise a policy aimed at the eradication of the Jewish religion, now considered both an evidence and a cause of the recalcitrance of the Jewish people. It was a question perhaps not so much of installing a new religion as of attempting to merge the local religion into the universally prevalent syncretistic pagan cult, as had happened without opposition in other parts of the neo-Hellenic world. With this in mind, the God of the Jews was identified with the Olympian Zeus, whose image (perhaps in the likeness of Antiochus himself) was set up for adoration over the altar in the Temple. This was the culmination of shame for the Jews, in whose eyes it was considered the Abomination of Desolation (*cf.* Dan. xi, 31). Before it, pagan rites abhorrent to the Jews were performed, while similar shrines were set up in the provincial centres. As a logical corollary, an attempt was made at the same time to suppress the observance of the traditional Jewish rites.

Discontent was now brought to a head, and in 167 an open revolt began in Modein, between Jerusalem and the sea, headed by a priest named Mattathias, of the house of Hasmon, with his five sons led by Judas (Judah) known as the Maccabee (hence the name Hasmonaeans given properly to the family; Maccabees is to some extent a misnomer, and its significance is disputed). More than once in recent years Jerusalem had been occupied by foreign forces on the Sabbath, when the Jews would not defend themselves. The observance of this precedent now would obviously have resulted in speedy disaster, and accordingly it was determined that in case of attack arms should be taken up in self-defense even on the day of rest. It may be said that, following the establishment in postexilic Judaism of the hold of the minutiae of Jewish observance, this marked the beginning of the rabbinic tradition of their mitigation—in the spirit of the Torah—in cases of extreme necessity. Thus the new Judaism was saved from being (as was the case within dissident sects) a cast-iron set of precepts that could not be varied in any circumstances.

3. The Campaigns of Judas Maccabaeus.—Antiochus' generals, Seron from Syria and Apollonius from Samaria, failed to overcome Judas, who defeated them by sudden night attacks, in particular in a spirited engagement at Beth-horon. At this time the Parthians were revolting against the Seleucids, Mithradates I was making himself independent, and Antiochus was seriously embarrassed. He determined to deal with the Parthians in person, but he ordered Lysias, his viceroy in Syria, to suppress the Jews. Lysias sent a strong force of infantry and cavalry, which Judas checked at Emmaus. Fresh Syrian forces were dispatched from the south. Either Judas routed them at Beth zur, by Hebron, or else they retired in consequence of political conditions in Syria. In any case, Judas gained his end. The road to Jerusalem lay open to him, though the Greek garrison in the citadel could not be dislodged. But the Temple was free. It was cleansed and rededicated on 25 Kislev (the event is celebrated at Hanukkah), 165 B.C., three years after it had been defiled.

After reoccupying Jerusalem, Judas proceeded to consolidate his position. The revolt, at first purely religious in motive and scope, became national. After the death of Antiochus Epiphanes in 163 B.C., Judas made a number of punitive raids in all directions, steadily extending the area he controlled or withdrawing the Jewish population where he could not establish effective rule. Finally he made preparations for assaulting the Greek garrison that still maintained itself in the Jerusalem citadel. This made it imperative for Lysias, now regent of Syria, to intervene. The latter inflicted a heavy defeat on the Jewish forces at Beth Zechariah, south of Jerusalem, where one of Judas' brothers died gallantly. Providentially, at this point a pretender made a bid for the Syrian throne, and Lysias had to hurry home to cope with the situation. Accordingly, an agreement was hastily entered into with the Jewish malcontents so as to satisfy some of their more serious complaints. In particular, the usurping Hellenizing high priest Menelaus, who had hitherto continued in office, was deposed, and a certain Alcimus (Hebrew Eliakim) appointed in his place. The new incumbent was not directly tainted like his predecessor by implication in the recent sacrilege, but he nevertheless proved unacceptable to the mass of the people because of his political associations. After a while therefore he retired to Antioch and appealed for help to Demetrius I Soter, who had then seized the Syrian throne. The latter sent his general Bacchides to restore order. This was effected without great difficulty, but the revolt flared up again immediately he had withdrawn, and Nicanor, the commander of the elephant corps, was routed and killed at a long-commemorated encounter in the historic pass of Beth-horon (161). Bacchides thereupon returned in overwhelming strength and crushed Judas' forces at Elasa (I Macc. ix), the Jewish leader being among the slain.

Syrian rule was once again effectively reasserted, without however a renewal of the former blunder of attempting to interfere

with Jewish religious observances and institutions. The patriot bands, now headed by Jonathan, the youngest of the Hasmonaean brothers, refused all compromise, nevertheless, and withdrew to Transjordan, from which they made perpetual raids. In the end it seemed simplest to enter into negotiations with Jonathan and recognize his representative position. He and his followers were permitted to re-establish themselves in Judaea provided they kept the peace. When however Demetrius found his throne threatened by Alexander Balas, claiming to be Antiochus IV's son, Jonathan was courted by both sides for the support of his veterans. He threw in his lot with Alexander Balas, but at a price. When Alcimus died, Jonathan was appointed high priest in his place, and in the autumn of 152 B.C. officiated for the first time in the Temple of Jerusalem. He was thus recognized as the *de facto* ruler of the country, like former high priests. Meanwhile he firmly extended the area that acknowledged his authority, profiting from the general anarchy to capture Jaffa and other coastal cities. Thus, temporarily, Judaea became to some extent—as seldom happened throughout history—a maritime state, the naval ambitions of the ruling house at this period being symbolized also on their public monuments.

In 143 B.C., however, after further victorious campaigns and steady extension of his territory, Jonathan was lured into a trap at Ptolemais by Tryphon, the general of Alexander Balas' young son, Antiochus VI Dionysus. Jonathan was then succeeded by Simon, the solitary survivor of the five heroic Hasmonaean brothers, who transferred his support to Demetrius of Syria in return for an amnesty and immunity from tribute. The *Akra* dominating Jerusalem was then evacuated by the Syrian troops (141), and in the autumn of the following year Simon's authority was approved by an assembly in the Temple court which confirmed him in the offices of high priest, prince and military commander, which were henceforth to be hereditary in his house. At about the same time he began to strike his own coins, the first ever issued by a Jewish ruler, then considered a token of independence. Thus, what had begun 17 years earlier as a revolt to secure religious freedom ended as a political movement that re-established the national independence, in abeyance since the capture of Jerusalem by the Babylonians in 586 B.C. Simon was murdered at Dok, near Jericho, in 135 by Ptolemy, his son-in-law, the governor of Jericho. During his rule prosperity had increased, and his death was a great disaster. With him perished two of his sons, Mattathias and Judas; he was succeeded by his surviving son, John Hyrcanus I (135–104).

The death of Simon marked the end of the generation of Hasmonaean liberators; all five brothers had died by violence, but they had been successful. When they rose in revolt their religion had been proscribed; Judaism, apparently, was doomed, and Judaea was secure in the grip of a despotic foreign power. In the short period of 26 years (168–142) the Maccabees, beginning as a band of desperate guerrillas, had secured tolerance for their religion; they had fought to a successful conclusion what is believed to be the first war for the freedom of conscience, and they had won their political independence against an overwhelming might. The success of these five brothers was due to three factors: the brilliant military and diplomatic skill and courage of the family; the civil wars and anarchy in Syria; and the intrigues and moral support of the encroaching Roman state. (*See* also MACCABEES.)

4. John Hyrcanus.—Meanwhile Antiochus VII Sidetes of Syria (139–129), the last effective representative of the Seleucids, had been endeavouring to reassert the Syrian authority in Judaea without success. He then again invaded the country and captured Jerusalem after a lengthy siege. Because of Roman intervention, however, he imposed mild peace terms, permitting John Hyrcanus to remain in power and even to retain recent conquests, subject to the recognition of Syrian suzerainty. Hence, when in 129 Antiochus was killed in battle and the Seleucid empire disintegrated, the Judaean ruler was able to reassert his complete independence and resume the policy of national expansion that was the keynote of Jewish history of the period.

Hyrcanus forced the Idumaeans (or Edomites) to accept Judaism, and he destroyed the Samaritan temple on Mt. Gerizim. During Hyrcanus' rule Judaea prospered, and in the Diaspora (*e.g.*, in Egypt, Cyrene and Cyprus) the importance of the Jews increased. Hyrcanus quarreled with the Pharisees, who objected to the combination of the high priesthood with temporal power, and joined their opponents, the Sadducees (for a description of these parties, *see* JEWISH SECTS DURING THE SECOND COMMONWEALTH). He died in 104 and was succeeded by his eldest son, Judas Aristobulus, who conquered Ituraea and planted Judaism there by force. He moreover adopted the title of king. Aristobulus was succeeded by another son of Hyrcanus, Alexander Jannaeus (103–76), whose continued support of the Sadducees made him disliked. Alexander intrigued with Cleopatra of Egypt and with Ptolemy. His reign was full of warfare, rebellion and bloodshed. On his deathbed he directed his wife, Salome Alexandra (76–67), whom he had destined for the succession, to reverse his policy and make peace with the Pharisees. As a result, her elder son, John Hyrcanus II, became high priest. The Pharisees, whom Alexander's massacres had driven to flight, returned. The queen was supported by Simon ben Shatah and Judah ben Tabbai, who are among the earliest rabbis known by name. When Alexandra died in 67 B.C., Aristobulus disputed the succession with Hyrcanus, his brother. War ensued, in which Hyrcanus besieged Aristobulus in Jerusalem, having, on the advice of his Idumaean councilor, Antipater, enlisted the help of Aretas (Harith), the king of the Nabataean Arabs. (*See* also HYRCANUS.)

5. Intervention of Rome.—In 66 B.C. Pompey had defeated Mithradates VI of Pontus and his son-in-law Tigranes. Learning of the war in Judaea, in 65 B.C. he sent Marcus Aemilius Scaurus, Sulla's stepson, to intervene, and to Scaurus both Hyrcanus and Aristobulus appealed. The latter won by bribery. Aretas retired and Aristobulus appeared to have triumphed. But Scaurus' superior was at hand. Pompey reached Damascus and immediately deputations followed him there. Aristobulus and Hyrcanus, the latter exploited by Antipater, sent their delegations and one more came from the Jewish nation, begging for the abolition of the kingship and the restoration of the sacerdotal theocracy. Pompey abolished the title of king but recognized Hyrcanus as high priest to rule the country as a Roman feudatory; in effect, however, Antipater secured power. Warfare broke out between the adherents of the two brothers, and the Roman legions participated. Pompey captured Jerusalem and a terrible massacre ensued, the priests being slain at the altar.

6. Roman Rule.—Rome then became the ruler. Aristobulus, his daughters and his sons, Alexander and Antigonus, were taken by Pompey to grace his triumph, but on the journey Alexander escaped and raised a revolt in Judaea. Aulus Gabinius, the proconsul, crushed the revolt. Hyrcanus was appointed guardian of the Temple and the country was split up into five districts governed by synods. Alexander and Aristobulus continued their raids. Antipater supported Gabinius and in return could do as he liked. In 54 B.C. Marcus Crassus, who succeeded Gabinius, plundered the Temple. He was defeated and slain by the Parthians in the next year. Cassius opposed the Parthian invasion of Syria, and Antipater, whose policy was to stand well with Rome whatever happened, aided him. In 51 B.C. Taricheae was captured and 30,000 Jews, who had espoused the Parthian cause, were sold as slaves. When Julius Caesar made himself master of Rome, he released Aristobulus and sent him, with two legions, to Judaea, in 49. But Pompey's emissaries contrived to poison him on the journey and Pompey beheaded his son Alexander at Antioch. In 48 Pompey himself was defeated and slain, whereupon Antipater joined Caesar's party. Hyrcanus was confirmed as high priest and Antipater made procurator of Judaea. Caesar conferred privileges on the Jews, and Suetonius (*Caesar* 84) mentions how bitterly his death was lamented by those of Rome.

7. Herod the Great.—At this point one of the most remarkable figures in the history of Judaea becomes prominent. This was Herod the Great, one of Antipater's sons, who, at the early age of 25, was appointed governor of Galilee, his brother Phasael being governor of Jerusalem. After Caesar's departure, one Hezekiah attacked the Syrians; he is described as a brigand, but more probably was fighting for patriotic motives. Herod seized and exe-

cuted him and a number of his followers. For this he earned the gratitude of Sextus Caesar, the governor of Syria, and the detestation of the Jews. He was summoned to appear before the Sanhedrin but he came to his trial with an armed bodyguard, overawing his judges. Sextus promoted Herod, who raised an army to attack Hyrcanus, but at Antipater's request he desisted. In 43 Antipater was poisoned. Confusion arose in Judaea. Herod repulsed a raid by Antigonus (in Hebrew Mattathias), the son of Aristobulus, who tried to take advantage of the situation.

After the defeat of Cassius at Philippi (42 B.C.) Mark Antony (Marcus Antonius) became master of Asia. Deputations approached him in Bithynia, one from the Jews accusing Herod and Phasael of usurping the power of Hyrcanus. But the last-named was aware of the power of Antipater, Antony's friend, and of his sons. These became virtually kings of the Jews. Step by step the Hasmonaean dynasty was giving place to the Idumaean Antipater. In 40 B.C. the Parthians, with Antigonus, invaded Syria. They captured Hyrcanus and Phasael, but Herod escaped to Rome. Hyrcanus was carried away to Parthia and mutilated so as to make him unfit for the high priesthood. Antigonus took his uncle's place and ruled for a few years (40–37 B.C.) as a Parthian tributary with the title of king. Meanwhile, in Rome, Herod was recognized as ruler by the senate. Before long, he returned and captured Jerusalem with Roman aid, Antigonus being beheaded.

Herod strove to conciliate the Jews. He married Mariamme, the grandniece of Hyrcanus, not only because he loved her passionately but because he hoped to gain favour by allying himself with the Hasmonaeans. When, in a fit of insane jealousy, he had her put to death, he was plunged into uncontrollable remorse. Her image haunted him all his life. By careful if harsh rule, efficient administration and trading activities, Herod amassed great wealth. He was known at home and abroad as a magnificent builder and patron. He filled Judaea with public buildings in the Roman style. He rebuilt the Temple with great magnificence and at enormous cost. He encouraged the Pharisees and he conformed to Judaism at least at home, though he temporized abroad. Religion was free so long as politics were eschewed. During this period the Diaspora increased and converts multiplied. Saints such as Hillel were among the notable teachers of the people. Herod preserved peace in his dominions until his death in 4 B.C. (*See* also HEROD.)

8. Herod's Successors.—Herod divided his kingdom by will into tetrarchies, to which he appointed his sons, Archelaus, the elder son of his Samaritan wife Malthace, being named ethnarch of Judaea, Samaria and Idumaea, and Antipas, her second son, tetrarch of Galilee and Peraea (Transjordan). Philip, a son by another wife, was given the northeast as a tetrarchy. Archelaus was about to set off to Rome, that he might be confirmed in his title by Augustus. But a revolt broke out in consequence of the execution, by Herod, shortly before his death, of Judah and Mattathias, two rabbis who endeavoured to remove from above the Temple gate the Roman eagle which they regarded as an emblem of idolatry. Archelaus was asked to punish their murderers. On his refusal riots broke out. Fighting between the Jews and the Romans took place, and a large number of Jews were massacred. Deputations reached Augustus putting forward rival claims and also the desire of the nation to get rid of the Herodians. In the end Augustus reaffirmed Herod's will, counseling Archelaus to deal gently with his people. He did not follow this advice, however. He removed the high priest and violated the pentateuchal marriage laws. His treatment of his subjects was so tyrannical that a joint deputation of Jews and Samaritans accused him to Augustus, who summoned him to Rome and then banished him to Gaul. (*See* also HEROD ANTIPAS; HEROD ARCHELAUS; PHILIP.)

9. The Procurators.—With this removal of their ruler at their own request the Jews obtained their desire but forfeited the last vestige of political independence; now the last trace of national liberty was gone and the power passed to the Roman procurators. The error of the Maccabees in invoking Roman aid had reached its logical consequence. No longer—save for a brief interval—was Judaea governed by a Jew. If the procurators had been capable and honest, no great harm would have occurred, but Roman provincial government was uneven. Very seldom were the two requisites combined in one administrator, and the harm done by the bad holders of the office was far greater than good predecessors or followers could counteract. At the outset trouble arose when the first procurator, Coponius, who was accompanied by P. Sulpicius Quirinius, the legate of Syria, endeavoured to take a census (A.D. 6–7) according to Roman methods, which conflicted with those of the Jews. If this is the census to which Luke (ii, 1) refers, the birth of Jesus would have to be dated in that year, but this is too late. The people submitted to the census, but this and similar incidents led to the formation of the Zealots (*see* JEWISH SECTS DURING THE SECOND COMMONWEALTH: *Zealots and Sicarii*). This body of malcontents, which was formed by Judas of Galilee and a Pharisee called Saduq, remained active down to the disaster of A.D. 70. As a whole the Pharisees were ready to wait and bear with patience attacks on their religion that were not too outrageous, but the Zealots were ever eager for warfare. They made headway especially in Galilee, then ruled by Herod Antipas. It is noteworthy that this province, Judaized so recently, was then the centre of Jewish nationalism. Herod Antipas, like others of his house, endeavoured to conciliate the Jews by observing Judaism, and to stand well with Tiberius, in whose honour he founded the city of Tiberias. Antipas, who had married the daughter of Aretas (Harith), the Arabian king, divorced her in order to marry Herodias, the wife of his half brother. The first consequence was trouble with the Arabs. In A.D. 36 disaster overtook his forces and Tiberius, his patron, died before help could be sent. The second consequence was his denunciation by John the Baptist (Mark vi, 14–29), whom he executed at the request of Herodias. But Antipas himself suffered through following the counsel of Herodias. He petitioned Caligula for the title of king but his presumption was resented. He was banished and (apparently) slain in A.D. 39.

Pontius Pilate, under whom Jesus was crucified, was procurator from A.D. 26 to 36. He outraged Jewish feelings in all ways, and the picture of him in the Gospels hardly bears out his character, in view of his acts. Not only Josephus but also Philo record the way in which he goaded the people to revolt. As soon as he arrived he broke the existing compromise under which only standards that did not bear the imperial image were brought to Jerusalem, since the images were held to be idols, as the emperors were deified. The Jews petitioned Pilate to remove the standards. He refused and when they importuned him for six days he threatened them with death, yielding only when he found them ready to accept martyrdom. He next created indignation by using Temple money for an aqueduct and proceeded to other forms of oppressive annoyance.

Caligula's succession as emperor in A.D. 37 was welcomed by the Jews. One of his friends was Herod Agrippa, the grandson of Herod the Great, and the Jews hoped to win Caligula's favour through Agrippa's presence at court. But trouble arose when Caligula laid claim to divinity and the Jews, alone of his subjects, were unwilling, out of religious motives, to acknowledge his godhead. Thereupon the Alexandrians attacked the Jews, set up the images of the emperor in the synagogues, sacked the Jewish quarter, insulted Jewish women and scourged the Jewish elders. Through Agrippa's influence, the governor was degraded, but ill feeling between the Jews and their fellow citizens continued. In A.D. 40 each side sent embassies to plead their cause, Philo acting as the Jewish spokesman. Philo's account of the embassy sheds an extremely vivid light on the restless, irresponsible character of the emperor. While the embassy was still awaiting Caligula's decision, the emperor commanded his statue to be erected in the Temple, but at Agrippa's intercession he canceled the order. In A.D. 41 Caligula was assassinated.

Claudius I, who succeeded Caligula, made Agrippa king over all the districts that his grandfather had ruled. One more the Jews had their own king, a popular monarch, who followed the Pharisees and was a strict Jew (*see* HEROD AGRIPPA I). He died in A.D. 44 and the rule of the procurators was restored. Under Cuspius Fadus, the patriot bandits were put down for the time. Theudas, who claimed to be a prophet, was followed by a number of people who looked for him to cleave the Jordan. He was captured and beheaded. After Fadus came Tiberius Alexander, an apostate Jew

from Egypt, a nephew of Philo. During his administration Helena, queen-mother of Adiabene, embraced Judaism with others of her family and purchased grain to relieve a famine in Judaea. The next procurator, Ventidius Cumanus (48–52), provoked the Jews to riot. A massacre took place in the Temple and there was a clash between Samaritans and Galileans. Cumanus was ultimately banished by the emperor and replaced by Felix (52–60), under whom the revolutionary movement grew to greater dimensions.

The country was once more full of armed malcontents, considered "brigands" by the Romans. They attacked Roman sympathizers, and on one occasion even the high priest was murdered in the Temple. False prophets appeared. Felix tried in vain to restore order. He was recalled by Nero. The succeeding procurators (Porcius Festus, 60–62; Albinus, 62–64; Gessius Florus, 64–66) did no better. Sacrilege and exaction, misunderstanding and ill will grew worse and more frequent. The Jews, roused to fury, at last rose in revolt, expelled the Romans from Jerusalem and utterly overwhelmed in the pass of Beth-horon a Roman punitive force under Gallus, the imperial legate in Syria (autumn, 66). A revolutionary government was then set up, which extended its influence to the whole country. Finally Vespasian was sent by Nero to crush the rebellion. He advanced from his winter quarters in Antioch early in 67. He was joined by Titus, and the Roman armies entered Galilee. The historian Josephus was at the head of Jewish forces there. His army was confronted by that of Vespasian and fled. After the fall of the fortress of Jotapata, Josephus gave himself up. The Roman forces swept the country.

While Jerusalem was invested, Rabbi Johanan ben Zakkai (*q.v.*) is said to have had himself conveyed out of the city and, coming to the Roman general, to have craved a boon. He asked to be allowed to establish a school at Jabneh (modern Jamnia). His request was granted, and this seemingly trivial concession saved Judaism. Johanan saw that Judaism could survive the Temple, that its future lay in the school and that the Bible was the Jews' portable fatherland. On the 10th of Ab in the year 70, amid circumstances of unparalleled horror, Jerusalem fell. The Temple was burned and the Jewish state was no more.

10. Judaea Capta.—From 70 to 135, the only hope lay in the "vineyard" of Jabneh. The Sicarii and Zealots held out until, one by one, their fortresses were reduced. In Egypt and Cyrene they continued their fruitless but heroic efforts. The Egyptian temple of Onias, which had existed for 243 years, was first closed and then destroyed. Nevertheless, under Vespasian and Titus the Jews continued to enjoy freedom of conscience. Domitian inaugurated a persecution which Marcus Cocceius Nerva ended. In Trajan's reign the Jews of Cyrene revolted but were subdued. Finally, in 132, Hadrian's intention to found a Roman colony on the site of Jerusalem and his proscription of some Jewish rites roused the last remnants of Palestinian Jewry to revolt. A bitter struggle ensued. Bar-Cochba (*q.v.*) was recognized as Messiah by the great rabbi Akiba ben Joseph, though some of Akiba's colleagues repudiated Bar-Cochba's pretensions. For three years the hopeless conflict raged; the Jews fought with the energy of despair, but in 135 the end came. Jerusalem and then Bethar (Bittir) fell. The holy city was thenceforth prohibited to the Jews, though the Christians, who had taken no share in the war, were allowed to come and go there freely. Many scholars date the breach between Judaism and Christianity to this event. (H. M. J. L.; C. R.)

III. A.D. 135 TO 1791

A. Learning and Culture in the Diaspora

1. Rabbinical Learning in the East.—The ruthless suppression of the rising of Bar-Cochba had decimated the population of Judaea. The centre of Jewish life in Palestine moved in consequence northward, to Galilee. Serious political aspirations were then at an end. Henceforth, the dominant position in the national life came to be occupied more and more by spiritual and intellectual leaders, the rabbis of this period being known as tannaim. Pharisaism, in its finest sense, became an increasingly strong force in daily life. Political leadership was taken over by the presidents of the Sanhedrin, or patriarchs, who ultimately obtained formal recognition from the Roman authorities, and enjoyed additional consideration among the people in virtue of their descent from Hillel (*q.v.*), and hence by tradition from David. The office, which had become firmly established by Gamaliel II of Jabneh after the destruction of Jerusalem, reached its zenith in his grandson, Judah ha-Nasi (135–217), known as rabbi par excellence. He is remembered for having completed the codification of the Oral Law by the redaction of the Mishnah, the basis of all the vast rabbinical literature of later times.

The intellectual activity of the latter half of the 2nd century seems to have been somewhat forced. Because of the ravages caused by constant wars and revolts, as well as by adverse economic conditions, the importance of Palestine was declining. The establishment of Christianity as the religion of the Roman empire, and the consequent increase of moral and physical pressure on the Jews, hastened the process, and at the beginning of the 5th century the patriarchate, already in decline, was finally abolished by the Roman authorities. But the great centre of Jewish population lay already outside the country, particularly in Mesopotamia, where the "exile" had continued throughout the days of the Second Temple. Babylonian students had been accustomed to come to Palestine and sit at the feet of its renowned teachers. By the time of the death of Judah ha-Nasi the younger settlement had become intellectually self-supporting.

Abba Arika, commonly known as Rab or "master," who had been a pupil of the great Palestinian patriarch, set up at Sura a famous school of rabbinical learning that retained its prominence until the 11th century. His younger contemporary, Samuel, or Mar Samuel (famous for his momentous maxim that "the law of the state is Law"), presided at Nehardea over an academy that long rivaled the other (*see* Samuel). During its temporary suspension because of the sack of the city by Odaenathus (Zenobia's husband) in 261, there arose in the neighbourhood the school of Pumbeditha. These three academies co-operated with the dwindling schools in Palestine in maintaining the traditions of Jewish learning, the teachers then being called amoraim. The discussions that went on in them, centred in the text of the Mishnah, were ultimately redacted as the Gemara, the whole body together forming the Talmud. The foundations of the less important compilation made in the decaying academies of Palestine were laid by Rabbi Johanan bar Napacha (199–279) in Tiberias; but it survives in a fragmentary state, and probably was never finished. Palestinian, too, was the Midrash—a vast compilation of homiletics, ethics, legend and folklore in the form of a commentary on the Bible. The fuller Talmud of Babylon, which exercised the most powerful influence upon Jewish life in later times, reached its final form at the close of the 5th century. It was far from being merely a code of religious practice. It was a whole literature, comprising law and theology, science, folklore and every other conceivable branch of intellectual activity, somewhat amorphously grouped about the text of the Mishnah. It was this that remained, after the Bible, the Jews' principal guide to life and object of study, and that gave Judaism unity, cohesion and resilience in the difficult period that lay before it. (*See* also Talmud.)

2. The Muslim Conquest.—The rise of the Muslims was an improvement over the anarchy of the declining neo-Persian state in which the talmudic literature and environment had flourished. Mohammed set out originally to win the support of the Jews in Arabia through his teachings of ethical monotheism, his borrowings from Jewish traditional lore, his introduction of dietary laws and his adoption of formal prayers and of special fasts similar to Jewish models. When the Jews rejected him he proceeded to destroy them or drive them out of Arabia. His successors, however, finally formulated a series of provisions that determined the status of all tolerated infidels, including the Jews. This was the "pact of Omar" (7th to 9th centuries), which established all infidels throughout the expanding Muslim world in a position of second-class citizenship. Its provisions, however, were frequently honoured more in the breach than in the observance.

The caliphs, once their original missionary zeal abated, showed themselves willing to accord an almost boundless toleration in return for a slender poll tax. In Mesopotamia intellectual activity

continued with renewed vigour after the downfall of Zoroastrian intolerance. The secular dignity of "prince of the captivity," or exilarch (*q.v.*), which had existed from remote antiquity, was maintained with renewed magnificence. Intellectual leadership, however, resided in the gaon (*q.v.*), the head of the academy, who continued to expound and develop the principles of the Talmud with an authority that was extended by the conquests of the Crescent. The widening of intellectual horizons which the Muslim influence ultimately brought about was typified in the gaon Saadia ben Joseph (*q.v.*; 882–942), who first exemplified the fruitful combination of Helleno-Arabic and Jewish culture. Jewish philology and philosophy both start with Saadia, being necessitated by the threatening Karaite schism (*see* KARAISM), for the check of which his labours were principally responsible. This double organization, under gaon and exilarch, continued until the 11th century, by which time the Jewries of the occident were strong enough to stand by themselves.

3. The Diaspora in the West.—Already, before the destruction of Jerusalem, the Diaspora had been a familiar phenomenon in Europe. The prisoners captured in innumerable wars and distributed through the empire as slaves had been followed (if not preceded) by merchants and traders. Latin writers from the period of Augustus onward show the extent to which Jewish practices were spread throughout the civilized world of their day. Paul found them in Greece and Italy, and the infant church consistently advanced where the synagogue had blazed the way.

By the beginning of the 4th century, settlements were to be found as far afield as Spain and the Rhineland. Indeed, it is probable that before the Roman empire had begun to decay Jews were present in all its greater cities. By the constitution of Caracalla (212) they had been admitted to the privileges as well as the burdens of Roman citizenship, and thereafter they occupied a position that was privileged by comparison with that of members of other dissenting religions.

With the christianization of the empire, the Jews' conditions was altered. It is true that they were comprised in the toleration accorded by the so-called edict of Milan (313), but their status was immediately and radically changed. The differentiatory policy of the church was adopted almost in its entirety by the state. From an *insignissima religio, certe licita* ("a most noted religion, undoubtedly lawful"), Judaism became the *secta nefaria* ("nefarious sect") or *sacrilegi coetus* ("sacrilegious gatherings") which figure in the edicts of the first Christian emperors. The policy of the church was far from being merely persecutory. Its intention was rather to prevent the inroads of Judaism by keeping its adherents from positions of authority and restricting social intercourse with them. At the same time, it regarded their preservation (if in ignominy) as evidence for the truth of Christianity, and frowned upon the use of force to bring them into the path of conformity. The papacy, true to the tradition set by Gregory I the Great, figured down to modern times alternately as the protector of the Jews from violence and the repressor of their "insolence," departing from this standard sometimes on the side of leniency; and Rome is almost the only city of Europe to preserve its Jewish community undisturbed from remote antiquity down to the present day. The secular rulers, however, did not show the same discrimination, and in the Byzantine empire in particular (especially from Justinian I, who was the first emperor to interfere with religious institutions), discrimination degenerated rapidly into oppression. The embodiment of the new principles in the *Codex Theodosianus* ultimately permeated the whole of western law with the idea of Jewish inferiority.

B. Middle Ages and Renaissance

1. Renascence of Jewish Culture.—With the barbarian invasions a momentary improvement had come about in the position of the Jews. The new rulers displayed at first that tolerance that arises from indifference, while those who adopted the Arian form of Christianity were sympathetically inclined toward the adherents of a stricter monotheism. Later, a reaction followed. In the 7th century there was a simultaneous wave of forced conversion throughout Europe from Constantinople to Toledo, reaching its height under the Visigoths in Spain, where the practice of Judaism was for a time utterly proscribed.

It was the Arab invasion that brought salvation. The ancient communities in northern Africa, which had waned under Byzantine intolerance, awakened to a new life, especially at Cairo and Kairouan. In Spain there came about a remarkable revival. The Jews knew no restriction upon their activities. Their linguistic and financial abilities won them high place in the administration. Under the aegis of Hasdai ibn Shaprut (*q.v.*; 915–975) and Samuel ha-Nagid (*c.* 993–1056) there was a remarkable renascence, in which the old traditions of the schools of Palestine and Mesopotamia, the manifold interests of the Moors, and the rediscovered sciences of ancient Greece were remarkably blended. Jewish poetry came to a new life, based on Arabic models, with Judah ben Samuel Halevi (*q.v.*; *c.* 1085–1141) and Ibn Gabirol (*q.v.*; *c.* 1020–*c.* 1050/70). Maimonides (*q.v.*; 1135–1204) represents in his many-sided activities, as physician, talmudist, codifier and philosopher, the Spanish school at its best. This tradition was proof against the intolerance introduced by the fanatical Almohads in the 12th century; for, partly from reasons of policy and partly imitatively, the earlier Moorish toleration was adopted by the growing Christian kingdoms. (*See* also HEBREW LITERATURE: *Europe in the Early Middle Ages.*)

Meanwhile, under the favourable rule of the Carolingians, important Jewish settlements had come into being in northern France and the Rhineland. Cultural life inevitably followed. But the tendencies of northern Jewry were sterner than those of Spain and centred in the interpretation and development of talmudic law rather than in humanism or philosophy. The first great name is that of Gershom ben Judah (*q.v.*), "the Light of the Exile," who published about the year 1000 the famous ordinance that forbade among western Jews the polygamy long since abandoned in practice. Solomon ben Isaac (Rashi) of Troyes (*see* RASHI; 1040–1105) summed up the tendency, his writings preserving for aftergenerations the old traditions of rabbinic scholarship. An extensive body of Tosaphists, or "supplementers," whose activities extended to almost every township of northeastern France, carried on his work.

But these were only varying facets of an intellectual activity that knew no boundary of country. A remarkably comprehensive educational system, insisted upon as a religious duty, resulted in a general distribution of culture unequaled in any other section of the population. The speculative tendency everywhere found its outlet in a vast mystical literature, afterward grouped about the *Zohar* (*see* CABALA). The 13th-century renascence was forwarded in no small measure by the translations from the Arabic made by, or with the help of, Jewish scholars—sometimes under the sedulous patronage of monarchs like Alfonso the Wise of Castile and Robert of Anjou. In Immanuel of Rome (*c.* 1261–1330), Dante's earliest imitator, Hebrew poetry became infused with something of the careless spirit of Italian verse, in which Immanuel was equally proficient. The Jewish physician or astronomer, living under the highest patronage, was fully as characteristic a figure as the merchant or financier.

The Jews of Europe of the 11th century onward were economically far removed from their ancestors in Palestine and Mesopotamia. The original settlers had included tillers of the soil, and the calling lingered on in many places, particularly in the south, to a late date. But the peaceful immigrant into a country already inhabited cannot easily settle on the land, and the growth of the feudal system, from which the Jews as strangers were naturally excluded, tended to accentuate their divorce from the soil. Accordingly, there was an inevitable tendency for them to specialize in commerce. In the "dark ages" the commerce of western Europe was largely in Jewish hands, not excluding the slave trade, and in the Carolingian cartularies Jew and merchant are used as almost interchangeable terms.

With the growth of a mercantile class the Jews became excluded from commerce, particularly in northern Europe. Hence they were forced to employ their capital in the only way left open to them, by lending it at interest. The attitude of the church in endeavouring to suppress "usury" naturally tended to concentrate

the profession more and more in the hands of those to whom the canonical prohibitions did not so fully apply, and against whom they could not readily be reinforced (the idea that the church approved the practice of usury by non-Christians is incorrect). Ultimately, other professions were closed to Jews by law in the greater part of Europe, though in Spain and Sicily they continued to some extent to pursue handicrafts and agriculture. The high probabilities of violence or expropriation naturally resulted in forcing up the rates of interest, though in point of fact the Jews charged no more than other usurers. Yet the advantage accrued rather to the crown, which did not scruple to avail itself to the utmost limit of its rights of taxation. The floating wealth of the country was soaked up by the Jews, who were periodically made to disgorge into the exchequer. The Holy Roman emperors in particular, as heirs to Vespasian, claimed exclusive proprietary rights, and their claims were imitated by other rulers. As *servi camerae regis* ("slaves of the king's chamber") the Jews of any particular place or country could be pledged, alienated or even expelled without compunction.

2. The Christian Reaction.—The third and fourth Lateran councils (1179 and 1215), roused to suspicion through the Albigensian movement, stimulated the reaction against the Jews. Besides renewing the old restrictions forbidding gentiles to enter into Jewish service or to be otherwise subordinated, they ordered the infidels to be distinguished by a special badge and forbade the faithful so much as to lodge among them, thus laying the foundation of the later ghetto (*q.v.*) system. These regulations were not everywhere immediately or consistently enforced, but they remained a part of the ecclesiastical panoply, to come again into prominence in the 15th century, in the wake of the Hussite wars and the preaching of John of Capistrano, and in the 16th, as a consequence of the Reformation.

The counteroffensive against heresy found its expression also in conversionist sermons at which attendance was enforced; in the censorship or confiscation of Hebrew books; and in compulsory religious disputations, the most important of which were those of Paris in 1240, of Barcelona in 1263, before King James I, and of Tortosa under the patronage of the antipope Benedict XIII in 1413–14. The inevitable result of all this was to make the popular prejudice still stronger.

The last country of western Europe to be settled by the Jews had been England, whither they penetrated in the wake of the Norman Conquest (in the Scandinavian countries they never figured to any appreciable extent). This marked the culmination of the western sweep that had been going on since the beginning of the Christian era and had made the Jews into an essentially European people. The backward swing of the pendulum began almost immediately. With the first crusade (1096), there took place in the Rhineland the first of the series of massacres that made the middle ages one long martyrdom for the Jews and ultimately had the effect of driving them back again toward the east. These were henceforth renewed on every conceivable pretext in almost every country of Europe. To reinforce racial and religious prejudice, the preposterous ritual murder accusation became common from the 12th century (*see* HUMAN SACRIFICE: *Ritual Murder*), and the even more fantastic charge of the desecration of the Host was formulated at the beginning of the 13th century after the definition of the doctrine of transubstantiation. Meanwhile, the financial activities of the Lombards and Cahorsins rendered the Jews less necessary in the field they had tended to monopolize and drove them into the meaner calling of pawnbroking.

The logical outcome of the changed condition was, in current opinion, to drive the infidel away altogether. This had previously happened in isolated cities or regions, but the first country to rid itself of the Jews entirely was England, whence they were expelled by Edward I in 1290. This was followed a few years later by the more deadly expulsion of the far more important communities of France (1306), which two partial recalls (1315 ff. and 1350–94) utterly failed to make good. From Germany, by reason of its special political conditions, there was no general expulsion. It figures instead as the classical land of Jewish martyrdom, where banishment was employed only locally and sporadically to complete the work of the long series of massacres. These reached their climax, though not their close, at the period of the Black Death in 1348–49, when the absurd charge of poisoning the wells became current. Some of the refugees crossed the Alps into Italy, where, because of the tolerant example of the Holy See, conditions were better. But the vast majority turned their steps toward Poland, where their settlement was especially encouraged by Casimir III the Great (1310–70). This was the origin of the vast nucleus of Jews in the old Russian empire who retained for centuries the German dialect (*see* YIDDISH LANGUAGE AND LITERATURE) which their ancestors brought with them from the west and imposed upon the indigenous communities which they found on their arrival.

In Spain the condition of the Jews, even under the Christian rulers, long compared favourably with that of their brethren in northern Europe. Nevertheless, with the passage of time and the growth of national and religious feeling, their situation deteriorated. In 1391, and again in 1411, a wild wave of massacre swept through the peninsula. Following the example of their fathers in Gothic times, many Jews (less stouthearted than their brethren elsewhere) sought refuge in baptism. To cope with the problem of these so-called marranos, who remained true at heart to their old faith, the Inquisition was introduced (1478). But the presence in the country of Jews true to their religion seemed a constant encouragement for their converted brethren to relapse. Accordingly, four months after the capture of Granada (which did away with all need for further conciliating this religious minority), Ferdinand V and Isabella issued the edict of expulsion (March 31, 1492) which put an end to the settlement of the Jews in Spain after so many centuries. This extended to the more distant possessions of the crown of Aragon—Sicily and Sardinia—in spite of the fact that the problem of the crypto-Jew was unknown in them. It was in vain that Isaac Abrabanel (1437–1508), the last of the long line of Jewish scholar-statesmen in the peninsula, begged for reconsideration. The edict was imitated in Portugal (1497) and in Navarre (1498) after a very brief interval. Almost simultaneously, the last remnant of the ancient French communities was banished from Provence. An expulsion from the kingdom of Naples (1510 and, more completely, 1541) and from the duchy of Milan (1591) followed the Spanish occupation. (*See* also INQUISITION: *Spanish Inquisition;* MARRANO.)

The whole of western Europe was now closed to the Jews, except parts of northern Italy and a few regions of Germany, together with the exiguous papal possessions in France. The marranos, indeed, continued a surreptitious existence in the peninsula, handing on their traditions in secret from generation to generation at the risk of their lives. It was their descendants, fleeing from the fires of the Inquisition, who, in the 17th century, founded the modern communities in France, Holland, England and even America. Of the earlier refugees the vast majority made their way, sometimes with indescribable difficulty, to the Muslim countries of the Mediterranean littoral. With them they brought their native Spanish tongue, which is spoken by their descendants to the present day. The greatest haven of refuge was Turkey, where the newcomers were sedulously encouraged by the sultans and treated with a favour that reached its climax in the meteoric career of Joseph Nasi, duke of Naxos (*q.v.*; d. 1579). The greatest masses of the Jewish people were thus to be found once more in the east, in the Russian and Turkish empires. The second westerly movement, which continued into the 20th century, may be said to begin with the deadly Chmielnicki massacres of 1648–49 in Poland. The few communities suffered to remain in western Europe—*i.e.*, in Italy, Germany and the papal possessions in southern France—were meanwhile subjected at last to all the restrictions which earlier ages had usually allowed to remain an ideal; so that, in a sense, the Jewish dark ages may be said to begin with the Renaissance.

3. Culture and Community in the Medieval Jewish World.—Medieval Jewry as an alien minority was not in a position to make any notable contribution to the culture of its environment except in science, medicine and philosophy. Yet it did much, if only by its mere existence, to encourage unitarian religious movements, to stimulate independent thought and to set an example of spiritual courage. In the Arab world in the 9th–12th cen-

turies, it furthered translations of Greek classics, encouraged the rise of the Mu'tazila philosophy, transmitted oriental folk tales and helped to introduce numerals. In Christian Europe after the 11th century it rendered aid in the translation from the Arabic (usually via Hebrew) of philosophic and scientific works of Greek origin, the original texts of which were now inaccessible in the western world; and made significant contributions in the fields of mathematics and medicine, astronomy and cartography. Through the philosophic writings of Ibn Gabirol and Maimonides it had some influence on medieval scholastic thought. (*See* JEWISH PHILOSOPHY.)

The waning of the Muslim threat in Spain in the 13th century, the growing christianization of Europe and the simultaneous rise of a powerful papacy furthered a Christian reaction that drove the Jews into a spiritual if not yet a physical ghetto. The Jews of Spain and Italy, to be sure, never divorced themselves from medieval secular culture; but the Jews of the orient and of central and eastern Europe were shut off from its influence.

In Christendom, the Roman Catholic Church, made nervous by the Reformation, wrongly suspected Jewish influences as partly the cause. In 1555 Pope Paul IV established the ghetto, enforced perpetual wearing of the Jewish badge and drastic separation of Jews from Christians, and excluded Jews from all honourable positions and occupations. The ghetto also led to conversionist sermons with compulsory Jewish attendance, censorship of Hebrew books and constant dread of kidnaping of Jewish children for baptism. But the popes never countenanced (save in one or two ex post facto instances) charges of ritual murder and desecration of the Host. Moreover, when other rulers expelled the Jews, the popes always permitted them to live in those areas subject to the papacy. The ghetto survived into the late 19th century.

In the troubled centuries of bigotry and misunderstanding the Jews found shelter in Judaism. In the ghetto Jewish separate communal life was legally recognized by the corporate medieval state. The Jewish community attempted to function as an elective representative democracy; in practice it tended to be plutocratic. The governing body was a small council, but its decisions were frequently subject to review by the rabbi who was the local communal judge. The council took the lead in assessing and collecting taxes and in administering the charities, the schools and the synagogues. The usual complement of paid officials included the rabbi, the cantor, the beadles and the ritual slaughterer. In Germany and eastern Europe, later on, large communities or groups of communities appointed or employed a liaison officer (*shtadlan*) to work with the secular authorities. Communal life concerned itself, in the main, with internal problems of organization, and raising of taxes for the gentile state and for the Jewish community, the preservation of its institutions of social welfare, and the administration of the Jewish courts which always exercised civil jurisdiction. Criminal jurisdiction was rarely tolerated by the state.

All these activities necessitated a great deal of legislation, and in this the autonomous Jewish community was granted the widest latitude. Ordinances were enacted by the Jews governing every phase of life: business, synagogue attendance, social morals, policing of the ghetto, and sumptuary laws, to suppress extravagance or forestall gentile jealousy, which regulated dress, amusements, card playing, feasting and other aspects of ghetto life.

The schools and philanthropies were highly important aspects of medieval Jewish life. Elementary education was compulsory, but was limited to religious instruction; this however included reading and writing at least. Secular disciplines were acquired sometimes privately at the hands of tutors. There was little incentive to pursue the sciences—with the exception of medicine—because of the exclusion of the Jews from the world about them. Gifted students were encouraged to continue their religious studies at rabbinical academies, where the career of rabbi often led to fame, if not to fortune. Because rabbinic law was statute in the ghetto, a very impressive corpus of Hebrew legal literature grew up in the course of centuries, embracing codes, commentaries and legal *responsa*. In addition, Hebrew literature was rich in works of science, folk tales, mysticism, travel and history.

The education of women was of a perfunctory type, but many did learn to read, and with the development of printing there appeared in Judaeo-German, Judaeo-Spanish, etc., a vernacular literature primarily intended for them, but increasingly read by men ignorant of Hebrew. This literature included secular as well as ethical-religious works.

The philanthropic or social welfare work of the community included the school system, the synagogues, the hospice, help for impoverished members of the middle class, and a ticket system of relief for migrants. Many of the charities were administered by semiautonomous *hebrot* or confraternities working under communal supervision. There were societies for dowering brides, burying the dead, redeeming captives, supporting schools, clothing the poor and sending aid to Palestine.

The characteristics common to the medieval Jewish community were: self-imposed discipline; the consideration of all religious, philanthropic, educational and self-defense problems as common concerns; and a strong sense of solidarity fortified by a uniform way of life.

4. Messianic Pretenders, Hasidism and Emancipation.—The compensations offered by a completely integrated communal life in the ghetto were not sufficient to maintain the morale of a Jewry that found itself almost completely expelled from western and central Europe by the 16th century, and ravaged during the revolts in Poland in the 17th century. Reacting in a fashion typical of Jewry for over 1,600 years, the Jews looked for relief to messianic pretenders. In 1648 Sabbatai Zebi (*q.v.*), a Smyrna Jew, proclaimed himself the long-awaited Messiah; by 1665 he was enthusiastically acclaimed by Jews everywhere until unmasked as an impostor the following year. A century later, under the leadership of Israel ben Eliezer, the Baal Shem-Tob (*c.* 1700–60), very large numbers of Jews in eastern Europe flocked to the new mystical and ethical sects of Pietists or *Hasidim* (*see* HASIDISM).

The forces that produced a false Messiah such as Sabbatai Zebi and a great spiritual and ethical movement such as Hasidism have a great deal in common. In both instances, the submerged Jewish masses were seeking "escape." In a political sense they yearned for physical leadership and security; spiritually they had a craving for an inner freedom which expressed itself in a protest against the intellectualism of the rabbis. The great contribution of the *Hasidim* was their stress on the ethical aspects of Judaism, on religious consecration and on the joy of living. They opposed formalism, in religion, decried asceticism and manifested a keen interest in man himself, particularly the common man. Messianic redemption and ethico-religious rebirth were thus for many Jews a form of emancipation from suffering. The Jews of central and western Europe, more directly influenced by the secular and liberalistic society in which they lived, sought emancipation, not at the hands of God, but at the hands of man. That emancipation, after slowly developing in the new lands of settlement in western Europe from the close of the 17th century, and in Germany after the intellectual achievement of Moses Mendelssohn, received formal expression at the time of the American and French revolutions.

(C. R.)

IV. MODERN PERIOD

A. THE AGE OF LIBERALISM, 1791–1919

1. Period of Emancipation.—A new world dawned for European Jewry with the French Revolution. The fall of the Bastille marked the beginning of the end of the Jewish dark ages. During the medieval period many Jewish disabilities had piled up in the Christian and Muslim lands. The Jew could not become a citizen or hold any government office, could not practise many of the professions or join a craft or merchant guild. He was frequently compelled to live in a ghetto and to wear a special badge and was subject to onerous taxation. Not infrequently he was compelled to pay humiliating travel toll for himself (*Leibzoll*) as well as for his cattle. A rounded education and a decent standard of living were beyond the reach of most Jews. These disabilities—with considerable variation—were current in practically all Christian lands; similar legal incapacities affected the Jew in Muslim lands and were incorporated in the rather fluid body of law known as the pact of Omar. The first outright emancipation of a large body of

European Jews occurred on Sept. 28, 1791, when the national assembly enfranchised French Jewry. This was the beginning of the liberal era, which reached its climax in the treaty of Versailles in 1919.

Western and Central Europe.—Emancipation of the Jews in France was itself the result of a spirit of liberalism and rationalism that had its roots deep in the Renaissance and the middle ages. Ever since the 16th century there had been a growth of tolerance among the thinkers and rulers of Europe. The Wars of Religion which ended with the peace of Westphalia (1648) established the right of tolerance for Catholics and Protestants within the Holy Roman empire. The growing national states, looking back to Roman and classical ideals, emphasized their own sovereignty, including the right to control the destiny of their Jewish subjects independent of church traditions. The mercantilist and capitalist state was willing to tolerate Jews if they could create wealth and if they could become "useful" citizens. These utilitarian motivations were supported by philosophic, rational and humanitarian considerations. The teaching of natural rights and natural religion made a place for the Jews, who were now looked upon as fellow human beings. The 16th-century Dutch welcomed them in their struggle against the Spanish empire; Oliver Cromwell wanted them to further English trade in the Spanish Main and to clip the wings of the rising Dutch state; Roger Williams and John Locke sincerely believed in religious liberty and encouraged the settlement of Jews in the British American colonies, and early in the 18th century John Toland, the Irish philosopher, in his *Reasons for Naturalizing the Jews* (1714) pleaded for a wide toleration of the oppressed Jews.

The 18th century saw the marshaling of the forces of liberalism. The French encyclopaedists led the way. Voltaire disliked the Jews, but his teachings made for freedom. Montesquieu and Rousseau pointed out abuses to which the Jews were subject, and Mirabeau and Abbé Grégoire asked for freedom for the Jews. The work of the French liberals found a sympathetic echo in G. E. Lessing's *Nathan der Weise* (1779). The model of this great plea for tolerance, Moses Mendelssohn (*q.v.;* 1729–86), greatly influenced the Prussian bureaucrat Christian Wilhelm von Dohm, who in 1781–83 published his essay *Über die burgerliche Verbesserung der Juden* ("On the Civil Improvement of the Jews"). The first real effect of this new teaching was felt in the distant English colonies in America, where by the Declaration of Independence (1776) and the constitution (1789) all rights and privileges were given to Jewish inhabitants. The Bill of Rights of the American constitution influenced France to emancipate the French Jews in 1791.

Napoleon—whether it was his will or not—became the testamentary legatee of the French Revolution. Wherever he went, he spread the teachings of French liberalism. Jewish equality was imposed in practically every land he conquered. There was a breath of freedom, at least for a few years, for the Jewries of the Netherlands, Switzerland, western Germany and Italy. But Napoleon himself entertained little sympathy for Jews. He called an Assembly of Notables in 1806 and a confirmatory Sanhedrin in 1807 in order to compel the Jews within his empire to assimilate themselves as speedily as possible into the new French civilization. He imposed a centralized consistorial type of church government upon the Jews, through which he completely subordinated the Jewish synagogue to himself in much the same way as he had done with the Catholics and the Protestants. Through the "Infamous Decree" of 1808, he "froze" the Jewish settlements in the German *départements* and exercised a dictatorial supervision over every important financial transaction into which the German Jews entered.

The fall of the first empire ushered in a period of reaction broken only by the liberal revolutions of 1830 and 1848. Most of the Napoleonic gains were lost, except in the Netherlands. But the spirit of liberalism was on the march, and gradually throughout the century the Jews of central and western Europe were given equality. The new Belgium gave the Jews all rights in 1830; Austria-Hungary gave them political freedom in 1867 and had granted legal recognition to the Jewish religion by 1896; the Italian states, in spite of papal opposition, completed their legislation in favour of Jewry in 1870; and even Germany, where many Jews had been partially emancipated through the Prussian decree of March 11, 1812, completed the task, as an empire, in 1871. Three years later, in 1874, the Swiss, after diplomatic encounters with the French and the United States, gave up their opposition to Jewish political equality. In the Scandinavian lands, Denmark granted equality in 1849 and Norway admitted Jews in 1851 and allowed them to hold public office in 1891. In Sweden, no Jew can sit on the council of state because it is the governing body of the state Lutheran Church, but in every other way the Jews have enjoyed full equality since 1870. The Spanish state, which had expelled its Jews in 1492, never laid down a clear-cut policy toward readmission or emancipation. Jews have been tolerated in the country since 1876, and by the middle of the 20th century as far as they were Spanish citizens the Jews enjoyed apparently full civil rights. Greece emancipated its Jews in the middle of the 19th century, and the Turkish revolution of 1908 brought a semblance of political freedom to the Jewish masses in Turkish lands.

The attainment of political equality in England, for Jews as for dissenters, was a slow process. As early as 1753 a bill was introduced to bring about the naturalization and emancipation of foreign-born English Jews, many of whom were cultured and wealthy. But public opinion was not prepared for this assault on traditional prejudice, and on Dec. 20 of that same year the "Jew bill" had to be repealed. It was not until 1830, after the repeal of the Test act and the emancipation of the Catholics, that the Jews again tackled the problem of equality. Even with the aid of the historian Thomas Macaulay, Robert Grant and a host of other liberals, they still made progress only slowly. Francis Goldsmid, a Jew, was called to the bar in 1833, and by 1855 all municipal offices were open to Jews. Finally, after a hard struggle, Lionel Rothschild took his seat in the house of commons in 1858, omitting from the oath the words "on the true faith of a Christian." In 1871 the University Tests act admitted men of all creeds on equal terms to all lay posts at the universities, in 1885 Nathan Mayer Rothschild, Baron Rothschild, took his seat in the house of lords, and by 1890 all offices were open to Jews except that of sovereign.

Russia.—The central and western European lands had therefore practically all granted equality of rights to their Jewish inhabitants by about 1870, but Jews in these countries formed only a minority of world Jewry. The masses of Jews lived in eastern Europe, in Russia, Poland and Rumania, amidst veritable medieval conditions. Russia, bitterly anti-Jewish, inherited the largest Jewry in the world when, in the years 1772–95, it shared in the partition of the old Polish republic. These Jews were "frozen" in the western provinces of the empire into a Pale of Settlement (1791), and there they remained until World War I.

The attitude of the Russian rulers toward the Jews in this huge ghetto from the time of Catherine II the Great (1762–96) to Nicholas II (1894–1918) was marked by curious inconsistencies; by occasional periods of sympathy alternating with the grossest brutality. In their moments of liberalism, various Russian rulers attempted to put the economic life of the Russian Jews on a sound basis by settling them on the soil and by establishing elementary schools to "civilize" them and to encourage their entrance into Slavic cultural life. Various commissions were appointed throughout the 19th century to study and to make recommendations to solve the problem of these millions of declassed people, but the recommendations of the liberal commissions were never accepted. Occasionally the same rulers who made gestures of liberalism to the Jews with one hand brutally repulsed them with the other. They were driven out of the villages in the borderlands, herded into the ghettos created within the larger ghetto of the Pale, deprived frequently of the chance of higher education, and conscripted into the army though denied the privileges of advancement and the rights of citizenship. Ritual murder charges abounded, and the horror of outright pogroms or state-tolerated and organized killings and massacres began to terrify the Jewish masses in the 1870s and 1880s. There was a short interlude of liberalism under the emancipator Tsar Alexander II (1855–81). In the period from 1855 to 1865 Jewish craftsmen, college graduates and wealthy

merchants were permitted to settle in Russia proper.

The assassination of Alexander II in 1881, however, ushered in a period of reaction that continued with only slight alleviation until 1917. The Romanovs, beginning with Alexander III (1881–94), cultivated an older Russian policy that was to have fateful consequences for all European Jewry: the policy of the scapegoat. The Russian landed magnates and bureaucrats ever since the early 19th century had refused to solve the social problems of the underprivileged peasant masses in a constructive fashion. The emancipation of the serfs only gave them the right to starve. To avoid a repetition of the Jacqueries which were not unknown in that land, the very magnates who had brutalized and exploited the serfs and peasants encouraged the belief that the Jews were the cause of all Russia's troubles. If the Jews could only be kept away from the peasants whom they "exploited," if the peasants would only recognize in the Jew the real religious and economic enemy, then they would be so busy hating and killing Jews that they would not have time to think of their own troubles or to demand redress from the despotic Russian state. It was this state and its tsars that organized and even financed massacres of the Jews as late as the beginning of the 20th century, during the reign of Nicholas II. This policy found a wider application than ever before in Russia's crisis years 1904–06. Russia's ignominious defeat by Japan in 1904–05 was followed by a working-class revolution which developed into a serious threat to the established order. The Jews were made responsible for all these events; the "Black Hundreds," consisting of heterogeneous reactionary elements, were organized to carry out the policy in the name of the tsar. Here was the classical diversion and scapegoat maneuver which was to be emphasized so effectively in the 1930s by Adolf Hitler.

The pogroms killed Jews but did not stop the social revolutionary fervour of the Russians. The defeat of Russia in World War I was followed by the Revolution and under the liberal government of Prince Georgi Lvov, the Jews of Russia were emancipated for the first time on April 2, 1917. The Bolsheviks, who came to power in November, made no changes in that respect. (*See* also ANTI-SEMITISM: *18th and 19th Centuries.*)

Poland.—Poland, which for the larger part of the 19th century enjoyed a sort of shadowy political existence in the larger Russian empire, did nothing for its Jews. Ever since the four years' diet of 1788–91, when the Jewish problem was first seriously debated, the forces of anarchy and bigotry, procrastination and rabid nationalism had made an equitable solution difficult. The Jews fought and died in the Polish revolution of 1831, only to be ignored in the brief moments of Polish triumph. When in 1919 the new Polish republic was created, minority rights for the Jews were forced upon Poland against the protests of its political leaders. The Allied powers at Versailles were determined to guarantee a large measure of political, cultural and social freedom to the various minorities incorporated in practically all the states in southern and eastern Europe. In the Poland of 1919, for instance, almost half the population was of minority stock, including White Russians, Ukrainians, Germans, Jews, etc. The means adopted by the Allied powers were the minority protective clauses. The clauses stipulated that the various religious and ethnic minorities were to be granted religious liberty, all rights of citizenship, the privilege of their own language and the right to their own school systems. The Jews were specifically excused from appearing in court on the Sabbath, and no elections were to be held on that day; they were also guaranteed a proportionate share of public funds for their own schools. The vigorous protests made by the Poles against the adoption of these minority rights—some of which prevailed even under the tyrannical tsars—proved the necessity for their enactment.

Rumania.—Rumania, too, was asked to subscribe to these minority right provisions. Rumanian history had been a repetition of that of Russia, if not worse. The story of the Rumanian Jews in the Turkish provinces of Moldavia and Walachia in the 19th century was a story of cruel, brutal mistreatment. To stop this international scandal the congress of Berlin insisted on the emancipation of Rumanian Jewry. This stipulation was laid down in the famous article 44. Rumania assented and then blandly followed a procedure which enabled it to circumvent the spirit of that clause, by declaring that Jews were "aliens" who would have to be naturalized individually by act of parliament; in the entire period from 1878 to 1919 only a few thousand Jews were naturalized, out of a Jewish population that was never less than 200,000. In the 50 years before World War I, Jewish disabilities, as reflected in petty oppression and limitations in educational and economic opportunities, were at their worst in Rumania. In view of such a history, it was imperative that the rights of the Jewish minority be protected. This the minority rights guaranteed by the League of Nations were expected to do. All in all, a dozen or more states and free cities declared their willingness to observe these and similar rights with respect to their minorities. This was in 1919 and 1920. The struggle that had begun in 1791 was finally over. The liberalistic age had reached its climax. Now, practically for the first time since the 4th century, the Jews all over the world were enfranchised and free—on paper.

2. Attempts by Jews to Expedite Emancipation.—The process of acquiring political and economic rights and, to a certain degree, social recognition was a long one. As has been seen, it began in 1791 and did not end until 1919. During this long century of liberalism, many Jews who appreciated the values of western education thought it necessary to do what lay in their own power to expedite the emancipatory process. As they conceived it, there was a double obligation: the obligation of the Jews to emancipate themselves spiritually, culturally and aesthetically, and the obligation of non-Jews to receive Jews and to accord them, at the very least, political equality. One of the first Jews to begin the drive for the entrance of the Jew into western culture was Moses Mendelssohn.

Mendelssohn was the first Jewish modern educator and emancipator. By translating the Pentateuch into German he encouraged his generation to divorce itself from the Judaeo-German vernacular. Through the simple and rational commentary to the Bible which he sponsored (the *Biur*), he taught his generation to think rationally. Through his philosophic writings Jews were again encouraged to view their religion from the perspective of contemporary philosophy. He strove to modernize the Jew and to make him acceptable to his non-Jewish fellow men, although he was always scrupulously orthodox in religious practice. His disciples carried on his heritage of a cautious assimilation of western cultural values in their Hebrew periodical *Ha-Me'assef* ("The Gleaner").

In the next generation, Leopold Zunz (*q.v.*), striving to achieve the same ends which had motivated Mendelssohn, proceeded from a different viewpoint. It was his belief that if the Jews could demonstrate to the world the worth and grandeur of their culture, a new respect would be engendered that would make for the acceptance of Jews into the family of nations. He insisted, however, that this evaluation of Israel's past should be made in a rigidly scientific spirit, and thus he gave birth to the *Wissenschaft des Judentums*, the "science of Judaism." As a result of his influence, of his writings and of the "school" that he inspired, the entire past of the Jews in all its cultural phases was opened to the scholarly world. Hundreds of popular and scientific Jewish periodicals were established, schools for higher Jewish learning were set up, chairs for the science of Judaism were created in the world's universities, Jewish museums were founded and great publishing societies were formed to popularize Jewish knowledge in the Zunzian spirit.

The desire to find a place in world culture and to enjoy the advantages of political, economic and social equality also stirred up individuals among the east European masses. Some of these men had served their cultural apprenticeship under Mendelssohn. They attempted to introduce the *Aufklärung* ("the Enlightenment") into the Russian empire. They became the Enlighteners, the *Maskilim*, finding authority for their name, if not their activity, in the verse from Dan. xii, 3, "And those who are wise shall shine like the brightness of the firmament." The medium they employed was not Yiddish, the vernacular of the masses, not Russian, the language of the overlords, but the classical Hebrew of the Bible.

This drive for enlightenment in eastern Europe, however, met with vigorous objections from rabbinical and lay leaders. It was

their contention that after Jews achieved a secular education and learned to appreciate its benefits they would be willing to surrender their Judaism, if the enjoyment of this culture were made conditional to their acceptance of Christianity. The demand—whether voiced or not—of the Jewish religious leaders was that the Russian government first emancipate its Jews; then cultural assimilation would be safe. This the government refused to do, and the Jewish masses consequently turned a deaf ear to the pleas of the *Maskilim*. *Haskalah* ("Enlightenment") never penetrated deeply into the consciousness of the Jewish masses, for it furthered the assimilation of the despised culture of the Russian oppressors, and its use of Hebrew as a medium limited its usefulness. Yet it was this very creation of a modern Hebrew literature that served as a valuable instrument of the Jewish nationalist or Zionist movement that made itself felt in Russia in the 1870s. *Haskalah*, which was basically assimilationist, did an about face and became particularistic, Jewishly nationalistic, and placed itself at the service of the Zionist movement after the pogroms of the 1880s. The desire for the acquisition of modern rights and culture moved thousands, but the hope of many of these people lay in the enjoyment of these rights in a free and restored Palestine. (*See* also HEBREW LITERATURE: *Haskalah Period, 1750–1880;* JUDAISM: *Modern Period: Enlightenment.*)

3. Assimilation and Environment.—Whenever the "medieval" Jews came in contact with the world of culture without, they were faced with the problem of establishing a balance between their Judaism and the outside world. Many Jews during the struggle for emancipation thought to solve their problems by outright conversion. It was this attitude that brought about the conversion of many persons who were to become distinguished in the 19th century, including Friedrich Stahl, one of the founders of German political conservatism, and Heinrich Heine, the poet. Similar motives prompted Jewish parents to have their children baptized; *e.g.*, Karl Marx was baptized when he was six years old, and Benjamin Disraeli at the age of 12. Others, eager to become an integral part of their environment, leaned toward Christianity, which they identified with patriotism and culture. It was the desire to prevent the secession of these cultured Jews that prompted German Jewish laymen such as Israel Jacobson (1768–1828) to initiate the Reform movement in Judaism which sought to tone down the traditional character of its religious services by the introduction of the vernacular and contemporary musical standards. A later generation, led by Samuel Holdheim, Abraham Geiger (*qq.v.*) and others in Germany, introduced the far more radical principle that only the moral law was binding on the Jews, and that ceremonial and ritual institutions must change in accordance with the needs of the time. This movement, designed to save Judaism from complete assimilation and disappearance, failed to become dominant in Germany or in the rest of Europe, because its break with the past was too abrupt and it excised too much of the strong emotional appeal of the Orthodox service. The *coup de grâce* for Reform as a mass movement was given in 1823 when the Prussian state closed its conventicles and forbade the slightest devjation from the Orthodox service. (*See* also JUDAISM: *Modern Period: Reform.*)

Those Jews who were convinced of the necessity of an adjustment between the rigid ghetto pattern of the 18th century and the demands of western culture, but were also of the belief that the reformers had gone too far, established the Conservative and the Neo-Orthodox movements. The Conservative Jews held to the authority of rabbinic law, at least formally; in actuality, they compromised with it by ignoring it or reinterpreting it where it conflicted with the demands of everyday life. The Conservatives, led by Zacharias Frankel (*q.v.*), took over all the externals of decorum and the use of the German vernacular introduced by the reformers; by improving their services without modifying the liturgy itself, they cut the ground from under the feet of the reformers. They applied themselves wholeheartedly to secular education and became an integral part of the movement of the *Wissenschaft des Judentums*. (*See* also JUDAISM: *Modern Period: Conservative Judaism.*) Even the extreme Orthodox dared not oppose the inroads of modernism if they intended to hold the younger generation. Under the aegis of Rabbi Samson Raphael Hirsch (*q.v.*) they surrendered themselves to modern education but attempted, at the same time, to observe the precepts of orthodoxy in every detail. Practically all Jews, in America and Europe, made a successful transition, spiritually and culturally, from the ghetto to the modern world. The world offered them political and economic and cultural opportunity; it was to their advantage to accept.

4. Anti-Semitism: The Minority Gentile Reaction to Jewish Assimilation.—As the Jew was confronted by manifold problems in adjusting to a new and better world, so the gentile, too, was confronted by a serious problem in adjusting to the new Jew. For at least 1,500 years, practically every instrumentality of church and state had been employed to vilify the Jews and to undermine their position in society. Contempt, or at best pity, was traditional in all circles; hatred was common. Gentiles who had been taught to disregard or despise the Jews as inferiors now found them taking their places as equals, as economic rivals or as professional peers. It was an emotional wrench for the average non-Jew to adjust himself to the new Jew, yet the great mass made this adjustment successfully. If they had not, Jews everywhere would be suffering disabilities. The fact that they have made it is a triumph of the democratic state and of modern Christianity. There was a small minority that would not reconcile itself to the changed status of the Jews; it was this irreconcilable minority that created the modern movement of anti-Semitism.

Unlike the anti-Jewish feeling which had preceded it, the new anti-Semitism was neither feudal nor church-inspired. The former motivations were not virulent enough to put into effect a scapegoat policy. Consequently, the modern anti-Semite politician abandons the arguments deriving from the middle ages and tries to exploit the desire of the *déclassé* lower middle class for a scapegoat. He can succeed only if his appeal is broad, and it can be broad only if he builds on foundations with rationalistic and scientific pretensions. The modern anti-Semite politician is the typical quack of politics. In order to succeed he must be first and foremost plausible. He cannot admit to any type of prejudice. He is not opposed to the "Jew." He is opposed to the "Semite" and on "scientific" grounds. The Jew, he insists, has no capacity for participation in modern culture; on the contrary, he is a menace to it because of his inherent "racial" traits. Anti-Semitism purports to be motivated by biological facts and cultural dictates. It declares that inasmuch as the Jew can only contaminate the world, he must be isolated or eradicated. Anti-Semitism, therefore, is dedicated to the destruction of the Jew. In this respect it is the very converse of the medieval religiously prompted dislike. The ambition of the medieval church, it was said, was not to burn but to convert the Jew. The church yearned to receive him; the modern anti-Semite yearns to annihilate him.

Because anti-Semitism is a pseudoscientific movement, it has an appeal for certain types of intellectuals. It is dangerous because it manifests itself in the organization of political parties determined to acquire power and to settle the "Jewish problem" by violence. Unscrupulous political leaders and demagogues have encouraged anti-Semitism in order to acquire a political following in a hurry by an appeal to a traditional latent prejudice. This explains the anti-Semitic line followed by demagogues in Europe and America from 1875 to the present day.

Anti-Semitism was early recognized and adopted by clever politicians and certain industrialists as a convenient tool to further political and economic reaction In France, in the Dreyfus case (1894; *see* DREYFUS, ALFRED), it was an instrument used by the royalists and the clericals in the attempt to overthrow the third republic; in Russia and Rumania, through legal disabilities and outright massacres, it served to deflect the masses of the population from the task of creating a truly democratic state and of solving their own social, economic and political difficulties. In Hohenzollern Germany it served to divert the people from the social demands of the rising labouring classes. Anti-Semitism was to become an important factor in the age of reaction which succeeded the age of liberalism. (*See* also ANTI-SEMITISM.)

5. Zionism: The Reaction to Anti-Semitism.—Anti-Semi-

tism, as a formal movement, was the reaction of non-Jews to Jewish emancipation. The organized Jewish reaction to anti-Semitism took the form of Zionism, the most vigorous and successful movement in modern Jewish life. Toward the close of the 19th century, many Jews, especially cultured Europeans, who sincerely believed that they had completely identified themselves with their environment were shocked by the recrudescence in modern guise of this ancient hatred of the Jew. They became convinced that if anti-Semitism could rise as a "scientific" and "intellectual" movement, and in France, the very source of Jewish freedom, then assimilation for the Jew was indeed hopeless. Yet these very persons had been influenced by the same political nationalism which in part had served to reject them. It was only natural, then, that they should seek a nationalistic interpretation of Jewish destiny.

The western and central European Jews who founded the Zionist movement found a mass following not in their own countries but among the Jews of eastern Europe, in Russia, Poland and Rumania, where Jews had been Zionists for centuries. Every page of Jewish liturgy and the vast rabbinical literature vibrated with love for the Holy Land, and the Bible inspired them with messianic ideals of a better life and a more just society. They refused to identify themselves with the pan-Slavism of their Russian oppressors or to assimilate the cultural ideas of the other east European states; in the orthodox Christian lands this could be done only in terms of religious conversion, and they refused to pay this price for a questionable security. Under the influence of the Russian pogroms, they followed enthusiastically the call for a Zionist congress which met at Basel in 1897 under the leadership of a Viennese journalist, Theodor Herzl *(q.v.)*. It was at this congress that the Basel program was formulated: "Zionism strives to create for the Jewish people a home in Palestine secured by public law." Herzl and some of his immediate followers had conceived of their problem as political; they were interested primarily in a political state for Jews, and if Palestine, the preferable location, was not available, then some other area, such as British East Africa, might do. But the east European masses were Palestinian nationalists, true Zionists. They insisted that Palestine alone was to be the Jewish homeland, and they carried this point. (*See* also ZIONISM.)

6. Jewish Cultural and Social Development to 1919.—A comparison of the intellectual and cultural status of the average Jew before 1791 with that of the 20th-century Jew would demonstrate that progress has been exceptional. The Jews of the 18th century were behind their non-Jewish contemporaries in secular education, literary taste, science, the arts and the social amenities of the western European world. Since then they have become completely modernized. There is no field of art, science, literature or music into which Jews have not entered and made a positive contribution. There is no democratic land in which they have not held high and responsible office. Paul Ehrlich, August von Wassermann and Sigmund Freud in medicine; Richard Willstätter and Fritz Haber in chemistry; A. A. Michelson and Albert Einstein in physics; Luigi Luzzatti, Disraeli, Lord Reading and Léon Blum in politics; Giacomo Meyerbeer, Jacques Halévy, Felix Mendelssohn-Bartholdy, Anton Rubinstein, Gustav Mahler and Arnold Schoenberg in music; Marcel Proust in literature—these are but a few of the men who made distinguished contributions.

In the economic field the social stratification in Jewish life was not so profoundly modified by capitalism as was the life of other groups. The middle class had been the dominant class in Jewry for more than a thousand years. The tendency of capitalism was to strengthen this large middle class further and to bring into sharp relief the two extremes: the few wealthy capitalists and the emerging Jewish proletariat. The Jewish middle class in Europe and in the Americas concentrated in white-collar jobs, in the professions and in the manufacture and sale of consumers' goods. In almost every country there were a few wealthy capitalists outstanding not only for their wealth but also for their lavish philanthropy. Distinguished among them were the English and French Rothschilds, Baron Maurice de Hirsch who endowed the Jewish Colonization association (ICA), the Schiffs, the Warburgs, the Rosenwalds, Nathan Straus and the Guggenheims. All these men gave millions for both Jewish and gentile philanthropies. Julius Rosenwald alone helped establish more than 5,300 Negro schools in the United States.

The same system that made possible the large fortunes also brought to birth the Jewish proletariat. Large numbers of Jews were artisans in Muslim lands, eastern Europe and the United States. Through the teachings of socialism these European and American workers became a class-conscious group, united in proletarian friendly societies and in Yiddish-speaking trade unions. In nearly all countries where Jews settled there were individual Jews active in socialist and trade-union movements: Karl Marx, Ferdinand Lassalle and Eduard Bernstein in Germany; L. D. Trotski, L. B. Kamenev and G. E. Zinoviev in Russia; the Adlers in Austria; Samuel Gompers, one of the founders of the American Federation of Labor, and Sidney Hillman of the Amalgamated Clothing Workers of America in the United States.

One of the characteristics of this age of the development of the factory system was the right of free movement. This right was vital in a period of an expanding and changing economy when millions of skilled and unskilled labourers were required for the exploitation of new continents. There were mass migrations of Jews and non-Jews through the 19th century, first from central and then from eastern Europe. As a matter of fact, this westward movement of Jewry from central and eastern Europe had already begun in the 17th century as a result of the Thirty Years' War and of the massacres during the Cossack and peasant revolts. Jews then fled to western Europe, not only to find a refuge but also to take advantage of the new economy on the North Atlantic littoral which had been stimulated by colonial growth abroad and mercantilist protectionism at home. The Jews of central and eastern Europe who continued this westward movement in the 19th and 20th centuries were impelled by a desire to escape from the legal and social disabilities in Germany and from outright pogroms in the Russian, Polish and Rumanian areas. In 1879 there were only about 250,000 Jews in the United States; it was an outlying colony of Jewish life. By 1914 Jewish communities with established traditions of service and responsibility to world Jewry had been established in the Americas; there were no fewer than 3,500,000 Jews in the United States and Canada.

7. World War I.—World War I affected the Jews primarily in the eastern European zones. Hundreds of thousands were uprooted from their homes in Russia, and their emancipation, along with that of the Russian masses in 1917, did not immediately ameliorate their position. The attempt of the Soviets to maintain themselves in power and the effort of the Russian counterrevolutionaries, the Poles and the Ukrainians, supported by the Allies, to drive them out, turned western Russia into a bloody battlefield in the civil wars of 1918–20. The Jews of the Ukraine were butchered by the thousands by invading troops and local guerrillas. When the Soviets finally gained the upper hand all discriminations—political and economic—against the Jews were abolished. A vigorous effort was made to crush anti-Semitism by outlawing it. No concessions, however, were given to Jews in the field of religion; religious services were grudgingly tolerated, but any attempt to impart group instruction to Jewish youth under 18 years of age was vigorously punished as a counterrevolutionary act. Individual instruction by parents was canceled out by the widespread propaganda against religion in every public institution. As a consequence of these activities, Judaism, as a religion, had no future in Russia because it could not reach its youth. But the Soviet authorities permitted a wide latitude in cultural affairs as long as social indoctrination remained in their hands. Jews were allowed the Yiddish vernacular, their own schools, courts and theatres, although the general tendency on the part of Jews was toward acceptance and assimilation of the nationalistic Russian culture.

B. The Age of Reaction, 1920–48

1. Postwar Reaction in Eastern Europe, 1920–39.—The social status and the political, economic and religious rights of the Jews in Russia were of the same quality as those of all other citizens in the Soviet federation. Nevertheless, the majority of the Jews became declassed because of their bourgeois economic activities. The desperate economic plight of these declassed un-

fortunates was alleviated only by the large-scale philanthropy of the American Jewish Joint Distribution committee and similar organizations in England and elsewhere. In 1924 the U.S.S.R. began to work with the American Jewish Joint Agricultural corporation (Agro-Joint) to settle the declassed Jews on the land, and the government made an earnest and successful effort to help them become artisans and industrial workers.

Thousands were also taken into the various state services. In accordance with established Stalinist policies they were permitted and encouraged to have their own agricultural colonies in the Ukraine, Crimea and finally in the Jewish autonomous region (Biro-Bidjan) on the Amur river. Biro-Bidjan, established in 1928, was not a conspicuous success as a Jewish state. The Jewish masses preferred to remain in Russia proper.

In marked contrast, the conditions of the Jews in the Soviet Union's neighbour states, Poland and Rumania, were most miserable. The Committee of Jewish Delegations at the Peace Conference, which petitioned the Allied powers at Paris in 1919, believed, mistakenly, that they had adequately protected the Jews and all other minorities through the establishment of minority rights. Within a few years, however, these rights proved altogether ephemeral. The League of Nations procedure for guaranteeing them did not work. With few exceptions the countries which subscribed to them set out to cancel or to circumvent them. There were no effective sanctions. The war had engendered a fierce spirit of chauvinism which was heightened by the creation of large armies, customs barriers, economic autarchy and a consciously developed policy of nationalizing all minorities even when these were on a superior cultural plane. Ruthless polonization and rumanization was the order of the day. The huge taxation inspired by this nationalistic program aroused the ire of the peasants and the industrial proletariat. This was only partially relieved by throwing the burden of taxation on the urban shopkeepers, a large number of whom were Jews. The Polish peasants and workers were miserable, for the closing of German and Russian markets was a severe blow to the Polish economy. The obvious remedy was to initiate widespread political, economic and social reforms. This the reactionary forces that now seized control refused or failed to do. There was another way.

There were about 3,000,000 Jews in Poland, most of them, it is true, in desperate economic plights, but some of them did manage to exist as artisans, petty traders and shopkeepers. The state believed that if these Jews could be compelled to migrate they would make economic room for the hungry peasants, and to stimulate migration the Polish government and all rightist parties engaged in a tacit conspiracy to make the lives of Jews so unpleasant that they would be compelled to migrate. This was in reality a policy of anti-Semitism, although the Polish and Rumanian governments did not issue laws disabling Jews as such. The chief medium of discrimination was the economic boycott. Jews were kept out of the civil services, the co-operatives and the government monopolies; they were discriminated against in the licensing of traders and craftsmen, refused bank loans, limited in the practice of law and medicine and in many instances driven out of the universities. Anti-Semitism served a manifold purpose; above all, it diverted the attention of the oppressed Polish masses from their own distress and the ineptitude of the government. Anti-Semitism, apparently, was good politics, for it cut the ground from under the feet of the outspokenly anti-Semitic opposition political parties; it satisfied the traditional current of anti-Semitism and, apparently, placated the growing colossus on the west, anti-Semitic Germany, where Hitler had come to power in 1933. The result of the state's attitude was that the status of the Jews constantly worsened in Poland; riots broke out, enormous property damage was done, and hundreds of Jews were wounded and killed. This was the situation when the Germans invaded in 1939.

2. Postwar Reaction in Central Europe, 1920–39.—During the period of the long armistice, 1919–39, the position of the Germans had changed radically. World War I had left them crushed. In this crisis there arose Hitler with an economically and socially appealing political platform and a promise of work, glory and a scapegoat. The Jews, together with the social democrats, the liberals and other "traitors," Hitler maintained, were responsible for the downfall of Germany. This appeal to anti-Semitism was supported by many respectable groups whose ultimate purpose was actually to destroy the Weimar republic. This task would be made easier if the republic could be equated with "Jewishness," which meant, of course, political and social liberalism and consequent justice to the Jews. When Hitler in Jan. 1933 became chancellor of Germany he immediately set out to implement his program, which included the destruction of what was probably the most distinguished Jewry in Europe. Although less than 1% of the total German population, the Jews stood out as a group noted for their interest in and contributions to German culture. They were—so they believed—completely integrated into the civilization and life of the country; about 27% of all Jewish marriages in Germany were intermarriages with non-Jews. Those German Jews, who did remain wholly Jewish, however, frequently showed an unusual appreciation of Jewish cultural and spiritual values.

In a series of laws, confiscations and pogroms between 1933 and 1938, Hitler succeeded in undermining the political and economic foundations of German Jewry, which according to him included thousands of German Christians of Jewish origin. By the Nürnberg laws of 1935 Jews lost their citizenship completely and were forbidden to intermarry with other Germans. As a result of the pogrom of Nov. 9–10, 1938, practically every synagogue in Germany was destroyed, thousands of Jews were imprisoned in concentration camps, and the major part of German Jewish wealth was confiscated by a huge punitive fine. By the time World War II broke out in 1939, Jews were no longer citizens, could attend no public schools, engage in practically no business or profession, own no land, associate with no non-Jew or frequent no park, library or museum, and were ordered to live in ghettos. By 1941 boys over 12 were conscripted into munition factories, all use of the telephone and public transportation systems was forbidden, and all Jews over 6 years of age were required to wear the yellow badge. This was the fate of the 1% of Germans who had given Germany 29% of its Nobel laureates.

The Nazis became convinced, after a few propaganda successes, that anti-Semitism could serve as an entering wedge into every country of Europe and the Americas. This was important in their scheme of world penetration and conquest. A residual spark of anti-Semitism existed in all Christian and Muslim countries, they believed, and would make those countries amenable to Nazi advances. Vast sums were spent for this purpose in practically every country in the world, with considerable success. By Sept. 1938 Benito Mussolini in Fascist Italy had issued an anti-Jewish law modeled on German anti-Semitic racial legislation; and the conquest and incorporation of Austria in 1938 and of Bohemia-Moravia in 1939 brought about the subjection of their Jewries. Hungary, with a background of anti-Semitism and of a *numerus clausus* ("limited number") in the professions, enacted its first anti-Semitic statute on the Hitlerian model in 1938. Rumania reached a climax of anti-Semitism in Dec. 1937 when Octavian Goga became premier. In the short period of a month Goga sponsored a series of Nazi anti-Semitic laws which threatened the complete ruin of Rumanian Jewry. He was speedily deposed by King Carol II, but, nevertheless, by Nov. 1939, more than one-third of Rumanian Jewry was disenfranchised. This meant that, as aliens, they were not permitted to work. (*See* also ANTI-SEMITISM: *1901 Through World War II.*)

3. Methods of Alleviating Distress, 1920–39.—What forces were at work stemming this postwar reaction? The League of Nations did succeed, if only by virtue of its existence, in preventing widespread bloody excesses against minorities. Enlightened public opinion, particularly in England and the United States, was a strong factor for several years in restraining brutality in several European countries.

Those forces, however, which might have been expected to rise to the support of the oppressed minorities in Europe between the wars failed to do so. The student bodies of central and eastern Europe, following old traditions, refused to line up with the liberals. With rare exceptions they were a prime source of reaction and violence. The liberal political parties had been crushed or

suppressed. In Germany the Socialists, who might have joined forces with other liberals, were seized with a paralysis which prevented any effective resistance to the Nazis; their strength was spent in struggle with the Communists. The protests of the churches, when they were made, were feeble and ineffective; certain individual churchmen and prelates were outright anti-Semites.

The methods of self-help employed by the Jews themselves served in a small degree to ameliorate their position. Some solved their problems by committing suicide; the majority hoped for emigration. The United States' restrictions on immigrants, introduced in 1921 and 1924 and not greatly altered until 1943, were a blow to Jewish hopes. From 1931 to 1941, 580,207 immigrant aliens were admitted to the United States; of these, 161,262 were Jews. This did little to alleviate the condition of the millions of Jews who were suffering under reactionary European governments during the period. Many Jews believed that if Palestine could be opened to immigration, the situation might be relieved. In this belief the Jews and the Polish government were in agreement, but the British authorities, for various reasons, refused to permit unlimited migration of Jews to the mandated state.

If the Jews were to improve their position in Europe between the wars, it had to be done largely through their own efforts and in the land in which they lived, and not through emigration. The refusal of the Nazis from 1933 on, to promulgate a charter defining even minimal Jewish rights made any cultural or economic program in Germany futile. Little but the relief of physical needs could be contributed by foreign Jews.

When disabilities were decreed in southern and eastern Europe, however, trade schools were set up, Jews were urged to make a vocational shift where this was thought to be helpful, a vast network of Jewish *kassas*, or loan banks, was established to provide credit for small businessmen, and a system of hospitals, clinics and summer camps for adults and children was supported. Much of this activity was financed by the American Jewish Joint Distribution committee.

The distress of the Jews, both economic and political, was in a large measure inherent in the national and international economic-political situation. Many Jews, therefore, attempted to help themselves by joining political parties dedicated to social improvement. In some countries, particularly Poland, many Jews supported the socialist parties; some individuals, particularly among the disillusioned and embittered but still idealistic youth, were sympathetic to communism. The mass of Jews all over Europe who still enjoyed the franchise supported the bourgeois, liberal and democratic parties. This helped but little, for when the attack came in 1933 it came not from the international left but from the anti-Semitic right, which was dedicated to the destruction of Jewry.

4. Jewish Cultural Development, 1920–39.—The general reactionary trend in European politics after 1920 and the rapid deterioration of civil and political rights after 1933 did not, as might be expected, bring about an immediate deterioration in Jewish cultural productivity. Religious, cultural and social organizations pursued their activities vigorously and on a high plane. In the relatively small Jewry of England a Jewish publishing house, the Soncino press, issued a translation of *Midrash Rabba*, the cabalistic *Zohar*, the pentateuchal commentaries of Rashi and an almost complete translation of the Babylonian Talmud. (It was eventually completed, in 35 volumes, in 1948.) German Jewry, in spite of serious handicaps after 1933, continued, until prevented, to publish two historical magazines and maintained great theological schools, publication societies and academies for research. The encyclopaedia *Jüdisches Lexikon* (four volumes) had already appeared in 1930; the *Encyclopaedia Judaica* reached the tenth volume between 1928 and 1934 before it was forced to discontinue publication for economic and political reasons. Prague, Czech., was a centre of Jewish belles-lettres. Historical research in this small Jewry was encouraged through *Jahrbücher* and periodicals. Jewry in Poland, in spite of its poverty, maintained a vigorous intellectual life. In 1934, for instance, it supported 175 Yiddish magazines and published 565 books of Jewish content in Hebrew, Yiddish, Polish and German. It had a network of Yiddish and Hebrew schools, making training in Judaism available to thousands. Lithuania, with about 165,000 Jews in 1939, was the home of the Yiddish Scientific institute (YIVO), which, using Yiddish as a lingua franca, published an excellent magazine, *Jivo Bleter*, and several other publications in history, pedagogy, economics and philology, all conceived and executed in the scientific spirit. (The central offices of this institute were moved to New York city in 1940.) An indication of the cultural activity of even a small country may be judged from the fact that Bulgaria in 1939, with a population of fewer than 50,000 Jews, had more than 80 Jewish cultural and philanthropic organizations.

5. World War II.—The victories of the German armies in the early years of World War II brought the overwhelming majority of European Jewry under the Nazis and their satellites. From the Atlantic to the Volga, from Norway to Sicily, Jews were deprived of all human rights. Their property confiscated, most of them were herded into ghettos and concentration camps and eventually deported under inhuman conditions to Poland, which Hitler had selected as the scene for his "final solution" of the Jewish problem. In 1941 the German government entered on a plan of extermination by more scientific and effective methods than mass shooting and starvation and disease, which were too slow as well as too "expensive." The most effective method for mass extermination was gassing in specially constructed gas chambers, from which the bodies were removed to adjacent crematoriums. In this manner, about 4,000,000 Jews were put to death in Oswiecim (Auschwitz), Majdanek, Treblinka, Dachau, Buchenwald, Bergen-Belsen and other camps. The total number of Jews exterminated by the Nazis during the war has been computed at about 5,750,000. It may have been considerably more, especially when indirect victims of Nazi brutality, half-Jews and persons previously not registered as Jews are included. (*See* also CONCENTRATION CAMPS: *Concentration Camps of Nazi Germany.*)

This plan of genocide was carried out with efficiency, and the victims, whose will to resist had been sapped by prolonged starvation and disease, were often unaware until the last moment that they were going to be gassed. Nevertheless there was some Jewish resistance, both passive and active, to this revolting crime. Where the population was friendly to the Jews, as in Denmark, France, Italy and Bulgaria, it proved possible to save considerable numbers of Jews by hiding them, furnishing them with false documents and even evacuating them to neutral countries. Thus a large part of Danish Jewry was secretly transferred en masse to Sweden, while some French Jews found refuge in Spain, Portugal and Switzerland. In eastern Europe, however, the Germans exploited the traditional anti-Semitism of the peasant, so that hardly any aid reached the Jews from the mass of the people, while not a few non-Germans were among the most brutal agents in carrying out the extermination campaign. Notwithstanding these unfavourable conditions, thousands of young Jews joined the various underground resistance movements and the partisans in Poland, the U.S.S.R. and Lithuania, France and Italy. Jewish partisans often formed their own units, and in France there was a special Jewish section of the *maquis* which distinguished itself in attacks against the Germans.

But it was above all in the major ghettos of Poland—Warsaw, Bialystok and Vilnius—that Jewish risings took place against overwhelming odds. In Warsaw, where at one time nearly 500,000 Jews had been concentrated, the last 40,000, almost unarmed, resisted the German deportation order and held out for nearly a month against regular German troops armed with flame throwers, armoured cars and tanks (April–May 1943). The reaction of the outside world to this tragedy was one at first of incredulity and later of horror and indignation. In a memorable scene on Dec. 17, 1942, the British house of commons rose in tribute to the Jewish martyrs on the continent of Europe. Unfortunately, the Allied governments were too preoccupied with their own effort to render effective aid in saving Jews, and throughout the war the gates of most countries remained closed to all but a handful of refugees.

The subsequent years tended to heal a few individual wounds, but the damage suffered by organized Jewry on the continent of Europe could not be repaired. Jewry's hopes became concentrated on Israel, the United States and Great Britain.

(J. R. Ms.; I. E.)

6. Post-World War II Period.—The main feature of the post-war period was mass migration, from eastern Europe to Palestine and western countries, and from the orient to Israel. At the end of World War II the great bulk of European Jewry was in the Soviet Union and unable to move. But the former big communities of Germany, Poland, Rumania, Hungary and Czechoslovakia, and the smaller communities of southeastern Europe, Greece, Yugoslavia and Bulgaria, were very much reduced, and survivors from concentration camps and Hitler's "final solution" (*i.e.,* total extermination) were not willing to be repatriated. Until 1950 they flocked into displaced persons' camps in Germany, Austria and Italy, then in Allied occupation. The majority were determined to reach the Jewish national home, but most had to wait till the state of Israel was established (1948). Then about 300,000 were moved, with the help of the International Refugee organization, the Zionist Jewish Agency for Palestine and the American philanthropic body the Joint Distribution committee. About an equal number chose to go to the United States, Canada, Australia and Latin America.

The stable communities of Europe, apart from the Russian, were the British and the French. Anti-Semitism had no hold, except in a lunatic fringe, and the two countries resumed their tradition of attracting refugees. France received a large increment from Algeria and Morocco when French oversea rule ended, and the French-Jewish community became the largest in western Europe. All Algerian Jews and some Moroccans were French citizens and had the right of admission. English Jewry, reinforced by refugees from Hitler, became the chief European centre of Jewish scholarship.

In 1959 a disturbing eruption of swastika signs broke out in west as well as in central Europe but was soon checked. The Jews who remained in central Europe were for the most part economically well off, having recovered compensation from Germany, but spiritually they were weak. The old centres of learning were destroyed, and many congregations were pitifully small. A Central Conference on Jewish Material Claims Against Germany devoted a substantial part of the German indemnities to Jewish cultural purposes, schools, talmudic colleges and libraries; and a movement for Jewish day schools spread from country to country and was connected with the Hebrew renascence in Israel. In the Soviet Union completely, and in the soviet satellite countries to a lesser degree, Jewish culture and the Yiddish and Hebrew tongues were repressed. Yiddish, which till World War I was the mother tongue of a majority of Jews, was now the language of less than one-quarter, and those mainly in America. Yiddish journals and literature, however, still flourished.

The Jews were everywhere essentially an urban and educated population, concentrated in big towns, engaged in commerce, industry and the liberal professions. The Russian-Jewish proletariat was destroyed, and the political prominence of Jews in the early Communist regime was crushed by the anti-Zionist campaign of the 1950s; but in the western democracies Jews rose to high political office. (No. B.)

C. The Creation of the State of Israel

The Jewish independent state of Israel was proclaimed in Tel Aviv (Tel Aviv-Jaffa) on May 14, 1948. Its Declaration of Independence read: "The State of Israel will be open for the immigration of Jews from all the countries of their dispersion." Thus were fulfilled the hopes of 2,000 years.

The establishment of Israel as a state was brought about by a combination of the forces of liberalism, which culminated in the treaty of Versailles, with the forces of reaction, which reached their climax in the events of World War II. The first real gesture toward the creation of an independent sovereign Jewish state in Palestine had been made in 1917. On Nov. 2 of that year Arthur James Balfour, secretary of state for foreign affairs of Great Britain, formally declared that

> His Majesty's government view with favour the establishment in Palestine of a national home for the Jewish people, and will use their best endeavours to facilitate the achievement of this object, it being clearly understood that nothing shall be done which may prejudice the civil and religious rights of existing non-Jewish communities in Palestine or the rights and political status enjoyed by Jews in any other country.

Three years later, in April 1920, the Supreme council of the Allies at San Remo included this declaration in the mandate for Palestine which was to be assigned to Great Britain by the League of Nations.

Yet, in spite of the Balfour declaration and the mandate, the evolution of a Jewish state in Palestine was marked by many problems. There were internal Jewish conflicts: the struggle between a socialist and capitalist economy; the demands of orthodoxy and the indifference of secularists. Nevertheless, within the ambit of the authority accorded to them by the Jewish community regulations, the Jews managed to effect a satisfactory modus vivendi.

The problem of Arab-Jewish relations was a far more serious one. Palestinian Arab nationalism, in turn, was furthered by politically ambitious Arab townsfolk, by the wealthy Arab landed class which feared the growing power and the liberal social program of the Jews, by some British authorities in Palestine and London who did not approve of the domination of the Jews in Palestine, and by Nazi and Fascist propagandists who hoped thereby to tear Palestine away from the British sphere of influence. The Arabs maintained that Palestine was theirs by virtue of occupancy and numerical superiority; the Jews asserted their right to the country based on historic tradition and ties, on their desperate need for a land of their own and on the record of what they had already done and what they expected to do for the country itself. And the British, in the Balfour declaration and, apparently, in the letters from Sir Henry McMahon, high commissioner for Egypt, to Sherif Husain ibn Ali of Mecca, promising the creation of an Arab state in the Arabic-speaking provinces of the Ottoman empire (1915), made commitments to both sides. The struggle between Jews and Arabs was epitomized in the Jewish demands for the right to free migration into the country and the freedom to purchase land in an open market. The Arabs and the British denied both. In order to emphasize their opposition to Jewish objectives, the Arabs in the period from 1920 to 1937 created many riots in the cities and in the farm settlements and took a considerable toll of Jewish lives. The Jews defended themselves vigorously and successfully, but were convinced that these riots could not have taken place without the connivance of the local British authorities. To bring peace to the embattled region the British appointed a series of commissions beginning with the Shaw commission in 1929 and ending with the London conferences and the white paper of May 17, 1939.

The general tendency of these commissions, conferences and white papers, which reflected British colonial and foreign office policy, was to scrap the Balfour declaration. This was already evident in June 1922—before the mandate was even ratified—when Winston Churchill, as colonial secretary, issued the white paper which detached a considerable part of Palestine to form the Transjordan state. The (Peel) Royal Commission of Inquiry in 1937 suggested the partition of the remaining part of Palestine between Jews, Arabs and English. This proposal was rejected by the British in 1938, and in May 1939 the British government proposed "freezing" Jewish settlement in Palestine by limiting immigration and by circumscribing land purchases. This was the status of the Palestinian Jewish situation when World War II broke out. (*See* also Palestine.)

With the outbreak of hostilities the problem was temporarily shelved. About 30,000 Jews in Palestine volunteered for service with the Allies and saw service in every theatre of war, and in 1944 these Jewish volunteers formed themselves into the Jewish brigade, which distinguished itself in the Italian campaign.

Later, during the war, there was increasing pressure put upon the British government to allow the immigration of more Jews into the country. The British refused, and as a result there were numerous violent outbreaks by terrorist elements which were condemned by the responsible Jewish authorities. After the war, an Anglo-American committee of inquiry visited Palestine and made certain recommendations which the British government refused to accept. Instead it decided to refer the problem of the mandate to the United Nations. In Nov. 1947 the United Nations decided by a large majority to terminate the British mandate and to establish in the area two independent states, one Arab and the other Jewish.

The Arab states refused to abide by this decision and went to war in order to obliterate it. On May 14, 1948, however, the Jewish independent state of Israel was proclaimed in Tel Aviv, and Chaim Weizmann became the first president.

Israel had won the "war of independence," but war left in its wake tragic consequences. Although armistice agreements were concluded in 1949 with the help of United Nations mediators, the Arabs steadfastly refused to recognize the new state of Israel. During the war thousands of Arabs left the country and became refugees. Israel took back about 80,000 of these refugees, but the bulk of them remained in the Arab states. Israel's offer of compensation for resettlement in the large undeveloped and underpopulated areas in the Arab states was refused. The Arabs also declared an economic boycott of the state of Israel. In addition, there were numerous incidents on the borders of Israel resulting in much loss of life and damage to the economy.

Yet notwithstanding all its dangers and difficulties, the state of Israel developed rapidly in population, in the setting up of agricultural settlements and in the establishment of industry. Like the Zionist movement which brought it into existence, the Jewish state is inspired by ideals of social experimentation and democracy. In spite of its size, its influence on world Jewry has been profound. It inspired a renascence of the Hebrew language and culture throughout the world, stimulated Jewish studies, intensified Jewish loyalties and imparted to Jews everywhere a dignity, a self-realization and an inner security which previously they did not possess. (*See* also ISRAEL; PALESTINE.) (J. R. MS.; I. E.)

D. JEWS IN THE UNITED STATES

With the arrival of the first group of 23 Jewish refugees from Brazil in New Amsterdam (New York) in 1654, the history of the Jews on the North American continent started. After three centuries in the United States, American Jewry became numerically the strongest Jewish community in the world, with a population of more than 5,500,000—about 3½% of the total population of the United States.

1. The Sephardic Period (1654–1830).—The early Jewish immigrants were Sephardic Jews who followed the Spanish Jewish rite, and many of whom had actually stemmed from Spain or Portugal (*see* SEPHARDIM, ASHKENAZIM AND ORIENTAL JEWS). Soon after their arrival in New Amsterdam they organized their religious and community life, although the first synagogue building in New York came into being many decades later. One of the leaders of these Sephardic immigrants, Asser Levy, who arrived penniless in 1654, rose to wealth and distinction, built together with Jacob Barsimson a slaughterhouse and became an executor of many Jewish and Christian estates; through his efforts Jewish settlers in New Amsterdam were admitted by the court to the burghership in 1657. In 1658 an additional group of Jewish immigrants from Amsterdam settled in Newport, R.I., possibly stimulated by the more favourable attitude of Roger Williams and his fellow colonists, and made Newport the second largest Jewish community at that time.

Among the many enterprising Jews of Newport were Jacob Rivera and Aaron Lopez, the latter a big shipowner, importer and exporter who developed an extensive trade in whale and sperm oil and in other goods to and from Europe. Following the foundation of the first synagogue in New York, Shearith Israel (Remnant of Israel), the Jews in Newport established the synagogue Yeshuat Israel (Salvation of Israel), later called Judah Touro synagogue after the great Jewish philanthropist; the oldest synagogue building in the U.S. still standing, it was declared a national historic site in 1946. Among the visiting scholars to Newport was Isaac Karigal from Hebron in Palestine (1773), who became a close friend of Ezra Stiles, later president of Yale college.

Soon new groups of Sephardic Jews from the Netherlands, England and the West Indies settled in other towns along the Atlantic seaboard and along the highways of transportation, engaged mainly in mercantile pursuits. By 1776 organized Jewish communities existed in five towns of the original 13 colonies—New York city, Newport, Philadelphia (Pa.), Charleston (S.C.) and Savannah (Ga.). One of the outstanding patriots and rabbis in the Revolutionary War period was Gershom Mendez Seixas (1745–1816). After the capture by the British of New York, where Seixas served Shearith Israel, he became the *hazzan* or minister and counselor of the Jewish congregation in Philadelphia when it established its first synagogue, Mikveh Israel (Hope of Israel). Among the leaders of this congregation were Haym Salomon (1740–85), a prominent merchant and broker to the office of finance who was entrusted with many diplomatic missions to Europe; the Gratz brothers, merchants, shippers and army purveyors; and the enterprising Joseph Simons of Lancaster, Pa., an Indian trader, merchant and landowner on a large scale—one of the first Jews to be naturalized in Lancaster (1749).

In 1790 there were not more than 2,500 Jews in the United States, but by 1830 there were about 10,000, under the spiritual leadership of the Sephardic Spanish Jews, though most of the rank and file were of German origin.

2. The German Period (1830–81).—Among the early Jewish immigrants there were already those of Ashkenazic stock (from central and eastern Europe), such as the Gratz brothers and Haym Salomon. It was not, however, until the Metternich age (1815–48) that the German Jews, particularly of the smaller towns of south Germany, despairing of opportunities at home, began to migrate to North America in large numbers. The number of Jews in the United States grew rapidly, and by 1860 about 275,000 had been settled. The majority of these immigrants were petty traders and peddlers, but they rapidly rose in social and economic status and by the time the Civil War broke out a number had become successful merchants and garment manufacturers; a few, such as the Speyers and Seligmans, were bankers.

During the Civil War the Jewish bankers of the north helped open the German market to U.S. bonds; thousands of Jews fought in the armies on both sides; there were also about nine Jewish general officers in the north; the former U.S. senator from Louisiana, Judah P. Benjamin (1811–84), was secretary of state and secretary of war in the Confederate cabinet.

After the Civil War, Jews continued their activity as merchandisers of consumers' goods. As garment manufacturers, they helped to introduce factory-made clothes. Thousands of Jews began to move inland and westward and became pioneer merchants. Second and third generations of German Jews later entered the professions and politics.

By 1871 the complete emancipation of German Jewry stopped emigration from central Europe, but approximately at the same time there began an ever-increasing flow of immigration of Jews fleeing from the economic and political distress of eastern Europe. This migration began to assume mass proportions by 1881 as a result of the Russian massacres and discriminating decrees against the Jews.

3. East European Period (1881–1924).—Though the Sephardic Jews ceased to emigrate to the United States after 1800, they continued to dominate American Jewry spiritually at least until 1830. German Jews, who began to arrive in larger numbers by that time, held undisputed sway over the cultural and administrational destinies of American Jewry until 1918. The new Jewish immigrants who flocked to the United States as early as 1870 were fleeing from pogroms in Russia, the Ukraine, Poland and Rumania. By the time the Johnson-Lodge bill of 1924 finally halted their immigration 2,500,000 settlers had arrived. The east European migration brought about changes in the economic and social characteristics of American Jewry, in occupational structure and in distribution, and raised numerically the Jewish population from about 0.6% to 3% of the total population in the United States.

Unlike the German Jews, the bulk of these immigrants concentrated in New York and became workers in the clothing industry, though many raised their standard of living and some of their children went into the professions. Some entered the labour movement and engaged in reform and socialist politics.

These immigrants were by no means a homogeneous group. They transferred many of the cultural and religious institutions of their homeland to their new country and organized *Landsmannschaften*, groups consisting of former residents of the same native town or province. Yet they had in common with earlier waves of

immigrants the cultural-religious heritage, the knowledge of Hebrew and Yiddish, were orthodox in their practice and fervently Zionist. They courageously opposed civil and political discrimination. Their hopes and sentiments were eloquently expressed by the poet Emma Lazarus (1849–87), who pleaded for the rights of the individual everywhere and whose poem "The New Colossus" was engraved at the base of the Statue of Liberty.

4. Refugees From Nazism (1936–46).—From 1936 a new migratory wave followed the east European immigration. Consisting of refugees from Germany, Austria, Czechoslovakia and other European countries which had been overrun by Nazi Germany, about 150,000 Jewish immigrants entered the United States in this period. Most of them were of high social and economic status, a cross section of the prosperous and cultured Jewish population of central Europe. This group soon adjusted itself well and rapidly achieved responsible positions.

Another stream of Jewish refugees numbering about 100,000 was comprised of those who had survived the concentration camps of the Nazi regime. They arrived after World War II virtually penniless and destitute.

5. The Emerging Type of the American Jew.—With the end of migration, Jews found themselves in a melting pot out of which was coming an American Jew who was distinguished from other citizens only by a different cultural and religious heritage, by his strong sense of kinship for Jews abroad and by his determination to help them attain necessary political, economic and cultural opportunities and security.

The economic prosperity of the United States caused also a rapid rise in the socioeconomic position of American Jewry. The economic and occupational distinction between the east European and German immigrants disappeared, and the formerly distinct elements merged into a single strong U.S. Jewish community.

The number of Jews who are annually assimilated completely into the larger Christian American community has reached considerable proportions; it is probable that 5% of all Jewish marriages—outside the areas of mass settlement—are intermarriages. The percentage in the metropolitan areas is probably smaller, but it continues to increase.

Following, and greatly exceeding, the trend for the entire U.S. population, Jews concentrated in the larger cities. Only about 0.2% of the Jewish population lives on farms, these few largely through the efforts of the Jewish Agricultural society. The integration of the vast Jewish population into the U.S. economy was greatly facilitated by technical expansion and the era of rapid industrialization during the time of the Jewish mass migration. Jewish economic adjustment in the United States proved thorough and far-reaching, and Jews achieved the status of a prosperous community. Yet there were occupational restrictions. Whether as manual labourers, clerical workers, or executives, it was difficult for Jews to secure entry into heavy industry, high finance, transportation, mining, public banking, insurance and public utilities. To a marked degree they experienced discrimination in the labour market. This discrimination was part of an anti-Semitic sentiment that was most vigorous in social affairs, less obvious in business and professional fields and even less expressive in political activity. The first vigorous expression of anti-Semitism modeled on European patterns occurred in the United States in the period from 1920 to 1924. The post-World War I wave of prejudice associated with the *Dearborn Independent* of Henry Ford, the forgery of the so-called "Protocols of the Learned Elders of Zion" and the revived Ku Klux Klan, however, was short-lived and by 1927 had withered and faded out.

6. Community Relations Agencies.—To defend their civil and political liberties, Jews created their own civic defense organizations. After the establishment of the Board of Delegates of American Israelites in 1859, Jews set up civic and protective agencies. The leading five agencies were the American Jewish committee (1906), which reflected primarily the point of view of the wealthier and more conservative groups and whose leaders included J. Schiff, L. Marshall, J. Rosenwald, Felix Warburg, Cyrus Adler and Joseph M. Proskauer; the Anti-Defamation league of the B'nai B'rith (1913), which spoke for middle-class Jewry; the American Jewish congress (1922), the spokesman of the Zionist movement and the proponent of a more democratic American Jewish life; the Jewish Labor committee (1934), which represented organized Jewish labour; and the Jewish War Veterans (1896).

7. Education.—The various types of Jewish educational institutions, such as Talmud Torah, *yeshiboth* and *heder,* which were developed by the successive waves of Jewish immigrants over the decades, gradually were transformed into more modern patterns, into congregational schools, Sunday schools and Hebrew weekday schools, all of which supplemented public-school education, the cornerstone of democracy for all Jewish children.

In New York the Bureau of Jewish Education (from 1910), with branches all over the country, guided Jewish educators of every shade to promote higher standards and goals of Jewish education.

Three major ideologies developed in Jewish life during the latter part of the 19th century: the Orthodox, Conservative and Reform. (*See* JUDAISM.) Despite their liturgical and theological differences, the three groups continued to be dedicated to the maintenance and furtherance of Jewish religious and cultural heritage.

The Hebrew Union college in Cincinnati, O., founded in 1875 by Isaac M. Wise (*q.v.*) and merged in 1950 with the Jewish Institute of Religion (founded by Stephen S. Wise in 1922), is the oldest U.S. rabbinical seminary and became the major training centre for rabbis and teachers of the Reform movement. The Union of American Hebrew Congregations organized a number of auxiliary organizations which welded large segments of American Jewry together, such as the National Federation of Temple Sisterhoods (1913), National Federation of Temple Brotherhoods (1923) and National Federation of Temple Youth (1939). (*See* also SYNAGOGUE ORGANIZATIONS.)

The Conservative movement created the Jewish Theological Seminary of America in New York city (founded by Sabato Morais in 1886) and developed it under the leadership of its president Solomon Schechter (*q.v.*) into one of the most important spiritual forces in the life of American Jewry. Many affiliated organizations and activities were established, including a teachers' institute; a unique library of Hebrew manuscripts; a Jewish museum; a popular weekly television and radio program, "The Eternal Light" (from 1944); a women's league; and a branch in Los Angeles, Calif., the University of Judaism (1947).

Out of the Conservative movement, though still associated with it despite basic ideological differences, grew the so-called Reconstructionist movement led by Mordecai M. Kaplan (*q.v.*) which stressed Judaism as a religious civilization; its principal views are expounded in its biweekly magazine, the *Reconstructionist* (1935).

Orthodox Judaism created the Rabbi Isaac Elchanan Theological seminary in New York (1896), which developed into the Yeshiva university, a liberal arts college, to which was added the Albert Einstein college of medicine in 1954. Its learned publications include, besides the *Scripta Mathematica, Talpioth, Horeb* and *Sura* in Hebrew. The Orthodox movement also organized the Hebrew Theological College of Chicago (founded by a group of Chicago Jews headed by Ben Zion Lazar in 1922; first president, Rabbi Saul Silber).

Each of these religious movements in American Judaism has an organization of its own rabbinical leaders and congregations, while the Synagogue Council of America (1926), an organization representing all Jewish religious groups in the United States, acts in the interest of Orthodox, Conservative and Reform Judaism alike.

Without any particular ideological affiliation stands the Dropsie college in Philadelphia, Pa. (1907), a nonsectarian postgraduate institute which trains scholars in Hebrew and Semitic subjects. Brandeis university in Waltham, Mass., is a nonsectarian Jewish-sponsored university (1947).

The training of Jewish leaders and teachers is supplemented through intensive cultural and religious programs by colleges of Jewish studies in the larger Jewish communities, as well as by summer camps such as the Brandeis Youth foundation (1941) and similar institutions.

The Hillel foundation was established by the B'nai B'rith (*q.v.*) at U.S. universities and colleges as a counseling service for Jewish students and as an agent for Jewish cultural and social activities

on the university campuses. The Jewish Chautauqua society (1893), sponsored by the National Federation of Temple Brotherhoods, brings knowledge of Judaism to the students and faculties of U.S. universities.

8. Scholarship.—Collective efforts of U.S. Jewish scholars created *The Jewish Encyclopedia*, a 12-volume work (New York, 1901–06), perhaps the greatest co-operative work by Jewish scholars in the U.S. and a landmark to Jewish learning. It was not superseded by the later *Universal Jewish Encyclopedia* (ten volumes, New York, 1939–43). Other co-operative endeavours stimulating Jewish historical, religious, literary and social studies include the *American Jewish Year Book* (sponsored by the American Jewish committee since 1889), with sociological and statistical surveys of American and world Jewry; such learned journals as the *Jewish Quarterly Review* (published by Dropsie college from 1910); the *Proceedings* of the American Academy for Jewish Research (1920); the Hebrew Union college *Annual* (1924); the *Jewish Social Studies* sponsored by the Conference on Jewish Social Studies (1939); and *Historia Judaica* (1938).

Devoted to the preservation and study of American Jewish historical records are the publications of the American Jewish Historical society (since 1893) and the *American Jewish Archives* (1948) of the Hebrew Union college–Jewish Institute of Religion. The Yale publications in Judaica of the Rabbinowitz foundation are later products of Jewish scholarly work.

The Jewish Publication Society of America (established in Philadelphia in 1888) provides important books in English on Jewish history, religion and current events; among its major contributions was a new English translation of the Holy Scriptures (1917, 1955) which became the authorized translation of the Bible for English-speaking Jews. The *Jewish Book Annual* (sponsored by the National Jewish Welfare board from 1940) is a bibliographical guide published in English, Hebrew and Yiddish.

The number of Jewish periodicals and journals published quarterly, monthly and weekly in the United States is large; they include *Commentary* (sponsored by the American Jewish committee from 1945), *Judaism* (published by the American Jewish congress from 1952) and the *Jewish Frontier;* all are dedicated to a wide range of religious, social and cultural problems.

9. Yiddish and Hebrew Cultural Values.—The cultural influence of eastern European immigrants expressed itself in a continuous literary productivity in Yiddish as well as in Hebrew. Yiddish secular schools, newspapers and theatre and a considerable Yiddish literature were created which continued to attract a not insignificant sector of American Jewry. The Yiddish Scientific institute (YIVO) with its large library of Judaica was transferred in 1940 to New York, where it continued its scholarly publications. (*See* YIDDISH LANGUAGE AND LITERATURE.)

Although the interest in Yiddish is declining, the interest of American Jewish circles in Hebrew is substantially increasing. The Hebrew language was brought with the first immigrants and remained basically the language of the synagogue and of the prayers. With the arrival of eastern European immigrants in the 19th century, a distinguished group of Hebrew writers arose who made notable contributions to modern Hebrew prose and poetry and who, from 1871 to 1914, published many Hebrew periodicals.

The *Histadruth Ivrith* (1922) became the rallying point of creative Hebrew writers in the United States, the central agency for the dissemination and furtherance of Hebrew language and literature. *Hadoar* ("The Post"), the only Hebrew weekly outside Israel was edited for almost three decades by Menachem Ribalow (1899–1953). *Bitzaron*, a Hebrew scholarly monthly (founded by Chaim Tchernowitz in 1939), and other learned Hebrew periodicals and books continue to appear. Many U.S. Jewish scholars made lasting contributions to their field of scholarship in the Hebrew language. The emergence of the state of Israel with Modern Hebrew as its official language greatly stimulated the study of Hebrew. The establishment of chairs of Modern Hebrew and of Jewish history and literature in many U.S. universities and colleges was an indication of this awakened interest in Hebrew culture. (*See* HEBREW LITERATURE.)

American Jewry's social and philanthropic activities are highly organized. Many lodges, benevolent societies, fraternal orders, free loan agencies, community centres, Young Men's Hebrew associations and other similar groups were organized.

Prominent agencies such as the ORT (an abbreviation for three Russian words meaning Organization for Rehabilitation and Training) federation (1924) sponsored vocational training, and the Hebrew Immigrant Aid society (1884) was principally concerned with sheltering and advising new immigrants. The National Council of Jewish Women (1893) also actively helped immigrants. The National Jewish Welfare board (JWB; 1917), an organization which served the religious needs of Jewish men and their families during wartime, also set as its major task the supplying of Jewish chaplains for the armed forces in war and peace.

10. Overseas Aid and Israel.—The prosperity of American Jewry, together with its keen sense of religious solidarity, enabled U.S. Jews to give financial aid to Jews in other countries; such organizations as the United Jewish Appeal and the American Jewish Joint Distribution committee (JDC; organized in 1914) became the major fund-raising instruments for overseas aid, for pogrom victims, for rehabilitation and relief, for physical care, vocational training and religious education.

Many American Jews were sympathetic toward the Jewish resettlement in Palestine. The idea of Zionism was not new in the U.S. In 1825 Mordecai Manuel Noah (1785–1851), a leading Jew of Philadelphia, presented to world Jewry a bold plan to settle Jews on Grand Island in the Niagara river near Buffalo, N.Y., as a temporary haven for persecuted European Jews; the scheme, called "Ararat," failed, however. With the publication of Theodor Herzl's *Der Judenstaat* (1896) and the issuance of the Balfour declaration in 1917 and under the leadership of such men as supreme court Justice Louis Brandeis, Richard Gottheil, Judah L. Magnes, Aaron Friedenwald and Stephen S. Wise, the ideology of Zionism achieved a firm foothold among American Jewry. Apart from the Zionist Organization of America and its many affiliated groups, it was Hadassah, the Women's Zionist Organization of America (established by Henrietta Szold [*q.v.*] in 1912), which made and continued to make major contributions to the welfare of the state of Israel (*see* HADASSAH). All U.S. Zionist groups were united under the auspices of the American Zionist council, the official spokesman of the movement.

The philanthropic aid of American Jews reached a climax of unprecedented generosity with the rise of the Nazis and the subsequent destruction of more than 5,000,000 Jews in central and eastern Europe. Enormous sums were collected for the rehabilitation of the remnants of shattered European and middle eastern Jewry.

The emergence and rise of the state of Israel had a great effect on American Jewish life. Financial and technical aid to Israel on a large scale became a prominent feature of American Jewish philanthropy. Help was expressed through a variety of channels, including commercial investment in Israel bonds, over $450,000,000 worth of which were sold in the U.S. between 1948 and 1960.

See also references under "Jews" in the Index. (W. J. F.)

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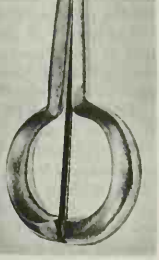
JEW'S-EAR, the common name for *Auricularia auricula,* an edible fungus belonging to the Basidiomycetes (*see* FUNGI). The fruiting body varies in shape from cuplike to that of the human ear. It is pinkish-brown to dark brown, very tough and flexible. It grows on the decaying wood of a wide variety of trees throughout the temperate zone. Watering the infected wood will produce successive crops of fruiting bodies. In the orient it is harvested, dried and sold commercially. (AR. H. S.)

JEW'S HARP, a small musical instrument of considerable antiquity. Although there is no apparent reason for associating the instrument with the Jews, the suggested derivation of "Jew's" from "jaws" seems to be unfounded. The notes produced by the instrument are limited, as in the natural trumpet, to the natural harmonic series, hence its older name, "Jew's trump." The Jew's harp consists of a slender tongue of steel fixed at one end to the base of a pear-shaped iron frame; the other end of the steel tongue is left free. The player presses the branches of the frame against his teeth and sets the steel tongue in vibration by plucking. The tongue itself produces only one note; the individual harmonics are isolated by altering the shape of the cavity of the mouth. (J. BL.)



JEW'S HARP

JEX-BLAKE, SOPHIA LOUISA (1840–1912), British physician, influential in opening the medical profession to women, was born Jan. 21, 1840, at Hastings, Sussex. She studied at Queen's College for Women, London, and in 1865 went to the United States to study education under Lucy Sewell, returning to England three years later. In 1869 she was admitted to classes in medicine at Edinburgh and in 1871 to hospitals. She returned to London in 1874 and was instrumental in establishing the London School of Medicine for Women. In 1877 she obtained the M.D. of Berne and became a licentiate of the College of Physicians, Dublin. In 1886 she established the Edinburgh School of Medicine for Women. She retired in 1899 and died at Rotherfield, Sussex, Jan. 7, 1912. Her written works include *Medical Women* (1872) and *American Schools and Colleges* (1886).

See M. Todd, *Life of Sophia Jex-Blake* (1918).

JEZEBEL (in the Douai version of the Bible, JEZABEL), daughter of Ethbaal, "king of the Sidonians" and priest of Astarte, became the wife of Ahab (*q.v.*), king of Israel. She was a woman of virile character, and offended Israelite political and religious feeling, the former by introducing those autocratic theories of monarchy so common in the east, the latter by her attempt to supersede the worship of Yahweh by that of the Tyrian Baal, Melkart. The first tendency is illustrated by the story of Naboth (I Kings xxi), the second by her persecution of the prophets of Yahweh (I Kings xviii, 4–13). In both directions the national feeling found expression in the prophet Elijah, whose challenge to the authority of Baal on Mt. Carmel resulted in the destruction of the Tyrian prophets (I Kings xx, 20–46), while his curse on Ahab and Jezebel was fulfilled in the massacre of the house of Ahab by Jehu (*q.v.*). Jezebel's name is often used in modern English as a synonym for a bold or abandoned woman.

JEZREEL, an ancient city of Palestine, capital of the northern kingdom under Ahab, on a spur of Mt. Gilboa in the territory of Israel. There Saul was slain in a battle with the Philistines. Saul's son, Ishbosheth, held it, and it was the residence of Ahab and Jezebel. Close by on the eastern side was the vineyard of Naboth. It was called Esdraelon in the book of Judith; to the crusaders it was Parvum Gerinum.

The valley of Jezreel (Emeq Yizrel), or Plain of Esdraelon, was an ancient trade route between the Jordan valley and the coastal plain. In postbiblical times it became swampland. The modern Jewish pioneering movement early turned its attention to it, and the region became Israel's main granary. A *kibbutz* called Izr'ael (Jezreel) was established near the site of ancient Jezreel in 1949. The site itself is occupied by the ruins of the Arab village of Zer'in. Jezreel was also the name of a town in the territory of Judah; Khirbet Tarrama, near Hebron, has been suggested as the site. (E. RO.)

JHABUA, a town and district in the Indore division of Madhya Pradesh, India, 40 mi. S. of Ratlam. The town, headquarters of the district, derives its name from Jhabbu Naik, a Labhana freebooter. It is situated on the edge of a lake called Bahadur Sagar and has narrow, steep and winding streets. There is an intermediate college. Pop. (1961) 6,315.

JHABUA DISTRICT (area 2,615 sq.mi.; pop. [1961] 514,384) is the westernmost district of the state. It is drained by the Anas river, a tributary of the Mahi, and is traversed by the forest-clad Rath, the northern ridges of the Vindhya mountains. Forests cover 18% of the district, and the cultivated land, "Mahidhawa," occupies 35% of the area along the Mahi tributaries. Wheat, maize (corn), millet and cotton are the chief crops, and manganese is mined at Rambhapur to the west, which is connected by tramway (streetcar) to Mehnagar station on the Ratlam-Godhra line

of the Western railway. Eighty-five per cent of the people are tribal; *e.g.*, the Bhils, Bhilalas and Patlias. The former princely state of Jhabua was ruled by the Rathors, originally from Jodhpur (*q.v.*). (D. G. Na.)

JHALAWAR, a district in the Kotah division of Rajasthan, India. Formerly a princely state, it was merged in Rajasthan on March 25, 1948. Area 2,405 sq.mi. Pop. (1961) 490,609. The climate is generally healthful and the nights are usually cool even in the hot season, which is less severe than in northern and western Rajasthan.

The ruling family of Jhalawar belonged to the Jhala clan of Rajputs and their ancestors were petty chiefs of Halwad in Kathiawar. Early in the 18th century a cadet of the house, Madhu Singh, finding favour with the maharaja of Kotah, received an important post which became hereditary. In 1771 the country came under the rule of Zalim Singh, a descendant of Madhu. In 1838 it was resolved with the consent of the chief of Kotah to dismember the state and to create the new principality of Jhalawar as a separate provision for the descendants of Zalim. A later Zalim Singh, who succeeded in 1875, was deposed in 1896 because of misrule and the administration was placed in the hands of the British resident. It was decided in 1897 to break up the state, restoring the greater part to Kotah, but forming the two districts of Shahabad and Chaumahla into a new state, which came into existence in 1899 with Kunwar Bhawani Singh, a descendant of Zalim Singh, as its chief.

The district headquarters are at Jhalrapatan or Jhalawar, 160 mi. S. of Jaipur. Pop. (1961) 9,128. The old Jhalrapatan, also called Patan, was founded by Zalim Singh in 1796 by the side of an artificial lake. Four miles to the north is the modern Jhalrapatan or Jhalrapatan *chhaoni* (cantonment) with the administrative buildings, the princes' palace and the military cantonment. The town is a centre of trade, the chief products of the district being oilseeds and cotton. (S. M. T. R.)

JHANG-MAGHIANA, a municipality consisting of twin towns, the headquarters of the Jhang district in the Sargodha division of West Pakistan, is located 120 mi. W.S.W. of Lahore. Pop. (1961) 94,971. Jhang is 2 mi. N. of Maghiana and two metaled roads connect the towns. The old Jhang, founded by Mal Khan in 1462 to the west of the present site, was destroyed by the Chenab river; the present town was founded by a *sanyasi*, Lal Nath, during the reign of Aurangzeb and has the temple of Nath in its centre. Maghiana, founded by Megha, an ancestor of the Maghiana Sials, has become more important than Jhang. It is a wool-collecting centre and has many hand looms for blankets and coarse cotton cloth. A large number of refugee weavers from India settled there after independence. In Jhang a government centre supplies blankets to the army and the hospitals. Government college is halfway between the two towns, and east of Maghiana lies the public garden beyond which is the tomb of Heer, the heroine in the love story of Heer and Ranjha.

Jhang District (area 3,401 sq.mi.; pop. [1961] 1,078,747) extends on both sides of the Chenab river and includes its confluence with the Jhelum at Trimmu. The Haveli canal, which starts at Trimmu, irrigates about 1,000,000 ac. of land to produce wheat and cotton. Chiniot, 52 mi. N.E. of Jhang-Maghiana, is famous for its wood carving and marquetry. The ruins at Shorkot have been identified by some with one of the towns captured by Alexander the Great. The modern history of Jhang centres on the clan of the Sials who exercised sway over a large tract between Shahpur and Multan until they fell before Ranjit Singh. (K. S. Ad.)

JHANSI, a city, district and a division of Uttar Pradesh, India. Pop. (1961) 140,217, excluding 21,126 in the cantonment. The city, 130 mi. S.W. of Kanpur, is situated on a rocky eminence. Immediately overlooking it lies the fort built by Bir Singh Deo of Orchha in 1613. Two degree-granting colleges are affiliated to Agra university. Jhansi is an important junction of the Central railways with lines radiating to Gwalior and Agra, Kanpur, Allahabad and Bombay via Bhopal. There is also a railway colony.

The city was founded by the Marathas who in 1732 were given one-third of the Bundela dominions by Chhatarsal, the Bundela chief. In 1806 British protection was promised to the Maratha rulers and in 1817 the East India company extended its rights over Bundelkhand under a treaty with the Maratha ruler or peshwa. In 1853 the peshwa, Gangadhar Rao, died childless, and his territories lapsed to the British. His widow, the rani of Jhansi, was given a pension but was not allowed to adopt an heir. She revolted and was one of the leaders in the mutiny (called by Indians the freedom struggle) of 1857. She died in battle at Gwalior.

Jhansi District (area 3,885 sq.mi.; pop. [1961] 1,087,479) lies in the extreme south and southwest of Uttar Pradesh. It was enlarged in 1891 by the incorporation of the former district of Lalitpur, and in 1950 by the mergers of three small princely states and parts of four others. The district forms part of the hill country of Bundelkhand, sloping down from the outliers of the Vindhya range on the south to the tributaries of the Jumna (Yamuna) on the north. The extreme south is composed of parallel rows of long, narrow, ridged hills. Through the intervening valleys the three principal rivers, Pahuj, Betwa and Dhasan, flow precipitately over ledges of granite or quartz. North of the hilly region is a considerable expanse of black cotton soil. The principal crops are millets, cotton, oilseeds, pulses, wheat, gram and barley. The *kans* grass is as destructive there as elsewhere in Bundelkhand, and the district is especially exposed to blights and droughts. Apart from Jhansi, the only other notable towns are Lalitpur (25,220), a trade centre for oilseeds, hides and clarified butter (ghee), and with fine Jain and Hindu temples; and the twin municipality of Mau-Ranipur (20,224), where a widely used red cotton cloth called kharua is made.

Jhansi Division (area 11,374 sq.mi.; pop. [1961] 3,498,827) is composed of the districts of Jhansi, Jalaun, Hamirpur and Banda. Among its ancient monuments are the famous Gupta temple at Deoghar and the artificial reservoirs and ruined fortresses belonging to the Chandel period in the 11th century. (B. Si.)

JHELUM, a municipality and district in the Rawalpindi division of West Pakistan. The town, the district headquarters, is 103 mi. N. of Lahore on the right bank of the Jhelum river (*q.v.*), where it is crossed by a bridge carrying the Lahore-Peshawar railway and the Grand Trunk road. Pop. (1961) 52,585 including 11,425 in the cantonment. The town is named after the river and is of modern origin. The old town, which may have been Bucephala of Alexander the Great, was on the left bank of the river. Before the construction of the bridge (1832) it was merely a collection of boatmen's huts. About 1532 some boatmen from old Jhelum settled on the right bank, for the better management of the ferry, and thus founded the modern town. It was an important centre of trade and owed its prosperity to the waterborne trade in salt. It is now a market for timber, the selling of which is the main occupation of the people. After 1947 a textile mill and cigarette, glass and plywood factories were established, and there are several sawmills. The town contains a degree-granting and an intermediate college, six schools and a women's mission hospital. It is also the army supply corps training centre.

Jhelum District (area 2,772 sq.mi.; pop. [1961] 749,229) stretches from the Jhelum river northward across the Salt range and the southeastern part of Potwar plateau to Rawalpindi district. Salt is quarried at Khewra in the Salt range and coal is mined at Dandot to the southwest. There are oil wells in the Chakwal area, the chief being at Balkassar. The district is intersected by numerous ravines and gullies. Wheat and bajra are the principal crops.

The history of the district dates back to the semimythical period of the *Mahabharata* and contains many historical sites including that of Alexander's battle with Porus, which may be the plain of Karri near Jhelum or Mong near Jalalpur. (K. S. Ad.)

JHELUM RIVER, in Kashmir and West Pakistan (the Hydaspes of Arrian, Alexander the Great's historian; Bidaspes of Ptolemy; Sanskrit Vitasta; Muslim Bihat, Wihat or Bihatab; modern Kashmiri Veth), is one of the five rivers of the Punjab. Its length is about 450 mi. It rises in a spring northeast of the Banihal pass; another important source is Lake Shesha Nag, at the head of the Liddar, a right-bank tributary. The Adpat, Bring and Sandran having united into one stream enter the Jhelum near Anantnag on the right bank. From there the river flows north-

west through the Vale of Kashmir, passing through Srinagar and on to the Wular lake. After leaving the lake, it flows across the Pir Panjal range for 20 mi. to Uri. The gorge below Baramula is 7,000 ft. deep with almost perpendicular sides. From Uri the river flows northwest to Muzaffarabad, where it is joined by the Kishanganga, and bending southward, follows the course of its affluent.

Below Domel (near Muzaffarabad) to the north of Jhelum the river flows in a rocky bed shut in by high mountains for about 110 mi. and forms the boundary between Kashmir and West Pakistan. Large quantities of timber are floated down from Kashmir.

Near Mangla, about 2 mi. N. of the Upper Jhelum canal, the river breaks through the outer folds of the Siwaliks into the plain. In the early 1960s a dam was under construction there. When completed the lake behind it would cover an area of 100 sq.mi. with a storage capacity of about 4,750,000 ac.ft. of water which would submerge the town of Mirpur and neighbouring villages. It would help in irrigating about 3,000,000 ac. and would have a power station with an installed capacity of 300,000 kw.

The Upper Jhelum canal leaves the river at Mangla and irrigates the upper part of the Chaj Doab. It joins the Chenab at Khanki. The Lower Jhelum canal starts at Rasul and irrigates the major part of the lower Chaj Doab. There are road and railway bridges at Jhelum on the main line and a trunk road to Peshawar. Below it the river flows southwest along the Salt range. There are bridges at Malakwal-Haranpur and Khushab-Shahpur, below which the river strikes almost southward to join the Chenab near Trimmu.

The catchment area, above the 1,000-ft. contour, is 13,030 sq.mi.; the area under glaciers 142 sq.mi.; and average annual runoff 23,860,000 ac.ft. The river starts rising in March, earlier than the other Punjab rivers. When heavy rains fall, it is liable to sudden freshets, the inundations from which are very useful to cultivation. In September the river normally subsides in good time for the sowing of rabi. (K. S. Ad.)

JHERING, RUDOLF VON (1818–1892), German legal scholar, who developed a philosophy of social utilitarianism which, unlike Jeremy Bentham's individualist theory, gave social needs the dominant position, was born at Aurich, East Friesland, on Aug. 22, 1818. In the early period of his career he wrote a treatise on possession (1868), using the traditional legal method of conceptual analysis. He soon, however, abandoned conceptualist jurisprudence, and wrote a famous book on purpose in law (*Der Zweck in Recht*, 2 vol., 1877–83; Eng. trans., *Law as a Means to an End* [1924]), maintaining that purpose is just as important in human conduct and law as cause is in the physical world. The book reflected Jhering's sensitivity to social and economic changes and the need to express relevant theories in jurisprudence. There were at the time many important social and economic changes going on in Germany, which were reflected in the first modern social legislation on employers' liability and in sickness, accident and old-age insurance. In addition to these contributions to sociological jurisprudence, Jhering emphasized social and psychological aspects of the judicial process. He ridiculed "concept jurisprudence" (*Begriffsjurisprudenz*) and the strictly logical, mechanical decision of cases. In his greatest work, on the spirit of the Roman law (*Der Geist des römischen Rechts*, 4 vol., 1852–65), he elaborated the relations of law to social change.

He died at Göttingen on Sept. 17, 1892.

See Jerome Hall (ed.), *Readings in Jurisprudence* (1938); Munroe Smith, "Four German Jurists," in *A General View of European Legal History* (1927). (J. Hl.)

JHUNJHUNU, a town and district in the Ajmer division of Rajasthan, India. The town lies about 90 mi. N.N.W. of Jaipur city. Pop. (1961) 24,962. To the west is a hill rising 1,684 ft. above sea level and visible for miles. The town contains the mausoleum of the saint Kamar-uddin Shah and a Jain temple 1,000 or more years old.

Jhunjhunu District (area 2,283 sq.mi.; pop. [1961] 719,650) is divided into three administrative subdivisions and four *tehsils*. The soil is everywhere sandy and the annual rainfall averages about 10 in. The chief crops are bajra, mung (moong beans) and gram. The increase in population and domestic animals (cattle, sheep and camels) has led to the destruction of trees, shrubs and grasses at a faster rate than that of their natural growth. As a result sand, blown by the wind, has been deposited on the fields, making them unfit for the growth of crops.

There are a few big towns in the district, of which Pilani is the chief. It has an engineering workshop and a powerhouse and is also a centre of technical education. (S. M. T. R.)

JIBUTI: *see* Djibouti.

JÍCAMA: *see* Yam Bean.

JIDDA (Arab. Juddah), in the Hejaz province, is the chief seaport of Saudi Arabia on the Red sea. Pop. (1960 est.) 200,000. It owes its name to the fact that it was once believed to be the burial place of Eve (Juddah means ancestress). Eve's reputed tomb was demolished by the Saudi government in 1928, in belief that it encouraged superstition. The principal importance of Jidda in history is that it constitutes the port of Mecca (50 mi. E.), where the majority of the pilgrims land for the annual Muslim pilgrimage. It has occupied its present site since the 17th century, the previous port having been at Al Aswad, 12 mi. S. In 1916 the town and its Turkish garrison surrendered to the British. From then until 1925 it formed part of the Sharifian kingdom of the Hejaz, but in the latter year it was captured by Ibn Saud and was incorporated into Saudi Arabia.

After World War II and because of the new wealth acquired by Saudi Arabia from oil royalties, the town was completely modernized and extended in every direction, especially along the Mecca and Medina roads, and in 1957 another road connected it with Medina, 265 mi. N.N.E. Plans were also made to link Jidda by rail with Mecca and Medina, and thence with Riyadh. Most of the streets are asphalted and gardens are to be seen everywhere, particularly in the extensive grounds of the royal palaces. A modern water supply for the greatly increased population of the town was installed, bringing water a distance of 35 mi. from the Wadi Fatimah. Water had previously been obtained from a sea-water condenser plant. At the same time the once famous *suqs* (bazaars) were demolished and the old town walls disappeared. The buildings of the town, once noted for their picturesque character, have been replaced by modern blocks of concrete flats, shops and hotels. A deepwater quay was also built at which several ocean-going ships could berth simultaneously. In former times passengers had to come ashore in boats. Modern medical facilities and accommodation have also been provided for the pilgrims, and there is a quarantine station to guard against the spread of epidemic diseases which might be carried by pilgrims. By the mid-1960s pilgrim visitation was estimated at between 100,000 and 120,000 annually. About one-third of these came by air and most of the remainder by sea. The airport of Jidda is well equipped by international standards. Non-Muslims are not allowed to visit Mecca. As a result Jidda is the diplomatic capital of the country and the location of the Saudi ministry of foreign affairs and all the foreign embassies and missions. The town is administered by a municipal council, and the surrounding district by the provincial governor.

See also Saudi Arabia; Hejaz. (X.)

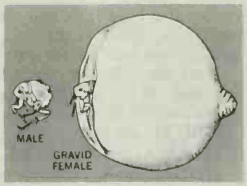
JIG. The origin of the word is possibly derived from Old French *giguer* ("to leap"); it is the name of a dance for one or more solo dancers, usually male. It is characterized by inert arms and rapid, intricate steps, performed in 6/8 time and usually in eight-bar phrases. "Scotch jigs" were admired at the 16th-century English court, but the celebrated Irish forms are not regarded as older than the 18th century. In England jigs were performed over crossed clay pipes, flails, etc., and in modern times the cognate clog dance (*q.v.*) remains a competitive skill in northern countries.

Jig is also used to denote a movement (usually called gigue) in a musical suite, deriving from the dance rhythm (*see* Suite); a stage song-and-dance act, popular in England and in Germany (as *Singspiel*) in the 16th and 17th centuries; and a mechanical tool of "jiglike" movements.

See article "Jig" by M. J. Dean-Smith in *Die Musik in Geschichte und Gegenwart*, ed. by F. Blume (1949). (M. J. D.-S.)

JIGGER FLEA (Chigoe), the common name of a small flea (*Tunga penetrans*) that burrows beneath the skin of man and his domestic animals in tropical America and Africa. This insect,

sometimes known as sand flea, has also been found in the southern United States and in India. In the U.S. the term "jigger" is sometimes used for the "chigger," a parasitic larval mite (*see* CHIGGER).



FROM G. HUNTER, W. FRYE AND J. SWARTZWELDER, "A MANUAL OF TROPICAL MEDICINE," 3RD ED., W. B. SAUNDERS CO., PHILADELPHIA, 1960

JIGGER FLEA OR CHIGOE (TUNGA PENETRANS). – ACTUAL SIZE OF MALE ABOUT 1 MM.; GRAVID FEMALE IS THE SIZE OF A PEA

The female of the jigger and other fleas of the family Tungidae attaches itself more or less permanently to its host. The jigger can be distinguished from other fleas by the presence of a toothlike prominence at the anterior dorsal tip of the head. After mating, the small (1 mm. long) fertilized female attaches to her host and gradually works her way beneath the surface of the skin. In this subsurface location she feeds, and as the eggs mature, swells to about 6 mm. in diameter, causing painful sores. The eggs are liberated through the posterior end of the body, which protrudes slightly from the ulcer in the skin of the host, or the eggs may be liberated with the exudates of the ulcer. The maggotlike larvae that hatch from the eggs feed on organic debris and, when mature, enter the pupal stage. The adults emerge from the pupae in from two to three weeks. As in other fleas, the immature stages occur in the cracks and crevices of the resting places of the hosts. The males and unfertilized females feed sporadically on their hosts in the manner of other fleas, but when the female is inseminated, she exhibits her characteristic burrowing behaviour.

While jiggers have been known to penetrate the skin in many regions of the body, they most frequently attack the tender skin between the toes. Secondary infection of the primary site of penetration is the most dangerous aspect of the attack of the jigger. Tetanus and gas gangrene are reported as frequent complications in Central America. Treatment consists of surgical removal of the flea and cleansing of the wound. Most human infection can be avoided by the simple precaution of wearing shoes in known infested areas. *See* also FLEA. (G. W. W.)

JIGS AND FIXTURES. A jig is a device to hold a piece of work being machined and to guide the tool during the cutting operation. Fixtures are clamping devices simply for holding work during any operation.

The best method of processing any single part depends on the size, shape and weight of the part, the material of which it is made and the method by which it is originally shaped. Many steps of the process may simultaneously require a cutting tool to remove the surplus stock and bring the original form to the ultimate size and shape, a jig or fixture to clamp the work in the desired position and a machine tool to hold and drive the cutting tool and support the work.

Jigs and fixtures should be designed so that the work is always inserted in the same way. A jig or fixture may be justified to facilitate an operation, speed up production or promote accuracy and interchangeability of the product. Jigs are usually employed in drilling, boring and sometimes reaming, while fixtures are more generally used in broaching, grinding, milling, planing, shaping, turning and tapping, welding and assembly.

Several types of drill jigs are in use. The simple jig clamps the work in position and has a plate, directly above the work, with a bushing to guide the tool and prevent its deflection while cutting. Because it is not attached to the machine table or bed, a box jig permits the drilling of holes in more than one side of a part while avoiding the need to reposition the part in the jig. Interchangeable guide bushings for such tools as drills, reamers and boring bars may be imbedded in different sides of the jig, and the box may be rotated to present the different sides successively. Similarly, a trunion jig permits successive drilling by a single tool in two or more faces, the jig and work revolving on a fixed axis. A multiple-stage jig is one in which operations on a piece may be performed either simultaneously or progressively. An indexing jig, having one or more stations, may rotate progressively in a horizontal or vertical plane as it is indexed from the first to the last station.

With modern cutting tools, actual cutting time has been greatly reduced and is often a small fraction of the time required to load work and unload it from the jigs and fixtures. Thus, simple, rapid, positive clamping has become a very important factor in the economy of such operations. Manual clamps and controls therefore should be within convenient reach of the operator, yet positioned safely away from the cutters. Also the cost of jigs and fixtures can be reduced if the amount of work produced is high.

For a description of some of the operations in which jigs and fixtures are used *see* MACHINE TOOLS. (O. W. B.)

JIHAD, popularly known as holy war, is a religious duty imposed by Muslim law for the spread of Islam. War and diplomacy were employed to achieve Islam's objective, but only religious purposes would justify resort to fighting. Thus the *jihad* was the Islamic *bellum justum*, which might be waged against unbelievers and the enemies of the faith.

Islam distinguishes four different ways in which its followers may fulfill their *jihad* duty: by the heart, the tongue, the hand and by the sword. The first is a form of spiritual purification, to be fulfilled by combating the devil and escaping his persuasion to evil. The second and third are mainly fulfilled in supporting the "right" and correcting the "wrong." The fourth is the fighting of unbelievers and the enemies of the faith. Believers were under obligation to wage war against all unbelievers. But Christians and Jews, who believed in God but not in Mohammed, were not treated in the same way as unbelievers. They were offered one of three propositions: (1) acceptance of the Islamic faith; (2) acceptance of Islamic rule and payment of a poll tax (*jizya*); (3) fighting on the same footing as other unbelievers.

Modern Muslim thinkers maintain, however, that the *jihad* does not necessarily mean an offensive war. They argue that Islam stresses the principle of the peaceful—not the hostile—relations among nations, and that the *jihad* in the sense of fighting was intended as a defensive measure when Islam was in danger.

See "Djihad," in *Shorter Encyclopaedia of Islam,* p. 89 (1953). (M. KI.)

JIHLAVA (Ger. IGLAU), an upland town in the South Moravian *kraj* (region), Czech., lies in the heights just to the east of the Bohemian-Moravian frontier. It is 77 km. (48 mi.) W.N.W. of Brno, on the Jihlava river, a tributary of Dyje. Pop. (1961) 36,487. Jihlava has had trading importance since the 12th century, and the city's archives go back to 1389. Its early prosperity derived from the silver mines, and a mint was established by the Premysl king of Bohemia, Otakar II, in the 13th century. In 1436 the negotiations with the Hussites which led to the acknowledgment of the Habsburg ruler, Sigismund, as king of Bohemia were concluded at Jihlava, and nearly a century later (1527) Ferdinand of Habsburg swore fidelity to the Bohemian statutes in the same city. In the 16th century a severe earthquake damaged the mines beyond restoration, but something of the early prosperity remains in the town architecture of the great square, the town hall and gate, and the Gothic church of St. James.

Jihlava was twice taken by the Swedes in the Thirty Years' War. Thereafter it was important chiefly for its substantial trade in grain and timber and for textile, glass and tobacco industries. Important road and railway routes between Prague, Brno and Vienna cross the heights at Jihlava. It was for long a focal point of German settlement in highland Moravia. In 1900 there were still only 4,200 Czechs in the town and in 1921, of the 70 villages in the Jihlava administrative district, 40 still had German majorities. The population of the town was 28,186 in 1921, with Czechs and Germans in roughly equal numbers; by 1952 almost all the Germans had disappeared. (H. G. S.)

JIMÉNEZ, JUAN RAMÓN (full surname JIMÉNEZ MANTECÓN) (1881–1958), Spanish poet, winner of the Nobel prize for literature in 1956, was born at Moguer, Huelva, on Dec. 24, 1881. Educated by the Jesuits and at Seville university, he spent the better part of his adult life in Madrid. From 1912 to 1916 he lived in the Residencia de Estudiantes, enjoying the company of other poets, for instance Antonio Machado, who lived there also.

In 1916 he married Zenobia Camprubí (d. 1956), the translator of Rabindranath Tagore. When the Spanish civil war broke out, he remained for some time in Madrid. Eventually he went into exile and lived in various countries including Cuba, the United States and Puerto Rico. He died on May 29, 1958, at San Juan, P.R.

Jiménez' life was devoted almost wholly to his writing. Though a very prolific poet, he yet took great pains not only with the continual revision of his published texts but even with the details of typography, in which he was responsible for some innovation in Spanish practice. His early work is characterized by a preoccupation with idealized landscape and with metrical experiment and shows the influence of the writers most widely admired by his generation: of the French Symbolists (especially Albert Samain) and of Jean Moréas on the one hand and of Rubén Darío on the other. The *Sonetos espirituales, 1914–1915,* however, are more reminiscent of the 16th-century Spanish lyric; and the period immediately following the poet's marriage was distinguished by the appearance of *Diario de un poeta recién casado* (1917), *Eternidades, 1916–1917* (1918) and *Piedra y cielo* (1919), as well as by an anthology of his own poems, *Poesías escojidas, 1899–1917* (1917). His *Segunda antolojía poética 1898–1918* was to have followed in 1920, but the author's afterthoughts delayed its actual appearance till 1922. In the work of these years may be discerned the early stages of Jiménez' progress in his effort to achieve a *poesía desnuda* or "naked poetry," the simple and graceful expression of intimate perceptions in detachment from all extraneous contingency and free from any regulation by rhyme or fixed metre (this consideration underlies the qualifying words in the titles of two books of 1923: *Poesía, en verso, 1917–1923* and *Belleza, en verso, 1917–1923*). It is not surprising that one critic can describe Jiménez as "the poet of the ineffable" while another reproaches him for "egocentricity." He pursued his new ideal of poetry in subsequent works: *Unidad* (1925), *Obra en marcha* (1928), *Sucesión* (1932), *Canción* (1936), *Antología poética* (1944), *Voces de mi copla* (1945), *La Estación total con las canciones de la nueva luz, 1923–1936* (1946), *Romances de Coral Gables* (1948); *Animal de fondo* (1949); and *Diario de poeta y mar* (1955).

Apart from the main current of his writing, three prose works by Jiménez must be mentioned: *Platero y yo* (1914; Eng. trans. by T. W. and M. Roberts, *Platero and I,* 1956; also by E. Roach, 1957), a classic both for adults and for children, on his life with his donkey, constantly reprinted; *Españoles de tres mundos: viejo mundo, nuevo mundo, otro mundo* (1942); and the Spanish translation (1920), in collaboration with his wife, of J. M. Synge's *Riders to the Sea.*

JIMÉNEZ (Ximénez) **DE CISNEROS, FRANCISCO** (1436–1517), Spanish cardinal, Grand Inquisitor and statesman, was the first of the great series of 16th-century ecclesiastics, both Catholic and Protestant, who, through sheer power of intellect and force of personality, rose from humble beginnings to a commanding position in the religious and political life of their countries. Jiménez was born at Torrelaguna, in Castile, in 1436, the son of a poor hidalgo tax collector, and was christened Gonzalo. He studied at the University of Salamanca and, after taking holy orders, spent a number of years in Rome (1459–66). He disliked the humanists at the papal court but seems to have been impressed by their learning. Paul II gave him an "expective letter" for the first vacant benefice in the archdiocese of Toledo. The archbishop, Alfonso de Carrillo, refused to accept the letter and, when Jiménez insisted on his rights, threw him into prison (1473). Refusing release at the price of giving up his claims, Jiménez remained in prison until 1479. In 1482 Cardinal Pedro de Mendoza, impressed by his ability and strength of character, made him vicar-general of the bishopric of Sigüenza. In 1484 Jiménez gave up this post and, apparently, a brilliant career, and became a monk in the Franciscan monastery of San Juan de los Reyes at Toledo, taking the name of Fray Francisco. But in 1492 Isabella of Castile appointed him her confessor, on Mendoza's recommendation. From then on, his influence grew rapidly. In 1495 he succeeded Mendoza as archbishop of Toledo. Despite violent opposition, he successfully reformed his own and other monastic orders.

Against the advice of the saintly Hernando de Talavera, archbishop of Granada (who was trying to convert the Moors of Granada by precept and education), Jiménez introduced forced mass conversions of the Moors. His intervention was the direct cause of the Moorish revolt of 1499–1500, and he must be held largely responsible for making the Morisco problem insoluble (*see* Moriscos). Jiménez was the guiding spirit behind the Spanish campaigns in north Africa (1505–10), which he financed in great part from his archiepiscopal revenues. Ferdinand of Aragon, however, was content with the capture of Oran and other ports, and refused to support Jiménez' plan of a crusade to conquer the whole of north Africa. But he appointed Jiménez regent of Castile in 1506 and Grand Inquisitor in 1507. That year Jiménez received the cardinal's hat.

During the following years, the cardinal was occupied mainly with the university of Alcalá de Henares (Lat. *Complutum*) which he had founded in 1500 as a centre for the teaching of Scotian and nominalist theology and of oriental languages. He attracted some of the finest scholars to Alcalá (though Erasmus would not accept his invitation) who published the famous Complutensian Polyglot Bible.

On the death (1516) of Ferdinand of Aragon, Jiménez once more became regent of Castile. He fought a courageous but losing battle against the rising resentment at the succession of a foreigner (the future emperor Charles V). Jiménez died at Roa, on Nov. 8, 1517, shortly after Charles arrived in Spain.

See W. Starkie, *Grand Inquisitor* (1940). (H. G. Ko.)

JIMÉNEZ DE QUESADA, GONZALO (*c.* 1500–1579), Spanish conqueror of New Granada (Colombia), was born about the year 1500, probably in Granada, Spain, where he was carefully trained for the law. In 1535 he accompanied Pedro Fernández de Lugo, *adelantado* of Santa Marta (northern Colombia), as auditor and *justicia mayor* of his colony; in the following year, although he had had no military experience, Lugo chose him to command an expedition to the headwaters of the Magdalena river. In Jan. 1537 he found himself on the great central plain of Colombia, inhabited by a group of Indian tribes called Chibchas, who had attained a relatively high state of culture. The ruler of the country, the Zipa of Bogotá, fled at the approach of the Spaniards, and Quesada occupied his capital. Toward the end of 1538 Quesada was preparing to start for the coast, when two more conquerors appeared—Sebastián de Belalcázar from Quito and Nicolás Federmann from Venezuela. Quesada successfully maintained the priority of his rights, and on July 8, 1539, sailed from Cartagena for Spain to urge his claims to the government, but his efforts were of no avail. On his return to New Granada he became at once the most influential person in the colony, protecting the colonists from the severity of officials and restraining the impetuosity of the *comenderos.* In 1569 he set out with 500 men on a quest for the fabulous Eldorado, which carried him into the trackless swamps of the Orinoco. He returned after nearly two years' wanderings with only 25 of his original company. Retiring to La Suesca, his country house, he turned to literature and composed *Los Ratos de Suesca* and a series of *Sermones.* Early in 1579 he moved to Mariquita, where he died on Feb. 16 of leprosy.

(W. B. P.; X.)

JIMSON WEED: *see* Datura; Solanaceae.

JIM THORPE, a borough of eastern Pennsylvania, U.S., and the seat of Carbon county, nestles in a narrow valley on the edge of the coal region where the Lehigh river cuts a deep gorge through the Blue Ridge mountains. Its original Indian name, Mauch Chunk ("bear mountain"), refers to a circular mountain east of the river. A summer resort, its scenic beauty can be viewed from Flagstaff park high above the town.

In 1954 Mauch Chunk and East Mauch Chunk merged, and adopted the name of Jim Thorpe (1888–1953), famous Indian football player whose body was brought there for burial.

The discovery of anthracite (1791) attracted settlers. The Lehigh Coal and Navigation company laid out the town and built the first industrial railroad in the United States (1828), a gravity switchback line which hauled coal to the Lehigh canal. Asa Packer, coal baron, whose home still stands, founded the Lehigh Valley

railroad to replace the canal in 1855.

Mining has given way to the manufacture of textiles, clothing, handbags and furniture. For comparative population figures *see* table in PENNSYLVANIA: *Population.* (J. C. A.)

JINGŌ, a legendary empress of Japan, wife of Chūai, the 14th sovereign, who reigned A.D. 192–200. She was also regent for her son Ōjin, the 15th mikado. According to the traditional records of ancient Japan, she lived for 100 years, dying in 269 after a remarkably active and eventful life. She is remembered primarily for the alleged divinely inspired and bloodless conquest of three Korean kingdoms in the year 200, accomplished under her personal leadership while she was carrying the unborn Ōjin. The traditional chronology of the period and even the historicity of this particular adventure are doubtful, but it is certain that during the 4th century the Japanese did establish hegemony in south Korea and on one occasion penetrated as far north as P'yongyang.

Whether or not a specific empress named Jingō ever existed, her legendary record may be construed as supporting evidence of the theory that a matriarchal society existed in western Japan during the protohistoric period. Chinese and Korean records, more accurate than the contemporary Japanese accounts, refer to the Japanese country of Wa as the Queen country and place it in close contact with China and Korea. It is quite possible that such an empress as Jingō ruled in western Japan and that her descendants extended their rule eastward, establishing in time a patriarchal government seated in the district of Yamato. (H. I. M.)

JINGOISM, an attitude of bellicose nationalism, the English equivalent of the term chauvinism (*q.v.*) that came into use in France during the Napoleonic Wars. The term apparently originated in England during the Russo-Turkish War of 1877–78 when the British Mediterranean squadron was sent to Gallipoli to restrain Russia, and war fever was aroused. Supporters of the British government's policy toward Russia came to be called "jingoes" from the fact that the phrase "by jingo" appeared in the refrain of a popular song:

> We don't want to fight, yet by jingo! if we do,
> We've got the ships, we've got the men,
> And got the money, too!

Use of the term "by jingo" has been traced to medieval magicians who made it part of their mysterious ritual. In some instances the term was used as a mild expletive similar to "by Jove!"

JINJA, the second town of Uganda, is situated at about 3,800 ft. above sea level on the east bank of the Nile where it issues from Lake Victoria. The Ripon falls were submerged in 1956 by the rise in the level of the water behind the dam for the Owen falls hydroelectric station. Founded in 1901, Jinja became a municipality in 1957; in 1959 its population numbered 29,741, of whom 9,913 were non-Africans, including 828 Europeans. It is the commercial and administrative centre for the populous territory of Busoga, which produces cotton, maize, peanuts and sugar; but otherwise the chief significance of the town is industrial. Jinja contains the smeltery for Kilembe copper, a steel rolling mill, a plywood factory, a tobacco factory and a grain-conditioning plant. A textile factory and brewery are sited in a separate township on the western (Buganda) side of the Nile. (S. J. K. B.)

JINNAH, MOHAMMED ALI (1876–1948), founder and first governor general of Pakistan, was born in Karachi, the son of a merchant, in Dec. 1876, probably on Dec. 25, which is observed throughout Pakistan as his anniversary. He gave early promise of intellectual distinction, and his community contributed to the expense of sending him to London, where he was called to the bar at the remarkably early age of 20. During his residence in England he acquired habits of punctuality, precision and self-control which blended for the rest of his life with the finest features of his own Islamic tradition. After his return to India in 1896, his initial legal practice in Karachi led on to an immediate success at the Bombay bar and, attracted by political life, he soon became known as one of the most promising adherents of the moderates in the Indian National Congress. His abilities set him high above all other Muslim politicians of the day, and his refusal to seek British patronage kept him out of the Muslim league until 1913, when that body at last adopted self-government for India as its goal. Although his ideas of winning home rule through Hindu-Muslim unity were far in advance of those of the rest of his community, he was elected president of the league in 1913.

Closer association with the rank and file of Muslims enabled him to understand, though he did not at that period share, their apprehensions at the prospect of being subordinated to the Hindu majority of the population when self-government along western parliamentary lines was won. He was confident that he could safeguard the future of the Muslims by constitutional provisos, and he negotiated in 1916 an agreement with the Congress (the Lucknow pact) which secured separate electorates and weighted representation for the Muslims in the future constitution. His confidence lasted through the brief honeymoon between the Congress and the league after World War I, but he viewed with growing uneasiness the hold which M. K. Gandhi's ideas were gaining over Congress policy. The Gandhian technique, essentially Hindu in conception, appeared to Jinnah to be substituting a characteristically Hindu ideology for the former endeavour to unite Muslims and Hindus in a common Indian nationalism. He broke finally with the Congress, but found the league uncongenial.

During the years that followed, he remained a lonely figure, but his reputation as a formidable personality, feared in debate and respected for outstanding integrity, steadily grew. Hindu-Muslim unity continued to attract him in theory, but he became profoundly disturbed by the contrast between Hindu unity of purpose and Muslim dissensions. The round table conferences in London (1930–32) filled him with distrust of Hindu intentions, and he withdrew from political life to practise before the privy council in London.

In 1934 his deep fellow feeling for the Muslim community and his conviction of their danger brought him back to India to head a reconstituted Muslim league. At first he remained dubious about the practicability of Pakistan, an idea which Sir Mohammed Iqbal had propounded to the league conference of 1930; but before long he became convinced that a Muslim homeland inside India was the only way of safeguarding Muslim interests and the Muslim way of life. It was not religious persecution which he feared so much as the future exclusion of Muslims *qua* Muslims from all prospects of advancement as soon as power became vested in the close-knit structure of Hindu social organization. To guard against this danger he carried on a nationwide campaign to warn his co-religionists of the perils of their position, and converted the league into a powerful instrument for unifying the Muslims into a nation. His fears were strengthened when the Congress monopolized office in all Hindu majority provinces after the 1937 elections, and in 1940 the league under his guidance adopted Pakistan as its goal.

During the seven years which followed, Jinnah displayed his true greatness. Having satisfied himself that Pakistan was a necessity, he resisted all pressure, whether from the British, the Hindus or certain of his fellow Muslims, to settle for anything less. Abuse, argument, persuasion left him equally unmoved. Deservedly, his followers gave him the title of *qaid-i-azam* ("supreme leader"), by which he continued to be revered in the state which he founded. After a bitter struggle, which many Indians neither forgot nor forgave, he won his victory: in Aug. 1947 Pakistan became a fact. Exhausted by his efforts, he survived only 13 months to guide the infant state through its early difficulties, dying on Sept. 11, 1948, in Karachi. But he had affixed his own indelible seal upon the nation he created, which continued to set its standards by the ideals he bequeathed to it. (L. F. R. W.)

JINNI (pl. JINN), in Arabic mythology, is the general term for supernatural beings below the level of angels and devils. From the intervention of jinn in human affairs, the *Arabian Nights* derives much of its charm and motion. Belief in their existence was common in early Arabia and has continued through the centuries among Arab and Muslim peoples. The jinn were believed capable of taking the forms of human beings, male and female, and of many different animals, notably snakes. They dwelt in all conceivable inanimate objects—stones, trees, ruins—underneath

the earth, in the air and in the fire. At times they were friendly to human beings, but mostly sought to punish them for some harm done the jinn intentionally or unintentionally. Jinn were responsible for many diseases and all kinds of accidents. Although they shared the bodily needs of human beings and could even be killed, they were free from all physical restraints and possessed extraordinary powers. These could be exploited by fortunate human beings who knew the proper magical procedure. In the Koran the jinn are repeatedly mentioned, and this gave rise to many subtle speculations that aimed at explaining their nature in terms of medieval science. According to Avicenna, "a jinni was an airy and rational animate being with a transparent body, capable of assuming various shapes—this being not a true definition but the idea suggested by the term." Avicenna's veiled skepticism was shared by many medieval scholars. It did not affect the popular belief, which, however, in modern times is losing ground steadily, as the jinn are said to dislike all innovations of modern technology. (F. Rl.)

JINOTEGA, a large department in the central highlands of northern Nicaragua. Area 5,869 sq.mi.; pop. (1959 est.) 69,059. Most of the people are concentrated in a small area in the southwestern part of the department; the remainder of Jinotega, which is rugged, rainy, forested and without transportation facilities, is largely uninhabited. The southwestern part, though also quite rugged, has fertile soil and produces coffee, tobacco, potatoes, vegetables, fruits and wheat. The town of Jinotega, which is the capital of the department, is connected by a second-class road with the Matagalpa highway, giving it access to the Pan-American highway. (C. F. J.)

END OF VOLUME TWELVE

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